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## A Statement from the Editors

Welcome to our eleventh issue of *Choices* (Q1 2007).

In this issue of *Choices*, we offer two collections of papers. One theme covers the topic of the rapid emergence of global food chains and how it has changed the strategic investment, marketing, and production decisions of food companies and farmers, as well as food and agricultural policy. The other theme addresses the impact of immigration on the U.S. farm sector. The included papers examine various facets of this issue, especially the impact of legal and illegal immigration on farm labor supply, wage rates, agricultural production, and rural communities. Useful policy implications are provided. This issue also contains an article on Defending America's Food Supply Against Terrorism.

Look for our final issue where we plan coverage on Water Quality. See our thematic coverage page at [www.choicesmagazine.org](http://www.choicesmagazine.org) for a complete list and planned schedule.

In light of the AAEA Board's decision regarding *Choices'* funding and the uncertainty as to whether another funding source will allow continuation, the editors will no longer accept new thematic proposals. Our schedule is full through June 2007 when our editorship ends. **Proposals currently in process will be moved through to publication.** This policy continues unless funding conditions change. **Grab bag submissions will**

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*Choices* is the outreach vehicle of the American Agricultural Economics Association (AAEA) and is designed to provide current coverage regarding economic implications of food, farm, resource, or rural community issues directed toward a broad audience. *Choices* publishes thematic-oriented groupings of papers and individual papers. The broad themes we will repeatedly visit in *Choices* are agriculture and trade, resources and the environment, consumers and markets, and agribusiness and finance. Submitted manuscripts are subject to peer review for publication consideration.

*Choices* is published at the end of each quarter of the year by the American Agricultural Economics Association. Visit our web site at <http://www.choicesmagazine.org>.

#### Editorial Communications

Potential manuscripts, thematic proposals, and comments can be submitted through <http://www.choicesmagazine.org/submissions.htm> or directly emailed to the editors at [Choices@ag.tamu.edu](mailto:Choices@ag.tamu.edu). Editorial communications can be sent to [Choices@ag.tamu.edu](mailto:Choices@ag.tamu.edu).

**continue to be processed until all issues through June 2007 are full.** We encourage you to submit single

articles for the "Grab Bag" section of *Choices*. For submission requirements, see [http://www.choicesmag-](http://www.choicesmagazine.org/submissions.htm)

[azine.org/submissions.htm](http://www.choicesmagazine.org/submissions.htm). **The deadline for grab bag submissions is April 15th.**



## Washington Scene

Coordinated by Allan W. Gray, Purdue University and Joe L. Outlaw, Co-Editor, *Choices*

As promised by the new Democratic leadership, the first 100 hours of the 110<sup>th</sup> Congress saw several high profile pieces of legislation quickly move through Congress. Since that time, work on the Iraq and Afghanistan War supplemental has drawn most of the Congress' attention prior to the Easter break. While the House and Senate version have not been conferenced to reconcile differences, the current Senate version of the supplemental spending bill contains \$20 billion more than requested and a timetable for withdrawal which is likely to draw a Presidential veto, only the second time in this President's Administration.

### Farm Bill

Discussion of the 2007 Farm Bill begins and ends with money. Specifically, how much money will be available to fund the leadership's agriculture program priorities? The March 2007 CBO Baseline indicates there is going to be significantly less funding available for the next farm bill than in the Baseline when the 2002 Farm Bill was passed. In response to this reality, both the Senate and House budget committees each forwarded budget resolutions instructing the finance committee to create an agricultural "reserve fund." The Senate set aside 15 billion, while the House set aside 20 billion. It still remains to be seen how the "reserve fund" would work, but under the pay-go budget rules imposed by the Democratic leadership any increase in agricultural spending would have to be off-set by increases in income or reductions in expenditures elsewhere. This greatly diminishes the likelihood that agriculture committees will see a substantial increase in funding for the 2007 Farm Bill.

Congressional leadership continues to indicate a desire to have the House and Senate versions of the Farm Bill finished before the summer recess. If successful, the two bills could be reconciled in conference committee once Con-

gress returned and passed before the end of the fiscal year, which would coincide with the end of the current Farm Bill. Over the past few weeks at least some of the leadership indicates that, if the proposed timetable is unachievable, they may opt to pass a year or longer extension of the 2002 Farm Bill, or at the very least the current commodity provisions.

Recent statements by Secretary Johanns indicate that there could be progress made on the bill soon. USDA is currently taking their proposals for the 2007 Farm Bill and developing legislative language to deliver to the agriculture committees. This marks the first time since the early 1980s that an Administration has been willing to provide actual Bill language for their proposals. This is an indication that this Administration is willing to spend some political capital to push its agriculture agenda; a far different stance from the leadership in place when the 2002 Farm Bill was written.

### Doha Round

While the negotiators are trying to revive the Doha Round of the WTO negotiations, there doesn't appear to be the substantial political will required from the U.S. and several other key countries to come to a conclusion. Without a substantial change in at least one of the trading powers' offers in the very near future, there seems to be little chance of getting a Doha Round agreement prior to the expiration of Trade Promotion Authority (TPA) on June 30<sup>th</sup>.

### Supreme Court Greenhouse Gas Ruling

In a recent 5-4 opinion, the U.S. Supreme Court ruled that the Environmental Protection Agency (EPA) has the legal authority under the Clean Air Act to regulate "green-

house gas” emissions from vehicles. In this decision, EPA was instructed to reconsider their decision not to regulate these emissions. It has been anticipated that regulating tailpipe

emissions will result in increased costs for the nation’s automakers. Depending on EPA’s reaction, stricter greenhouse emissions requirements could further boost the demand for

fuels like Ethanol and Biodiesel that are generally better with respect to greenhouse gases than fossil fuels.



# Overview: Globalizing Food Chains: Producer, Company, and Policy Responses

By Bruce A. Babcock and Helen H. Jensen, Guest Editors

The rapid emergence of global food chains has changed how food companies and farmers think about strategic investment, marketing, and production decisions as well as food and agricultural policy. But trade negotiators for developed countries continue to spend most of their time protecting the interests of domestic commodity producers, whereas the top priority of developing country negotiators is to shield their agricultural sectors behind import tariffs while fighting for lower tariffs in developed countries. Even as these efforts continue to bog down any progress in the Doha round of negotiations in the World Trade Organization, the realities of increased urbanization in developing countries, continued income growth in most countries, economies of scale, and comparative advantage are working together to transform the food choices of consumers in both developed and developing countries. The case studies included in this issue of *Choices* highlight some of the key issues facing companies, farmers, and governments as supply chains globalize.

Increased demand by rich-country consumers for a wide variety of high-quality and unique food products has opened up opportunities for food companies and producers around the world. The decreased cost of providing consumers information about product attributes has greatly increased the feasibility of meeting these demands with specialized products. The article by Stricker, Mueller, and Sumner illustrates how this decreased cost of information transmission through an Internet presence can be used by producers of boutique products to greatly expand the geographic range of their customer base, thus allowing them to achieve greater scale than they would be able to if they were limited to local sales only.

The increased demand for quality by consumers is often accompanied by demands for increased assurance

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that the products meet strict sanitary and phytosanitary (SPS) guidelines. Both developed and developing countries are finding that new investments in upgraded food production and processing systems are needed to meet these international guidelines. Pork production systems provide a good example of the trends. Batres-Marquez, Clemens, and Jensen show how these investments are slowly transforming how pork is produced and processed in Mexico, with perhaps unintended impacts on the types of pork products that are being offered domestically. Lence shows how these investments have transformed Spain's pork industry and speculates about whether Spain's producers will choose to make the next set of investments needed to meet ever-stricter requirements.

The technical upgrades and investments required to meet rich-country SPS guidelines put developing countries at a distinct disadvantage internationally, according to many observers. Dong and Jensen review the difficulties that China is experiencing as it tries to upgrade its regulatory system in order to meet international standards. The

authors argue that, ironically, perhaps the biggest hurdle for China to overcome is a lack of central control over SPS systems being used to produce food. The study by Boland, Perez, and Fox shows that developing countries occasionally have an inherent advantage over rich countries in meeting new demands of international consumers. In their study of the Uruguayan beef industry, the authors show how reliance on a traditional grass-fed production system has given the country's producers an advantage at meeting the growing demand for natural beef. After all, it

is easier to adopt a certification system for natural beef when all cattle in the country are grass fed. In this case, country-of-origin labeling of U.S. beef could work in favor of Uruguayan beef producers. The Uruguayans could then differentiate their beef, raised in pastures, without the use of antibiotics and growth-promotants, from U.S. beef, finished with 50,000 other animals in large feedlots. This is yet another example of the complexity of decisions and their effects, both intended and unintended, in global supply networks.

The guest editors would like to acknowledge the suggestions of the anonymous reviewers and the assistance of Roxanne Clemens and Sandra Clarke in preparing the articles for this theme issue.

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# Mexico's Changing Pork Industry: The Forces of Domestic and International Market Demand

By S. Patricia Batres-Marquez, Roxanne L. Clemens, and Helen H. Jensen

*JEL Classifications: Q13, Q18*

Once dominated by traditional and small-scale production systems with little regulation, Mexico's pork industry now includes modern, vertically integrated production systems and federal inspection of packing and processing plants. Recent structural changes have resulted in three distinct segments within the production and processing sectors as the industry works to adjust to international and domestic demand for better product quality, stricter sanitary practices, and increased supplies yet continue to meet the needs of low-income consumers. As the structural changes continue, the industry faces several challenges that will affect its ability to become both internationally and domestically competitive. To meet these challenges, the Mexican government is faced with decisions about implementing and enforcing regulations and providing incentives to encourage continued development and best serve domestic consumers.

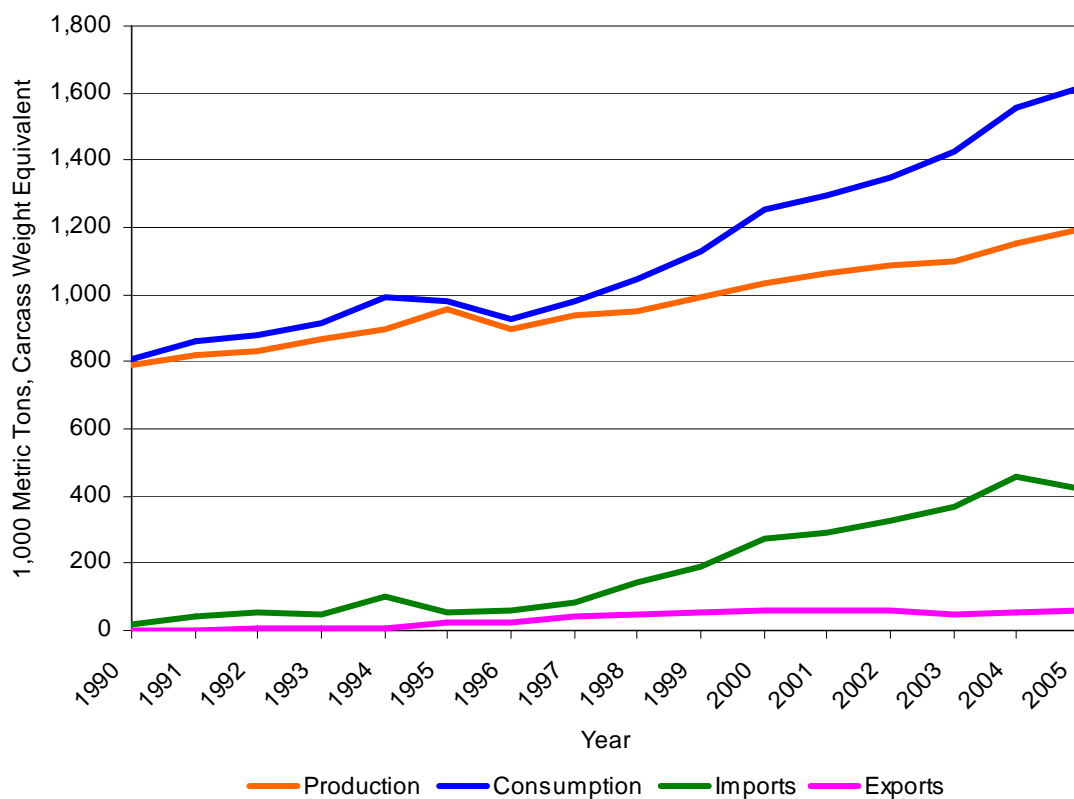
## Background

The structure of Mexico's pork industry has changed significantly in response to the implementation of the North American Free Trade Agreement (NAFTA), changes in consumer demographics, and the industry's desire to increase pork exports. The trade liberalization allowed under NAFTA has played a major role in spurring the rapid expansion of pork imports into Mexico to help keep pace with steadily growing demand (see Figure 1). Many of the structural changes to Mexico's pork production and processing sector have taken place since the phase-in period of NAFTA began in 1994. During this period, Mexican pork producers have worked to meet increasing domestic

demand for pork and better pork quality and to meet competition from imported pork and the poultry meat products that substitute for pork in many processed products. Processed products are popular in Mexico because of flavor; convenience; the range in quality and price that makes them affordable to many consumers; and the perception of many consumers that cooked, processed products are safe. Imports of live U.S. slaughter hogs have also been an important component of Mexico's pork industry trade, although numbers have been highly variable. Between 1996 and 2005, exports of U.S. slaughter hogs to Mexico ranged between a low of 14,700 head (1997) and a high of 201,500 head (1998); in 2005, exports totaled 130,100 head.

Pork has always been an important part of the Mexican diet, but a growing middle-income class, greater urbanization, overall population growth, and the greater availability of imported pork due to NAFTA have helped drive the sharp increase in pork demand. In 2005, per capita pork consumption reached 33.1 pounds, a 30.4% increase since 1995 (SAGARPA, 2006). Between 1990 and 2005, domestic pork production increased by 50%, but total consumption increased even more rapidly (see Figure 1). Along with the increase in pork demand, a growing number of Mexican consumers are demanding higher quality and greater safety in pork products. At the same time, a significant portion of Mexico's population does not have access to retail outlets that sell pork produced under sanitary conditions and can afford only the lowest-quality, lowest-priced pork.

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**Figure 1.** Pork production, consumption, imports, and exports in Mexico, 1990-2005.

Source: USDA Production, Supply and Distribution Online: <http://www.fas.usda.gov/psdonline/psdHome.aspx>.

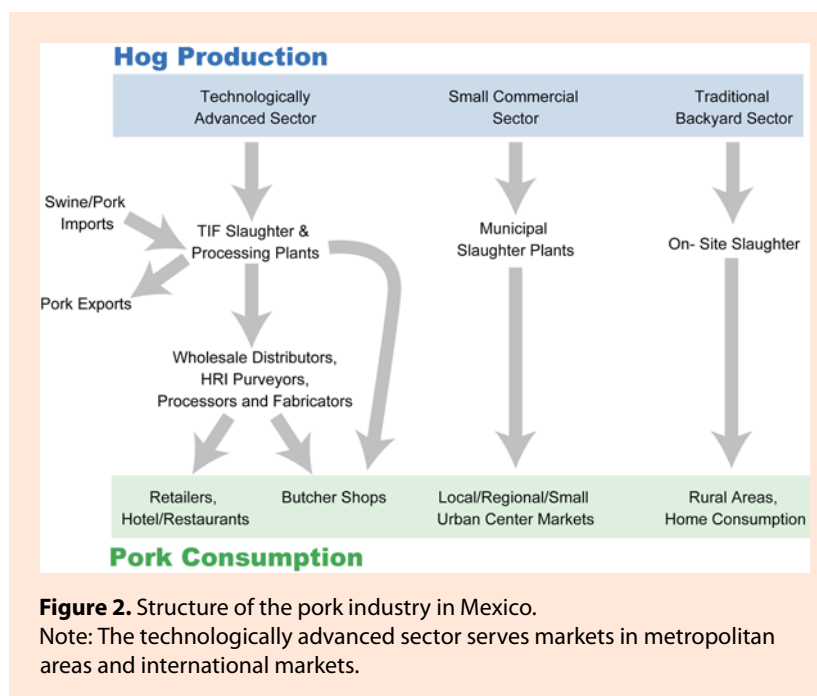
During this period, the Mexican pork industry has worked to increase exports, although this trade is relatively small compared with import volumes (Figure 1). Although Mexico is a net pork importer, the Mexican pork industry is competitive in providing some labor-intensive cuts that require trained labor to produce and some high-value-added cuts to export markets. Japan and Mexico signed a free-trade agreement in 2004, and exports under this agreement began in April 2005. During 2005, Mexico exported 46,906 metric tons (carcass weight) of pork to Japan, the largest export market for Mexican pork (USDA, 2006). In contrast, Mexico exported a mere 11,663 metric tons (carcass weight) of pork to the United States.

Meeting international standards for the product quality and sanitary practices required to export pork has further encouraged greater integration and efficiencies in the production and processing sectors. But, as a large net importer of pork, Mexico must increase production and/or imports to replace any exported pork if domestic demand is to be met. To increase domestic production and compete with imported pork, the industry will need to continue to expand production from its vertically integrated systems.

The desire to export has also required that the Mexican industry improve sanitation practices in the segments of the production and processing sectors involved in exporting. Sanitary and phytosanitary (SPS) standards in the United States and

elsewhere have limited live hog and pork exports from Mexico. For example, U.S. food safety import regulations require that pork and pork products imported from Mexico meet all the same food safety standards applied to similar products produced in the United States. The efforts to upgrade slaughter and processing facilities to meet these standards are discussed in the following section. Another important effort has been the attempt to eradicate export-limiting swine diseases.

Classical swine fever (CSF) prevented live animal and pork exports until Mexico was able to regionalize CSF-free states. Under regionalization, the Mexican government recognizes 13 Mexican states as CSF-free. In addition to CSF-free areas, Mexico has two other CSF zoo-sanitary



areas: eradication areas and control areas. In the eradication areas, located in Central Mexico, vaccination for CSF is prohibited; producers rely instead on depopulation and restrictions on movement of live animals should an outbreak occur. In contrast, CSF is considered endemic in the control area of Mexico, located in southern Mexico. Here, vaccination is used continuously to reduce pig production losses. Movement of live hogs and meat between zones is regulated or restricted, which has influenced industry development and limited export potential for producers and processors in some states.

The need to meet international sanitary standards and competition from imported pork has helped shape government policies that are resulting in improved pork quality and safety. However, government and industry resources are limited and modernization has not reached all segments of pork production and processing. As the production and processing sectors continue to modernize, the Mexican pork industry faces significant

challenges because of differences in the product quality required by a more modern pork distribution system and export markets, in contrast to that accepted and preferred by many domestic consumers.

### Production and Processing Systems

Production and processing of hogs and pork products in Mexico are undergoing important structural changes, driven by adjustments in the domestic market and international rules of trade. Modern, technologically advanced production and processing systems have emerged, and rapid urbanization has shifted opportunities toward more integrated marketing channels. However, the modern sector coexists with a more traditional domestic sector, and today three distinct sectors exist in the Mexican pork industry. Technology, resources, and location differentiate the three live animal production systems and the unique pork product

distribution and marketing channels supplied by each (see Figure 2).

### Live Hog Production

Hog production systems in Mexico can be separated into three types: technologically advanced, small commercial (semi-technically advanced), and traditional backyard. These systems are differentiated by the level of technology employed, degree of vertical integration, and quality of hogs produced (see USDA, 1999, for more details; see Batres-Marquez et al., 2006, for full references on all data).

Firms that operate technologically advanced production systems raise hogs at specialized sites, use advanced breeding methods, and implement strict animal health regimes, such as vaccination against disease and multi-site production systems. Most of these vertically integrated firms control the entire process, from hog production through pork distribution. The hogs are fed milled feeds and balanced rations, and this production system consistently produces the highest quality hogs of the three systems. These operations have shown the greatest expansion in response to increased pork demand in Mexico, and this expansion is expected to continue in response to an overall increase in demand, as well as demand for better quality and greater safety.

Small commercial operations produce fewer pigs per unit than do the technologically advanced producers. The small commercial producers may use breeding stock similar to that of the technologically advanced firms but lack the animal health controls and marketing systems used by the technologically advanced producers. These producers are less likely to feed balanced rations and cannot consistently produce hogs of uni-

formly higher quality. In response to the need for increased efficiencies to increase pork supplies and to compete with the increase in inexpensive imports allowed under NAFTA, many of these small commercial producers have exited the industry because of their inability to produce animals more efficiently and to meet increased quality standards, such as weight ranges, that are required by many live hog buyers. As a result, the scale of production has increased and the industry has become more highly concentrated and integrated, and this trend is expected to continue.

The reduction in small commercial production and the expansion of technologically advanced production have taken place alongside continued production using traditional backyard methods. Traditional backyard production is still quite common and found throughout the rural and semi-urban regions of the country. These traditional hog production systems are used in areas where there are few or no formal commercial channels. The hogs normally are fed low-quality feedstuffs and are of the lowest quality among the production systems. This production segment has declined, but economic and geographic limitations that prevent a large number of domestic consumers from obtaining pork from the other segments mean that this segment will remain part of the pork industry for the foreseeable future.

### ***Pork Slaughter and Processing***

As with live hog production facilities, slaughter and processing systems can be separated into three types: federally inspected, or “Tipo Inspección Federal” (TIF), plants; municipal plants; and traditional on-site slaughter. The facilities differ mainly by the degree of technology used, the size of capital

investment, and the services the plants offer.

The TIF slaughter and processing plants use state-of-the-art technologies and have the highest sanitary standards and most advanced technological processing levels in Mexico. These plants are certified and federally inspected by the National Service of Health, Innocuity, and Agro-alimentary Quality (SENASICA) of the Agricultural, Livestock, Rural Development, Fishery, and Food Secretariat (SAGARPA). In addition, some of Mexico’s TIF plants are HACCP-certified by the USDA Food Safety and Inspection Service, and some are individually approved by the Japanese government to export pork to Japan. TIF plant services include slaughtering, carcass handling, packaging, refrigerated storage, and fabrication of processed products (for example, hams and salamis) for both domestic and imported pigs and pork. An individual TIF plant may provide slaughter services only, slaughter and fabrication/processing services, or fabrication/processing services only.

TIF slaughter plants generally obtain hogs from technologically advanced, vertically integrated production systems that produce animals raised to meet high quality standards for the higher-end domestic market and for international markets. Also, the slaughter of imported hogs is restricted to TIF plants. TIF fabrication/processing plants use raw materials from TIF slaughter plants and imported products. The products from TIF slaughter and fabrication plants are mainly sold in large urban areas, and a small percentage is exported. Only pork slaughtered in TIF plants can be exported, once the importing country has accredited that the TIF plant complies with its sanitary controls.

TIF plants have existed in Mexico since 1947, but use of these plants has been increasing. A 1994 law on animal health requires that all new slaughter and meat plants built in Mexico be TIF plants. In addition, many companies are renovating existing plants in order to obtain TIF certification. In 2005, there were 95 TIF slaughter plants in Mexico. TIF pork plants processed 5.1 million pigs, a 25.9% increase over the number of hogs processed in 1998. TIF pork slaughter operations are concentrated in four states. In 2004, 43% of all hogs slaughtered in TIF plants were slaughtered in the state of Sonora, 21% in the state of Mexico, 14% in Guanajuato, and 11% in Yucatan. Eight other states accounted for the remaining 12% of TIF slaughter (Conferacion Nacional de Organizaciones Ganaderas, 2005).

As the number of TIF plants has increased, so has the share of hogs slaughtered in these plants with respect to total hogs slaughtered in Mexico. In 1991, only 11% of all slaughtered hogs were slaughtered in TIF plants, whereas in 2005, about 36% of all hogs were slaughtered in these plants. However, despite the general shift of production to the more modern processing sector, many TIF plants are working below their capacity levels—about 55% to 60% capacity according to one estimate. Because imported live hogs must be slaughtered in TIF plants, the underutilization of slaughter and processing capacity in Mexico encourages more live hog imports when market conditions such as U.S. hog prices and currency exchange rates are favorable.

Despite the incentives to use TIF facilities, several factors limit their use and segregate the market between the TIF plants and municipal slaughter plants, especially with regard to

small commercial producers. First, shipping of meat in refrigerated containers makes meat transported from TIF plants to retail and consumer markets relatively more expensive than meat produced, processed, and marketed through local market channels. A second factor that limits the use of TIF plants is their geographical location. Even though TIF plants are located near major hog production areas, they are inaccessible to many producers dispersed throughout the country because of high transportation costs and other logistical problems. Third, many small producers do not meet the animal quality standards of the federally inspected slaughter plants.

In contrast to TIF plants, municipal slaughter plants offer limited services, namely, slaughtering and carcass handling (cutting). These plants do not follow strict sanitary controls such as appropriate refrigeration, yet they are the main processors of hogs in nonmetropolitan areas of the country. According to some estimates, there are 866 municipal slaughter plants located throughout Mexico. Most of these plants are old and have not received proper maintenance. They lack the equipment and resources necessary to dispose of by-products properly and therefore are a source of contamination, particularly groundwater contamination (Lastra Marin and Peralta Arias, 2000). This segment of the slaughter industry is expected to decline as more producers use TIF plants for slaughter and processing, but the decline likely will be slow. Mexico's small commercial operators have traditionally sent their animals to municipal and/or private slaughterhouses where slaughter costs are about 30% to 40% lower than those of the TIF slaughter plants. These lower costs are passed on to consum-

ers, at least in part, through lower prices of meats sold in local, regional, and small urban center markets.

A sizeable proportion of producers in Mexico still use traditional on-site slaughter. These slaughter practices correspond to a traditional/ancestral slaughtering system practiced even before the Spanish colonization of Mexico. Although the share of hogs slaughtered under this system has fallen, about 36.1% of hogs were slaughtered on site in 1997, mainly in rural areas. The pork harvested under this system is used mainly for family (subsistence) consumption, although some is sold fresh for local domestic consumption. This system remains an important source of pork for many consumers because of its low production cost, low price, and the preference by some consumers for freshly slaughtered meat.

### **Government Incentives for TIF Production**

As noted, slaughter and fabrication in TIF plants are more expensive than in municipal plants or on-site slaughter. To support the modernization of the meat industry, the Mexican government has provided subsidies to producers to encourage slaughter and processing at TIF plants and at registered plants in the process of becoming certified as TIF plants. In 2003, for example, producers received approximately \$7 per head (on average) for hogs slaughtered in TIF plants to cover the higher cost of meeting hog quality standards of TIF plants. In 2004, producers received about \$4.63 per animal to cover the cost differential. Hogs slaughtered under the subsidy program must be five to six months of age, weigh 85 to 120 kilograms, and be produced in Mexico. Programs like this are designed to pro-

mote the use of TIF plants, a key component to expanding Mexico's export of pork and to improving the quality and safety of fresh pork in the domestic market.

### **Challenges to the Industry**

Both expanded domestic production and imports have been used to meet the rapid increase in Mexico's consumer demand for pork. Rising consumer incomes, more consumer information about food safety, and more efficient distribution will help drive demand for pork produced in TIF plants and increase consumer willingness to buy packaged (rather than freshly butchered) meats. These changes will, in turn, continue to drive ongoing structural changes in the domestic pork production, slaughter, and processing sectors.

Key to the continued development of a more modern and integrated production and processing sector is the increased domestic movement of live pigs (brought about through improved animal health and disease control), as well as channeling more pigs and pork through the modern sector. Such changes will require improvements in infrastructure (for example, new and improved roads and cold chains) to expand the use of TIF plants and to encourage the development of marketing channels that support high-quality products. Such changes will also require continued government regulatory and financial support.

The Mexican government's scarcity of financial resources relative to the country's needs will force the government to make choices about the most effective use of scarce resources for future development of the pork sector. The three levels in the industry's production and processing systems are likely to remain a part of

Mexico's pork industry, although the proportion of hogs produced and slaughtered in each will gradually change. In the near term, Mexico's industry can take advantage of different consumer markets through exports of high-valued cuts. However, given that Mexico's export market for pork is small and importing countries certify only a portion of TIF plants for export, policies that encourage increased exports may limit the overall industry's potential to increase quality and safety in the domestic market. Government policies that encourage industry-wide improvements in quality and safety could reasonably be expected to help bring about the long-term changes necessary to support a pork industry that benefits all consumers.

### Acknowledgment

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### For More Information

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# Grass-Fed Certification: The Case of the Uruguayan Beef Industry

By Michael A. Boland, Lautaro Perez, and John (Sean) A. Fox

*JEL Classifications: Q13, Q17*

Uruguay is a small beef-exporting country. It is located between Argentina and Brazil, both of which rank among the world's largest beef producers and exporters. Uruguay has approximately 57,000 agricultural/livestock operations, of which 29,000 (52%) are pasture-based beef and sheep ranches. Of these, about 19,000 specialize in breeding (cow-calf operations), 6,000 are calf-to-beef type operations, and 4,000 specialize in finishing. Over half the ranches are classified as family farms with less than 200 acres, while another quarter are considered transitional farms with less than 900 but more than 200 acres. About 5% are farms of over 3,500 acres (MGAP-DIEA, 2005).

In 1995, the World Organization for Animal Health declared Uruguay free of foot-and-mouth disease (FMD). This status was lost temporarily in December 2000 but was regained in May 2003. The country prohibits the import of live animals and/or genetic material from countries affected by FMD or other exotic diseases. Uruguay is also classified in the lowest possible risk category for bovine spongiform encephalopathy.

Uruguay's new sanitary status opened its access to several important markets, which until then had been closed to the country's noncooked beef exports. Fueled by improved market access, exports became even more important to the economy. In 2005, meat exports accounted for about 26% of the total value of Uruguayan exports, with beef accounting for 22%.

Uruguay beef serves as an example of one industry's effort to obtain international certification for its grass-fed beef production system. Certification, in conjunction with Uruguay's already highly developed cattle identification and tracking system (the DICOSE system), is viewed as central in the development of a national brand image for

Uruguayan beef, analogous to that associated with New Zealand lamb.

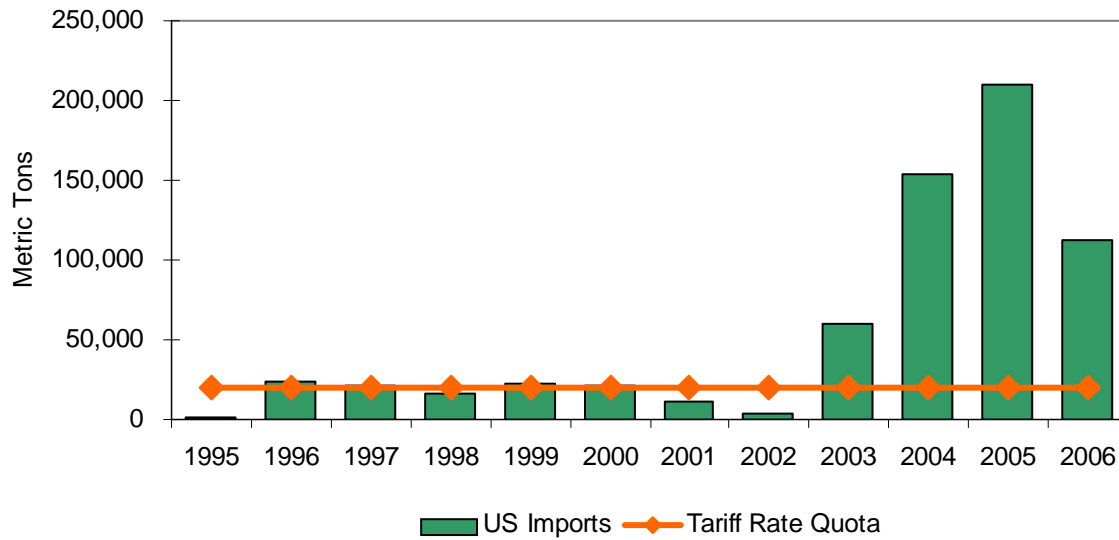
## Industry Expansion

Uruguayan beef production expanded following the achievement of FMD-free status in 1995. Expansion was facilitated by a significant decline in sheep numbers due to falling wool prices. Sheep numbers declined from 26 million in 1991 to 10.8 million in 2005. As of June 30, 2005, the cattle inventory was at a record high of 11.95 million head. Slaughter rose to a record 2.39 million head in 2005, almost triple the levels registered in 1990.

Beef exports grew because of improved market access, productivity gains, and small and decreasing domestic consumption. Exports averaged 138,000 metric tons, carcass weight, from 1990 to 1994—about 40% of total production. Between 1995 and 2000, exports jumped to an average of 232,000 metric tons, accounting for about 60% of production in 2000. In 2005, exports reached a record 478,699 metric tons carcass weight (equivalent to 292,248 metric tons shipped weight), accounting for 80% of beef production, and only 15% was exported chilled. Chilled exports have increased in the last three years, as most organic and natural beef is shipped as chilled. Normally, frozen beef is mixed with U.S. beef to increase its leanness. There is no difference in quality between frozen and chilled beef.

Notwithstanding the dramatic growth in exports, Uruguay still supplies only around 5% of the approximately 6 million metric tons of beef traded internationally, although beef represents 75% of total Uruguayan production. In recent years, the United States has become the largest export market for Uruguayan beef, accounting for

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**Figure 1.** Uruguayan beef exports to the United States, 1995 to 2005.

52% and 76% of total tonnage of beef exports in 2004 and 2005, respectively. The market share decreased in 2006 due to increased demand from Russia in the first six months of 2006. Other major markets include Canada, European Union (EU) countries (United Kingdom, Germany, Spain, and Portugal), Israel, Russia, and Mercosur members (Argentina, Brazil, and Chile).

Beef exports to the United States are regulated by a World Trade Organization (WTO) negotiated tariff rate quota (TRQ) currently set at 20,000 metric tons per annum for chilled and frozen beef, as shown in Figure 1. Exports within the quota are subject to a nominal fixed tariff of 4.4¢ per kilogram (approximately 2¢ per pound), while above-quota exports are subject to an ad valorem tariff of 26.4%. Between 1995 and 2002, exports to the United States were generally limited by the quota. However, between 2003 and 2005, tight beef supplies and higher prices in the United States led to a significant increase in U.S. imports from Uruguay (nearly 210,000 metric tons

in 2005). The above-quota imports, on which the 26.4% tariff was paid, consisted primarily of lower-quality beef destined for the hamburger market. The structure of the U.S. market for Uruguayan beef has also changed in recent years. Between 2001 and 2004, the number of U.S. importers handling Uruguayan beef increased from 29 to 67, while the share for the top five importers fell from 86% to 56%.

### The DICOSE Traceability System

In 1973, the Uruguayan government created the División de Controlar de Semovientes, today known as DICOSE, within the Ministry of Livestock, Agriculture, and Fisheries, to account for domestic animal stocks and movements (Marshall, Boland, & Conforte, 2002). The objective was to curtail smuggling and help with the eradication of FMD. Under the DICOSE system, farmers are given a code consisting of a region number, a police station number, and a farm number. Every time an animal is moved, bought, or

sold, the movement must be recorded and the animal accompanied by its paperwork. The system is similar to having a passport. Police sign all sales documentation, with copies going to the seller, the buyer, the Ministry, and the police. Ministry inspectors check all trucks and documentation at each slaughter plant before unloading. Farmers are audited at random every year, and they must present an annual animal stock balance.

With DICOSE, Uruguay was one of the first countries in the world to be able to trace animals back to their origins, and the Ministry could use the system to ensure that farmers and slaughter plants were complying with sanitary requirements. Once animals reach the carcass disassembly stage, however, it is virtually impossible to track each cut because of multiple cutting lines in most plants. Thus, while an individual cut cannot be traced back to an individual animal, it can be traced to a specific lot number. A system that would maintain individual identity for each animal as it moves through the car-



**Figure 2.** Uruguay's USDA Process Verified Certified Natural Beef label.

cass disassembly stage would be costly to implement, and there are currently no economic incentives for such a system. However, processors are now projecting plant layouts capable of tracing each individual cut in the deboning line. Some plants already provide this service for specific European consumers.

In September of 2006, Uruguay began a mandatory individual cattle traceability program. All animals born in September 2006 or later must be ear tagged (one visual tag and one radio frequency identification tag) for traceability purposes. The basic components of the Sistema de Identificación y Registro Animal (Animal Identification and Record System) are

- individual animal identification,
- farm identification (for example, geographic identification; unique identification; and the DICOSE for farms, plants, and auction yards),
- recorded information, and
- ownership and cattle movement records.

Thus, Uruguay currently is able to track individual animals until they reach the plant and by animal lot in and after they leave the plant. In 2010, Uruguay will implement post-

plant meat traceability. Individual animal traceability has been mandated by Japan, South Korea, Canada, Australia, New Zealand (after October 2007), and the EU (only France, the United Kingdom, and Ireland are in compliance).

In the United States, 90% of cattle go through a feedlot system in which growth hormones are used to enhance feed efficiency and lower production cost. In contrast, Uruguayan cattle are fed primarily on pasture alone, and while some supplemental grain-based feed may be used, the use of growth hormones is strictly prohibited. Thus, Uruguay is also in compliance with EU rules on hormone use. In addition, antibiotics in feed are not used in pasture-based systems.

### **Product Differentiation and Certification**

Product differentiation is recognized as a key factor in enhancing demand for Uruguayan beef in export markets (Perez, Boland, & Schroeder, 2003). In 2001, the National Meat Institute (INAC— Instituto Nacional de Carnes) of Uruguay developed the “Certified Natural Meat Program of Uruguay,” with the dual objectives of

differentiating and increasing consumer confidence in Uruguayan meat products. The program involves international certification of compliance with various protocols in both the animal production and industrial phases of meat production. In August 2004, USDA announced that Uruguay's Certified Natural Beef is “Process Verified.” In other words, the beef is verified according to this process of compliance (see Figure 2). The main components of the Certified Natural Meat Program of Uruguay are food safety, traceability, animal welfare, and environmental sustainability. These are expressed in the following claims made for animals marketed under the program:

- Source verified—All cattle can be fully traced from ranch to harvest, fabrication, and packaging. Identification of animals is by means of individual plastic ear tags.
- No added hormones—No growth hormones of any kind or equivalent growth promotants have ever been administered to the animals.
- Not fed antibiotics—No sub-therapeutic antibiotics have been fed or administered as a supple-

ment in feed or water for the purpose of growth promotion.

- No animal proteins in feed—The animals have never been fed proteins of animal origin except maternal milk.
- Grass fed—All animals in the program have been grown, raised, and fattened on a grass diet. Restricted supplementation levels are accepted to support grazing.
- Open range—Animals have never been confined to yards or feedlots at any time in their lives, and are raised in open pastures year round.

The program is voluntary; members (farmers and slaughter plants) join with the objective of adding value to their product. Independent certification firms verify that members are in compliance with protocol claims, and thus certification involves the entire production chain from animal production to meat cutting, packing, and labeling. The country brand is “Uruguay Certified Natural Beef” and the label, shown in Figure 2, is the intellectual property of INAC. Its use is granted subject to endorsement of the accredited certifying firm.

Certification under this program links the product with its country of origin and essentially attempts to establish Uruguayan beef as a brand identity similar to that of New Zealand lamb as described by Clemens and Babcock (2004). However, there is one important difference. Uruguay is attempting to use a broad certification program based on USDA standards, whereas New Zealand is marketing the country without a formal certification program. Ultimately, the intent is a quality assurance program to certify that the whole country conforms to a process of producing high-quality grass-

fed beef. Table 1 shows the progress of the certification program.

### Benefits of Certification

The objective of certification is to differentiate Uruguayan beef from that of competitors and thereby enhance demand. To illustrate the potential benefits, consider the impact on exports to the United States. As noted, the majority of Uruguayan beef shipments to the United States in 2004 and 2005 were out of quota, as the country has only 2.8% of the quota compared with 54% for Australia and 30.6% for New Zealand, and these shipments were subject to the 26.4% tariff. Given the differential treatment of in- and out-of-quota exports, exporters minimize tariff exposure by reserving the quota for higher-value chilled beef exports and shipping lower-priced manufacturing beef out of quota. Thus, demand for its beef outside the quota has changed Uruguay from a small to a major exporter of beef to the United States, and since 2003, the United States has been Uruguay’s principal market.

In general, it is not economical to ship high-quality beef out of quota because the tariff would not allow the product to compete with U.S. domestic producers, with other exporters to the U.S. with more quota, or eventually with the alternatives for those cuts that Uruguayan exporters have in other international markets. However, because chilled beef still comprises only a small fraction of Uruguayan beef exports, the 20,000 ton quota is not yet a limiting factor. For example, in 2004, only 7,562 metric tons of high-quality chilled beef were shipped to the United States, and the remainder of the quota was filled with lower-quality frozen beef.

**Table 1.** Progress of the Uruguayan certification program, 2004 to June 2006.

	2004	2005	Jan. to June 2006
<b>Certified farms</b>	56	186	277
<b>Animals in certified farms</b>	90,000	300,000	550,000
<b>Certified slaughterhouses</b>	1	3	10
<b>Exports (metric tons)</b>	0	17	482

### Lessons for the Future

Since eradicating FMD in 1995, Uruguay has been expanding its beef exports, particularly to the United States. In addition, acceptance of the DICOSE traceability system and the Uruguayan ban on growth hormones provide access to the EU market. Exports to the United States are constrained by a TRQ, and exports to the European Union are constrained by a WTO-negotiated Hilton quota. Uruguay has 6,300 carcass tons in the quota, which must be boneless. Eligible animals must have been exclusively pasture raised since their weaning. The beef is produced from animals kept on registered and approved farms that comply with conditions of production of animals eligible for the European Union as determined and verified by Uruguayan authorities.

To date, Uruguay has filled its U.S. TRQ with a combination of high- and low-quality beef. Certification of Uruguayan natural grass-fed beef would differentiate and enhance demand for high-quality Uruguayan beef and would be expected to lead to a situation in which the entire TRQ is filled with high-quality beef. Additional enhancements in demand as a result of certification would benefit the holders of the TRQ permits, but because overall demand for Uru-

guayan beef would not increase, there would be no price benefit for Uruguayan producers. Producers would, however, benefit from a negotiated increase in the TRQ.

What lessons does the Uruguayan example hold for domestic and international producers responding to opportunities in the United States? In the past few years, almost a dozen producer alliances in the United States have become process verified, and a number of other initiatives are underway. In March 2005, the state of South Dakota implemented the first state-certified beef program in the United States. Under that program, consumers will be able to trace a product back through the meat-packing plant, to the feedlot where the animal was fed, and to the ranch where the animal was born. A similar initiative in Iowa would create a label for "Iowa-80" beef. The success of such programs hinges on their ability to market a brand name tied to a distinct set of desirable attributes. Given the range of attributes that some consumers appear to value (for example, traceability, hormone free, grass fed, no antibiotics, no genetically modified grain), there appears to be room in the market for several such differentiated products.

However, as programs proliferate and face competition from foreign programs such as Uruguay's, the initial benefits are likely to diminish. Similarly, domestic efforts such as the

Iowa-80 certification program might prevent loss of market to Uruguayan imports. Regional programs such as this would not exclude imports or impede other countries in developing their own brand identities, with the possible exception of EU products developed under *terroir* labels, which are only applicable for EU countries. But that is a regional label using legislation and not a private effort for differentiation. Alternatively, U.S. producers could seek alliances with producers in other countries such as Uruguay to provide beef of this type, or U.S. producers could invest in processing facilities in other countries, as they have done in Uruguay. Clearly, some countries such as Uruguay may have highly differentiated products that will become more competitive with U.S. beef. Producers involved in alliances seeking to differentiate their beef by geographic origin or by the process with which the beef was produced must realize that producers in other countries can develop similar products and that in a global beef market domestic certification programs are not likely to present significant barriers to market entry.

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# Challenges for China's Agricultural Exports: Compliance with Sanitary and Phytosanitary Measures

By Fengxia Dong and Helen H. Jensen

*JEL Classifications: Q13, Q18*

In the food safety arena, a clear role for government is to adopt sanitary and phytosanitary (SPS) measures to protect human, animal, and plant life or health. Relative to developing countries, developed countries tend to adopt more stringent food safety standards and regulations with a broader scope and to rely increasingly on certification and traceability. The additional costs of compliance for meeting international SPS requirements are higher for firms operating in developing countries because they must take additional steps to meet international food safety regulations and standards. Therefore, their comparative advantage, achieved through lower production costs, will tend to be reduced because of high incremental compliance costs. Given that a high proportion of developing countries' exports are agricultural and food products and that export destinations are mainly developed countries, concerns have arisen that SPS measures are affecting developing countries' access to export markets.

China provides a good example of the potential and problems of compliance with SPS requirements and other private standards required by foreign retailers because many of the problems China is facing in agricultural production and in exports are common to other developing countries. Developed countries, including Japan, account for a major share of China's agricultural exports. Thus, examining China's SPS conditions in agricultural production, efforts to overcome SPS problems, and ability to adjust SPS controls to demand in the markets of developed countries provides lessons on approaches that might be used by other developing countries faced with similar

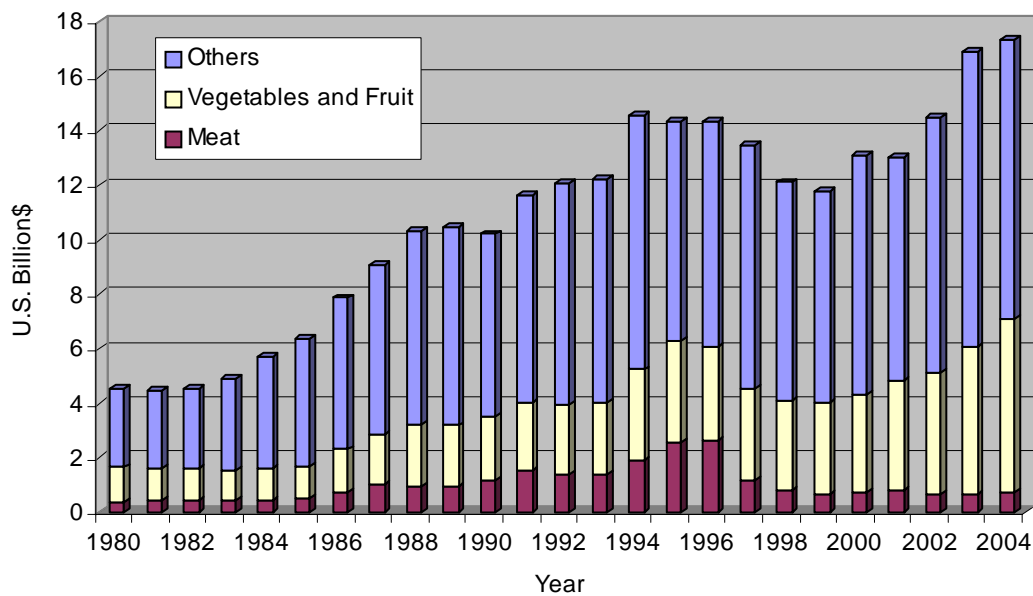
problems. Given the major challenges found in China, we focus the SPS issues on food safety and quality control.

## Sanitary and Phytosanitary Issues for Agricultural Exports

After 15 years of negotiations, China became the 143<sup>rd</sup> full member of the World Trade Organization (WTO) on December 11, 2001. Since then, with eliminated or lowered tariffs, China's bilateral trade has grown significantly. In 2004, the value of Chinese exports of agricultural products exceeded \$17.3 billion (see Figure 1). As shown, fruits and vegetables represent a growing share of agricultural exports.

Despite prospects for economic rewards from expanded trade, several problems have emerged. Chinese farmers and exporters had anticipated a large, positive impact on domestic production with accession to the WTO, especially for labor-intensive agricultural products such as vegetables, fruits, livestock and poultry products, and seafood. However, these products have been hardest hit by the need to meet significant SPS standards, and this has dampened substantial growth in these agricultural exports. According to a recent investigation by China's Ministry of Commerce, about 90% of China's exporters of foodstuffs and agricultural products were affected by foreign technical trade barriers; exporters suffered losses totaling US\$9 billion a year.

China's recent experiences with SPS barriers have been mainly with the European Union, Japan, and the United States. They are the leading importers of China's agricultural products, accounting for about 68% of total Chinese



**Figure 1.** Chinese agricultural product exports.

Source: FAOSTAT (<http://faostat.fao.org>)

vegetable and fruit exports over the 1998-2000 period. But, at the same time, these three markets accounted for 41%, 30%, and 24%, respectively, of the trade losses attributable to SPS measures in 2002. An illustrative example is Japan's ban on China's frozen spinach in July 2002 after pesticides called chlorpyrifos were found in the product. Prior to the ban, imports from China accounted for 99% of Japan's annual imports of 40,000 to 50,000 metric tons of spinach. Because failure to pass SPS inspections often leads to closer inspection of future exports, China's agricultural products have confronted much stricter inspection in these markets following several of the SPS-related problems. Currently, Chinese exports of seafood, vegetables and fruits, tea, honey, poultry meats, and red meats are creating the most frequently encountered SPS problems. Excessive pesticide residues, low food hygiene, unsafe addi-

tives, contamination with heavy metals and other contaminants, and misuse of veterinary drugs have been major issues.

### **Current Sanitary and Phytosanitary Conditions**

China's SPS problems can be attributed to many factors, most of which are common to developing countries. Although there is a dual system of production, with some export-oriented enterprises co-existing with primarily domestically oriented production, it is hard to keep the two separate in the national supply chain, and the overall level of food safety in domestic production will inevitably affect the expansion of China's agricultural exports.

### **Regulatory and Oversight Systems**

Because the Chinese government is still working to perfect its SPS regulatory and oversight systems, regula-

tion and supervision of food product quality do not yet provide the necessary guidance for agricultural and food production. Some industries and commodities have no technical standards, and there is no sound food safety law to support and upgrade inspections. With respect to restrictions on pesticide residues, Codex has over 2,500 maximum residue levels, the European Union has over 22,000, the United States has over 8,600, and Japan has over 9,000. By comparison, China has only 484, and fewer than 20% of these conform to Codex levels.

Many technical standards and regulations in China are outdated, duplicative, or inconsistent with international standards. Moreover, the establishment of agricultural standards involves 10 government ministries, with little coordination from the central government down to the county level. As a result, each level of government has developed its

own standards. This dispersed structure neither facilitates coordination nor supports effective implementation of food safety regulations. In addition, the lack of technical, institutional, and managerial capacity to control and ensure compliance makes the regulations and standards less effective.

### **The Production Environment**

The lack of effective regulation of quality, coupled with widespread noncompliance with existing regulations, has resulted in Chinese producers often misusing or abusing chemicals and drug inputs (for example, chemical fertilizers, pesticides, and antibiotics). Antiquated production techniques and technology, environment pollution, and a low-quality input supply make production conditions worse. According to inspection reports of agricultural produce sampled by China's Ministry of Agriculture in July 2005, over 10% of vegetables in farmers markets and supermarkets contained excessive pesticide residues based on Codex food standards.

In animal production, there are persistent violations of regulations on drug additives and quality standards. In 2005, China's Ministry of Agriculture conducted sample inspections nationally on feed and feed additives and veterinary medicine. About 9% of samples drawn from feed and feed additives production, marketing, and utilization firms or households were substandard. Besides prohibited drug additives, lead, aflatoxin B1, and *Salmonella* were the most common adulterants or types of contamination found. In addition, 25% of veterinary medicine samples were substandard in terms of quality.

The small scale of fresh produce and livestock operations in China and the fact that they are relatively

scattered across producing areas contribute to the abuse of agricultural chemicals and noncompliance with regulations. For example, 66% of swine producers had an annual production of less than 50 pigs in 2005. Controlling the use of chemicals and veterinary drugs in such a vast country—with more than 700 million farmers and many more household farming operations—is extremely difficult.

Poor machinery and low management levels in household operations also contribute to SPS problems. Small-scale farmers have little or no motivation to comply with SPS regulations if they do not face penalties for noncompliance as they face increased production risks. Even when large-scale, standardized production might develop, compliance with SPS standards can lead to significant increases in production costs, and, in the short term, the potential loss of revenue can be a significant barrier to change. With such an unfavorable situation, meeting higher food safety and quality standards leads to higher costs, which constrain expansion of China's agricultural product exports.

### **Inspection Technology and Information Transfer**

Lack of up-to-date inspection equipment limits China's ability to conform to internationally accepted assessment procedures. Much of China's current inspection and testing technologies and instruments are antiquated and unable to meet the demand for services in terms of quality and scale of operation, especially when pesticides and veterinary drug residue tolerances are set at very low doses (for example, parts per billion and parts per trillion).

In addition, inefficient information systems and isolated domestic

markets mean that market information and other technical requirements may not be communicated in an efficient manner. The lack of effective information channels across governments, industries, and regions means that even if some firms or industries confront SPS problems in export markets, other firms or industries are not likely to be informed on a timely basis. Many farmers do not have access to information about SPS standards, let alone to the resources required to comply with these standards, such as appropriate technologies and scientific and technical expertise. Most producers have only a limited awareness of SPS measures in general and lack an understanding of their importance.

### **China's Progress on Resolving Problems**

With increasing interaction with world markets, China's government and traders have recognized SPS problems and are taking actions to improve the production and marketing environment. Recent investment in state-of-the-art processing facilities, transportation and distribution infrastructure, and improved testing and product control have improved quality and supported increased development of food markets (in particular, dairy, meat, fruits, and vegetables). These improvements contribute to the expansion of exports by increasing the overall supply available to both domestic and export markets. In the dairy sector, for example, companies are beginning to invest in technologies to increase milk quality, and emerging national brands are establishing credible reputations for quality and safety (Fuller et al., 2005). Some of this product is available for export. In addition to efforts to update agricultural and food stan-

dards and regulations and to educate producers on requirements for production methods in international markets, the Chinese government is trying to attract foreign investment, support large enterprises, and promote good agricultural and manufacturing practices. In the meantime, the private sector is working to coordinate international standards and thus increase access to world markets.

### ***Foreign Direct Investment, Dragon-Head Enterprises, and Industry Associations***

With relatively scarce capital internally, the government has encouraged foreign direct investment (FDI) in agriculture. Such investment can introduce capital, advanced technology, and management and marketing skills to improve product quality, increase exports, and assist in the transition from traditional to modern agricultural operations. Currently, agricultural production and food processing sectors each account for only about 2% of total FDI. Except for a few inland provinces, FDI in general has been concentrated in the southeast coastal areas. The Chinese government has further opened its agricultural sector to the outside world and has provided favorable policies and terms to attract FDI through preferential taxes and improved infrastructure.

China's government has supported the development of leading, large-scale enterprises, or "dragon-head" enterprises, as these targeted enterprises can bring along many enterprises and farmers by involving them in their supply chains and providing them guidance on production practices that improve food safety and quality. Currently, about 500 key dragon-head enterprises have formed at the national level, and over 2,000 have formed at the province level.

Approximately 30% of all farm-households sold products to these industrial enterprises. The national- and provincial-level key dragon-head enterprises are mainstays of the move toward a more industrialized agricultural system. Because it is difficult for an enterprise to deal directly with thousands of dispersed farm-households or for a farmer to directly contact or negotiate with these enterprises, more and more industry associations have been formed voluntarily by producers and processors. These national or local industry associations are acting as a bridge and link between the government, enterprises, and farmers. And they are effective in working out strategies for industry development, safeguarding members' rights, improving cooperation and experience exchange among members, and conveying information on food safety standards and requirements.

Additional FDI, key dragon-head enterprises, and industry associations also offer some hope to small-scale farmers with low management skills and poor production techniques that they might benefit from expanded export markets. Small-scale farmers organizing to operate as single large-scale entities allows them not only to gain economies of scale but also to more easily standardize production and comply with SPS measures at lower costs. This improved organization and investment may allow small-scale producers to remain competitive in the stricter food safety environment required in international markets.

### ***Hazard Analysis and Critical Control Point Systems and Good Practices***

Following the lead (and requirements) of the United States and other countries, China has turned to implementation of Hazard Analysis

and Critical Control Point (HACCP) systems as another approach for reducing SPS and food safety problems and improving access to world markets. In 2002, China's General Administration of Quality Supervision, Inspection, and Quarantine introduced regulations requiring export-oriented enterprises producing six kinds of food (canned food, aquatic products [excluding fresh, frozen, air-cured, and pickled/salted products], meat and meat products, frozen vegetables, fruit/vegetable juice, and frozen convenience food containing meat or aquatic products) to pass a HACCP system examination for hygiene certification before producing, processing, or storing exported food. As expected, firms wanting to enter export markets have rapidly embraced the use of HACCP systems. As microbial contamination is the number one food safety issue (43% of illnesses caused by food poisonings were linked to microbial contamination in 2005), improved risk-based control systems, such as HACCP, along with frequent inspections by government agencies, can reduce the risks of microbial contamination on the supply side. To the extent that HACCP is successful in improving the quality of the manufacturing process, the use of HACCP systems is expected to greatly improve the sanitary condition of those exported foods.

However, because producers of most exported products and production services at various stages of the supply chain are not required to adopt HACCP or to use good manufacturing practices in processing or good agricultural practices in the fields, the responsibility for improving SPS conditions comes through self- or market-oriented discipline. Producer efforts toward good practices are motivated primarily through

incentives to earn more revenues by way of foreign exchange in export markets, and through the threat of lost payments and business from foreign customers should problems occur.

### **Opportunities and Challenges for China**

Although SPS conditions as a whole in China are low, a number of enterprises, especially those that are export-oriented in the coastal and open provinces and regions, have reached SPS levels consistent with international levels. The improvements in food quality and product safety are a result of their operating in relatively open markets and exporting to developed countries, as well as their investment in modern food production, processing, and distribution industries. These markets are now mostly controlled by the “invisible hand” of international market forces, and producers can quickly adjust production to market signals. Their good practices can have spillover effects on domestic production and potentially expand supply sources available to export markets. This provides an optimistic prospect for China’s food quality and safety. Recent estimates show that China has an opportunity to compete successfully because of low production costs that offset relatively high internal marketing costs (USDA, 2006). However, large regional differences limit prospects for broad participation in international markets, and it will take a long time for China to make the necessary adjustments to improve the overall SPS conditions in the country. During the transition, the potential for exports of China’s agricultural products will vary, depending on the destination countries (which have different levels of

SPS requirements), product varieties, and the capacity of producers to conform to SPS standards.

Although the WTO SPS Agreement requires members to ensure that SPS measures are based on sufficient scientific evidence, there are some well-founded concerns that countries may abuse SPS measures by using them as trade barriers. As China works to respond to the SPS regulations of other countries, concerns have risen that some countries will use SPS barriers to keep out lower-cost Chinese products, which are very competitive in world markets. Consequently, importing countries may look to restrict imports from China by setting relatively high standards or strict inspections in order to protect domestic markets. As China faces continuing SPS conflicts, the government has looked to bilateral negotiations to resist unfair trade restrictions and discrimination and is likely to call upon the WTO to coordinate and resolve trade disputes. As a member of the WTO, China can participate in the negotiation and establishment of international regulations and standards. What remains to be seen is whether China will improve its market opportunities under its new access to scientific review processes.

Asia has been the dominant destination for China’s seafood, meat, vegetable, and fruit exports, accounting for over 50% of China’s total exports in each category. Since U.S. exports have been of a different type, or seeking different destinations or market niches, China’s exports of processed fruits and vegetables, which account for 60% of its total value of fruit and vegetable exports, generally had not posed challenges to U.S. exports. However, notable competition to U.S. exports brought about by China’s increasing exports has been seen in the U.S. apple juice

market and in Asian fresh fruit and vegetable markets, especially apples, onions, and edible brassicas (mainly broccoli and cabbages).

The value of China’s apple juice exports to the United States increased from \$1 million in the early 1990s to \$108 million during the 2002-2004 period, and China has replaced the United States as the leading exporter of apple juice to Japan and Canada (USDA, 2006). And, due to low production costs and proximity to Japan, China’s fresh vegetables are more price competitive than are U.S. vegetables. Declining U.S. market share in other Asian markets is also coinciding with increased vegetable exports from China.

At the same time, growth in China’s domestic market, fueled by increased consumer income, modernization in the retail food system, and better transportation and distribution networks, has begun to compete with export outlets for the country’s high-quality and processed food products, and this may dampen the expansion of products destined for international markets.

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# The Transformation of Spain's Pork Sector: Can It Continue?

By Sergio H. Lence

*JEL Classifications: Q13, Q18*

Compared with the other major players in the world pork market, Spain has experienced profound growth and transformation within its pork sector over the past 20 years. Between 1985 and 2003, pork production in Spain increased by 139%, reaching 3.3 million metric tons per year, and Spain became the second-largest pork producer in the European Union (EU).<sup>1</sup>

The substantial increase in pig production in Spain was largely propelled by EU membership in 1986, which induced a relocation of EU pig operations that favored Spain's lower labor and feed costs, lower population density, and looser environmental regulations. At the same time, Spain's pig producers were forced to become more competitive with other EU producers or risk being put out of business. This situation became even more pronounced with the creation of the EU single market in 1992, which increased both regulations and competition but also created new opportunities for marketing higher-quality products that meet stricter safety standards and are capable of commanding price premiums. The producers who succeeded were the ones who adopted state-of-the-art technologies, became highly efficient, and implemented innovative approaches to organization and management.

In the late 1980s, Spain was a net importer of pigmeat, producing slightly over 95% of its consumption. However, as a result of the substantial transformation experienced by its pork sector, Spain has become a large net exporter, shipping about 450,000 metric tons of pork (2001-2003 average) and 1.1 million live slaughter pigs (2002 total) per year. Spain's pigmeat production exceeded consumption

by more than 15% in 2002. Although most of this trade occurs among EU member countries and total exports are small relative to those of Denmark and the Netherlands, Spain has attained an increasingly significant role in EU pork trade (see Figure 1).

The transformation in pig production in Spain was led by the feed industry, which consolidated into fewer, larger firms and became organized into private corporations or cooperatives. The greater resources of these larger firms allowed them to become integrators by entering into contracts with pig producers. Under most such contracts, the integrator owns the animals and provides feed, technical assistance, veterinary services, and other inputs, and the producer provides facilities and labor. These arrangements gave integrators the required scale to reduce costs by negotiating better terms with input providers.

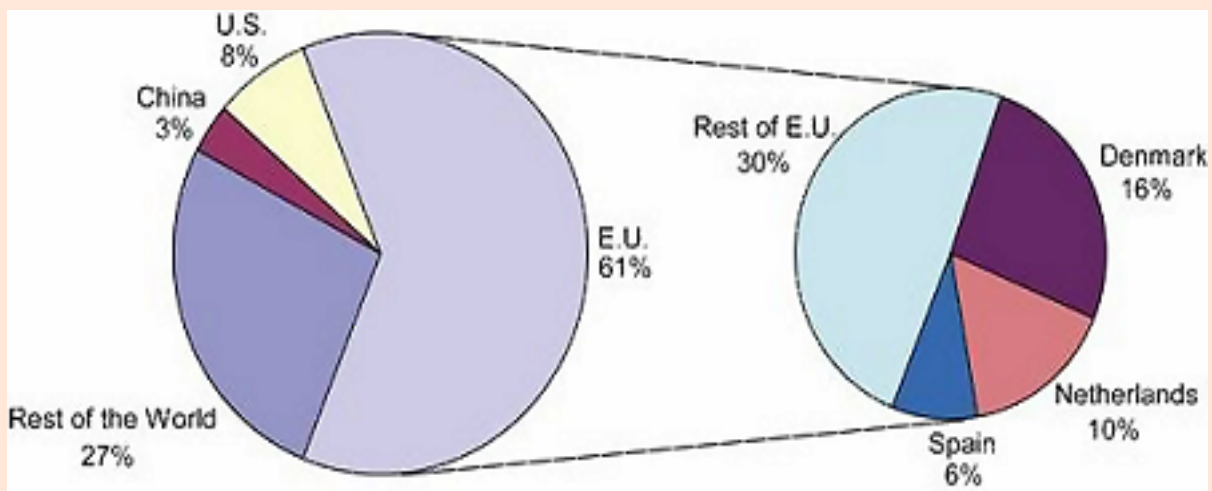
Spain's pork sector faced several other challenges along the path to its current success. Spain's pork producers and processors now face new challenges in the form of a more regulated production environment. Will Spain be able to maintain its competitiveness within the EU? The following discussion addresses this question by looking at the results of earlier challenges, how new policies and regulations are changing the EU industry, and implications for the future success of Spain's pork sector.

## Drivers of Change

### *Domestic Demand*

A major driver of the significant expansion of Spain's pork sector has been domestic demand. Meat consumption, of pigmeat in particular, has grown at a remarkable rate in Spain over the last two decades. Between 1985 and 2002,

1. Unless otherwise stated, the term EU refers to the 15 member countries prior to the 2004 enlargement.



**Figure 1.** World pigmeat exports, average 2000-2002.

Source: FAOSTAT (<http://apps.fao.org/default.jsp>).

Note: Annual world pigmeat exports averaged 8.0 million metric tons in the 2000-2002 period.

annual per capita meat consumption in Spain increased by more than 50%, from 77.9 kg to 118.5 kg, and annual per capita pork consumption almost doubled, from 36.5 kg to 66.6 kg, over the same period. As a result, in 2003 Spaniards ranked as the world's second-largest consumers of pigmeat on a per capita basis, behind Austrians.

The noticeable increase in the domestic demand for pigmeat can be largely attributed to the substantial growth in per capita income experienced by Spain after it joined the EU. Spaniards have a strong preference for cured meat products. On a per capita basis, Spaniards are the world's largest consumers of cured ham, and cured products in general account for about half of the consumption of processed pigmeat. In turn, processed meat makes up 80% of total pigmeat consumption in Spain. Cured products are relatively expensive items and tend to be more responsive to increases in income than are more economical meat products. Thus, increasing income levels in Spain translated into higher

demand for cured products such as "Serrano ham."

Spain's significant income growth is likely attributable, at least in part, to its accession into the EU. Given this, it is reasonable to expect Spain's income growth rate to fall to more normal levels, implying that domestic demand is unlikely to drive growth as prominently in Spain's pork industry.

#### **Animal Disease**

Outbreaks of classical swine fever (CSF) in 1997 and 1998 and the discovery of bovine spongiform encephalopathy (BSE) in the United Kingdom in 1997 had a noticeable impact on the rapid pace of transformation in Spain's pork sector. While more than 800,000 pigs were being culled in an attempt to eradicate CSF, many consumers were responding to the news of BSE by substituting pork for beef. The simultaneous drop in pork supplies and increase in pork demand led to a sizeable jump in pig prices, triggering a flurry of investment in new state-of-the-art production facilities.

Then, as output from the new facilities entered the market and the pork supply increased, prices fell to record lows, prompting the least profitable pig operations to exit the business. The outcome of this process was a swine sector consisting mostly of new operations with modern facilities and extremely efficient production practices. Small operations virtually disappeared; most medium-sized operations became associated with either cooperatives or corporations; and two or three large producers came to control more than 80% of pig production in Spain.

The CSF outbreaks also triggered vertical integration in the meatpacking industry. Reduced capacity utilization due to culling, together with the high pig prices, led the largest meatpacking firms to integrate with pig producers to ensure a steadier stream of animals for their operations. Some of these companies integrated vertically downstream as well, establishing their own chains of retail shops. Much of the integration took the form of cooperatives, associations, and corporations, although some meatpackers opted to establish

their own pig production facilities to secure supplies.

### **Technological Change**

Increased vertical integration and construction of new facilities allowed Spain's swine sector to become a technology leader within the EU. Prior to these changes, Spain's pig producers lagged other major EU producers in the use of technology. Now, more than half of Spain's pigs are produced in state-of-the-art facilities, some of which can house more than 10,000 sows.

This technological advancement has been accompanied by increased specialization, both in type and geographic location of production operations. Specialized farrowing and finishing operations are now far more common than are farrow-to-finish operations, and production has tended to concentrate in the regions of Catalonia (finishing), Castilla-Leon (farrowing), and Aragon (finishing). One likely driver of Castilla-Leon's farrowing specialization is its greater distance to ports, resulting in a higher relative cost of imported feed.

As noted, most of Spain's large-scale meatpacking operations became vertically integrated after the CSF outbreak. However, the processing industry remains very atomistic.<sup>2</sup> As of 2000, there were about 900 slaughterhouses, 2,300 cold warehouses, 2,100 meatpacking plants, and 4,700 processing plants for the red meat sector as a whole. Pork

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2. *It is worth pointing out, however, that in general the pigmeat processing sector in the EU is much less concentrated than in the United States. One notable exception is in Ireland, where the sector is dominated by two firms.*

makes up about 60% of all meat supplies, and the industry tends to be somewhat more concentrated for pork than for other meats. In 2003, the top 10 slaughterhouses accounted for 30% of pig slaughter, and the top 36 slaughterhouses accounted for 60%.

The large number of processing plants stems in part from the substantially larger share of processed pork (80%) sold relative to sales of unprocessed pork (20%). Still, there is evidence of inefficient use of processing plants, with capacity utilization estimated at less than 30%, although Catalonia's meat plants appear to be substantially larger and/or more efficiently utilized than is the average meat plant in Spain.

### **Product Differentiation**

Spaniards have a strong preference for cured pork products and are the world's largest consumers of cured ham on a per capita basis. In recent years, the processed pork market has experienced a major shift toward quality differentiation. To target demand for high-quality products, the industry has begun to implement traceability systems throughout the pork market channel, and producers of cured pork products have been highly proactive in seizing opportunities and offering products with greater appeal to consumers. Among other initiatives, Spanish producers have taken advantage of EU legislation on geographical indications and traditional foods. As of January 2007, for example, Spain was one of only nine EU countries with protected designations of origin (PDOs), and one of only two with designations of traditional specialty guaranteed (TSGs) for pork products.<sup>3</sup> Spain had the only ham TSG (Serrano ham) and held four PDOs for ham alone (surpassed only by Italy).

These efforts to promote high-quality cured products are exemplified by Serrano ham, a typical ham consumed by Spaniards. Historically, Serrano ham was not strictly standardized in terms of quality. Recognition of Serrano ham as a TSG changed this situation by providing legal protection to the Serrano ham designation and requiring stringent, standardized production processes and quality norms. The aggregate value of all hams marketed as PDOs increased by over 200% between 1991 and 2002, and the market for Serrano ham increased at a significantly higher rate than did markets for other pork products.

### **Government Support Programs**

The EU Common Agricultural Policy (CAP) stipulates provisions to stabilize pork markets, mainly by setting up a price system and regulating trade with non-EU countries. To cushion large price declines, the CAP price system allows the EU Commission to issue aid for private storage and/or export refunds for pork products when prices drop below 103% of the basic price established by the EU. The price system also allows the EU Commission to authorize intervention purchases of pork when prices fall substantially below the basic price. Although intervention purchases have not been used for at least two decades, aid to private storage and export refunds have often been used. Also, pork imports from non-EU countries are subject to licenses and taxes, and additional import duties can be levied when there is a risk that imports could destabilize the EU market.

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3. *Interestingly, none of the new EU members had PDOs or TSGs for pork products.*

The EU also provides special financial assistance for animal disease emergencies. To prevent the spread of diseases such as CSF, the CAP forbids animal movement in affected areas and stipulates the purchase and destruction of animals in these areas. These operations are co-financed by the EU Commission and the member states. This type of financial assistance proved to be very important for Spain during the 1997 CSF outbreak.

Historically, EU producers of many commodities received government support in the form of direct payments, but this has not been the case for swine producers in Spain. In 2003, the EU announced a major reform of the CAP, including provisions designed to shift producer support from direct payments to decoupled payments (that is, from output-dependent payments to payments not linked to production volume). In the case of pigs, the impact of the CAP reform is estimated to be minimal because swine producers have not received direct payments.

Some sources predict that EU swine producers will benefit indirectly because the CAP reform will reduce the price of feed grains. However, others argue that cheaper feed grains will likely enhance the competitiveness of pig producers in countries that joined the EU in 2004. Thus, the overall impact on Spain's pig producers will most likely be very small, with any minor indirect benefit from lower feed prices being offset by stronger competition from some of the newly merged states.

### **Environmental and Animal Welfare Regulations**

Concurrent with the development of Spain's swine sector, high population density and increased environmental concerns over intensive production

systems have triggered tighter EU environmental regulations. Given the higher compliance costs associated with these regulations, many EU producers either reduced herd sizes or exited the business. In relative terms, Spain's lower population density and less-demanding regulations provided a more nurturing background for new investments in pig production than did other EU countries. Now, however, the increasing geographic concentration of pig production and limited availability of land on which to dispose of manure have heightened environmental concerns.

In response, EU and national legislation have imposed ever stricter environmental regulations. These regulations limit inventories and output in some of the most affected EU regions and provide incentives to induce pig producers to exit the industry. For example, new regulations for Catalonia restrict the maximum size of individual production facilities and require producers either to have a minimum amount of land available per animal for waste disposal or to invest in advanced manure-handling technologies. Some producers are forming cooperatives and using EU subsidies for alternative sources of energy to build waste disposal plants that transform livestock waste into electricity and fertilizer.

In addition, recent legislation at both the EU and national levels reflects public concern over animal welfare (see ECDGA, 2004). In 2001, the EU Council adopted two directives establishing new minimum animal welfare standards for pig production. Among other measures, the directives ban the use of tethers and individual stalls for pregnant sows and gilts, establish minimum light requirements and maximum noise levels, require that pigs have perma-

nent access to materials for rooting and playing, and establish a minimum weaning age of four weeks. Such controls will be applied to producers in third countries exporting pork to the EU as well.

In 2004, the EU Council approved new regulations for the welfare of pigs during transport. The regulations include rules for trips lasting more than eight hours, significantly higher standards for vehicles used to transport live animals, and checks on vehicles using satellite navigation systems. Significantly for Spain, the EU Commission has agreed to propose new regulations before 2011 regarding maximum travel times and animal densities during transport.

The stricter transportation regulations will increase the cost of moving pigs, reduce the feasibility of transporting live animals, and will likely have a noticeable impact on Spain's swine industry because the geographic specialization of its production operations requires substantial movement of animals within the country. In addition, even though Spain is neither the EU's largest exporter nor the EU's largest importer of pigmeat, Spain is a major trader of live animals.<sup>4</sup> In 2002, Spain imported 1.5 million pigs (mostly piglets from the Netherlands

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4. *The largest exporters of pigmeat in the EU are Denmark and the Netherlands, whereas the largest importers are Germany and Italy. In 2002, pigmeat exports by Denmark and the Netherlands were almost three and two times larger, respectively, than Spain's pigmeat exports, and pigmeat imports by Italy and Germany were about ten and eight times greater, respectively, than Spain's pigmeat imports.*

and France) and exported 1.1 million pigs for slaughter (mostly to France and Portugal).

Overall, this more demanding regulatory environment can be expected to limit the rate of growth of pig production in Spain, and in the EU in general. Further, the new rules will likely be easier to implement in new facilities, which may provide countries joining the EU in 2004 or later a relative advantage over traditional EU production regions as the former develop their pork sectors.

### **EU Enlargement**

In May 2004, the EU enlarged to 25 member countries. The 10 new member countries immediately added 30.8 million pigs to the EU herd, an increase of about 25.4% from the previous inventory. In the near term, EU enlargement does not seem to pose a threat to Spain's pork production industry. Of the new members, Poland has by far the largest number of pigs, but production is highly fragmented, and only 10 of Poland's 3,000 pig slaughterhouses are authorized to export to the EU-15 (the 15 EU countries before expansion). Hungary added the second-largest number of pigs, but about 20% of these stocks are held on small family farms with aging facilities. Significant investment will be required to upgrade the pork sector in either country.

In the longer run, some of the same forces that promoted pork production in Spain (such as lower labor costs and more lenient environmental regulations) may favor relocation of production to new member countries. And, as noted, the competitiveness of producers in the newly merged countries will likely be enhanced if the CAP reform leads to cheaper feed grains. Competitive feed

costs, lower environmental standards, and the proximity of large import markets (for example, in Russia and the Ukraine) should attract foreign investment to Poland, Hungary, and the Czech Republic. For example, U.S.-based Smithfield Foods, the world's largest pork processor and hog producer, has recently made significant investments in Poland (and in Romania, as well). According to its Web site (<http://www.smithfield-foods.com/home.asp>), Smithfield Foods has anticipated "... that through its adoption of a market economy, Poland will resume its place as a premier and dominant supplier of meat and other agricultural products to Europe and other parts of the world."

Counteracting the impact of the potential competition from the new member countries in world markets is the prospect for a substantial increase in their domestic pork consumption. The 10 countries that joined the EU had a combined population of 74 million, all with a long-standing tradition of consuming pork. Although income levels in the new member countries are lower than those in the former EU15, they are likely to increase at a relatively rapid rate for the foreseeable future, which should help drive increased pork consumption.

### **Future Implications**

Spain has achieved enviable success in modernizing and expanding its pork sector, but its producers and processors will need to continue along the path of rapid transformation to remain competitive. It appears, for example, that Spain's processing sector is ripe for consolidation. The high volume of slaughter pig exports, the large number of small plants, and the high level of

underutilized capacity suggest significant inefficiencies in this sector.

Additionally, the costs of implementing increasingly restrictive environmental and animal welfare regulations in Spain will likely hamper the trend toward greater geographic specialization and growth in live pig exports. The regulations may also give pork producers in the 10 new EU member states an advantage as they incorporate provisions of the regulations in newly constructed facilities. Similarly, rationalization of the processing sector in those countries will likely involve the construction of state-of-the-art plants that have lower costs and are able to meet more stringent food safety regulations required by export markets.

Although the CAP reform is not expected to have a major impact on Spain's pork sector, the recent addition of 10 new member states to the EU may have a big effect. The magnitude of this impact will depend on the extent to which producers and processors in the new member countries obtain capital to build or upgrade facilities to meet increased consumption within their own countries.

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# Marketing Wine on the Web

By Susanne Stricker, Rolf A.E. Mueller, and Daniel A. Sumner

*JEL Classifications: Q13, Q17*

Wine purveyed on the World Wide Web joined many similar ventures with a big splash in the late 1990s. And, as with such ventures, some swam, some just bobbed, while others simply sank.

Marketing wine is information-intensive. Information moves with the product in every marketing step: sellers must find buyers or vice versa, sellers must describe the wine (shielded from sampling in its tightly sealed bottle), a price and other conditions must be posted or negotiated, and the winery and its customers must have proof of having agreed on an enforceable, legal sales contract. Advances in the technical efficiency of providing and communicating information may therefore reduce transaction costs and change the composition of total marketing costs for wine. Cost reductions from increased information efficiencies translate into an extended relevant market for any one winery, and into richer and more intensive communication between the winery and its customers. Moreover, changes in the composition of marketing costs may affect the competitiveness of sales channels, and new sales channels may become economically viable.

The Web has revolutionized communication and it provides the platform for e-commerce, defined as the use of the Web for buying and selling goods and services (OECD, 2003). Winery Web sites that are listed on Google or on other search engines make it easy for buyers to find their favorite winery. If properly designed and programmed, the Web site may provide customers with rich information about the wines that are offered, although wine, unlike books, music CDs, and DVDs, cannot be sampled on the Web. Maintaining a wine shop on the Web, where customers may purchase wines online, reduces information costs for wineries and their customers, but because wine is a physical product, distribution costs per bottle of wine remain largely unaffected by e-commerce. Nevertheless, the changes in the composition of marketing

costs brought about by the Web may be large enough to cause wine sales to increase, to shift a significant part of total wine sales from conventional sales channels to the Web, or to shift the composition of wine consumption.

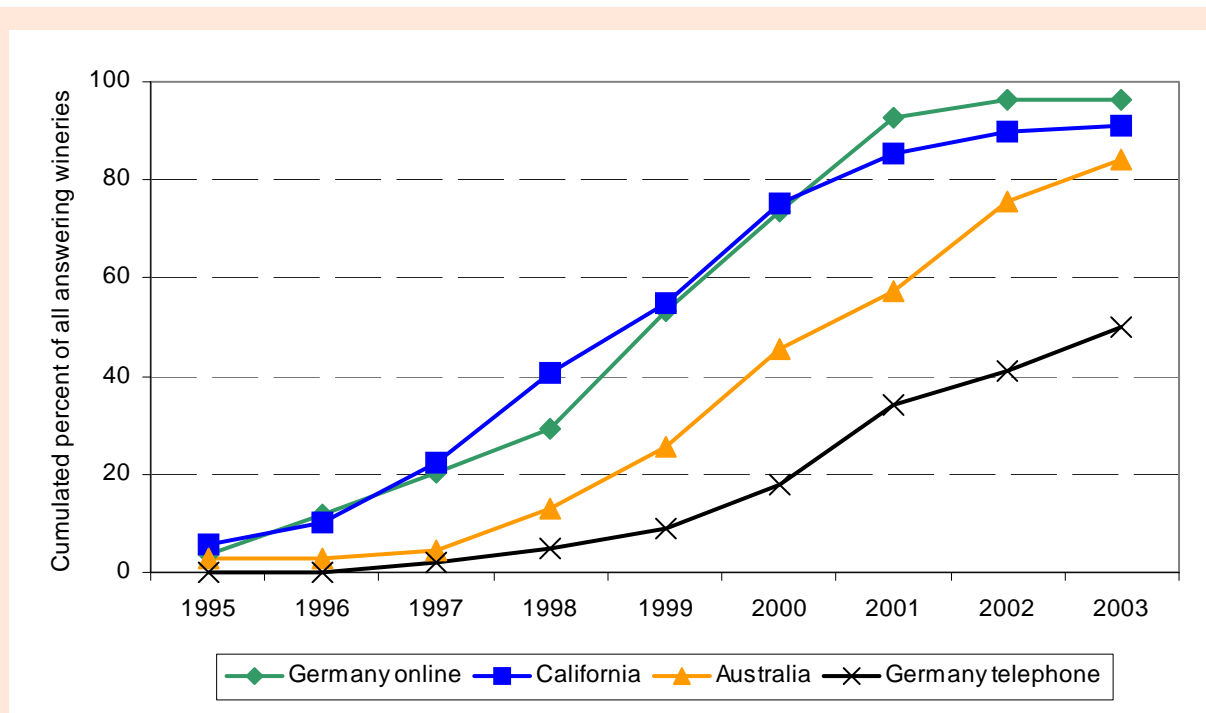
California wineries were early adopters of e-commerce, providing an opportunity to study the adoption, use, and impact of the technology. Moreover, because e-commerce has not spread evenly through all branches of U.S. agriculture, lessons learned from the wine industry may provide useful insights for entrepreneurs and policymakers concerned with accelerating the uptake of e-commerce in the rest of agribusiness. We decided to conduct an empirical study of the practice of e-commerce by wineries in California. We also included in our study wineries from Australia and Germany so that we can compare e-commerce practices across wine industries. Here, we summarize the key results (see Stricker, 2004, for more information).

## Online Winery Survey

We surveyed wineries in California, Australia, and Germany during the third quarter of 2003. We contacted by e-mail 1,690 wineries, asking them to fill out a questionnaire on the Web, and received 268 online responses: 89 from California, 70 from Australia, and 109 from Germany. In addition, we received 100 survey responses for German wineries through telephone interviews.

## Wineries in California, Australia, and Germany

The wine industries of the three regions differ with respect to the size composition of their wineries and the significance of direct sales. California wineries (which number about 2,500) are predominantly family owned and operated businesses. A few large wineries, such as E. & J. Gallo Winery, Robert Mondavi Winery, Sebastiani Vineyards & Winery, and Bonny Doon Vineyard, have established



**Figure 1.** Cumulative share of wineries with Web sites by region, 1995–2003 (n=368).

brands that are well known, and they market most or all of their wine through established retail channels. Many of the smaller wineries produce insufficient quantities to supply large supermarket chains, and they sell much of their wine directly to consumers and restaurants.

The wine industry in Australia has been growing at a rapid pace, and it, like the wine industry in California, is characterized by a small number of larger wineries and a large number of smaller ones. As of 2003, there were 1,625 wine producers in Australia of which only 324 crushed 50 tons or more of grapes. Of the 324 wineries, the smallest 122 jointly crushed less than 1% of all grapes, and the largest 11 winemaking businesses accounted for more than two-thirds (68.6%) of the national grape crush in 2003. The size distribution of wineries in Germany is less skewed because there are hardly any large wineries with well-established brands

while there are very many small wineries.

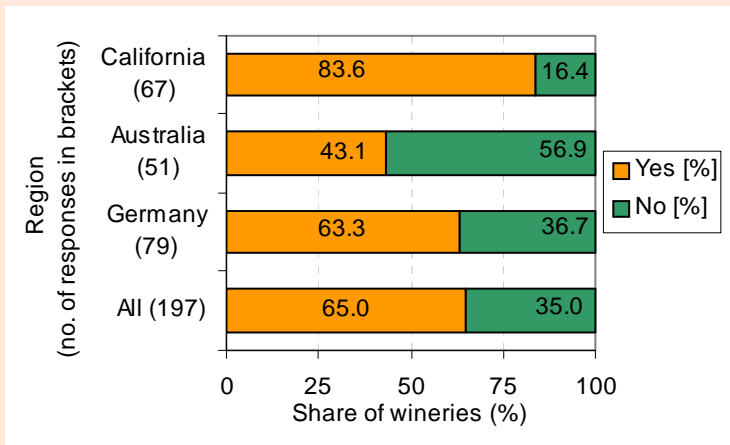
The wine industries in general are reflected in our sample. The respondent wineries from California are mostly family owned and operate large vineyard areas compared to the wineries in Australia and Germany. California wineries also employ the most full-time labor, on average. Median wineries in Australia and Germany are of comparable size – in total as well as in our sample, but the share of family-owned wineries is much smaller in Australia than in Germany.

### Web Site Diffusion and Use for Wine Sales and Tourism Promotion

The diffusion of Web sites among wineries in California, as well as in Australia and Germany, has the typical sigmoid shape (Figure 1). Wineries in California created Web sites as soon as the Web began to expand

into commerce in 1995. Diffusion was slow until 1997, when only about 20% of the respondent California wineries maintained a Web site of their own. After 1997, it took only four years until more than 80% of the California wineries had established a presence on the Web. After 2001, few additional California wineries joined the ranks of wineries with an online presence. In California, Web site diffusion is nearly complete, with 98% of the respondent wineries operating a Web site.

Most Web sites of California wineries (75%) are designed for online sales. The share of wineries that use their Web sites for selling wine is considerably lower in Australia (59%) and in Germany (42%). Web sites can also be used for promoting a winery's tourism activities, such as winery tours, restaurant and barbecue facilities, or accommodations. Given the low cost of Web space, we were surprised that California wineries made such limited use of the Web



**Figure 2.** Share of wineries whose Web site has increased direct wine sales.

to promote tourist activities aligned with their wineries. Although nearly two-thirds (61.8%) of California wineries offer winery tours, only 40.4% advertise winery tours on their Web sites, and only about half of the wineries that offer accommodations or picnic facilities make visitors to their Web sites aware of what is available.

## Lessons Learned

We can highlight five lessons from our survey on winery e-commerce.

### 1. Marketing wine on the Web works

More than 80% of California wineries claimed that their Web site had increased their direct wine sales (Figure 2). The percentage of wineries with increased direct wine sales from their Web site is particularly high in California. In Australia and Germany, Web sites boosted direct wine sales for only about half of the wineries surveyed.

The results in Figure 2 should be interpreted with care. If wineries that are particularly successful on the Web are more likely to participate in online surveys than those with indifferent or worse impacts of their Web

sites on wine sales, our results put winery e-commerce in a better light than it actually deserves.

### 2. Winery Web sites stimulate tourism activities

Most wineries in California that promote tourism activities on their Web sites reported that tourism activities have increased (Figure 3). We do not know whether the increase can be fully attributed to the Web site. However, most wineries in Australia and Germany also reported increased tourism activities, and Web site promotion most likely increases tourism activities at a winery.

### 3. Web site usability and maintenance are key

Web sites must be both functional and easy to use, and visiting them should be a pleasant experience. The designs of winery Web sites varied widely, and we did not attempt to measure the impact of design characteristics on Web site impact. We found, however, a significant relationship between the frequency of Web site maintenance and direct wine sales and tourism activities. If the frequency of Web site maintenance is a reliable indicator of the

effort and attention a winery gives to its Web site, this effort seems worthwhile.

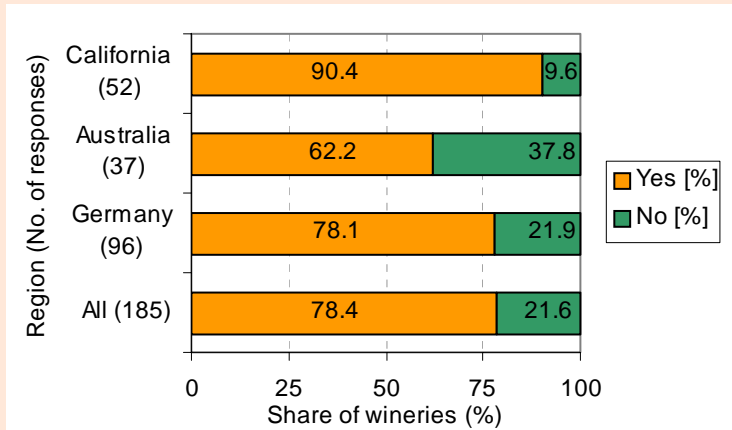
### 4. Sales channel conflicts must be resolved

All wineries that sell wine on the Web also use conventional sales channels, and the Web channel overlaps with conventional channels with regard to the products and customers. Moreover, marketing wine on the Web may constrain pricing of wine in conventional channels because prices posted on a Web site can be so easily monitored. However, only about half (52%) of the California wineries offered the same collections online and offline, and California wines sold on the Web are, on average, \$1.45 per bottle more expensive than all wines offered by our respondent wineries. We cannot say whether the higher prices, on average, are caused by the desire to avoid channel conflicts or whether they are the result of high shipping costs in direct wine sales in the United States.

### 5. Transport costs still limit the size of the market

When e-commerce was an infant industry, pundits foresaw the "death of distance." Direct marketing on the Web is, however, best suited for goods that can be digitized. For these goods, the Internet reduces both transaction and delivery costs. In contrast to words, music, video, and air tickets, wine cannot be digitized and must be shipped in its bulky form. Moreover, delivery of wine must comply with U.S. alcohol laws.

Delivery costs for wine are still high, and the costs of shipping small consignments of wine internationally are prohibitive. In 2003, it cost between \$11 and \$17 to ship a 12-bottle case of wine within California, and between \$13.50 and \$54.00 per



**Figure 3.** Share of wineries whose Web site has increased the use of tourism activities.

case outside of California. High international shipping costs keep most wineries from accepting orders from abroad. A California winery that once accepted an order from the United Kingdom reported shipping costs of \$140 for eight bottles. Compared to bulk shipments, which cost less than \$1 per bottle shipped from California to a re-seller in Europe, shipping costs for small consignments typical of direct marketing orders are grossly unattractive. Selling wine on the Web is therefore an activity that continues to be strictly constricted by distance and is only feasible at the upper end of the price range.

### Outlook: Long-tail Opportunities for Wineries

Information technology advances rapidly. The Web site technologies available in 2003, at the time the survey for this study was conducted, are now known as Web 1.0 technology, which is currently being superseded by Web 2.0 technologies. The new technologies enable users to interact with each other by means of blogs, wikis, public Web spaces, and allow monitoring of Web users' behavior in

the Web-sphere. The new technologies further extend users' capacities to search for suitable products, and they allow users to share information about products and producers. Examples of the new technologies are book reviews not by editors but by normal readers on Amazon.com and ratings of sellers by buyers on eBay or on Amazon. Similarly, given the opportunity, we would expect wine connoisseurs to make public their opinions of wines that are sold on the Web, thereby complementing wine recommendations and ratings provided by wine gurus and vendors. Publicly accessible information of this kind allows buyers to venture into the long tail of markets that consists of highly diversified market niches that may not be provided by established middlemen (Anderson, 2006).

Since we conducted our survey, the U.S. Supreme Court has struck down state laws that prohibited California wineries from selling wine directly to out-of-state consumers, and many states have now liberated direct interstate wine sales. Whereas these new laws will benefit all California wineries, the new Web tech-

nologies will be mostly to the advantage of small boutique wineries.

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# Overview: Immigration, U.S. Agriculture, and Policy Reform

by Ximing Wu, Guest Editor

Immigration has increased significantly in the past two decades. In March 2005, there were 37 million foreign-born U.S. residents. Among them, 31% were naturalized citizens, 39% were legal immigrants and nonimmigrants, and the remaining 30% were unauthorized immigrants. It is believed that the actual number of unauthorized immigrants is even higher. Due to the rising number of unauthorized foreigners, there is an increasing pressure on immigration policy reform. In fact, one of the priorities of both the previous and current House and Senate is the reform of the current immigration policy.

The farm sector is one of the most important sectors that hires a large number of immigrants, especially low-skilled immigrants. Moreover, more than half of the immigrants working in the farm sector are unauthorized. Not surprisingly, the most significant recent immigration policy changes had its roots in agriculture. In 1986, under the Special Agricultural Worker legalization program of the Immigration Reform and Control Act (IRCA), more than 1.1 million Mexicans became legal immigrants.

## Policy Reform

The influx of immigrants and the looming immigration reform obviously poses both an opportunity and a challenge to U.S. agriculture. Three options are discussed in current policy debates on immigration reform: (1) status quo, (2) enforcement of border security, and (3) enforcement, plus guest worker programs and legalization. The general consensus is that the status quo is not optimal. However, there is a heated debate between the enforcement-only approach and the comprehensive approach. The 2005-2006 House supported the enforcement approach while the Senate favored the comprehensive approach. The current Senate has again listed immigration

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reform as one of its priorities and is now working on a new initiative concerning this issue.

In this special theme, we review the impact of immigration and the possible consequences of various policy reforms on U.S. agriculture, labor market, and rural communities.

## Labor Market

One of the concerns of enhancing border security is its potentially negative impacts on the labor supply to the U.S. farm sector, which relies heavily on foreign workers. However, as suggested by Emerson, and Boucher and Taylor, the practical effectiveness of border security enhancement can be rather limited. On the one hand, foreigners determined to cross the border often eventually succeed, maybe after repeated trials. On the other hand, this enforcement will also deter unauthorized immigrants who want to cross the border from within the United States.

Regarding the legalization proposal, there is a concern that once given legal status, there will be an exodus of newly legalized foreign workers from the farm sector. However, Emerson argues that the available evidence does not support this claim. In terms of legalization's wage impact, Emerson suggests that the overall wage cost of

immigrants might be higher because of the elimination of wage penalty for unauthorized immigrants, but this will probably be compensated by the removal of potential risk associated with hiring unauthorized foreigners.

A popular perception of immigrants' impact on native Americans is that increasing immigration lowers the wages of native workers. Although there is limited evidence on the high-skilled segment of the labor market supporting this claim, it is generally not true for low skilled workers, including farm workers. One reason offered by Lewis is that native Americans and foreign workers tend to have different kinds of jobs, even when they are in the same sector or labor market segment.

### **Agricultural Production**

Although their impacts on native Americans are small, immigrants are found to influence the U.S. agricultural production through various channels. Emerson and Lewis both suggest that farmers tend to adapt different production technologies

and crop mixes according to the relative supply of low-cost farm labors. Because of the adaptability of technology and crop mix, the long-run effect of policy reform is projected to be small.

### **Fiscal Impacts**

Like native Americans, most immigrants pay taxes. At the same time, some of them are eligible for public services. Although there are some concerns on the fiscal burden imposed by immigrants on the public service system, existing evidence often suggests positive net fiscal impacts. Regarding unauthorized immigrants, Lewis reports that the percentage of this group taking advantage of public services is significantly smaller than that of other groups. On the other hand, most immigrant workers, regardless of their legal status, pay payroll taxes.

### **Trade**

The relationship between trade and immigration goes in both directions. Boucher and Taylor report that the

North American Free Trade Agreement (NAFTA) increased the immigration from Mexico. On the other hand, Emerson indicates that reduction in foreign labor supply can prompt changes in trade, especially trade in labor-intensive agricultural products.

### **Rural Communities**

Even in rural areas, the immigrant population differs from native residents in their social, economic, and cultural lives. Martin reviews various approaches and their consequences on how rural communities deal with the influx of immigrants. It is suggested that if private-public partnerships share the costs of integrating migrant workers, their families will turn an increasing immigrant workforce into a "positive externality" that benefits both local agriculture and community development.

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# Policy Shocks and the Supply of Mexican Labor to U.S. Farms

By Stephen R. Boucher and J. Edward Taylor

*JEL Classifications: F16, F22, J43, J61*

Immigrant farm workers from Mexico are unquestionably one of the most critical inputs to U.S. agriculture. They have facilitated the expansion of fruit, vegetable, and horticultural production, particularly in the Southwest. Their availability affects production technologies and enhances the ability of U.S. producers to compete with low-cost producers abroad.

A study of the supply of labor to U.S. farms immediately takes one to villages in rural Mexico where farm labor migration originates. According to the National Agricultural Worker Survey (NAWS), 78% of the U.S. farm workforce in 2001-02 was foreign-born and 75% was from Mexico. Just over half of all farm workers were unauthorized immigrants (U.S. Department of Labor, 2005). The actual share of unauthorized workers in the farm workforce is likely higher than this, because some do not reveal their true legal status.

In 2003, with support from a USDA NRI grant, we launched what to our knowledge was the first study of U.S. agricultural input supply ever conducted outside the U.S. borders. The Mexico National Rural Household Survey (ENHRUM), carried out jointly by UC Davis and El Colegio de Mexico in Mexico City, canvassed a nationally and regionally representative sample of households in rural Mexico in an effort to ascertain what drives the supply of labor to U.S. farms and the effects of U.S. immigration and trade policies on farm labor migration.<sup>1</sup> This paper summarizes our key findings.<sup>2</sup>

1. ENHRUM is the Spanish acronym for *Encuesta Nacional a Hogares Rurales de México*.

2. Boucher, et al. (2007) provide a more detailed discussion of this research.

## The Importance of Mexican Migrant Labor

Nowhere are the U.S. and Mexican economies and societies more closely interwoven than through migration. The 2000 U.S. Census found that 9.2 million, or 1 out of every 12, Mexican-born persons were living in the United States.<sup>3</sup> Analysis of the March 2005 Current Population Survey found that 30% of the foreign-born population was unauthorized, and 56% of the unauthorized migrant population, or 6.2 million, were from Mexico (Passel, 2006). These migrants are employed primarily in agricultural and low-skilled manufacturing and service jobs. While migration draws human resources out of households and communities throughout Mexico, it also generates a major source of income for the Mexican economy. The Banco de Mexico (2006) estimates that Mexican migrants sent home, or remitted, \$20 billion in 2005. Migrants, the “people export,” thus generated four times more revenue for the Mexican economy than agricultural exports and only slightly less than oil exports. Migrants to U.S. farms come overwhelmingly from rural areas, where poverty is concentrated in Mexico. Remittances from farm workers represent a *de facto* poverty alleviation policy, providing injections of capital into areas cut off from credit markets and that have been more spectators than participants in Mexico’s recent growth. Understanding the dynamics of U.S. agricultural labor migration and the potential impacts of policies on these dynamics, thus, is a research priority from the viewpoint of policymakers and farmers in Mexico.

3. Census data on the foreign-born are available online at <http://census.gov/prod/2003pubs/c2kbr-24.pdf#search=%22mexico%20foreign%20born%202000%20census%22>.

This is also a priority for policy makers and farmers in the United States. Labor constitutes approximately one-third of total costs of fruit, vegetable, and horticultural production in the United States. Most new entrants into the farm workforce are unauthorized immigrants from rural Mexico. California highlights the importance of Mexican migration in U.S. agriculture. It is the largest agricultural producer in the United States. Nearly all its seasonal agricultural workforce comes from households in rural Mexico. NAWS data reveal that more than 90% of California's 1996 seasonal workforce was foreign-born, and 90% of these foreign-born workers were from Mexico (Mines, Gabbard, & Steirman, 1997).

### Immigration and Trade Policies

How have immigration and trade policies affected the supply of Mexican labor to U.S. farms? We examined the effects of the three key immigration and trade policy changes of the last twenty years: 1) Increased border enforcement expenditures; 2) The 1986 Immigration Control and Reform Act (IRCA); and 3) The North American Free Trade Agreement (NAFTA). These are the major policy shocks that may have affected the supply of rural Mexican labor to U.S. farms.

Increased enforcement along the U.S.-Mexico border, through such operations as Gatekeeper and Hold-the-Line, was aimed at directly deterring unauthorized immigration from Mexico by making illegal border entry more costly. While this may make villagers think twice about attempting to migrate, past research suggests that the majority of those who attempt an illegal border crossing eventually succeed. Because

increased border enforcement also potentially has the unintended effect of deterring return migration from the United States back to Mexico, the net effect is ambiguous (Public Policy Institute of California, 2002; Singer and Massey, 1998).

IRCA represented a unilateral policy effort by the United States to control migration via sanctions against employers who knowingly hire unauthorized immigrants. However, it also included a one-time general amnesty program and two special concessions to U.S. farmers. The Special Agricultural Worker (SAW) Program legalized an additional 1.2 million immigrants, the majority from Mexico. The Replenishment Agricultural Worker (RAW) program allowed for new immigration to alleviate farm labor shortages caused by SAWs leaving agriculture. However, the RAW was never used, because the Department of Labor determined that there were no farm labor shortages in the early 1990s, despite employer sanctions.<sup>4</sup> Indeed, the U.S. Commission on Agricultural Workers (1992, p. xix-xx) concluded that there was "a general oversupply of farm labor nationwide" and, "with fraudulent documents easily available," employer sanctions were not deterring the entry of unauthorized workers.

NAFTA opened borders for trade and investment between Mexico and the United States and reinforced an on-going process of agricultural liberalization in Mexico. NAFTA and the concurrent domestic reforms in Mexico were only partially motivated by migration concerns; nevertheless, they were expected to have far-reach-

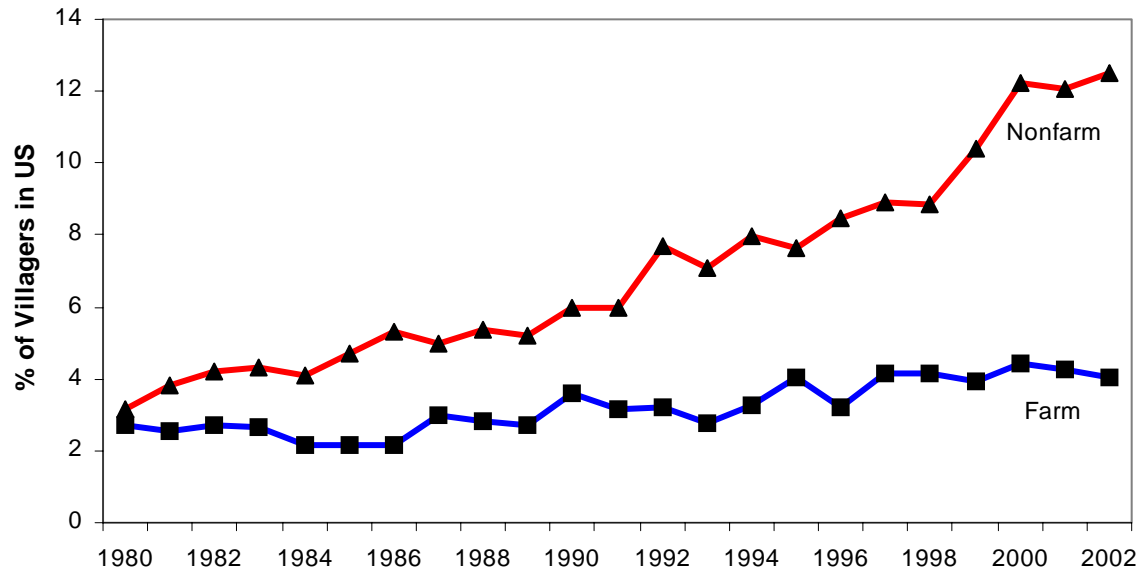
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4. *An excellent discussion of IRCA and U.S. agriculture appears in Martin (1994).*

ing impacts on migration flows. President Salinas argued that opening up markets would help Mexico export more goods and fewer people, thereby reducing migration pressures. In theory, however, the effects of NAFTA on migration from rural Mexico are ambiguous. On one hand, one would expect economic liberalization to decrease production of maize and other goods that could be imported more cheaply from the United States, increasing emigration pressures. On the other hand, it could stimulate agricultural exports, as well as nonagricultural production in Mexico that may absorb displaced rural workers. Thus, just like border enforcement and IRCA, NAFTA's effects on migration from rural Mexico to the United States are ambiguous.

### Data Challenges

Analyzing how a specific policy impacts migration dynamics is no easy task. In order to see whether or not and how migration patterns change in response to a policy, data on the number of migrants and where they work are needed for a sufficiently long period both before and after the policy is implemented. Until very recently, this type of data has not been available. The United States and Mexican Census of Agriculture and Population are too infrequent and do not collect the necessary information on immigration and sector of employment. Data are available on the number of apprehensions at the border; however, these data do not indicate where successful migrants work. Finally, scattered village surveys in Mexico provide some detailed migration information. However, the samples are small, not nationally representative and, in most cases, do not cover sufficiently long time periods



**Figure 1.** Percentage of Mexican villagers in U.S. farm and non-farm jobs.

to examine the impacts of new policies.<sup>5</sup>

The ENHRUM overcomes these problems. This survey was administered to 1,600 Mexican households in 2002 and is representative of rural Mexico at both the national and regional levels. The survey is unique in that it makes it possible to explore the dynamics of U.S. agricultural labor supply from Mexico and how they may have changed over time. It does so by reconstructing individuals' migration and work histories, including immigrants' sector of employment in the United States each year between 1980 and 2002. This time period is sufficiently long to permit us to examine both IRCA's and NAFTA's impacts on migration patterns. In what follows, we will focus on the West-Central region of Mex-

ico, including the states of Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, Nayarit, San Luis Potosí, and Zacatecas, because it has the longest history of sending migrants to the United States. According to the NAWS, in 2001-02 the largest share of Mexican-born farm workers (46%) was from just three West-Central Mexican states: Guanajuato, Jalisco, and Michoacán. From 2001 to 2004, 51.6% of the U.S. agricultural work force and 65.2% of California farm workers were from this region.

### Migration Trends

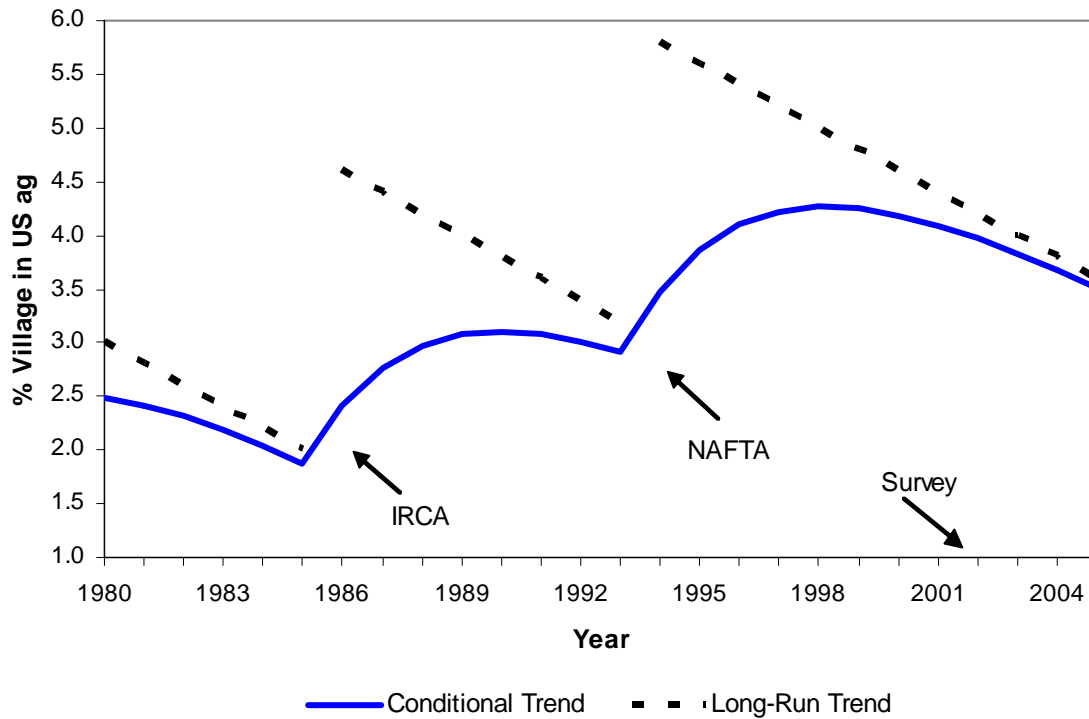
How have overall patterns of migration to the United States from this region evolved over the past two decades? Figure 1 shows the fraction of adults from the villages that migrated to the United States to work in farm and non-farm jobs. The figure reveals several interesting patterns. First, overall migration to the United States increased sharply.

Combining farm and non-farm migration, the share of villagers working in the United States increased from 5.8% in 1980 to 16.5% in 2002. The trends are quite different, however, for the two sectors. While the share of villagers migrating to farm and nonfarm jobs was nearly the same in 1980, migration to non-farm jobs increased much faster than to farm jobs. Nevertheless, a slight increasing trend is evident in migration to farm jobs as well. The fraction of villagers migrating to farm jobs increased from 2.7% in 1980 to 4% in 2002. The question we explore is 'what role, if any, did the policies play in this trend?'

### Findings and Discussion

What would migration to U.S. agriculture have looked like in the absence of the three policies described above? To answer this question, we econometrically model the dynamics underlying the farm labor migration curve in Figure 1. We do

5. *Some of the Mexico sample-based studies include Cornelius, 1989; Donato, Durand, & Massey, 1992; Orrenius and Zavodny, 2003.*



**Figure 2.** Conditional migration trends to U.S. agriculture.

this using a standard dynamic panel technique in which the current share of villagers in U.S. farm jobs depends on the past share, a time trend, other variables affecting the economic returns and costs of migrating, and variables measuring the three policy changes. This method makes use of both the time series and cross-sectional variation in the data. We test whether the migration trend changed significantly in years when U.S. border enforcement expenditures increased and in 1986 and 1994 when IRCA and NAFTA, respectively, were implemented.

Two main findings emerge from the analysis. First, once we control for other variables shaping migration, increases in border enforcement expenditures do not affect migration to U.S. farms. This suggests that border enforcement, even if it increases the odds of apprehension on a given

attempt to cross the border, does not deter new immigration. An alternative explanation is that increased enforcement decreases new migration, but also deters return migration by those already in the United States who anticipate a more difficult re-entry in the future.

The second major finding is that the upward trend in farm labor migration evident in Figure 1 was, in fact, policy induced. Without IRCA and NAFTA, the trend would have been negative; that is, over time, the share of rural Mexicans migrating to work on U.S. farms would have decreased. Figure 2 isolates the impacts of IRCA and NAFTA. The downward sloping dotted lines show that in the medium to long run there is a tendency for migration to farm jobs to decline. This decreasing trend, however, was temporarily interrupted first by IRCA and then

by NAFTA. The solid curve shows that each policy was associated with about a one percentage point increase in the share of villagers migrating to U.S. farm jobs over the four-year period following the policy's implementation. This represents nearly a 40% increase compared to pre-policy levels.

The finding that farm labor migration increased after IRCA suggests that the SAW legalization program created a stimulus for migration that outweighed the deterrent effect of employer sanctions for hiring unauthorized workers. There are three ways in which legalization may have increased farm migration. First, family reunification invariably follows legalization. This would bring new migrants from rural Mexico into rural areas of the United States and possibly into farm jobs. Second, there may have been a surge in new migra-

tion to apply for easy legalization under the SAW program. Third, the SAW program may have sent a message to rural Mexicans that working on U.S. farms could provide access to future legalization programs.

Interpreting the positive effect of NAFTA on farm migration is difficult because of the many complex changes underway in Mexican agriculture and the overall economy. Nevertheless, an increase in migration is consistent with agricultural production and productivity trends in Mexico. Both Mexico's agricultural exports and its grain imports increased sharply after it joined NAFTA. At the same time, Mexico's export agriculture became more capital intensive, resulting in an overall decrease in farm employment. For example, in 2002, Mexican agriculture produced 15% more output with 10% fewer workers than in 1991 (Taylor, 2003). The bottom line is that, for rural Mexicans lacking the human capital to transition into nonfarm sectors, NAFTA and related reforms may have increased the incentive to migrate to the United States in search of farm work.

### Migration and the Future of Agricultural Labor Markets

This analysis raises interesting and critical questions for agricultural labor markets in the United States. We are now more than ten years after the implementation of NAFTA. Figure 2 suggests that the initial increase in migration to U.S. farms that was associated with NAFTA has played itself out, and the long-run trend of decreasing agricultural labor migration is reasserting itself. This is consistent with recent increases in real agricultural wages and reports of labor scarcity on farms (*Rural Migration News*, 2006). In light of this,

farmers and policymakers face two alternatives. One alternative is to take new measures to increase the supply of foreign labor. This option is controversial, as reflected by the heated debate over legalization provisions in current immigration reform proposals. Our findings suggest that, with or without immigration reforms, the trend in supply of labor from rural Mexican households to U.S. farms is decreasing. This raises questions concerning the long-run feasibility of using gatekeeper policies to increase this labor supply. The other alternative is to allow farmers to adjust to a tighter labor market via labor-saving technologies and farm management practices. The choices that are made will have far reaching ramifications for farmers and farm workers in the United States, as well as for households in rural Mexico.

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# Immigration Reform, Agriculture, and Rural Communities

by Philip Martin

*JEL Classifications: J61, J48, J08*

The farm workers of tomorrow are growing up today outside the U.S., making immigration policy a major concern of farmers who hire workers and the agricultural communities in which immigrant farm workers increasingly settle. Farmers have relied on waves of newcomers to fill especially seasonal jobs for the past 150 years in California, but immigrant farm workers have, over the past two decades, spread throughout the United States. According to the National Agricultural Workers Survey (NAWS), most hired farm workers were born and educated abroad, and most are not legally authorized to be employed in the United States.

In the mid-1980s, when perhaps a quarter of the farm workers in states such as California were unauthorized, a last-minute compromise between farm employers and worker advocates allowed 1.1 million Mexicans, a sixth of the adult men in rural Mexico, to become legal immigrants under the Special Agricultural Worker legalization program of the Immigration Reform and Control Act (IRCA) of 1986. IRCA's sanctions on employers who knowingly hired unauthorized workers were expected to halt illegal migration, and farmers were expected to raise wages and improve conditions in order to retain legal workers. Fears of labor shortages prompted a new survey, the NAWS, and an easy-entry guest worker program to quickly provide additional workers, the never-implemented Replenishment Agricultural Worker program.

In fact, IRCA accelerated unauthorized migration, and Latino immigrant farm workers spread throughout the U.S., from seasonal jobs on farms to construction, service, and manufacturing jobs in rural and agricultural areas (Martin et al., 1995). Today, seasonal farm jobs continue to serve as a port of entry for newcomers from abroad, increasing the risk of a sudden change in the availability

and cost of farm workers in the event of enforcement of existing or revised immigration laws. At the same time, many workers and their families are unsure of their future in the U.S., while the communities in which they live struggle to cope with growing numbers of foreigners and do not know if they are sojourners or settlers. Rising numbers of unauthorized foreigners, as well as agreement that the status quo is not optimal, have increased pressures for immigration reform.

## Immigration Reform

In March 2005, there were 37 million foreign-born U.S. residents, including 31% naturalized U.S. citizens, 39% legal immigrants and nonimmigrants such as foreign students and legal temporary workers, and 30% unauthorized. The increase in the number of unauthorized workers has been especially fast in recent years, with the estimated number of unauthorized foreigners rising faster than the number of legal immigrants in some years.

Opinion polls find that most Americans want additional steps taken to prevent illegal migration. A December 2005 *Washington Post*-ABC News poll reported that 80% of Americans think the federal government should do more to reduce illegal immigration, and 56% agree that unauthorized migrants hurt the United States more than they help it (Balz, 2006). An April 2006 *Los Angeles Times* poll found that 63% of Americans favored stepped-up enforcement, as well as a guest worker program to deal with illegal migration, while 30% favored stepped-up enforcement only (Barabak, 2006).

The House and Senate took distinctly different approaches to illegal migration in 2005-06. The House, in December 2005, approved the Border Protection, Antiterrorism, and Illegal Immigration Control Act (H.R. 4437)

**Table 1.** Status of foreign-born U.S. residents, March 2005.

	Percent	Millions
<b>Naturalized U.S. Citizens</b>	31%	11.5
<b>Legal immigrants and nonimmigrants</b>	39%	14.4
<b>Unauthorized</b>	30%	11.1
<b>Total</b>	100%	37

Source: Passel, 2006, p. 3.

on a 239 to 182 vote. It takes an enforcement-only approach to unauthorized migration, calling for mandatory screening of newly hired, as well as existing employees, to ensure they are legally authorized to work in the United States and adding more fencing along the Mexico-U.S. border. It also includes several controversial items, such as making "illegal presence" in the United States a felony, which may make it hard for unauthorized foreigners to eventually become legal immigrants. The House bill does not include a guest worker or legalization program, under the theory that enforcement should be proven effective before additional migrant workers arrive legally and before the government deals with unauthorized foreigners in the United States.

The Senate approved the Comprehensive Immigration Reform Act of 2006 (S2611) in May 2006 on a 62-36 vote. It too contains measures that would increase border enforcement and require employers to verify the legal status of their employees by submitting information to a new government database. However, the Senate bill also includes new earned legalization and guest worker programs, the "comprehensive" approach favored by President Bush.

The major legalization provisions would allow unauthorized foreigners in the United States at least five years to become "probationary

immigrants" by proving they had worked in the United States paid any back taxes and a \$1,500 fee, and passed English and background tests. At the end of six years of continued U.S. work and tax payments and another \$1,500 fee, these probationary immigrants could earn regular immigrant visas. Unauthorized foreigners in the United States for two to five years would have to satisfy the same requirements, but in addition, return to their countries of origin and re-enter the United States legally. Those in the United States less than two years would be expected to depart, although they could return legally as guest workers.

The Senate bill has two new guest worker programs. Under the proposed H-2C program, employers in any U.S. industry could "attest" that they need migrants and that the employment of migrant workers "will not adversely affect the wages and working conditions of workers in the United States similarly employed." Foreigners outside the United States with job offers from such U.S. employers could pay \$500 and obtain six-year work permits. Employers could apply for immigrant visas on their behalf of H-2C visa holders after one year of U.S. employment, and H-2C visa holders could apply for immigrant visas on their own after four years of U.S. work and passing an English test.

The second new guest worker program, the Agricultural Job Opportunity, Benefits, and Security Act (AgJOBS), would allow up to 1.5 million unauthorized foreigners who did at least 150 days or 863 hours of farm work during the 24-month period ending December 31, 2006 to obtain a blue-card probationary immigrant status (this information is for S340 and HR371, AgJOBS as introduced January 10, 2007). Blue-

card applicants must pay an application fee as well as a \$100 fine, and apply in the period between seven and 18 months after enactment.

Blue-card holders could earn an immigrant status by doing (1) at least 150 days (at least 5.75 hours) of farm work during the first three years, (2) 150 days of farm work per year for three years and 100 days in one year in the first four years, or (3) 100 days of farm work a year during the first five years. Blue-card holders could also do nonfarm work and travel in and out of the United States. After proving that this farm work was done and that income taxes were paid, blue-card holders could pay \$400, plus an application fee, and apply for immigrant status for themselves and their immediate families. Blue-card workers are eligible for UI and EITC benefits, but not welfare benefits such as Food Stamps.

The House bill makes reducing illegal immigration and employment its top priority and does not deal with unauthorized foreigners in the United States or employer requests for new guest worker programs. Some House leaders have suggested that, as new enforcement measures make life more difficult for unauthorized foreigners, some will depart on their own, and eventually the smaller number that remains could be legalized.

The Senate bill involves a three-legged stool of enforcement, guest workers, and legalization. No one knows how its components might interact to affect farm workers and farm labor markets. For example, would legalization lead to a new industry creating work histories of at least two years or 150 days of farm work, or would immigration adjudicators tap into administrative data systems such as those for unemployment insurance to determine work

done? Would workers without documentation leave the United States, or would they go further underground in the U.S. economy, perhaps complicating the enforcement of labor and tax laws?

### Implications for Agriculture

Some 555,000 U.S. farms reported hiring workers in the Census of Agriculture (2002), with the largest 10% reporting 60% of all workers hired.<sup>1</sup> These workers are both newcomers to the farm labor force, meaning they had their first U.S. farm job less than 12 months before being interviewed, as well as more established workers. Newcomers interviewed by the National Agricultural Workers Survey (NAWS) are almost all unauthorized; a higher percentage of established farm workers are legally authorized to work in the U.S. Newcomers have about 10% lower earnings, reflecting both their lack of experience and unauthorized status.

Newcomers were in the United States less than 24 months and employed in U.S. agriculture less than 12 months before being interviewed.

Farmers worry about what will happen if the influx of unauthorized workers slows as a result of stepped up border and interior enforcement. The turnover rate among farm work-

1. *The 2002 Census of Agriculture reported 554,434 farms hired 3 million workers and paid them \$18.6 billion; the 55,431 farms that hired 10 or more workers hired 1.8 million workers. Workers are reported by each farm on which they are employed, making COA data counts of farm jobs, but these "direct-hire" data exclude workers brought to farms by intermediaries such as labor contractors.*

**Table 2.** Newcomer and established farm workers, 1993-2000.

Unauthorized (%)	Newcomer			
	1993-94	1995-96	1997-98	1999-00
California	91	97	96	99
Other U.S.	99	100	100	97
<b>Established Farm Workers</b>				
California	31	32	30	49
Other U.S.	35	35	40	39
Average Hourly Earns(\$)	Newcomer			
California	5.02	5.35	5.53	6.13
Other U.S.	5.34	5.09	5.43	6.01
<b>Established Farm Workers</b>				
California	5.78	5.72	6.25	6.81
Other U.S.	5.48	5.79	6.02	6.88

Source: NAWS.

ers is at least 15%, meaning that only 85% of the workers employed one year are also employed the next. If enforcement stopped newcomer entries, farmers could turn to guest worker programs to obtain workers.

The current H-2A program presumes that U.S. farmers will normally find sufficient U.S. workers to fill farm jobs. Farmers anticipating too few U.S. workers can ask the U.S. Department of Labor to certify their need for foreign workers, which occurs after supervised recruitment efforts and inspection of housing for out-of-area workers. Requesting H-2A workers alerts unions and advocates, who sometimes sue employers for not hiring U.S. workers who respond to the (required) farmer's ads. Advocates often raise questions about the need for foreign workers in areas with double-digit unemployment rates. Even though over 95% of farm employer requests for H-2A workers are certified by the Department of Labor, many farmers say the program is "unworkable."

Farmers want three major changes in the H-2A program that are included in the AgJOBS provisions of the Senate bill. First, they want attestation to replace certification. Under attestation, employers

control the border gate by making assertions to the government that they have vacant jobs and are paying the prevailing wage, foreign workers arrive, and enforcement responds to complaints. Second, farm employers want to pay a housing allowance of \$1 to \$2 an hour rather than provide the free housing required under the current program.

Third, farmers want to eliminate or freeze the Adverse Effect Wage Rate (AEWR), the minimum wage they must pay to legal guest workers, \$9 an hour in 2006 in California.<sup>2</sup> The AEWR is usually the highest of the three wages farmers must offer: the federal or state minimum wage, the prevailing wage, or the AEWR. AgJOBS would freeze the AEWR at its 2003 level, \$8.44 an hour in California, for three years while it is studied. Rolling back the AEWR to its 2003 levels could save current users of H-2A workers 5-7% on wages and

2. *The AEWR is higher than the wage offered to many farm workers because it includes the earnings of piece rate workers, who have higher hourly earnings but work fewer hours.*

make it easier for more farmers to begin hiring H-2A workers.

Farmers confronting increased production and marketing risks realize that the rising share of unauthorized farm workers adds another risk to their operations. The rising labor risk is being dealt with primarily by investments in the political process, as farmers try to convince policy makers that they need legal workers at current costs if steps are taken to reduce illegal immigration. Despite reports of farm labor shortages over the past few years, plantings and sales of labor-intensive crops have continued to increase.

### **Implications for Communities**

The typical newly arrived seasonal farm worker is a 25-year old male from rural Mexico who is not authorized to work in the United States (NAWS). While in the United States, newcomer farm workers earn an average \$8 an hour for 1,000 hours of farm work, earning about \$8,000 (the 2006 poverty line is \$9,800 for one and \$20,000 for a family of four). Many workers form or unite families in the United States, especially as they move up the U.S. job ladder to less seasonal nursery, livestock, or farm-related processing and packing jobs.

Young immigrant workers soon have U.S.-born children, which means that immigrant families in rural and agricultural areas are often mixed in the sense that some members are unauthorized, some may be legal, and others may be U.S. citizens by birth. Eligibility for public services is uneven, with all children obliged to attend K-12 schools, but only legal low-income U.S. residents are eligible for means-tested benefits such as Food Stamps, Medicaid, and other assistance. Since many farm

and rural employers do not provide health insurance and other work-related benefits, there can be impacts on local emergency rooms as immigrants and their families seek services and are unable to pay bills. Many rural areas are not expanding public services, making it more difficult to add bilingual services that educate newcomers about their rights and responsibilities (*Rural Migration News*, Quarterly; Pfeffer and Parra, 2005).

Immigration has always meant change, from the number and characteristics of the people living in an area to new patterns in housing, culture, sport, and ways of life. In some rural areas, the choice may be to diversify or depopulate, since local industries may shrink or shut down without immigrant workers. In other areas, immigrants swell populations and introduce new forms of mobility to rural America. Instead of local young people leaving rural areas for college, immigrants may arrive to fill entry-level jobs that the U.S.-educated children reject. The result can be an immigration treadmill, as some rural employers depend on a continued infusion of newcomers, while some local residents resent the changes that accompany immigration.

Agriculture is associated with both the “positive externalities” of preserving open space and providing a living link to the founding fathers and “negative externalities” associated with items from waste disposal to water pollution. Without new private-public partnerships to share the costs of integrating migrant workers and their families, an increasing immigrant work force could come to be seen as a new negative externality associated with farming and processing. Some evidence of such community reactions is already evident in

Midwestern cities that rejected opening or re-opening meatpacking plants because of their fear of an influx of migrant workers.

Turning immigrants into a positive externality in rural and agricultural America requires leadership and commitment from employers, community leaders, and the immigrants themselves, but this leadership is unlikely to be forthcoming until the legal status of the foreigners is clarified. Rural America’s voice in the current immigration debate has been dominated by farm and other employers seeking to legalize access to a continued inflow of migrants. Rural leaders who do not directly benefit from such migration may have to decide if guest workers or immigrants are in the best interest of their communities. A guest worker future would mean more solo men living in temporary quarters while they work in the United States, allowing significant production facilities in areas with relatively few families. An immigrant future would mean more families and an associated integration challenge.

### **Conclusions**

Farmers and farm-related industries increasingly rely on foreign-born workers to fill mainly entry-level jobs. Many and perhaps most of these immigrant workers are unauthorized, increasing risks of sudden changes in labor costs in what is already a risky business and complicating integration efforts in rural America.

Today’s immigration reform debate has important implications for farmers, farm workers, and rural communities. There are three major options: status quo, enforcement only, and enforcement plus guest workers and legalization. The status

quo gets agriculture and associated industries a labor force, but with growing risks and externalities that are increasingly perceived as negative by most Americans. Enforcement threatens to raise labor costs and force adjustments, most likely unevenly across rural areas. Enforcement, coupled with guest workers and legalization, would potentially open a new era for rural America. If history repeats itself, legalization of unauthorized workers would expedite mobility out of farm and farm-related jobs, with the vacuum filled by guest workers. If the guest workers were allowed to become immigrants, as in the Senate bill, the result could be a significant demographic and economic change in rural America.

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# The Impact of Immigration on American Workers and Businesses

By Ethan Lewis

*JEL Classifications: J2, J43*

Immigration policy has become a vigorously debated topic in Washington. Strident demands for more restrictive policies and criminalization of illegal immigration are clashing with proposals to expand the number of temporary work visas and preserve America's traditional openness to immigration. In the meantime, surveillance along the Mexican border has been substantially increased. Farmers, many of whom depend heavily on undocumented Mexican labor, are understandably nervous and claim that the border crackdown is already leading to labor shortages.<sup>1</sup>

This article describes what role immigrants play in the U.S. economy and what economic impact they have on the United States. It examines immigration broadly, but because of its importance to the farm sector, special attention is given to Mexicans, who make up one-third of recent immigrant arrivals and over half of farm sector labor. Economists' research suggests that workers, consumers, and businesses likely benefit from higher immigration, but this is traded against potentially adverse distributional consequences for low-skilled Americans. However, most estimates suggest that the harm to low-skilled Americans is small. One reason for this seems to be that employers are able to adapt their production techniques to the types of workers that are available.

1. For example, a recent *Wall Street Journal* article featured a lettuce farm on a border town in Arizona, which claimed it was unable to fully harvest its crop as a result of the border crackdown (Jordan, 2005) and a recent *Associated Press* headline asserted directly, "U.S. Farmers Facing Labor Shortages" (Johnson, 2007).

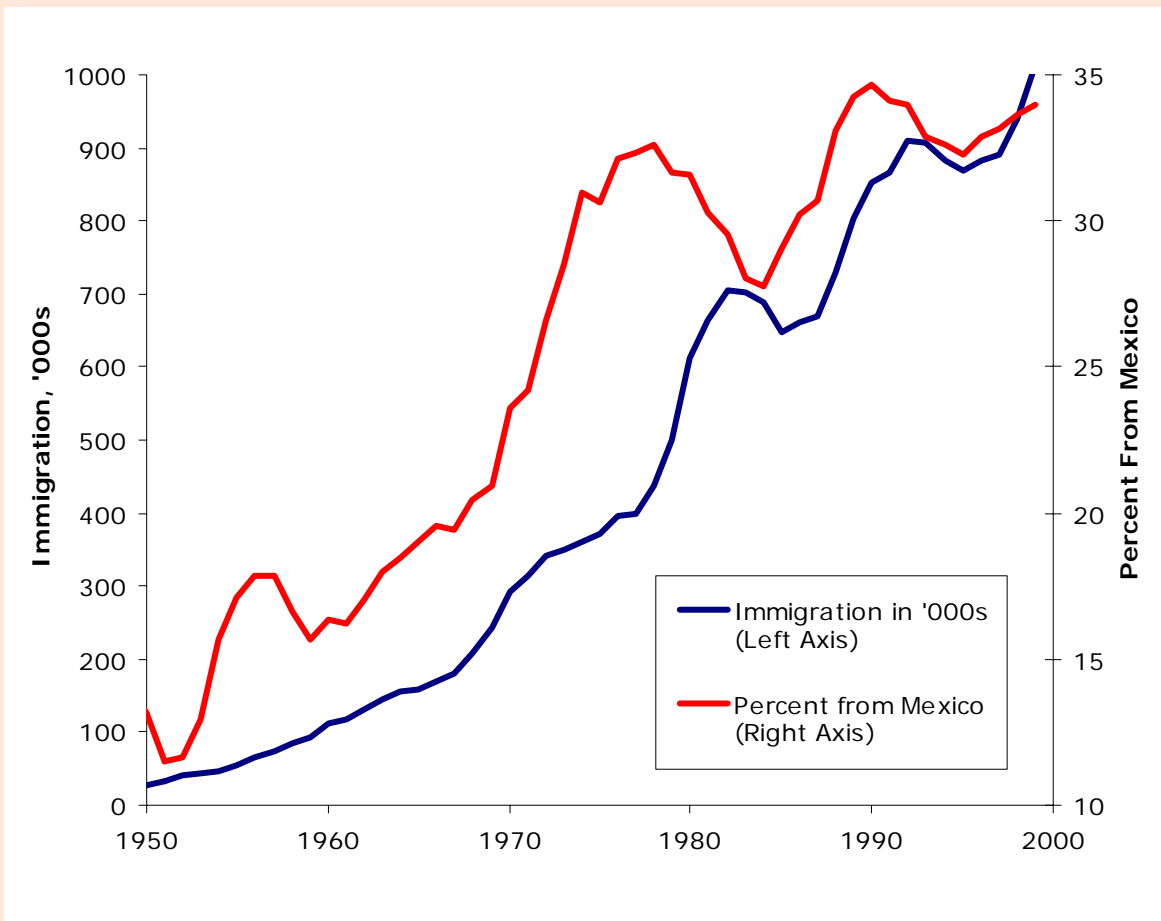
## Immigrants in the U.S. Economy

A factor likely contributing to clashes over immigration policy is the rapid growth in the sheer volume immigration, particularly from Mexico. Figure 1 shows the number of immigrants coming to the United States in each year of the post-war period and the proportion who are from Mexico.<sup>2</sup> Since the 1970s, Mexican immigration has dominated these inflows. Migrants from Mexico, many undocumented, now represent one-third of new immigrants.

Immigrants, and especially Mexican immigrants, tend to be less skilled compared to native-born Americans. One way to illustrate this is with their levels of education. Table 1 shows that one-third of all immigrants, and over two-thirds of Mexicans, never complete high school (many Mexicans, in fact, never attend high school), compared to only 16% of native-born Americans. Nevertheless, many other immigrants are also highly skilled; a larger proportion of immigrants than natives have advanced degrees.

Mexicans' skills are also reflected in the sectors in which they work. According to the Census, a disproportionate share of Mexicans (compared to natives) work in agriculture, construction, manufacturing, and retail (mostly restaurants). From the point of view of the industry, Mexicans are most important to agriculture. Table 2 shows that roughly half of all workers and three quarters of new hires in agriculture were undocumented Mexican immigrants.<sup>3</sup> In California, the numbers are even starker: 93% of new hires are undocumented Mexican immigrants. It is understandable, therefore, that farmers would

2. These figures are from the Census, which a number of studies have shown capture most illegal immigrants (e.g., Van Hook and Bean, 1998), in addition to legal immigrants.



**Figure 1.** Number of immigrants and percent from Mexico by year of arrival (from 2000 Census of Population, based on five-year moving average).

be concerned about an increase in border enforcement.

Another feature of recent immigration, which may contribute to policy clashes, is the dispersion of immigrants to parts of the country that have little recent experience with immigration. Some markets, especially in the Southeast and West, have experienced rapid changes in their ethnic mix as they have gone from being places that receive virtually no

3. *New hires are highlighted because they are likely to be more vulnerable to a border crackdown. Each year, 5-10% of farm workers are new hires.*

immigration to being new major immigrant destinations. In a recent paper, David Card and Ethan Lewis (2005) showed Mexican immigration has experienced a similar geographic dispersion, as fast job growth in the Southeast and other parts of the West have lured Mexicans away from traditional strongholds.<sup>4</sup> Traditionally, over 60% of Mexicans have settled in

4. *For example, during the 1990s, the number of Mexican immigrants in Phoenix, Las Vegas, Atlanta, Denver, Austin, Portland (WA), Raleigh-Durham, Greensboro, Salt Lake City, and Seattle grew over 300% (Card & Lewis, 2005).*

California, but since 1990, it has been less than half.

Along with the migration out of California, this paper showed Mexicans have shifted significantly out of agriculture towards construction. This sector shift recently received attention when thousands of Mexicans showed up in the Gulf Coast, a traditionally low immigration area, looking for hurricane reconstruction-related employment, but it is actually part of an ongoing shift of Mexicans out of agriculture.<sup>5</sup> The trend implies that farmers may find it increasingly difficult to recruit Mexican labor regardless of U.S. immigration policy.

**Table 1.** Education mix of native- and foreign-born workforce, 2000 (from 2000 Census of Population).

Education Level	Native-Born	All Immigrants	Mexican Immigrants
High School Dropout	11.6%	33.7%	66.8%
High School Graduate	28.3%	19.3%	17.9%
Some College, <4 years	33.0%	20.7%	11.2%
4-Year College Degree	17.9%	15.1%	2.7%
Advanced Degree	9.2%	11.2%	1.4%

**Table 2.** Sources of U.S. farmworkers, 2000-2002 (from the National Agricultural Workers Survey).

	Mexico-Authorized	Mexico-Unauthorized	Other (including U.S.)
<b>All U.S. Farms</b>			
All Farmworkers	24.2%	50.4%	25.5%
New Hires	3.1%	76.2%	20.7%
<b>California Farms</b>			
All Farmworkers	42.8%	50.3%	6.9%
New Hires	2.6%	93.1%	4.3%

### Overall Labor Market Impacts

What are the consequences of immigration for the United States? Are we economically better or worse off as a result of immigration? A misconception of some policymakers (or perhaps a position they take for rhetorical convenience) is that each immigrant who gets a job displaces one U.S.-born worker.<sup>6</sup> Because the scale of the U.S. economy is not fixed, however, this extreme position is unwarranted. Immigrants are not just workers after all, but consumers, and immigrant demand for products and services expands employment.

The story would end there if immigrants had skills in the same proportions as U.S. workers. Because immigrants are disproportionately low skilled, however, Americans ben-

5. *There have been several recent news stories on Mexican labor in the Gulf Coast area, and at least one Associated Press story made the explicit link to hiring difficulties in agriculture (Minor, 2006).*

efit from immigration. Economic theory says that immigration makes other inputs into production – like skilled labor and land – relatively “scarce,” and therefore raises their market value. To put it into concrete terms, if there are more low-skilled workers per acre of land, farmers can harvest more crops per acre of land, so their land is more valuable. U.S. consumers also benefit to the extent that immigrants drive down the cost of goods and services which use a lot of low-skilled labor, such as household production (maids and nan-

6. *For example, in a 2004 Senate hearing Tennessee Senator Lamar Alexander asked “If we have 8.4 million unemployed, according to our official statistics, and if 6 million illegal immigrants are working, are these 6 million taking the jobs that the 8.4 million want? Also, if these 6 million were not here, would we suddenly have virtually full employment?” (Congressional Record, 2004).*

nies). In a recent study, Cortes (2005) studied the impact of immigration on prices in 25 large U.S. metropolitan areas. She found that a 10% increase in immigration lowered the price of “low-skilled intensive” goods and services by 1%. The overall benefits to the U.S. economy are probably not trivial. A 1997 study by the National Research Council estimated that in the mid-1990s, Americans gained between \$1 and \$10 billion per year from immigration’s labor market impacts alone.

Not everyone benefits from immigration. Just as with international trade, the net benefit is positive, but there are both winners and losers. In this case, immigration’s benefits derive from reducing wages in the less-skilled jobs that immigrants take. While the average American will not be harmed by this – relatively few Americans work in low-skilled jobs – immigration may reduce the earnings of some low-skilled Americans. Determining the magnitude of these distributional consequences is the subject of a vigorous ongoing academic debate.

### Distributional Consequences

Although simple economic theories say that immigration will push down the wage of less-skilled Americans compared to other types of workers, it does not say how much wages will decline. This is an empirical question.

A large body of research attempts to evaluate immigration’s impact on wages. The most common approach exploits the fact that immigrants are geographically clustered. (For example, 80% of Mexicans historically settled in either California or Texas). These studies compare the labor market outcomes of U.S. natives in markets with more and less immigration.

There have been a large number of studies that have taken this approach. These studies typically examine groups of workers who might plausibly be expected to take similar types of jobs as low-skilled immigrants (for example, African-American high school dropouts). These studies also typically find that the impact of immigration is quite small. A 1995 summary of this research by Rachel Friedberg and Jennifer Hunt concludes, "Most empirical analysis . . . finds that a 10% increase in a fraction of immigrants in the population reduces native wages by at most 1%." One concern could be that wages cannot adjust because of minimum wage laws or union contracts. However, these same studies tend to find immigration does not have much effect on unemployment.

Studies since this 1995 summary have attempted to find narrower groups of Americans whose wages are affected by immigration. A 2001 study by David Card found immigration had a slightly larger impact on the relative wages of natives working in similar types of occupations as immigrants. Cortes (2005) found that the relative wages of native-born Hispanics with low English proficiency were lowered by immigration, but, as in previous studies, African-Americans' wages were not. Many studies (including Card, 2001; Peri & Ottaviano, 2006) find immigration lowers the wages of other immigrants.

The area analysis approach has been criticized as potentially understating immigration's impact due to the fact that immigrants may choose to live in cities with higher wages (or higher wage growth). That is, immigration does not make wages lower in high immigration cities than in low immigration cities; it makes wages

lower than they otherwise would have been in high immigration cities, something which is difficult to assess. One of the more interesting and credible ways researchers have addressed this problem is by examining areas affected by large waves of refugees. Since refugee immigration is arguably not driven by the economics of the markets where the immigrants settle, these events arguably provide good "natural experiments" with which to evaluate the impact of immigration. Card's (1990) evaluation of the impact of the Mariel boatlift on Miami's less-skilled workers was the first to employ this approach. Despite the magnitude of the event – the boatlift increased the number of low-skill workers in Miami (relative to other types) by over 10% in less than a year – Card found little evidence of even any short-run adverse consequences for Miami's low-skilled workers.<sup>7</sup>

Harvard University's George Borjas criticizes the area analysis approach for another reason. He argues that because the U.S. economy is highly integrated geographically, immigration's impact is not limited to the particular areas where immigrants settle, but rather is dispersed throughout the country. As a result, he argues, immigration's impact cannot be evaluated through cross-market comparisons. Instead of

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7. *Findings from other refugee studies since have confirmed these results. For example, Kugler and Yuksel (2006) found that Latin American refugees displaced by Hurricane Mitch in 1998 had little impact on the markets in which they settled. Similarly, Hunt (1992) found that a wave of Algerian refugees had little impact on the French labor market.*

comparing across geographic markets, Borjas examines the U.S. as a whole and exploits variation over time and across skill groups in the volume of immigration.

In a widely-cited 2003 paper studying immigration in general, and in a 2005 paper with Larry Katz focused on Mexican immigration, Borjas combines data from several decennial censuses and divides workers into education-work experience-year "cells" (categories). For example, the highest immigration cell in Borjas (2003) is high school dropouts with 16-20 years of experience in 2000 (50% foreign-born); the lowest immigration cell is high school graduates with 1-5 years of experience in 1960 (1.2% foreign-born). Comparing across cells rather than across regions of the country, he finds that native-born workers in cells that experienced larger increases in immigration, also experienced a relatively slower wage growth. His estimates imply an immigration-induced 10% increase in the supply of low-skilled workers reduces low-skilled wages by 4%.

Borjas's approach is not without problems. Bohn and Sanders (2005) find his estimates are sensitive to removing a small number of data points. In essence, the estimated impact appears to largely derive from the fact that there was a decline in the wages of high school dropouts between 1980 and 2000, at a time when many high school dropout immigrants were coming to the United States. It is tempting to link the two events, as Borjas's estimates do, but researchers have identified a number of other phenomena that may also have contributed to the decline, including technological change, increasing trade with the developing world, and a large decline in the real value of the minimum

wage. Borjas does not control for any of these other macroeconomic forces, and his estimates imply that most of the decline in the wages of high school dropouts was due to immigration. In addition, Raphael and Ronconi (2005) show that many of the high immigration experience-education groups are populated by Americans with high incarceration rates (young high school dropouts), which also harms average earning in those cells. Raphael and Ronconi show that once the effects of incarceration are taken into account, the estimated effects of immigration on wages are small.<sup>8</sup>

A different problem for Borjas' finding is that there is little evidence of immigration's impact being geographically dispersed in the way he describes. Two mechanisms underlie the geographic dispersion in Borjas' argument: the movement of people and intercity trade. The idea that these movements should, in the long run, make wages the same in all markets. Empirically, though, neither mechanism appears to be a major source of local labor market adjustment to immigration. Although a recent study by Borjas (2006) shows that native-born Americans expected to compete with immigrants avoid high immigration areas, an earlier study (Borjas, Freeman, & Katz,

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8. *On the other hand, Borjas and Abdurrahman Aydemir obtain similar results in Canada and Mexico, countries which have had very different immigration experiences from the United States. In Mexico, in fact, variation comes from workers emigrating to the United States rather than immigration. In Canada, immigrants are disproportionately high skilled, rather than low-skilled.*

1997) found similar estimates were sensitive to what was controlled for. Studies by Card and DiNardo (2000) and Card (2001) find little evidence that intercity migration of American workers dissipates local immigration shocks. The idea that the impact of immigration is geographically spread by native flight is also difficult to square with the simple fact that high-immigration areas tend to have more unskilled workforces.

Lewis (2003) and Card and Lewis (2005) also find little evidence that local immigration shocks are transmitted to the rest of the country through intercity trade. The theory behind the idea is that if immigration pushed down low-skilled wages in one market (say, Los Angeles), then employers in low-skilled industries that make goods that can be traded between markets (like apparel) would flock to that market and bid up wages for low-skilled workers. In fact, changes in industry mix are virtually uncorrelated with immigration flows. Both papers found that movements of industries across metro areas account for less than 10% of immigration-induced skilled mix shocks.

### **Then How Do Labor Markets Adjust to Immigration?**

Although economic theory does not specifically say how much immigration should affect low-skilled wages – only that it should push them down – the small estimates coming out of studies that compare across markets is nevertheless somewhat surprising to many economists. In fact, the size of immigration's impact depends on how similar U.S. and immigrant workers are and on how the economy is able to adapt to immigration.

One reason the impact of immigration might be small is that immigrants and native-born workers, even

in narrow education-experience groups, tend to work in different kinds of jobs. Trejo (1998) shows minimum wage immigrants and natives work in different jobs.<sup>9</sup> Peri and Ottaviano (2006) show that the overlap in the occupations of immigrant and native-born high school dropouts is no more similar than the overlap in the occupations native-born high school dropouts and native-born high school graduates. Still, the lack of occupational overlap could just reflect the fact that immigrants have displaced natives from certain types of jobs.

Another reason the impact of immigration may be small is that the economy might adjust to immigration in ways economists' models typically do not allow. For example, most models assume the same technology is used in all labor markets, and, related to this, machinery is assumed to be equally useful in substituting for work done by skilled and unskilled workers. In fact, research since Griliches (1969) suggests that machinery substitutes are better for low-skilled tasks than skilled tasks. Models in which technology and the stock of machinery are allowed to adjust more freely to immigration predict a smaller impact of immigration on wages.

To find out how important this is, Lewis (2005) examined the effect immigration has on employers' use of different production technologies and machinery. The paper focused on the use of automation technologies, like robotics, which were first used in U.S. factories during the 1980s. The paper found that in areas where immigration made less-skilled

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9. *Trejo found, for example, many of the minimum wage jobs immigrants take were in agriculture.*

labor abundant, plants used significantly less automation technology and less machinery generally than similar factories elsewhere. Similar sorts of adjustments occur in other sectors. Low-skilled immigration also appears to depress the adoption of computers (Doms & Lewis, 2006).

Possibilities for substitution of capital and technology for workers are likely to exist in agriculture as well. Researchers sometimes speculate that the abundance of Mexican labor forestalls greater mechanization (for example, Palerm, 1991). Examples are easy to think of: the Australian wine industry tends to rely on automatic harvesters to harvest their grapes, while California relies heavily on Mexican labor.<sup>10</sup> Future research may uncover exactly how adaptable the farm sector is to shifts in labor mix, but it does seem likely that farmers have some capacity to adapt if the level of Mexican immigration falls either because of increased border enforcement or because Mexicans are moving to other sectors of the economy.

## Summary

A boom in immigration to the United States has raised urgent concerns over what our immigration policy should be. In this context, it seems important to understand the consequences of higher levels of immigration for the United States. While the pro-immigrant aphorism “immigrants do jobs natives won’t do” is overstated, it is true that few Americans work in the low-skilled

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10. *This is not to say that the reduced mechanization is a bad outcome; on the contrary, it makes more economic sense to harvest crops with labor-intensive methods when labor is abundant.*

jobs that immigrants, especially Mexican immigrants, disproportionately take, such as in agriculture. As a consequence of this, most Americans benefit from immigration. Immigration may reduce the wages of some low-earning American workers who compete with immigrants for jobs, but evidence suggests U.S. labor markets are sufficiently flexible to absorb immigrants without greatly depressing low-skilled Americans’ earnings. One reason for this seems to be that employers are able to adapt their production methods to the available work force, which portends well for their ability to adapt to looming changes in immigration policy.

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# Agricultural Labor Markets and Immigration

By Robert D. Emerson

*JEL Classifications: J43, J61, J68*

Foreign workers have been an important part of U.S. labor-intensive segments of agriculture throughout U.S. history. Typically, these are specialty crops such as tree crops, vegetables, and nursery and greenhouse crops. Each requires large amounts of labor relative to other resources used in production. Tree crop and vegetable production on only has very large labor requirements, but the requirements are often concentrated into a very short time span of a relatively few weeks, particularly at harvest time. Nursery and greenhouse production has large, but nearly year-round labor requirements. While there has been considerable mechanization in agriculture, a number of fruits and vegetables, particularly for the fresh market, continue to be hand-harvested. Most greenhouse and nursery production utilizes manual labor.

Hired farm employment in the United States is dominated by foreign-born workers: 78% of crop workers were foreign-born in 2001-2002 (Carroll et al., 2005, p. 3). The same report indicated that 53% of crop workers lacked proper authorization to work in the United States during this same time period (p. 6). Most of the recent policy debate has concerned the latter group, the illegal foreign population in the United States. Although agricultural workers are now a small part of this population estimated to be 11.5 - 12 million in 2006, the proportion of workers in agriculture who are illegal is among the highest of any occupation (Passell, 2006). With the major presence of illegal foreign workers in agriculture and the legislative emphasis on illegal foreign workers, there are two sets of economic issues to isolate: 1) the economic effects of a significant augmentation of the workforce through legal immigration, and 2) the economic effects of working in an illegal immigration status. Emphasis is given to the

following economic indicators regarding the agricultural labor market: wage rates, length of time working in agriculture, technology, crop mix, and capital flows.

## Economic Issues

### Wage Rates

*Legal immigrants.* While some economists suggest that increased immigration has reduced wage rates for native-born, unskilled workers (Borjas, 2003), most have found negative wage effects of increased immigration extremely difficult to demonstrate once all appropriate adjustments are made. For example, the 1980 Mariel Boatlift from Cuba to Miami increased the Miami labor force by 7%, but had no significant effect on wages of comparable Miami workers (Card, 1990). A second example is the sudden, unanticipated 14% increase in the Israeli labor force by Russian émigrés over 1989-1996, resulting in no significant wage effects in the Israeli economy (Gandal, Hanson, & Slaughter, 2004). These two cases encompass both extremes of the skill distribution of immigrants: the Mariel Boatlift was a relatively low-skilled population, while the Russian emigrants to Israel were a relatively skilled group. Card (2005) summarizes studies based on U.S. data: “. . . although immigration has a strong effect on relative supplies of different skill groups, local labor market outcomes of low skilled natives are not much affected by these relative supply shocks” (p. F321).

The most important economic consideration in absorption of large numbers of immigrants without significant wage effects is that the host country operates as an open economy with minimal restrictions on trade in goods, production resources, and capital. The economic

**Table 1.** Real average hourly earnings for U.S. agricultural workers: constant (2004) dollars.

Item	1989-1998	1999-2001	2002-2004
<b>Authorized Workers</b>	7.49	7.97	8.31
<b>Unauthorized Workers</b>	6.90	7.26	7.25
<b>Difference</b>			
<b>Dollars</b>	0.59	0.71	1.06
<b>% of Authorized</b>	8	9	13

adjustments mitigating the wage effects are technological change, changes in the output mix of the economy, and the employment of additional factors of production complementary to the additional labor (Gandal, Hanson, & Slaughter, 2004; Freeman, 2006).

*Unauthorized workers.* Not only are most hired workers in agriculture foreign-born, but over half are unauthorized for work in the United States. Although there may be no significant wage effects from immigration, there are likely to be significant wage differences between authorized and unauthorized workers. The average earnings reported in Table 1 suggest sizeable differences in reported hourly earnings by authorized and unauthorized workers. Observed differences were 8 and 9% for the periods 1989-1998 and 1999-2001, respectively. Following 2001, however, real hourly earnings for unauthorized workers fell 13% below authorized worker earnings for the 2002-2004 period.

There are a number of reasons why the earnings of groups of workers could differ. For example, they may have different levels of experience, they may be of different age groups or gender, or they may be doing different types of work, etc. A standard way to address the question and isolate the effect of legal status, is to utilize the observed earnings of different types of workers to predict

their earnings in each legal status while holding all other worker and job characteristics constant. Estimates based on the 1989-2004 NAWS data for various combinations of worker and employment characteristics are summarized in box 1. Estimates suggest a wage penalty of 11% after 2001 for a typical illegal worker in agriculture. The wage penalty is much higher for skilled workers, but most agricultural workers are unskilled, not skilled.

The estimated wage penalties summarized in box 1 are qualitatively similar to earlier research by Taylor (1992) and Isé and Perloff (1995). The estimates are also in line with an estimated wage penalty of 14% to 24% for the broader labor force based on legalization under the General Legalization Program of the 1986 Immigration Reform and Control Act (IRCA) (Kossoudji & Cobb-Clark, 2002).

The ultimate question is what will happen to wage rates in agriculture under alternative immigration policy scenarios? Suppose for the moment that there are no changes in technology with the change in immigration policy so that the structure of labor demand by agriculture remains unchanged. With full legalization of unauthorized workers and access to guest workers, market-determined wage rates would be expected to remain at the level they currently are for legal workers; the only difference would be the absence of a wage pen-

**Box 1. Estimated wage penalties for lack of legal status\***

- 11% after 2001 for a typical illegal worker in agriculture (unskilled, employed directly by a grower, paid hourly, and working in California).
- As large as 23% of the predicted authorized wage.
- Two to three times larger in many cases following 2001 compared to 1989-2001.
- Two to three times larger for skilled work than for unskilled work.\*\*
- Larger for piece rate work than for hourly wage work.
- Smaller for workers employed by labor contractors than for workers employed directly by growers.

*\*Iwai et al., 2006a. For ease of comparison with other estimates in the literature, these and subsequent wage effects have been converted to the estimated penalty as a percentage of the wage as an authorized worker. In Iwai et al. (2006a), the effects were expressed as estimated premium for being legal as a percentage of the predicted wage as an unauthorized worker.*

*\*\*The Iwai et al. (2006a) definition for a skilled worker was someone doing supervisory work.*

alty for the formerly illegal workers.<sup>1</sup> The direct wage cost would clearly be

1. Note that the farm wage is largely determined by the nonfarm wage, and as noted earlier, research has largely shown that increased numbers of legal immigrants in the economy have had no significant effect on wage rates. Also, as summarized in the following section, research does not suggest an exodus from agriculture with legalization.

higher for employers under this scenario. However, a significant part of the eliminated wage penalty must be interpreted as a risk premium to the employer to compensate for potential losses through: 1) uncertainty about the potential removal of labor at a critical production time resulting from an immigration regulatory change, 2) the potential discovery and removal of illegal workers under existing regulations, or 3) facing penalties from having employed illegal workers. The remainder of the wage penalty is best attributed to the lower opportunity cost of illegal workers resulting from their more limited alternatives in an illegal employment status. The removal of this latter component of the penalty through legalization would result in a higher cost to employers if all workers were legal. However, the opportunity cost component has surely diminished over time as illegal workers have become more widely dispersed throughout the economy (Passell, 2006).

The alternative scenario of full removal of illegal workers, closing the border, and no significant guest worker program could result in increased wage rates in agriculture under the assumption of immobile capital and no changes in production technology or product mix in agriculture or other industries. It is argued below, however, that immobile capital and fixed technology and product mix are unlikely scenarios, and that once these assumptions are relaxed, the wage effects would be greatly reduced or eliminated.

A related issue is the extent to which illegal workers utilize more public services than their tax contributions. Moretti and Perloff (2000) found that participation in welfare programs<sup>2</sup> by unauthorized farm worker families was 8% in contrast to

27%, 30%, and 42% for citizen, amnesty, and green card farm worker families, respectively. Participation in social insurance programs<sup>3</sup> by unauthorized farm worker families was 2% in contrast to 21%, 38%, and 41% for citizen, amnesty, and green card farm worker families, respectively. Their analysis based on the NAWS does not permit a comparison of the tax contributions with service usage. However, since most pertinent tax payments are via payroll deductions or sales tax collections, the general belief is that tax contributions vary little by legal status. Examining the experience for overall U.S. immigration, a National Research Council publication reports that "... the average long-term fiscal impacts of immigration are generally found to be positive under most scenarios..." (Smith & Edmonston, 1997, p. 354). Their analysis included not only welfare and social insurance programs, but all public services, including public education. Important qualifications of their summary statement are the variations by attributes of the immigrants (a negative (positive) impact for immigrants with less (more) than a high school education), and a negative impact on state and local governments in areas of high immigration, but a strong positive impact at the federal level.

#### **Work Duration**

Labor availability is a continuing concern by agricultural employers. Labor-intensive specialty crops often have a narrow window when certain activities must be accomplished,

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2. *AFDC, Medicaid, food stamps, WIC, general assistance, or public housing.*
  3. *Unemployment insurance, disability insurance, or Social Security.*

requiring relatively large amounts of labor at those times, but relatively little labor during the rest of the year. Typically, crops requiring manual labor for harvest are the most time-critical and labor-intensive. The fact that the grower's income from the crop is contingent upon a timely harvest of the crop, the availability of labor at this point is obviously a major concern to the grower. One element of this concern is that currently undocumented workers in agriculture would leave agriculture for alternative employment once they achieve a legal immigration status. Similar concerns at the time of the passage of IRCA resulted in the Replenishment Agricultural Worker program (RAW) of IRCA. The RAW program provided authorization for foreign workers to legally work in agriculture if there were an agricultural labor shortage as determined by the Departments of Agriculture and Labor. Since a shortage was never declared by the Departments, the RAW program was never actually implemented.

Access to foreign workers has been one way that agriculture has attempted to secure a timely labor force. The vast *Bracero Program* (P.L. 78) was operational from 1942-1964 largely in the western states authorizing the migration of labor from Mexico to U.S. agriculture. The H-2A program (and its precursors) for agriculture was initially between the British West Indies and the United States, but more recently has focused on workers from Mexico. Although there were only 7,011 persons with H-2A visas admitted in fiscal year 2005, there were 22,141 in fiscal year 2004; the largest number over the past decade was in fiscal year 2000 with 33,292 persons with H-2A visas admitted (U.S. DHS, 2006, Table 26). The H-2A program clearly

accounts for a very small portion of the agricultural labor force. The program is typically found to be too cumbersome and expensive by growers: "H[-]2A is bureaucratic, unresponsive, expensive, and prone to litigation" (U.S. Congress, 2006).

AgJOBS (Agricultural Job Opportunities, Benefits, and Security Act of 2007, H.R.371, S.340) is a proposed guest worker program for agriculture that has the support of both labor advocates and grower organizations. A similar AgJOBS bill was attached to the U.S. Senate immigration proposal, S. 2611 in the 109<sup>th</sup> Congress. The distinguishing characteristic of AgJOBS, the *Bracero Program*, and the H-2A program is that each of them ties the worker for varying periods of time specifically to agricultural employment. The former *Bracero Program* and the H-2A program were, and are, strictly for agricultural work with no path to permanent residency in the United States. The proposed AgJOBS offers adjustment to a legal status for existing unauthorized agricultural workers meeting past agricultural work requirements in the United States, and with a possible path to permanent residency. Nevertheless, the initial years have a required period of work in agriculture. Future foreign workers would be permitted through a streamlined H-2A program, but again restricted to agriculture.

The restrictions on legalized workers to work proscribed amounts of time in agriculture stem from concerns by the industry about the availability of labor at critical times. In the context of existing unauthorized workers, the concern is that once authorized for work in the United States, they will leave agriculture for employment in other industries. Research to this point in time does not support this concern.

Existing research indicates that if illegal agricultural workers were to be legalized, their expected length of job would *increase* (Hashida & Perloff, 1996; Tran & Perloff, 2002; Iwai, Napasintuwong, & Emerson, 2005; Iwai, Emerson, & Walters, 2006b). Iwai, Emerson, and Walters (2006b), for example, find that the likelihood of remaining in agriculture upon being legalized ranges from a one percentage point reduction to an *increase* of 7.3 percentage points. Of 32 combinations of worker characteristics considered, only five resulted in a decrease in the likelihood of remaining in agriculture; among these five, only two were realistically relevant combinations. One noteworthy result is that the likelihood of remaining in agriculture generally increased modestly following 2001; correspondingly, the *increases* in the likelihood of remaining in agriculture attributed to a hypothetical legalization were generally smaller after 2001. A somewhat different methodology used by Iwai, Napasintuwong, and Emerson (2005) suggests an increase in job duration of an unauthorized worker of 4.4% upon becoming authorized under a program such as the Seasonal Agricultural Worker (SAW) program under IRCA, or by 3.9% by becoming a permanent resident. The effects are not large, amounting to slightly fewer than three more work days. However, they are *positive* when the concern has been that once legal status is obtained, there would be *less* attachment to agriculture.

Hashida and Perloff (1996) and Tran and Perloff (2002), using data from the 1989-91 NAWS, found qualitatively similar results. A somewhat different approach was taken by Emerson and Napasintuwong (2002), who examined information on the number of years workers

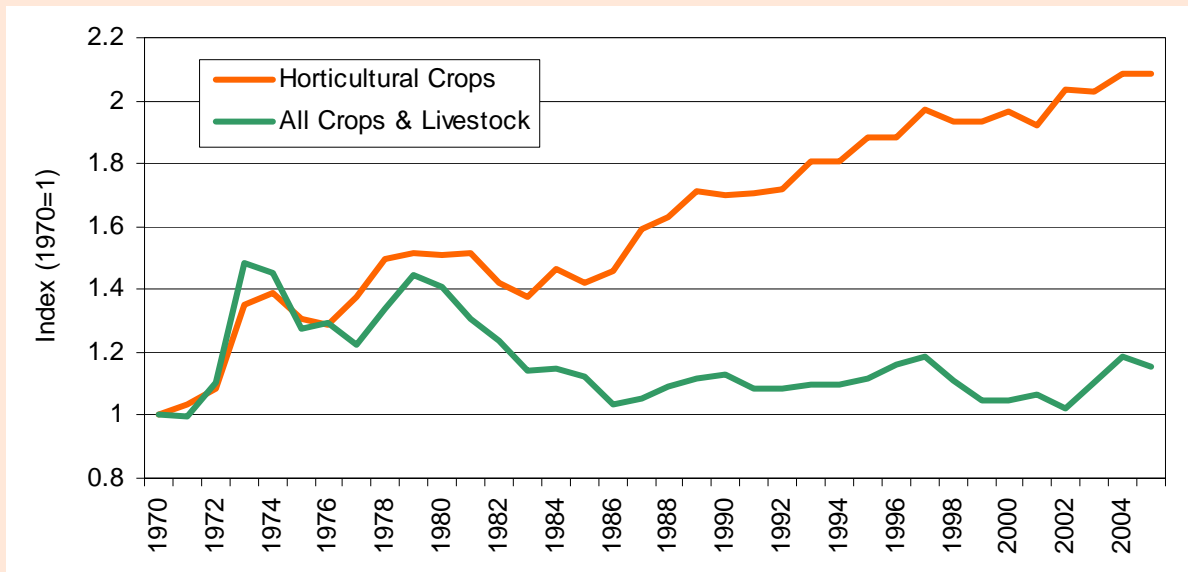
reported having worked in agriculture in the United States. Their results suggested that the expected number of years of work were larger for authorized than for unauthorized workers.

### **Technology and Labor**

U.S. agriculture has a long history of technological innovations, with considerable evidence suggesting that new technologies developed in the United States save labor given a history of relatively abundant land (Hayami & Ruttan, 1970). An early example of agricultural producers responding to changes in the labor market by changing production techniques is the adoption of the mechanical tomato harvester in California. A major source of labor for California agriculture was the *Bracero Program* until its termination in 1964. Schmitz and Seckler (1970) summarize the adoption:

The first 25 harvesters were used in California in 1961. By 1964, 75 were in use; a year later, 250. The number increased to 1,000 in 1967 (Lynch, 1968), when approximately 80 percent of the California acreage was harvested by machines. (p. 570)

The agricultural labor market experience starting in the 1970s through the present time has been the reverse of the termination of the *Bracero Program*: workers have increasingly flowed across the border seeking employment opportunities. Napasintuwong and Emerson (2004), using data for Florida, found that while technology had been labor-saving prior to IRCA, it became labor-neutral following IRCA as foreign-born workers became the dominant labor source for agriculture. In other



**Figure 1.** Index of deflated cash receipts for U.S. horticultural crops and all agriculture.

words, technologies employed in agriculture no longer had the effect of continually reducing the quantity of labor relative to other inputs for given input price ratios.

Shifts in technology can also alter the extent to which inputs are substitutable for each other. Napisintuwong and Emerson (2004) found that labor was a substitute for capital throughout most of the time period, but from the mid-1980s through the early 1990s, there was some indication that labor and capital were complements when viewed as changes due to a change in the price of capital. The implication is that if more stringent immigration legislation were to stimulate the ready availability of new mechanized technology, and at a lower cost, it would not necessarily follow that the employment of hired labor would decrease. Another interesting finding is that capital and labor are more easily substitutable when returns to labor change than when capital prices change. This implies that it is easier to substitute capital for labor (such as adopting mechanized technology)

when labor becomes more expensive than it is to substitute labor for capital when capital becomes more expensive. In the context of the mechanical tomato harvester noted earlier, once the harvester was adopted in the late 1960s, a larger reduction in the relative price of labor would be required to shift back to hand harvesting than the initial reduction in the relative price of capital required to adopt the harvester.

The substitutability of labor and capital has implications for various forms of immigration policies. For example, a policy sealing the border, deporting all unauthorized workers, and authorizing no guest workers could result in temporarily higher wage rates for agriculture in the immediate term. The Napisintuwong and Emerson (2004) substitutability estimates suggest that such a policy would stimulate the adoption of additional available labor-saving technology, with increased substitution of capital for labor. With a hypothetical 10% increase in the wage rate, their estimates suggest an 18% increase in the capital-to-labor

ratio. By contrast, a less restrictive policy toward foreign workers would reduce the incentives for adopting new mechanical technology, and reduce the extent of substitution of capital for labor.

### **Crop Mix**

In addition to changes in technology, producers also adjust to the relative availability of labor through changes in the mix of crops produced. Deflated cash receipts from horticultural crops (vegetables, fruits and nuts, and greenhouse and nursery crops) in the United States more than doubled from 1970 to 2005 (Figure 1). By comparison, deflated cash receipts for all U.S. crops and livestock increased by less than 16% over the same time period. This shift in production is to be expected in part from increased demand for many horticultural products as consumer income rises. However, the real price for horticultural products *fell* by 20% between 1970 and 1999.<sup>4</sup> Moreover, since horticultural products are internationally traded goods, domestic demand can be, and

**Table 2.** Summary of economic issues.

Item	Likely effect relative to <i>status quo</i>	
	Closed border	Legal migration
<b>Wage rates</b>	Minimal to none (wage penalty disappears)	Minimal to none (wage penalty disappears)
<b>Work duration</b>	Minimal	Minimal
<b>Technology</b>	Labor-saving technology developed and adopted	Technology neutral among productive factors
<b>Crop mix</b>	Shift away from labor-intensive specialty crops	No change
<b>Capital flows</b>	Potential production shift to other countries	No change

is, met by a combination of domestic and international supply.

Cash receipts from U.S. horticultural crops represented 21% of all U.S. agricultural cash receipts in 2005; the comparable figure for 1970 was less than 12% (U.S. Department of Agriculture, 2006). However, since horticultural crops are the labor-intensive component of agriculture, they represent a much larger portion of expenditures on labor. Labor expenditures by horticultural farms were 51% of all farm labor expenditures in 2002 (U.S. Department of Agriculture, 2004).

Clearly, the agricultural product mix shifted over this 35-year period toward more labor-intensive commodities. Napasintuwong and Emerson (2004) have found that agricultural technology has become more perishable crop-producing since IRCA, and has become increasingly biased against other types of agricultural products such as the grains and livestock. A restrictive immigration policy of border closure, deportation of unauthorized workers, and autho-

rizing no foreign workers could slow the technology bias toward producing more perishable crops.

### **Capital Mobility**

Coincident with the labor intensive characteristic of specialty crop agriculture is that specialty crop farms tend to be quite large with substantial capital investment. Although fruit and tree nut, vegetable and melon, and greenhouse and nursery farms represent only 9% of all U.S. farms, they represented 26% of U.S. farms with the value of land and buildings exceeding \$10,000,000 in 2002 (USDA, 2004). In the long term there may not be increases in wage rates due to either closing the border or a shift to legal migration. However, the short term effect of a threat to close the border could be an increased risk of labor availability. Furthermore, one mechanism through which market forces result in minimal wage effects is the movement of capital to either other industries or countries where the expected return on capital is higher. One example of this type of capital movement is the shift of some leather leaf fern production from Florida to Costa Rica, Ecuador and Guatemala, ostensibly in reaction to labor market considerations. The result is increased international trade in lieu of labor mobility.

4. *The price index is a quality adjusted price index calculated from data provided by Eldon Ball, and deflated by the GDP deflator. See Ball et al. (1997) for the methodology.*

## **Summary**

Opinions vary widely about the future course of immigration policy in the United States as evidenced by the stark contrast between the House of Representatives bill “Border Protection, Antiterrorism, and Illegal Immigration Control Act of 2005” referred to the Senate in January 2006 (H.R.4437 109<sup>th</sup> Congress, 2<sup>nd</sup> sess.), and the Senate bill “Comprehensive Immigration Reform Act of 2006” passed in May 2006 (S.2611 109<sup>th</sup> Congress, 2<sup>nd</sup> sess.). H.R. 4437 would close the border, deport all illegal aliens, and offer no provision for guest workers in agriculture or any other industry. S. 2611 would increase border enforcement, authorize a guest worker program, provide a path to permanent residency for guest workers, and incorporate AgJOBS as a subtitle of the act. The House and the Senate were unable to transcend their differences prior to the November elections, choosing not to meet in a Conference Committee. The end result prior to the November elections was the passage by the House and the Senate of a House of Representatives sponsored bill, the Secure Fence Act of 2006 (H.R. 6061), directing the Department of Homeland Security to erect fencing on hundreds of miles of the U.S. – Mexico border. The bill was signed by the President amid verbiage that this was one small component of comprehensive immigration reform. Subsequently, limited funds for fencing were authorized in the Department of Homeland Security’s appropriations bill for fiscal year 2007.

Given the strong differences of opinion on immigration reform, does economics offer any useful guidelines? While economics typically cannot determine which policy approach is best (that is a political choice), it

can provide useful information on the economic effects of alternative approaches. The effects discussed earlier are summarized in Table 2. Considerations particularly relevant for agriculture are offered below.

### **Closing the Border**

Closing the border is frequently discussed as one option in immigration reform. The Secure Fence Act of 2006 takes a step in this direction. However, there is considerable doubt raised in the literature about the effectiveness of previous efforts to reduce the flow of illegal workers across the border (Hanson, Robertson, & Spilimbergo, 2002). At the core of the problem are wage differentials between the United States and Mexico on the order of six to one (Freeman, 2006). When illegal workers are willing to risk their lives for the opportunity to work in the United States, it is highly questionable that fencing or other approaches will achieve the desired end. At best, the approaches can make it more difficult to enter, and therefore a higher risk to potential entrants. But, if immigrants are already willing to pay the ultimate price, the reduction may be less than hoped for by the policy's proponents. Moreover, rising deaths among border-crossers will eventually exceed a politically acceptable level for a "nation of immigrants."

Suppose for the moment that the border were effectively closed, all undocumented workers were deported, and no guest workers were permitted, much as the approach of H.R. 4437 (109<sup>th</sup> Congress). With the proposed two-year window for removal of illegals, the industry would be likely to adjust quickly to the new environment. Three likely adjustments would be changes in product mix, production techniques, and capital flows. While significant

increases in the relative importance of specialty crops occurred with the inflow of foreign workers since the 1970s, it is questionable that the increase would be extensively reversed. A more likely scenario is that production techniques would adjust to the new environment, adopting more labor-saving technology. There might also be a flow of capital out of some specialty crops to production areas outside the United States.

The remaining question concerns potential changes in wage rates for agriculture under a scenario of no access to foreign workers. The wage rate that agriculture pays is largely dictated by the wage rate paid for unskilled labor in the much larger nonfarm economy. As indicated above, past levels of immigration have been estimated to have only minimal negative wage effects on unskilled native workers; most agricultural employment draws from the unskilled labor market. As long as agriculture employs largely unskilled labor, wage rates are not likely to significantly change in real terms, regardless of the level of foreign workers.<sup>5</sup> The way that labor earns a premium above the unskilled wage rate is to develop skills that are in demand in the economy, thus moving out of the unskilled labor pool. In the absence of higher productivity, there is little basis to argue that a person's wage will increase. Only if agri-

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5. *All workers would now be earning the market wage; the undocumented group would no longer be present earning the market wage less the legal status penalty. To the extent that the legal status penalty is a risk premium for the employer, the employer's cost per worker would remain unchanged.*

cultural employers shift to employ a more highly skilled labor force would the average real wage rate for the industry be expected to change significantly. Although this is a potential outcome of a highly restrictive immigration policy, it is not the same as a wage increase. The *average* wage rates may be higher, but they would be higher because the composition of the labor force had changed to be more highly skilled, on average. The wage rate of unskilled workers would still remain at its nearly constant level in real terms. In this scenario, technology and/or the product mix would have changed to require fewer unskilled workers and relatively more skilled workers. The important point to recognize is that the substitution of skilled for unskilled workers would not be one for one, but rather, fewer skilled workers substituting for a given number of unskilled workers. Consequently, the wage bill would not necessarily increase.

### **Legal Migration**

If some flow of people across the border for work is currently inevitable, the more relevant issue is how to convert this to a legal flow and determine its effects. Legal migratory flows across borders consist of two types: permanent migration, or *immigration*, and temporary migration, technically, *nonimmigrants* of which those entering specifically for work are *guest workers*. Most recent permanent immigrants have been authorized under the family reunification provisions of the 1965 Immigration Reform Act. While most are of working age upon arrival in the United States, their admission is not on the basis of an employer request or a particular job skill. One potential reform would be to increase the number of legal immigrants, and to use employment skills as Canada does as a crite-

tion for entry. Other possibilities are to auction visas to prospective immigrants (Freeman, 2006) to capture some of the gains that immigrants achieve through immigration, and assure that those with the greatest potential and desire are the ones who gain entry for immigration. Regardless of the approach, Congress would have to determine an upper limit to legal immigrants. Recent Congressional proposals have addressed formal immigration through potential paths to permanent residency for existing undocumented workers, their families, and proposed guest workers. There was no political sentiment prior to the November election, if at all, to adopt the latter proposals.

Nonimmigrant guest worker programs are an alternative to permanent immigration and serve as a means of augmenting the labor force typically to meet specific expressed employment needs. They are typically for limited employment duration and incorporate numerous regulations, as in the existing H-2A program for agriculture regulating the terms of employment, and particularly the minimum wage for guest workers and their domestic counterparts at the same employer.

Two sets of guest worker proposals were set forth in the 109<sup>th</sup> Congress: a general guest worker program, and a program specifically for agriculture (AgJOBS). Both appeared separately in various Senate bills, and both were encompassed in S. 2611. Two features of these proposals have been politically problematic: allowing illegal workers meeting certain requirements to become legal guest workers, and opening a path to permanent residency for guest workers meeting various employment criteria and law-abiding behavior.

A concern specific to agriculture is that if all currently illegal workers

become authorized, there will be an immediate exodus from agriculture to nonfarm jobs. The available evidence on this issue does not support the contention. Perhaps most important is that employment in agriculture is no longer the primary source of employment for illegal workers. Over half are employed in three broad industry groups: construction (20%), leisure and hospitality (17%), and manufacturing (14%) (Passell, 2006). Moreover, available evidence is that illegal workers approach employment in agriculture in the same way that domestic U.S. workers have for generations: few look to manual labor in agriculture as a lifetime career. The present employment pattern with illegal workers does not appear greatly different than it has in the past with domestic workers: they remain in agriculture for a few years and then move on to some other mode of employment. Clearly, there are some who choose to work in agriculture for a lifetime; however, that is not the case for the majority of hired farm workers.

The AgJOBS proposal addresses the industry concern by incorporating required periods of work in agriculture if a formerly illegal worker authorized under the program is to be eligible for continued work in the United States, and subsequently a path to permanent residency. In addition, AgJOBS would maintain a streamlined H-2A program specifically for employment in agriculture. While there are clearly unique aspects of agricultural employment, restricting employment to one industry raises additional concerns. One of the ways that workers address working conditions and wages that they find unsatisfactory is by terminating their current employment and seeking employment elsewhere where working conditions better meet their pref-

erences. Workers who are tied to a single employer or industry have limited ability to address work-related problems. As a result, they tend to be addressed by additional regulations, and often litigation. Freedom of movement by workers among employers and industries may be far more effective than regulations in establishing agreeable working conditions and wages.

In closing, there are two realistic options: do nothing, or establish a legal mechanism for migration. Closing the border is not a viable option: the economic pressures to enter the United States from neighboring countries are simply too great. While doing nothing is always an option, the approach goes against the national fabric of a "nation of laws." Instituting legal mechanisms for migration formalizes the process by removing workers from the shadows and employers from a guessing game about the legal status of their employees. Regardless of the approach taken, research has shown that technical changes in the production process and product mix changes address most of the required economic adjustments, leaving the structure of wages largely unaltered. Workers switching from an illegal status to a legal status will command a higher wage, but it is not unreasonable to argue that employers are already incurring that wage difference as a risk premium due to employees in an illegal work status. The nation gains overall through added economic activity of the temporary or permanent migration augmenting the labor force. The immigrants and complementary factors of production (land, capital, and complementary labor) capture the gains, and substitute labor absorbs any losses. Wage losses through migra-

tion, however, have been extremely difficult to demonstrate.

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# Defending America's Food Supply against Terrorism: Who is Responsible? Who Should Pay?

By Thomas F. Stinson, Jean Kinsey, Dennis Degeneffe, and Koel Ghosh

*JEL Classifications: Q18, H44, H56*

Most Americans are confident their food supply is safe from natural contaminants. Even though the federal Center for Disease Control (CDC) estimates that about one person in four contracts a food-borne illness each year, and that 325,000 hospitalizations and 5,000 deaths occur annually due to consumption of inadvertently contaminated food (Mead et al., 2002), the public generally believes the food they purchase will not make them sick. Occasionally, well-publicized product recalls occur, such as the Fall 2006 discovery of *E. coli* 0157 H7 in spinach. But, those recalls are generally interpreted as signs government agencies are exercising proper diligence in protecting the nation's food supply, not as warnings that America's food supply is unsafe.

Al Qaeda's September 11 attacks and the subsequent anthrax incidents raise an additional concern for America's food industry. Deliberate contamination of the nation's food supply is a real possibility and the economic and psychological implications of an attack on the food supply are sobering. Some foods are more susceptible to deliberate contamination than others, but there is no practical way one can eliminate the possibility of being affected. Food terrorism utilizes a vector that affects everyone. Were the same 325,000 hospitalizations and 5,000 deaths that we routinely accept from accidental food contamination to come instead from a terrorist act, there would be a national crisis.

Policy makers and the food industry are beginning to recognize the importance of defending our already safe food supply from terrorism. Preparing for, protecting against, and planning responses to attempts to deliberately

contaminate food with unfamiliar toxins with high mortality rates has become a national and a food industry priority.

At present, there is little empirical information on how consumers view food defense. Public policy makers and food industry executives have been forced to generalize from their experiences with food safety as they plan strategies to protect the food supply chain. But, there are important differences in perceptions and in policy between food safety and food defense. It will be necessary to do more than simply transfer lessons learned about the public's attitude about food safety policy to plans for food defense.

This paper reports results from a large survey of U.S. residents conducted in August 2005. That survey, designed primarily to provide information about public attitudes and concerns about terrorism, also included a set of questions contrasting consumer perceptions of food safety and food defense. Differences found in the degree of public concern and in the public's perceptions of who is responsible and who should pay should be useful to the food industry and to public officials as they shape future food defense policy.

## How Do We Think about Catastrophic, but Low Probability Events?

Psychologists know that consumers willingly accept high levels of risk voluntarily, but are loath to be subjected to risk and uncertainty that is involuntary (Lowrance, 1976; Kuchler & Golan, 2006). Classic examples are general acceptance of the risk of injury or death from driving an automobile compared to outrage and anger over the sub-

stantially lower risk of contracting a dreaded disease like cancer. The low risk of being harmed by a terrorist attack on the food system, an event almost totally out of an individual's control and something one could be subjected to involuntarily, would be expected to produce more fear and public outrage than would more common and more likely hazards.

Consumers must eat food to live; ultimately an involuntary but familiar act. Death or severe illness caused by eating deliberately contaminated food is an involuntary risk, and therefore more troubling than a risk taken voluntarily like air travel. That means consumers would be expected to allocate more, on a risk-adjusted basis, to protect the food supply against a terrorist attack than to protect against airline hijackings.

### **How Concerned are Americans about Food Terrorism?**

An Internet survey of public attitudes and concerns about terrorism was conducted during the first week of August 2005. The survey was funded by the National Center for Food Protection and Defense.<sup>1</sup> A representative sample of 4,260 U.S. residents over the age of 16 completed the interview. Their responses were then weighted by age, race and ethnic origin, sex, income, and geographic region to balance or align the sample with the characteristics of the national population. The weighted results can be interpreted as reflecting the beliefs of the national population,

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1. *The National Center for Food Protection and Defense was established and funded by the Department of Homeland Security in July 2004. It is administered at the University of Minnesota.*

not simply the responses of those surveyed.

Our survey's major finding was that the public, even though they believe a terrorist attack on the food supply chain to be slightly less likely than other types of terrorism, would devote a greater proportion of the nation's anti-terrorism budget to protect against an attack using the food supply than to protect against any other type of terrorist event (Stinson et al., 2006). Respondents were given a list of seven types of terrorist attacks – airlines, other public transportation, monuments, food, power grid, release of chemical or biological agents, and other – and asked, "Of every \$100 currently being spent to protect the country from terrorism, how do you think it should be divided across the following types of attacks?" Protecting the food supply was the highest priority. The public would spend about \$1.13 to protect the food supply for every \$1.00 spent to provide security for the airways.<sup>2</sup>

The federal Transportation Safety Agency currently spends more than \$5 billion annually to prevent terrorists from hijacking aircraft (U.S. Office of Management and Budget, 2006). Although data are incomplete, that amount appears to be well beyond what is currently being spent for food defense or food safety.

In fiscal 2006, USDA's share of the \$8.6 billion budgeted government-wide for the national mission of defending against catastrophic threats was \$238 million (U.S. Office of Management and Budget, 2006).

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2. *More complete results from that portion of the survey, including the exact wording of the question, is available at <http://foodindustry-center.umn.edu>; click on Consumer Terrorism Survey.*

A General Accounting Office (GAO) report estimated combined spending on food safety activity by the USDA's Food Safety and Inspection Service, the FDA, and the state agricultural and health departments to total about \$1.3 billion in 1999 (GAO, 2001). While there are no estimates of total current private sector spending for food safety, USDA reports that meat and poultry processors spent about \$380 million annually and made \$570 million in long-term investments between 1996 and 2000 to comply with USDA's 1996 Pathogen Reduction/Hazard Analysis Critical Control Point (PR/HACCP) regulation (Ollinger, Moore, & Chandran, 2004). That same survey found the U.S. meat and poultry industry made an additional \$360 million on food safety investments during that period for items not required by the PR/HACCP rule.

### **Most Confident U.S. Food Supply is Safe; Few Believe it is Secure from Terrorism**

When public attitudes about food safety and food defense were probed, some dramatic differences were found. Respondents were asked to indicate their level of confidence that the food supply is safe. They were also asked how confident they were that the food supply was secure against terrorism. Responses were categorized using a six-point, forced-choice, Likert scale with 1 being not at all confident and 6, extremely confident. Only 36% of the public indicated they were not confident (rankings 1 through 3) that the food supply was safe and less than 4% indicated they were not at all confident. Nearly two-thirds (64%) indicated an above average level of confidence (rankings 4-6), with 5%

claiming to be extremely confident (Figure 1).

The percentages reversed when respondents were asked their level of confidence that the food supply was secure against terrorism. More than 62% said they were not very confident and 15% said they were not at all confident. Only 38% indicated an above average level of confidence in the ability of the food supply system's ability to absorb a terrorist attack without endangering public health and well-being.

### Processors and Government Primarily Responsible for Food Safety and Defense

Our food travels many paths, makes multiple stops, and is handled by many persons on its way from farm to fork, so assigning responsibility for food defense is not a simple task. Its public goods nature means food defense is everyone's job, but also, no one's job. Those surveyed were asked, "With whom does the responsibility for the safety of the food you consume lie?" They were asked to organize their responses by ranking the different parts of the food supply chain, from farmers to retailers, as well as consumers and the government from 1 (least responsible) to 6 (most responsible). The same question was also asked for food defense.

The public assigns the greatest responsibility for food safety to the government and to food processors and manufacturers. More than 55% of U.S. residents ranked manufacturers and processors as either most responsible or second most responsible for food safety, and 30% ranked them most responsible. More than 45% of the public ranked government either most responsible or second most responsible, and nearly 33% (more than for food processors

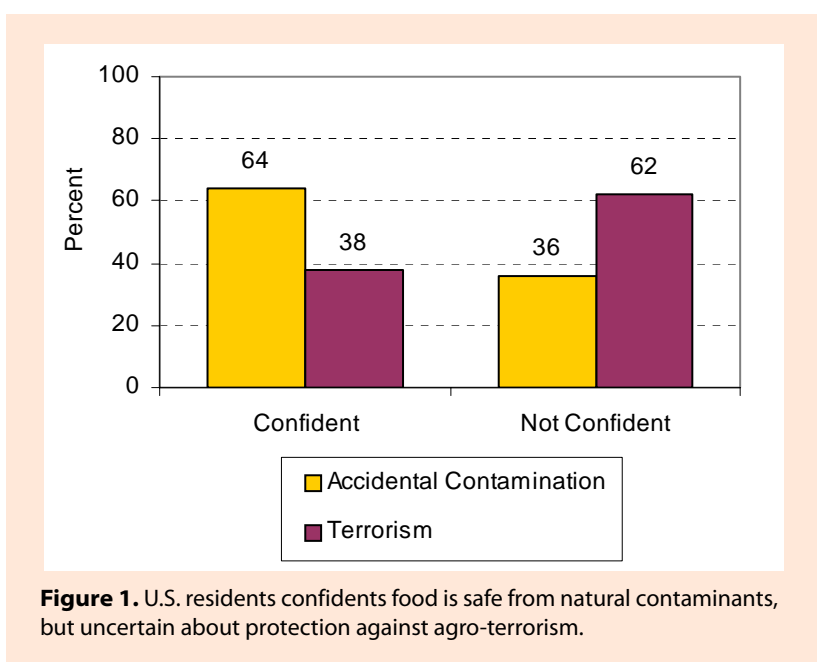


Figure 1. U.S. residents confident food is safe from natural contaminants, but uncertain about protection against agro-terrorism.

and manufacturers) ranked them most responsible. Consumers and farmers, on the other hand, were believed to be much less responsible for food safety. Farmers were ranked least responsible or second least responsible by 45% of the public. Consumers are seen as even less responsible. They were placed in one of the bottom two categories by 58% of the public. More than 47% said consumers were least responsible for food safety.

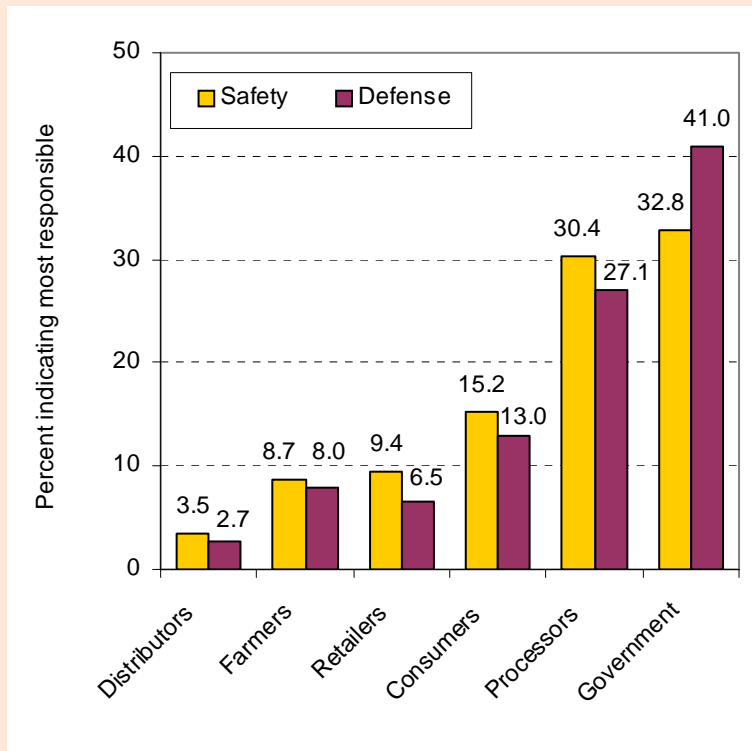
### Americans Say Government Has Primary Responsibility for Food Defense

Responses to the question 'who is responsible for food defense?' were similar to those for food safety, but with an important difference. The public assigns the government a larger role in food defense than food safety. Nearly 41% of U.S. residents believed the government bears primary responsibility for protecting the food supply against terrorism; 33% assigned the government primary responsibility for food safety (Figure

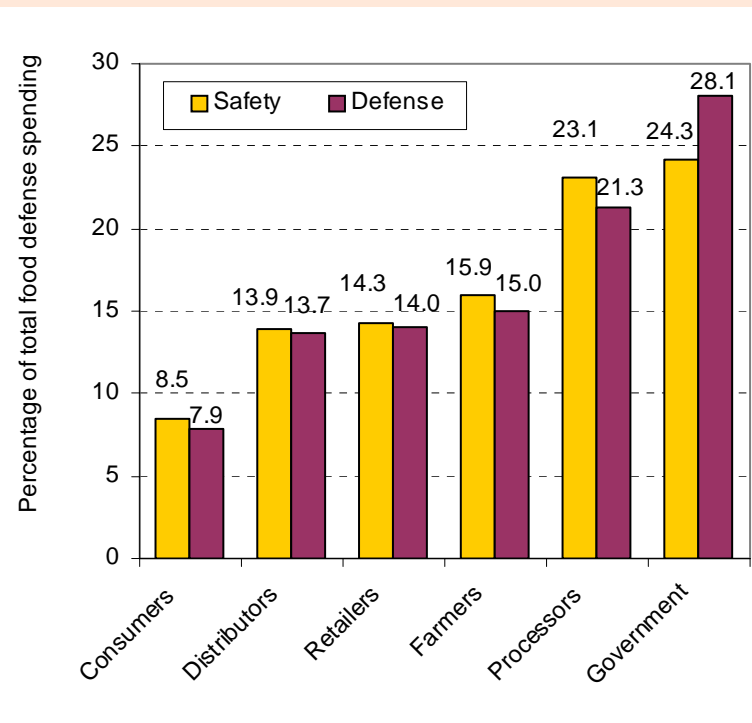
2). Only 27% thought processors and manufacturers were the most responsible for food defense. Again, consumers and farmers were seen as those least responsible.

### Who Should Pay for Food Safety and Food Defense?

Respondents also were asked, "If the cost of providing food safety is \$100, what portion of the \$100 should be borne by the following parties?" The same list of food supply chain components, from farmers to retailers, as well as consumers and the government, was provided. A similar question was asked, regarding 'who should pay for food defense?' Responses indicate the public believes the government should bear the largest portion of the costs of both food safety and food defense (Figure 3). And, consistent with the public's belief that the government has a larger role in food defense programs than in food safety, the portion of food defense costs that should be borne by the government (28%) was greater than that for food safety



**Figure 2.** Public sees government as most responsible for food defense.



**Figure 3.** Public expects government and food processors to pay for food defense.

(24%). Manufacturers and processors were assigned the second highest percentages, which is also consistent with the public's perception of those most responsible for food safety and food defense. Consumers were assigned the smallest proportion of the costs of food safety and food terrorism; about 8% of each.

Finally, respondents were asked, "For every \$100 spent on both food safety and food defense, how much should be spent on food safety (reducing the risk to your food from natural and accidental contaminants), and how much should be spent on food defense (reducing the risks to your food from deliberate contamination)?" The survey found the public believes that about the same amount should be spent for food defense as food safety. Survey results show that, on average, U.S. residents would allocate 52% of the combined food defense/food safety budget to food safety, and 48% to food defense.

Some researchers believe that 50-50 responses are more likely to reflect the fact that respondents did not know how to allocate resources between the choices offered, not true preferences (Bruine de Bruin et al., 2002). Since more than half of all responses indicated a 50-50 split between spending for food safety programs and spending for food defense, the percentage allocation was also calculated after omitting all 50-50 responses. That subset would spend slightly more (55%) on food safety, leaving 45% of the combined food safety and food defense budget for food defense.

### Looking Ahead

Terrorism poses new challenges for the food industry and for the government. Simply following and enforc-

ing best food safety practices will not provide sufficient protection against a terrorist attack on our food supply. The particular challenges posed by terrorism will require new approaches by the government and the food industry. Improved security all along the food supply chain will be essential, as will an expanded regimen of testing for potential toxins. Voluntary compliance is not guaranteed, and additional regulation of food processors is also likely to be necessary. Results from this survey indicate the public is concerned about food defense and that they will hold both the government and food manufacturers responsible should a food terrorism incident occur.

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## Coming Attractions

### *Resources and the Environment*

#### **Water Quality and Agriculture**

Catherine L. Kling

Concern about water quality in agriculturally dominated landscapes continues to grow. In this set of papers the key water quality problems and management approaches relevant to corn belt agriculture are described and assessed both in terms of their effectiveness and their costs.

