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Table of Contents

The Western Economics Forum

A peer-reviewed publication from the Western Agricultural Economics Association

Purpose

One of the consequences of regional associations nationalizing their journals is that professional agricultural economists in each region have lost one of their best forums for exchanging ideas unique to their area of the country. The purpose of this publication is to provide a forum for western issues.

Audience

The target audience is professional agricultural economists with a Masters degree, Ph.D. or equivalent understanding of the field that are working on agricultural and resource economic, business or policy issues in the West.

Subject

This publication is specifically targeted at informing professionals in the West about issues, methods, data, or other content addressing the following objectives:

- Summarize knowledge about issues of interest to western professionals
- To convey ideas and analysis techniques to non-academic, professional economists working on agricultural or resource issues
- To demonstrate methods and applications that can be adapted across fields in economics
- To facilitate open debate on western issues

Structure and Distribution

The *Western Economics Forum* is a peer reviewed publication. It usually contains three to five articles per issue, with approximately 2,500 words each (maximum 3,000), and as much diversity as possible across the following areas:

- Farm/ranch management and production
- Marketing and agribusiness
- Natural resources and the environment
- Institutions and policy
- Regional and community development

There are two issues of the *Western Economics Forum* per year (Spring and Fall).

Send submissions to:

Dr. Rhonda Skaggs
Editor, *Western Economics Forum*
Dept. of Agricultural Economics & Agricultural Business
New Mexico State University
MSC 3169 Box 30003
Las Cruces, NM 88003
Phone: 505-646-2401
Fax: 505-646-3808
email: rskaggs@nmsu.edu

Immigration Reform: Implications for Agriculture

Philip Martin[1]

Abstract

About half of U.S. farm workers are not authorized to work in the United States. Pending immigration reforms aim to prevent the entry and employment of more unauthorized foreigners, but they differ on what to do about unauthorized workers already in the United States. These unauthorized workers are not likely to disappear overnight, and agricultural adjustments to a legal work force are likely to be determined by enforcement patterns, the structure of new guest worker programs, and the speed at which current farm workers find nonfarm jobs.

Introduction

About 95,000 foreigners a day arrive in the United States. Over 90,000 are nonimmigrant tourists and business visitors as well as foreign students and workers welcomed at airports and border crossings daily. Another 3,000 are immigrants who have been invited to become permanent residents of the United States, and up to 2,000 are unauthorized foreigners, usually Mexicans who evade border controls plus some foreigners who entered legally, say as tourists, but did not leave as required.

Is the arrival of 30 million nonimmigrants, a million immigrants, and 500,000 to 700,000 unauthorized foreigners a year something to be welcomed or feared? There is no single answer, which helps to explain American ambivalence about immigration. On the one hand, presidents often remind Americans that the motto *e pluribus unum*—from many, one—signifies a willingness to welcome foreigners seeking opportunity while strengthening the United States with new blood and ideas. On the other hand, Americans have worried since the days of the founding fathers about the potential economic, political, and cultural changes caused by immigration.

Opinion polls consistently find that most Americans want the U.S. government to take additional steps 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). In December 2005, the House approved the Border Protection, Antiterrorism, and Illegal Immigration Control Act (H.R. 4437) on a 239 to 182 vote. President Bush commended the bill (Bush 2005), saying: "I applaud the House for passing a strong immigration reform bill… I urge the Senate to take action on immigration reform so that I can sign a good bill into law."

If eventually enacted into law, H.R. 4437 would require U.S. employers within two years to submit Social Security and other data on newly hired workers to government agencies by telephone or computer. If the data submitted do not match that in government records, employers are to notify workers to correct the problem within 30 days, or the worker could no longer be employed. Employers would have six years to verify the legal status of their current employees. H.R. 4437 also cracks down on unauthorized foreigners in the United States by making "illegal presence" in the country a felony, which may make it hard for such persons to eventually become legal immigrants. The bill introduces penalties on those who support or shield illegal migrants, which could affect churches and other migrant support groups.

[1] The author is Professor, Department of Agricultural and Resource Economics, University of California, Davis.

Perhaps the most controversial item in H.R. 4437 is a provision that calls for building 700 miles of additional fencing along the Mexico-U.S. border. There are already about 50 miles of fencing on the border, and H.R. 4437 would extend this fencing to over a third of the 2,000 mile Mexico-U.S. border.

Even though President Bush has been calling for a guest worker program since his election in 2000, H.R. 4437 does not include one. Rep. Tom Tancredo (R-CO), chair of the 90-member House immigration reform caucus, explained the absence of a guest worker program by saying: "Our borders must be secured and our laws must be enforced before any guest worker plan can go into effect." (Quoted in Bush and Congress: Action? 2006. Migration News. Volume 13. Number 2. January. Web site: http://migration.ucdavis.edu/mn/more.php?id=3155_0_2_0.)

The Senate took up immigration reform in March 2006, and approved the Comprehensive Immigration Reform Act of 2006 (S2611) on a 62 to 36 vote May 25, 2006. CIRA deals with border enforcement in Title 1, calling for 370 miles of additional fencing on the Mexico-U.S. border, interior enforcement in Titles 2 and 3, including a requirement that all U.S. employers check whether new hires are legally authorized to work in the United States, creates a new H-2C guest worker program in Title 4, provides additional immigration visas to reduce the backlog of foreigners waiting for them in Title 5, and allows some unauthorized foreigners to earn immigrant status and eventual citizenship in Title 6.

The CIRA's most controversial provisions deal with enforcement, the new guest worker program and legalization. The CIRA would add 14,000 Border Patrol agents to the current 11,300 over the next five years and increase detention space for apprehended foreigners (for comparison, New York City has about 36,000 police). The CIRA also calls for 370 miles of additional triple-layered fencing, at a cost of $3 million per mile, and 500 miles of vehicle barriers at a cost of $1.3 million a mile along the Mexico-U.S. border.

The Senate approved by a 58-40 vote a new verification system to begin 18 months after enactment. Newly hired employees would present a passport or REAL ID driver's license (issued by states after 2008) to employers, who would submit the data to a Department of Homeland Security (DHS) database with Social Security and immigration numbers. DHS would notify employers within three days that the new hire was authorized to work or unauthorized. If there is uncertainty, the worker could be hired until the system is 99% accurate.

Workers deemed unauthorized would have 10 days to challenge the DHS determination, and would be considered legal if DHS did not reconfirm unauthorized status within 30 days. The Senate bill includes a provision requiring DHS to reimburse workers if it makes a mistake, such as saying the worker was not authorized when he was. Employers would face fines of $20,000 for hiring illegal workers on a first offense, and could face prison terms if they had a pattern of hiring unauthorized workers (the House bill has $30,000 fines and prison terms up to 30 years). The Senate bill calls for the number of inspectors enforcing employer sanctions laws to increase from 200 to 10,000.

The Senate bill would add an H-2C visa program to a list that currently includes H-1A, H-1B, H-2A, and H-2B. Employers in any U.S. industry could attest that the employment of H-2C migrants "will not adversely affect the wages and working conditions of workers in the United States similarly employed" and not lead to the termination of U.S. workers 90 days before and after the H-2C migrants are employed. Foreigners with job offers from such U.S. employers could pay $500 and obtain six-year work permits.

U.S. employers would set the process of employing H-2C workers in motion by filing their job vacancies in an electronic job registry, offering at least the minimum or prevailing wage "for the occupational classification in the area of employment, taking into account experience and skill levels of employees" (DOL would calculate prevailing wages for occupations). If U.S. workers are unavailable, the employer would issue job offers to foreigners, who would use them to obtain H-2C visas in their countries of origin. Employers in metropolitan or micropolitan statistical areas with unemployment rates "for

unskilled and low-skilled workers during the most recently completed six-month period [that] averaged more than 11%" could not hire H-2C workers.

The CIRA has three legalization programs to deal with the 11 to 12 million unauthorized foreigners in the United States. The compromise embraced by a majority of Senators divides the nonfarm unauthorized into three groups based on their length of time in the United States. The estimated seven million in the United States at least five years before April 5, 2006 could become "probationary immigrants" by proving they worked in the United States, by paying any back taxes and a $1,000 fee, and by passing English and background tests. At the end of six years of continued U.S. work, tax payments and another $1,000 fee, they could apply for green cards or immigrant visas, although they would have to go to the back of the visa queue (total fees were raised to $3,250 during Senate deliberations).

The estimated three million unauthorized foreigners in the United States for two to five years could receive a three-year Deferred Mandatory Departure status if they satisfied the same fee, tax, and English requirements. In addition, they would have to return to their countries of origin within three years and then re-enter the United States legally. These unauthorized foreigners can apply for readmission before they leave the United States, and the "touchback" requirement can be waived if it would cause "substantial hardship."

Finally, the two million unauthorized foreigners in the United States less than two years would be expected to depart, although they could return legally with H-2C visas. The usual bars on legal re-entry would be waived for these unauthorized foreigners (those illegally in the United States six to 12 months are barred from legal re-entry for three years, and those illegally in the United States more than 12 months are barred from legal re-entry for 10 years).

On a 50-49 vote, the Senate allowed unauthorized foreigners who later become legal immigrants to receive Social Security credit for the work they did while unauthorized if the appropriate taxes were paid The Senate defeated another amendment, 40-55, which would have delayed legalization and guest worker programs until DHS certified that U.S. borders were secure, and approved the Salazar amendment 79-16, which allows legalization and guest worker programs to go into effect when the President determines that they are in the national interest.

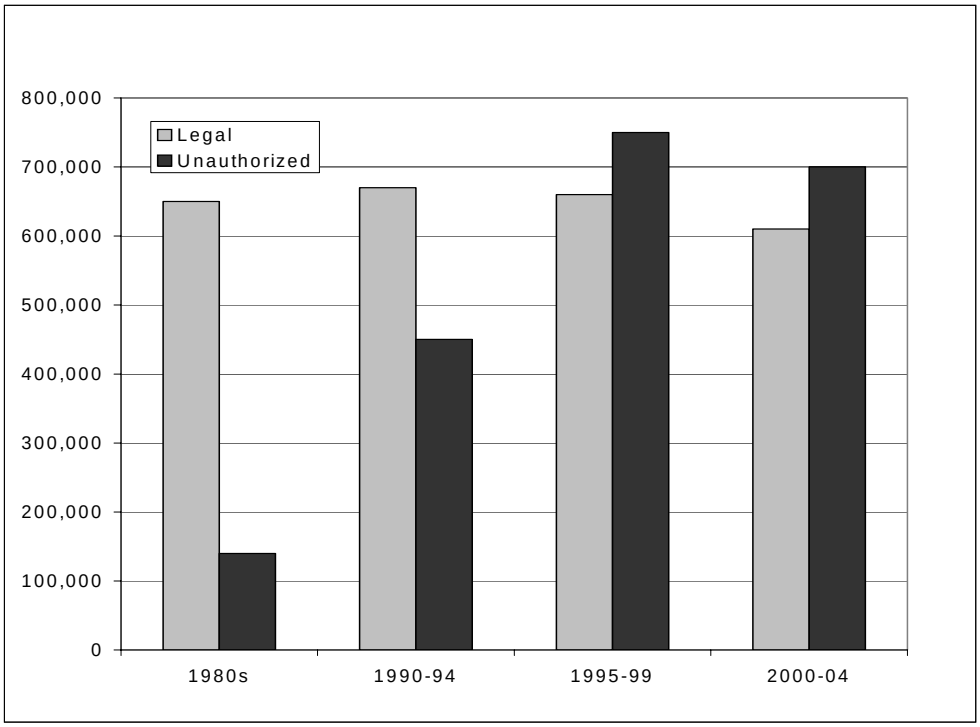
Unauthorized Farm Workers

There were an estimated 10.3 million unauthorized foreigners in the United States in March 2004, a number that has been increasing by over 700,000 a year in the past decade (Passel 2005). In a few recent years, the inflow of illegal migrants exceeded that of legal immigrants (Figure 1), so that almost 30% of the 35 million foreign-born U.S. residents are unauthorized, as are 55% of the 11 million Mexican-born U.S. residents.

Most unauthorized foreigners in the United States are employed, but not in agriculture. Almost two million of the unauthorized are children under 18, and others are housewives or retired, so that seven to eight million unauthorized are in the U.S. labor force of 150 million. Most of these unauthorized workers are between the ages of 18 and 40, and half arrived since 1995.

Most unauthorized workers are employed in the nonfarm economy, in service occupations that range from janitors to restaurant workers, in food processing, meatpacking and other manufacturing, and in construction. However, agriculture may be the only U.S. industry that has more than a million employees and half of its workers unauthorized (U.S. Department of Labor 2005).

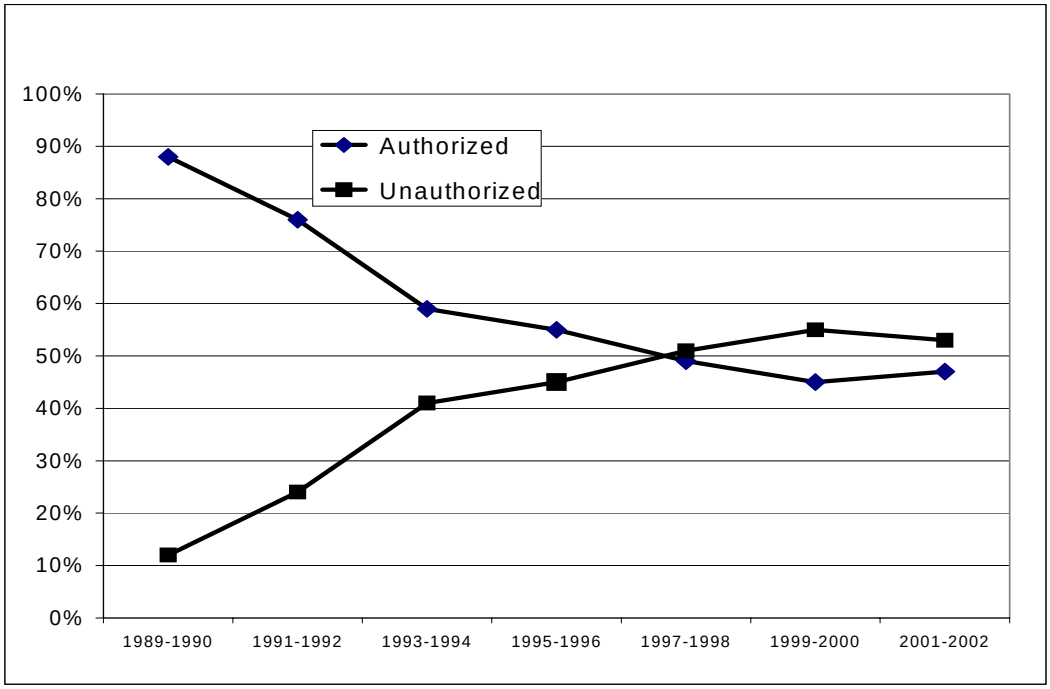
Figure 1. Legal and unauthorized immigration, annual averages, 1980-2004.



Source: Passel (2005).

The U.S. Department of Labor (DOL) has been surveying workers employed on crop farms for the past 15 years, and found that the percentage of unauthorized workers has been above 50% since the late 1990s (Figure 2). In the DOL National Agricultural Workers Survey (NAWS) data, the unauthorized share of the crop work force has stabilized in recent years, perhaps because tougher border enforcement is slowing new entries while the boom in construction and other nonfarm labor markets has drawn more unauthorized seasonal workers out of agriculture.

Figure 2. Authorized and unauthorized crop workers: 1989-2002.



Source: NAWS, www.dol.gov/asp/programs/agworker/naws.htm.

There are no government estimates of unauthorized workers in livestock, but most observers believe that livestock workers are more likely to be legal because a higher share of livestock jobs are year-round and many offer benefits such as housing. One way to put parameters on the number of unauthorized farm workers is to separate workers employed in crops and livestock, and apply different unauthorized percentages to each group.

When the U.S. Department of Agriculture relied on the Current Population Survey to estimate the number of farm workers, there were an estimated 2.5 million farm workers, defined as persons employed for wages on farms sometime during a typical year, including 1.8 million in crops and 700,000 in livestock (Smith and Coltrane 1981).[2] If 45% of the crop workers and 25% of the livestock workers are unauthorized, there would be almost one million unauthorized U.S. farm workers (Table 1). If the unauthorized percentage is higher, say 2/3 of the crop workers and a third of the livestock workers, there would be about 1.4 million unauthorized farm workers. Finally, if the unauthorized shares are lower, say 35% and 15%, there would be about 700,000 unauthorized farm workers.

Table 1. Estimating unauthorized farm workers.

	Middle	High	Low
Unauthorized % in crops/livestock	*45/25*	*67/33*	*35/15*
Hired workers	2,500,000	2,500,000	2,500,000
Crop workers	1,800,000	1,800,000	1,800,000
Unauthorized %	45	67	35
Unauthorized crop workers	810,000	1,206,000	630,000
Livestock workers	700,000	700,000	700,000
Unauthorized %	25	33	15
Unauthorized livestock workers	175,000	231,000	105,000
Total unauthorized	985,000	1,437,000	735,000

Source: See text.

The number and share of unauthorized workers has traditionally varied by well-known parameters, including size of employer and commodity, with large farm labor contractors (FLCs) providing workers to harvest less-perishable crops such as citrus having some of the highest shares of unauthorized

[2] Estimates based on other data sources suggest that the hired farm work force remains at this level. The U.S. Census of Agriculture (COA) reports farm labor expenditures but not the number of hours worked. If COA expenditures by crop (NAICS 111) and livestock (NAICS 112) farms are divided by the average hourly earnings of field and livestock workers extracted from quarterly National Agricultural Statistics Service (NASS) Farm Labor Survey reports to estimate hours worked on crop and livestock farms, the total is 2.7 billion hours in 2002, or 1.4 million year-round equivalent jobs of 2,000 hours each.

About 68% of these hours were reported by crop farms, and 32% by livestock farms. In the NAWS, workers had an average of 1.4 farm employers in 12 months of 2001-02, suggesting that COA's 3 million farm jobs were filled by 2.1 million workers. However, NAWS found that 21% of crop workers were employed by farm labor contractors (FLCs), and increasing the worker count by 21% results in an estimate of 2.6 million workers. The NAWS covers only crops. If NAWS data on average employers and FLCs are applied only to crop workers, and we assume that double-counting of livestock workers in the COA is offset by workers brought to livestock farms by contractors, the result is a total 2.7 million farm workers in 2002, from 1.7 million crop workers (68% of 3 million = 2.1/1.43 employers per worker x 1.21 for FLC workers) plus 3 million x 32% or 972,000 livestock workers.

workers (Thilmany 1994; Martin et al. 1995). However, differences between less perishable citrus and more perishable strawberries have been disappearing as unauthorized workers spread throughout agriculture. Indeed, some areas that have more recently begun to hire foreign-born workers, including many midwestern and southeastern states, may have higher shares of unauthorized workers than states that have long relied on unauthorized workers such as California.

Even though almost half of U.S. crop workers may be unauthorized, few farm employers are fined for employing such workers. There are several reasons. First, there is little enforcement of laws against hiring unauthorized workers. In FY04, the government enforcement agency Immigration and Customs Enforcement issued only three notices of intent to fine (NIF) U.S. employers for violations of employer sanctions laws, down from 1,000 to 2,000 NIFs a year in the 1990s (ICE: Worksite Enforcement. 2006. Migration News, Volume 13. Number 2. January). Second, most employers protect themselves from fines of up to $10,000 by copying the documents presented by newly hired workers.

Federal law requires new hires to present documents to their employers attesting to their identity and right to work. Many unauthorized workers buy drivers' licenses that show identity and immigration visas (green cards) and Social Security numbers that show right to work, documents that can be purchased at swap meets for less than $100. In the event of an inspection, the worker may be detained if the documents are false, but employers are not fined because they checked worker documents as required. Indeed, in an effort to prevent discrimination, employers can be fined if they demand particular documents from particular employees. Under both the House and Senate bills, internet-based reporting of data on new hires would immediately put the employer on notice that there is a problem with a particular worker, provided that government databases are accurate.

Agriculture's Stake

Agriculture's three major interests in pending immigration reform proposals are currently unauthorized workers, future guest workers, and enforcement. Some farmers fear that hundreds of thousands of currently unauthorized workers will disappear overnight, a highly unlikely scenario.

Although the House bill does not include a guest worker program that legalizes currently unauthorized workers, it includes a two-year phase-in of the internet-based system to verify the legal status of new hires and a six-year phase in of the requirement to verify current employees. Thus, even under a worse-case scenario for farmers worried about "losing" unauthorized employees, there would likely be attrition rather than a sudden disappearance of current workers. The Senate bills, of course, allow currently unauthorized workers to become legal guest workers.

The seasonal farm labor market resembles a revolving door, in the sense the newcomers arrive, are employed for about a decade, and then return to their countries of origin or more often find nonfarm jobs and settle in the United States. If there is 10% annual turnover in a 2.5 million strong farm work force (the estimate of the U.S. hired farm work force used in government publications and academic articles), 250,000 farm workers exit each year and keeping the farm work force stable requires 250,000 new entrants.

Since virtually all new entrants to the farm labor force are born outside the United States, farm employers are very interested in government rules that regulate their access to workers abroad. If stepped up border and interior enforcement slows the influx of unauthorized workers and turnover remains at current levels, farm employers will be interested in far more than the 40,000 legal guest workers a year requested under the current temporary worker program, known as the H-2A program.

The H-2A program is named after the section of law that authorizes it, and presumes that U.S. farmers will normally find sufficient U.S. workers to fill farm jobs. However, farmers anticipating too few U.S. workers can file job orders at their local employment service (ES) offices and ask the U.S. Department of Labor to certify their need for foreign workers. The ES and the farmer are expected to seek U.S.

workers during a mandatory recruitment period. However, since farmers do not request certification until they have found H-2A workers abroad, most do not really want U.S. workers, and recruitment finds few.

The request for H-2A workers alerts unions and advocates, who sometimes sue employers for not hiring U.S. workers who respond to the farmer's ads. In addition, farm employers requesting H-2A workers must offer approved housing, which means that DOL inspectors arrive to check housing. Applying to the government for H-2A workers in areas that often have double-digit unemployment rates tends to bring unwelcome attention to farm employers who may have been operating out of the limelight with unauthorized workers, explaining why many farmers say the H-2A program is "unworkable." Proposals to make the H-2A program more employer-friendly include AgJOBS, discussed below.

The third uncertainty for agriculture is enforcement. Fines or sanctions on employers who knowingly hire unauthorized workers were introduced by the Immigration Reform and Control Act of 1986. The theory was that sanctions would "demagnetize the U.S. labor market" because foreigners would quickly learn that, even if they eluded the Border Patrol, they could not get U.S. jobs. This theory did not work because of the availability of false documents and little enforcement.

A mandatory internet-based verification system could make enforcement easier. For example, if employers learned that the data on a newly hired worker were suspect, but continued to employ the worker after 30 days, there could be a presumption that they knew the worker was unauthorized. Similarly, by having all employers submit data on all newly hired workers, enforcement agencies will be able to spot problem industries, areas, and employers.

AgJOBS

One of the legalization programs in the Senate bill, the Agricultural Job Opportunity, Benefits, and Security Act (AgJOBS), deals only with unauthorized farm workers. As the number of unauthorized farm workers rose in the 1990s, farmers asked Congress to approve a new guest worker program for agriculture that did not require DOL certification or free housing. President Clinton opposed these proposals, issuing a statement June 23, 1995 that said: "I oppose efforts in this Congress to institute a new guestworker or '*bracero*' program that seeks to bring thousands of foreign workers into the United States to provide temporary farm labor."

With illegal migration rising and Clinton threatening a veto, there was little serious effort to get Congress to approve an alternative guest worker program. However, the Senate approved a version of what became AgJOBS as an amendment to an appropriations bill in 1998, showing that farmers were gaining support in their effort to win approval of a non-certification guest worker program (Martin 2005).

After the election of Vicente Fox in Mexico and George W. Bush in the United States in 2000, farm employers and worker advocates reached a compromise to deal with unauthorized farm workers. Farm employers wanted a new guest worker program with two major features, no certification and no housing, while worker advocates wanted a system under which currently unauthorized workers could become immigrants. Before the elections, these talks were at a standstill but, in December 2000 employers and worker advocates reached a compromise: farmers would be allowed to self-certify their need for guest workers and pay a housing allowance to out-of-area workers rather than provide them with housing. Worker advocates won the promise of a path to immigrant status for unauthorized workers and their families. This "earned amnesty" raised the ire of law-and-order members of Congress, and the AgJOBS compromise was not enacted (Martin 2005).

AgJOBS was pushed out of the limelight by the Fox administration, which made improving conditions for Mexicans in the United States its top foreign policy priority. During the spring and summer of 2001 the Mexican government made a four-pronged proposal that included legalization, a guest-worker

program, ending border violence and exempting Mexico from ceilings on immigrant visas. Foreign Minister Jorge Castaneda, reflecting 2001 expectations of a breakthrough, added: "It's the whole enchilada or nothing." (Quoted in Terrorism, Guest Workers. 2001. Rural Migration News. October. Web site: http://migration.ucdavis.edu/.) Just before September 11, 2001, Mexican President Fox in Washington D.C. said he expected a comprehensive new immigration agreement before the end of 2001.

The CIRA version of AgJOBS would offer currently unauthorized farm workers a path to immigrant status for themselves and their children and offer farmers easier access to legal guest workers. It 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, 2005 to pay $500 and obtain blue-card temporary resident status (this employment can be verified with pay stubs, tax filings, contracts, etc., and the legalization program would run for five years). Blue-card holders who perform at least 100 days of farm work each year during the 5-year period beginning on the date of enactment, or at least 150 work days each year in a 3-year period after enactment, could become legal immigrants (a work day is at least 5.75 hours). While in blue-card status, foreigners could also do nonfarm work, travel legally in and out of the United States, and get work authorization for their spouses, who would not have to work in agriculture, as well as legal status for their minor children in the United States.

The blue-card program also reforms the H-2A program, allowing farm employers to attest they need foreign workers, allowing them to pay a housing allowance in lieu of providing housing to out-of-area workers, and freezing the adverse effect wage rate at 2002 levels. In addition, dairy farms would for the first time be able to hire H-2A workers, even though their demand for labor is year round.

Conclusions

As Congress debates immigration reform in 2006, there could be comprehensive reform, dealing with all unauthorized workers in the United States, or piecemeal reform, such as enacting only AgJOBS. If there is comprehensive reform, Congress could mandate enforcement first and allow guest workers or legalization later, as in the House bill, or have new enforcement measures introduced together with guest workers and legalization, as in the Senate bill. In 1986, IRCA had legalization first and enforcement second, an approach absent from the 2006 discussion.

Agriculture has a higher stake in the 2006 debate than it did in the 1986 debate for two reasons. First, labor-intensive agriculture is far larger than it was two decades ago; in the 2002 Census of Agriculture, the value of fruits and nuts, vegetables and melons, and nursery crops was $43 billion, up from $18 billion in 1987. Second, there are more unauthorized workers, and they are far more widely dispersed within agriculture and across the United States than in the mid-1980s, so that more farmers would likely be affected.

However, the major change between 1986 and 2006 is that experience has taught what does **not** work. A generous legalization program and weak enforcement, as in the late 1980s, increased illegal immigration and spread unauthorized workers throughout the United States. Two decades later, there may be much tougher enforcement and fewer opportunities for currently unauthorized workers to become legal immigrants.

Farm employers and worker advocates are cooperating to preserve the labor status quo at least temporarily with AgJOBS. However, the guest workers likely to be a larger share of the workforce if AgJOBS was enacted could become a flashpoint, as employers and advocates tangle over their wages and working conditions.

There are alternatives available, including cooperating with government to reduce dependence on foreign workers, as during the 1960s. A combination of government support for mechanization research, restructuring jobs so that more workers can be employed in agriculture longer, and perhaps

allowing U.S. production of some labor-intensive crops to shrink could be better for agricultural competitiveness than legalizing the labor status quo.

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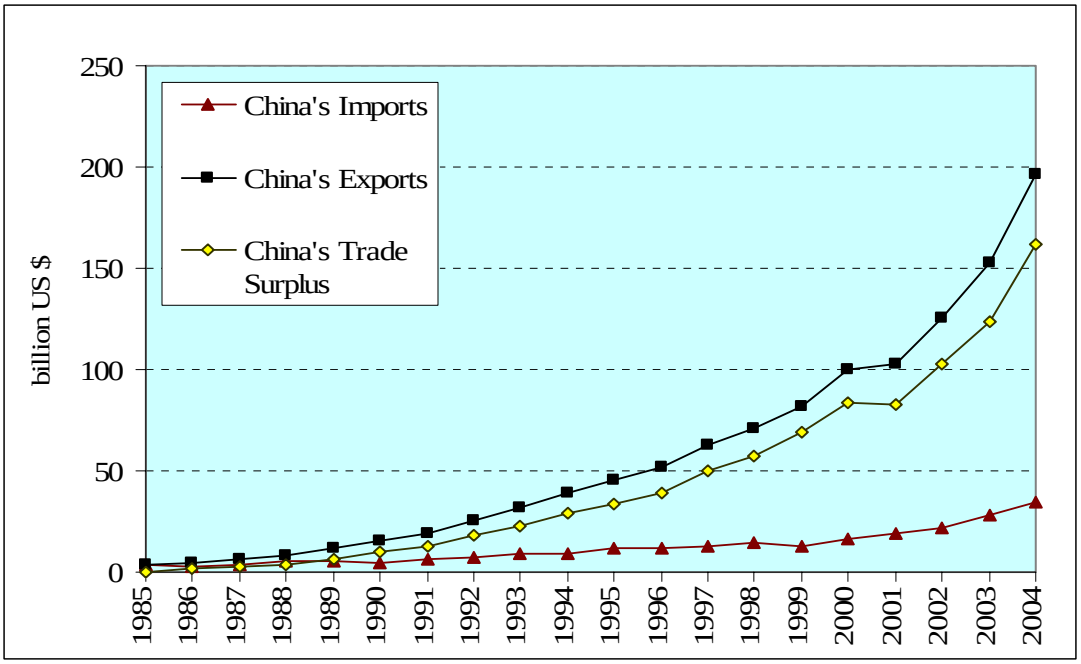
China's Trade Surplus with the United States: The Role of Exchange Rates

Won W. Koo and Renan Zhuang[1]

Introduction

Bilateral trade between the United States and China has increased dramatically over the past two decades. In particular, China's trade surplus with the United States has increased steadily with the growing trade volume between the two countries. According to the U.S. Census Bureau, China's trade surplus with the United States rose from $0.01 billion in 1985 to $33.79 billion in 1995, and it jumped to $161.94 billion in 2004 (Figure 1). China's imports from the United States have increased only slightly, while its exports to the United States have increased sharply since the mid 1990s.

Figure 1. Bilateral trade value between China and the United States.



Source: U.S. Census Bureau.

China's recent trade surplus with the United States has led some economists to claim that the Yuan is undervalued (e.g., Goldstein 2003; Chang and Shao 2004; Coudert and Couharde 2004). However, this opinion is countered by the fact that China's overall trade surplus (about $30 billion at the end of 2004) has not been as large as the surplus with the United States, which implies that China has trade deficits with other countries.

China pegged its currency (Yuan or Renminbi) to the U.S. currency at 8.27 Yuan per dollar from 1994 to July 20, 2005. From July 21, 2005, China has adopted a managed floating exchange rate system based on a basket of currencies. The principal currencies in the basket include the U.S. dollar, euro,

[1] The authors are Professor and Director and Research Assistant Professor, Center for Agricultural Policy and Trade Studies, Department of Agribusiness and Applied Economics, North Dakota State University.

Japanese yen, and Korean won. Before 1994, China had used a fixed exchange rate system and a double-track exchange rate system in succession.

The objectives of this paper are: (1) to identify characteristics of bilateral trade between the United States and China, (2) to examine the effects of exchange rates (exchange rate between the United States and China and exchange rates between the United States and other Asian countries) on trade flows between the two countries, and (3) to evaluate the roles of other factors (including bilateral trade value, market openness in the two countries, and the U.S. foreign exchange reserve) in bilateral trade between the countries.

Characteristics of Sino-U.S. Bilateral Trade

The characteristics of bilateral trade between the United States and China have changed over time. Prior to the early 1990s, the pattern was inter-industry trade on the basis of differences in resource endowments. The United States exported technology and capital intensive goods (e.g., machinery, equipment, and pharmaceutical products) to China and imported labor intensive goods (e.g., apparel, clothing, footwear, and furniture) from that country. However, intra-industry trade between the two countries has increased significantly since the mid-1990s. A major increase in China's exports of high-technology products demonstrates a surge in bilateral intra-industry trade based on product differentiation.

In order to gain insight on the bilateral trade patterns, we examine Sino-U.S. bilateral trade in three sectors: agricultural commodities (AGR), middle-technology manufacturing commodities (MID), and high-technology manufacturing goods (HIGH). The sectors are established on the basis of standard international trade classification (SITC) code. The AGR sector includes foods, live animals, beverages, and tobacco. The MID sector includes fertilizers, chemical materials, essential oils, and nonferrous metals. The HIGH sector includes metalworking machinery, transport equipment, medicinal and pharmaceutical products, and motor vehicles.

As shown in Table 1, Chinese exports to the United States have increased for all three sectors over time. However, the country's export value in the HIGH sector has grown at an increasing rate from $4.73 billion in 1989 to $121.12 billion in 2004. The share of China's exports to the United States in the HIGH sector (percentage of China's export value in the HIGH sector over China's total export value) increased from 39% in 1989 to 62% in 2004. In contrast, the share of Chinese exports in the MID sector decreased from 56% in 1989 to 37% in 2004. The export share of the AGR sector decreased from 4% in 1989 to 1% in 2004. The changes in China's exports indicate that the country's increased trade surplus with the United States is due mainly to its rapid increase in HIGH sector exports.

While U.S. exports to China in both the MID and HIGH sectors have increased over time, they have grown at a much slower pace as compared to the corresponding imports from China. The share of U.S. exports to China in the HIGH sector (percentage ratio of U.S. export value in the HIGH sector over its total export value) increased from 38% in 1989 to 51% in 2004. The share of U.S. exports in the MID sector increased slightly from 42% in 1989 to 45% in 2004. The export share of the AGR sector decreased from 20% in 1989 to 4% in 2004. The HIGH sector has taken the largest share in bilateral trade value between the two countries.

Figure 2 shows that the U.S. trade balances with Japan and South Korea have deteriorated, due mainly to the appreciation of the U.S. dollar relative to the Japanese Yen and South Korea Won since the Asian financial crisis starting in 1997. This is because goods produced in Japan and South Korea became relatively cheap in terms of the U.S. dollar, while goods produced in the United States became relatively expensive in these countries. China's trade balances with Japan and South Korea have also deteriorated, since the Chinese Yuan was pegged to the U.S. dollar and appreciated against the Yen and Won. China has imported technology intensive inputs and/or processing technology from its neighboring countries and used them to produce final products which are exported to the United States

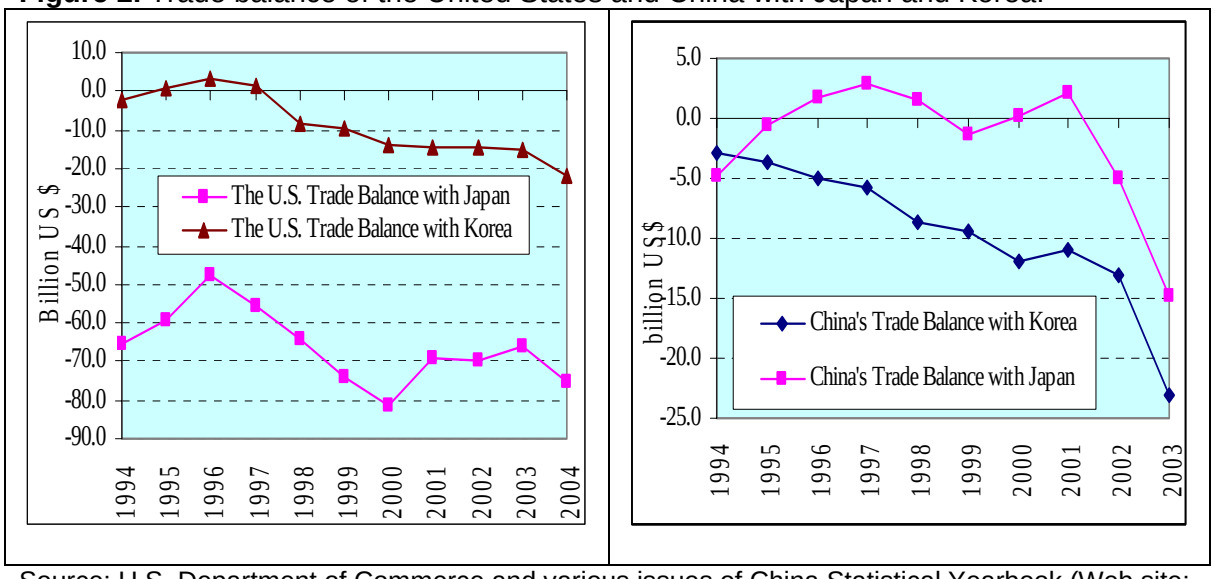
(called the third country effect). This explains why China's trade surplus with the U.S. in the HIGH sector has increased much faster than in other sectors.

Table 1. Sino - U.S. bilateral trade value by sectors (in billion US$).

Year	China's Exports to the U.S.			U.S. Exports to China		
	AGR	MID	HIGH	AGR	MID	HIGH
1989	0.50	6.76	4.73	1.19	2.42	2.20
1990	0.55	8.69	5.98	0.54	2.08	2.19
1991	0.49	10.68	7.81	0.41	3.02	2.85
1992	0.67	13.97	11.02	0.34	2.64	4.48
1993	0.61	16.86	14.06	0.37	2.08	6.32
1994	0.54	19.36	18.87	0.42	3.29	5.58
1995	0.61	21.10	23.80	1.71	4.60	5.44
1996	0.68	23.21	27.65	0.89	4.71	6.37
1997	0.76	27.94	33.87	0.58	4.83	7.40
1998	0.76	30.46	39.89	0.82	4.28	9.15
1999	0.89	34.38	46.54	0.41	4.57	8.14
2000	1.06	41.09	57.86	0.50	6.52	9.25
2001	1.19	42.96	58.20	0.53	6.86	11.84
2002	1.56	50.37	73.36	0.59	7.92	13.54
2003	2.04	59.10	91.21	0.93	12.89	14.59
2004	2.40	73.17	121.12	1.39	15.63	17.68

Source: U.S. Department of Commerce.

Figure 2. Trade balance of the United States and China with Japan and Korea.



Source: U.S. Department of Commerce and various issues of China Statistical Yearbook (Web site: http://www.stats.gov.cn/tjsj/ndsj/).

Empirical Model and Estimation

Empirically, we specify China's export share in a sector as a function of price differences for goods in the sector between the two countries, U.S.-China exchange rate, weighted average exchange rates between the United States and other Asian countries, the reserves of U.S. foreign exchange, and factors indicating market openness in the United States and in China. Since the annual time series data for prices of goods in individual sectors are not available, we use the bilateral trade value in each sector to represent the difference in prices between the two countries. We use the weighted average

exchange rate between the United States and other Asian countries to examine the effects of these countries on U.S.-China bilateral trade (third country effect). Moreover, we use the lagged dependent variable to capture dynamics in bilateral trade. The model is in semi-log functional form with all the independent variables in natural logarithm form.

Bilateral trade data reclassified according to Standard International Trade Classification (SITC) are obtained from the U.S. Department of Commerce online database (Web site: http://tse.export.gov) for the AGR, MID, and HIGH sectors. In order to obtain an appropriate number of observations for regression analysis, following a suggestion by Feenstra, Markusen, and Rose (2001), we have classified the sectors into SITC two digit industries: 14 industries for the AGR sector, 28 industries for the MID sector, and 13 industries for the HIGH sector. The weighted average real exchange rate between the United States and the Asian countries is calculated by aggregating the real bilateral exchange rates with bilateral trade values as weights for the countries (Web site: http://www.ers.usda.gov/Data/exchangerates). Data for gross domestic products, GDP deflators, consumer price indices, and reserves of foreign exchange are obtained from the International Financial Statistics online database (Web site: http://ifs.apdi.net/imf/about.asp).

The specification of our model has a potential endogeneity problem because the independent bilateral trade value variable could be correlated with the error term. To solve this problem, we use the error component two-stage least squares estimator (EC2SLS) developed by Baltagi (1981; 2001). Three instrumental variables are chosen. The first is the natural logarithm of the sum of real gross domestic products of the United States and China. According to studies using gravity type models (e.g., Glick and Rose 2001; Rose and Wincoop 2001), the sum of income between two trading countries is strongly correlated with trade volume between the countries, but tends to have no effect on the export share of a specific country. The second and the third instrumental variables are the natural logarithms of U.S. and China consumer price indices.

Results and Discussion

The estimation results are summarized in Table 2. All of the estimated coefficients have their expected signs and most of them are significantly different from zero, indicating that most of the independent variables are important factors in explaining increases in China's export share.

Table 2. EC2SLS estimation results (dependent variable is China's export share).

Independent Variables	Estimated Coefficient	Z-value
U.S.-China exchange rate	0.125[b]	2.29
U.S. - Asian countries exchange rate	0.102[b]	2.27
Bilateral trade value	0.035	1.25
Market openness in China	-0.072	-1.46
Market openness in the U.S.	0.316[a]	2.82
U.S. foreign exchange	0.093[b]	2.48
Lagged China's export share	0.453[a]	11.49
Intercept	-0.048	-0.12
R^2	0.764	
Number of observations	825	

Note: a, b, and c represent significance levels of 1%, 5%, and 10%, respectively.

The estimated coefficient for the U.S.-China real exchange rate variable ($ln\, RE_t^{us,ch}$) is 0.123, implying that a 1% increase of the real value of the U.S. dollar against Chinese Yuan would lead to an increase of at least 0.123% in China's export share.

The estimated coefficient for the weighted average exchange rate between the United States and other Asian countries is 0.102, implying that a 1% increase in the real value of the U.S. dollar against currencies in other Asian countries would lead to an increase of at least 0.102% in China's export share. Appreciation of the Chinese Yuan against currencies of other Asian countries means goods produced in the Asian countries will be relatively cheaper in China. As a result, China would increase its imports of technology intensive intermediate goods and/or processing technology from Asian countries and use them to produce final goods which the country exports to the United States, resulting in an increase of China's export share. U.S. market openness and the U.S. foreign exchange reserve are other important variables affecting China's trade surplus with the United States.

Conclusion

Our study suggests that the pegged exchange rate system has contributed to China's increased trade surplus with the United States. China has imported intermediate goods and/or processing technology from the Asian countries, produced final goods using its cheap labor, and exported those goods to the United States. This implies that the new Chinese exchange rate system, in which the Chinese Yuan is pegged to a basket of currencies, including the U.S. dollar, may reduce the effects of other Asian countries on U.S.-China bilateral trade (the third country effect), and thus may improve the U.S. bilateral trade balance with China. Our study also reveals that the U.S. bilateral trade balance could improve if the Chinese Yuan appreciates against the U.S. dollar. In addition, U.S. market openness and the U.S. foreign exchange are important factors in explaining increases in China's trade surplus with the United States.

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Results Based Risk Management Education

Jon Newkirk and Dennis Fiess[1]

Introduction

The globalization of agricultural commodity markets, rapidly rising production costs and daunting environmental challenges are forcing farmers and ranchers to make dramatic changes in how they manage their businesses. In turn, we as education providers are being forced to rethink how to provide the business management information farmers and ranchers need to succeed. To be of value to the "new breed" of agricultural producer, we must adopt innovative ways to deliver the tools they need to succeed in today's high risk environment. That is what we call **Results Based Risk Management Education**. A discussion of several major factors driving the need for change in risk management education is presented below.

The role of government – Increasingly, government policy makers are placing greater confidence in the ability of producers to make sound business decisions. They continue to pass market-oriented farm legislation and crop insurance reforms which allow producers to become more active in managing their profit opportunities and risks.

Outside forces – Many factors are forcing producers to make risky, but potentially profitable, decisions regarding their businesses. These factors include increased global competition, rapid changes in the structure of production agriculture, changes in the marketing of agricultural products in the farm supply sector, new technology, and more volatile weather patterns.

Risk Connections – Increasingly, decisions in certain risk areas are affecting the risk levels and profitability of other aspects of farming. For instance, more lenders are now requiring sound business plans before approving credit. Thus, good management of marketing risks can lower borrowing cost and result in long-term financial stability.

In the past, we have been able to evaluate the success of our educational programs by the number of people attending workshops, the number of brochures mailed or the amount of material distributed. That approach is no longer enough. Instead, we must focus on the **targeted results** we expect farmers and ranchers to learn, achieve, or apply as a consequence of their participating in our program. For example, for a program focused on business planning, success would be measured by how many participants actually created a business plan, or a program on family succession planning might be measured by how many families actually developed a written plan.

Risk Categories

The risks that farmers and ranchers must manage on a daily basis fall into five general categories: production risk, financial risk, marketing risk, human resource risk and legal or institutional risk.

Production Risk – In earlier times, the Land Grant College system led the way in developing new production technology and the Cooperative Extension Service accepted the responsibility for helping producers incorporate that technology into their management practices. In recent years, the private

[1] The authors are Director and Deputy Director, Western Center for Risk Management Education, Washington State University.

sector has become much more active in providing grower education about production risk issues, but Extension still plays an important role in creating a bridge between the researcher and the farmer.

Financial Risk – The vast majority of today's producers rely on borrowed money. Managing interest rates and cash flow has become a major risk management challenge for producers. Improved information systems, including the internet, are providing producers new buying opportunities that can help control production costs. Enterprise analysis is becoming a critical risk management tool. The rapid increase in farm size and therefore budget size is often outpacing the ability of producers to manage them. It is the rare producer who does not need improved financial risk management skills.

Marketing Risk – There was a time when all that was required of a producer was to produce. Once he/she delivered their product to the grain company or the auction barn, it was someone else's responsibility to do the marketing. Things have changed dramatically. Market volatility, product quality and food safety issues, more informed consumer buying habits and U.S. monetary policy are just a few of the things that producers must now consider when making marketing decisions. Growing urban populations that are becoming increasingly concerned about environmental and food safety issues are creating formidable challenges while at the same time offering exciting new direct and or niche marketing opportunities. Well thought out marketing strategies are rapidly becoming a necessary ingredient in any successful farm management plan.

Human Resource Risk – Divorce is one of the major factors in farm bankruptcies. It is the rare multigenerational farm operation that doesn't encounter serious "family" problems. Farm family succession issues are always at, or toward the top of the list when producers are asked about the risk management issues they are dealing with. Absent a well thought out succession plan, the future of the farm can be in real jeopardy. As farm sizes increase, farm transfer and labor management issues become increasingly important. Experience tells us that human resource risk issues can be some of the most daunting challenges that farm families face.

Legal or Institutional Risk – Taxes, environmental regulations, farm programs, product liability issues, workers' compensation, farm labor policy, etcetera all fall under this category. As with all of the risk management categories, the legal risk issues that farm families face are increasing both in terms of number and in scope.

Results Based Risk Management Education

The Extension results based risk management education program is national in scope and is administered by the Cooperative State Research Education and Extension Service (CSREES). It is administered through four regional risk management education centers located at Washington State University, University of Nebraska, Texas A&M University and the University of Delaware plus the University of Minnesota Digital Center that houses the National Ag Risk Education Library. Each Center receives funding through CSREES that is in turn distributed in their respective regions through a competitive grant process. Both public and private entities are encouraged to apply. The application process is relatively simple and is done entirely online at www.westrme.wsu.edu. All grant award decisions are made by an independent review panel of agricultural professionals representing both the public and private sectors. Grant awards are generally between $5,000 and $40,000. Progress reports are easily filed on line. When each project is completed, the final report is posted on the Digital Center's web site (www.agrisk.umn.edu) to be used as a reference for public and private educators planning similar projects.

Criteria

There are certain criteria the review panel uses to evaluate each application, each of which is discussed below.

Targeted Results – First and foremost, what are the verifiable, targeted results that producers will learn, achieve and/or apply as a result of participating in the project? It is important that applicants think through what they anticipate their participants will really do as a result of their participation. Simply attending a workshop or visiting a web site are not enough. For example, if the applicant is proposing a program to help producers improve their marketing skills, the project will likely include the benefits of having a written marketing plan. The result we are looking for is that the producer actually writes the plan. In a program on succession planning, it is not enough that participants simply gain information. Rather, they must take actions like holding a family meeting, contacting a lawyer or writing a will as a result of participating in the program.

Producer Demand – Why will producers choose to participate? It is easy to identify what producers "need to do" to improve their farming business. We are all aware of education programs that have included dynamic speakers providing much needed information, but no producers showed up. American businesses learned years ago that to succeed, they must create the products their customers want rather than what is easy or the most profitable for them to produce. That paradigm change revolutionized how businesses developed and marketed their products. We are learning that same lesson with grower education programs. It is essential that we create programs that producers want, rather than what we want to create or what we think they need.

Collaborators – Experience teaches us that strong teams produce strong programs. Outside collaborators or partners can contribute several things to a project.

- Expertise – In today's technical world, it is critical that we provide producers with accurate and timely information. Collaborators are a good source of that information. No one can be an expert on everything. By the judicious use of collaborators, the project director can strengthen the project and really impact the producer results ultimately achieved.

- Access to producers – Producers decide to participate in a program for a variety of reasons, one of which is familiarity with someone who is involved. In some cases, the right collaborator can dramatically increase the likelihood that people will participate. For example, involving a local lawyer with good name identification in the community or region in a succession workshop will increase the likelihood of success.

Results Verification – We want applicants to tell us how they will verify how successfully they have reached their targeted results. In a marketing project, how many marketing plans were actually written? In a business planning project, how many business plans were created? Verification can be accomplished through a variety of means including evaluation forms completed by participants, follow up site visits or phone calls and other anecdotal evidence. If done properly, the verification process, in total, comes down to a simple yes or no answer; did the project accomplish the specific targeted results that were included in the application?

Potential for Wider Usage – In certain circumstances the review panel will consider a project that may not fit the first four criteria, but has the potential to create longer term producer results. For example, we are currently funding a project designed to learn how to reach the new and evolving audiences for risk management education. Although it will be difficult to measure targeted producer results, the information gained may lead to improved results in a wide range of other projects.

Innovation – Similar to the wider usage criteria, there are potentially circumstances where an innovative project did not meet the results based criteria, but could still gain approval from the review panel

because of its innovative nature. New usage of technology such as web based learning is an example where a successful project could lead to improved results in other projects.

Summary

The Extension Results Based Risk Management Education program is a new approach to an old problem. How do we most effectively provide farmers and ranchers with the improved risk management skills they need to thrive in today's rapidly changing business environment? There is growing evidence that it is working. We regularly receive comments from project directors, collaborators and participants alike that our concept of focusing on results rather than activities is a valuable new tool to use in delivering quality risk management education to farmers and ranchers. We are proud of our efforts and anyone interested in providing quality risk management education to their producers is welcome to join us. You can find out more details on the Center's web site www.westrme.wsu.edu or by calling 509-477-2168.

River Basin Indicators: a Framework for Evaluation in the Rio Grande

Bruce P. Hooper and Frank A. Ward[1]

Purpose and Objectives

The American West has been the front line of river basin management challenges for more than one hundred and fifty years. Many of the world's water policy challenges and responses originated in the West, including the need to develop innovations in water law, establishment of interstate water-sharing agreements, and the search for measures to settle and develop river basin economies in dry and isolated places. These challenges facing the West continue today, with debates focusing on policy responses to climate change, measures to meet the needs of endangered species, and growing demands for a scarce resource resulting from unprecedented regional population growth. This paper aims to provide economists and other water policy practitioners with insights into measures of effectiveness for designing and evaluating river basin management programs.

River basin management is emerging in the American West and elsewhere as a focus for natural resources management (White 1997; Chave 2001; Howe 2005). The thrust is on collaborative decision-making (Michaels 2001; Sabatier et al. 2005), promoting best practices (World Bank 2006), strengthening decision-making (Hooper 2005) and international agreements for basin collaboration (e.g., the United Nations Convention on the 'Law of the Non-Navigational Uses of International Water Courses' and the European Water Framework Directive). There are growing calls for a national dialogue and interagency coordination in the United States and elsewhere to establish, facilitate and maintain basin management (Loucks 2003; American Water Resources Association 2005; Vigmostad et al. 2005; Howe 2005; Jacobs 2005).

Despite these advances, there has been limited development of evaluation frameworks of river basin governance, especially in basins experiencing critical water shortages. This paper seeks to begin addressing this gap. The aims of this paper are twofold: (1) to develop a framework for identifying potential performance indicators that reflect the key governance aspects of effective water allocation in drought prone basins, and (2) to describe an application of the performance indicators to the Rio Grande Basin of North America, a basin currently experiencing its seventh consecutive year of drought.

Development

Key Performance Indicators

The framework described in this paper was developed from the results of an international review of experiences of practitioners, consultants, basin managers, aid agencies, and water resources managers. This review was conducted as part of a separate project reported in detail by Hooper (2006). The sources of these data were an extensive review of the literature for the period 1970 to present; a review of experiences of practitioners, consultants, basin managers and water resources managers in the field; a review of previous experiences in developing evaluation frameworks for

[1] The authors are Associate Professor, Department of Geography and Environmental Resources, Southern Illinois University and Professor, Department of Agricultural Economics and Agricultural Business, New Mexico State University. The authors thank three anonymous reviewers for their valuable comments on an earlier version of this paper. Support by the New Mexico Agricultural Experiment Station is gratefully acknowledged.

Australian catchment management; lessons learned from large scale restoration projects in North America; structured and unstructured discussions with UNESCO Hydrology for Environment, Life and Policy program staff; and comments solicited from independent basin management experts and U.S. Army Corps of Engineers staff.

The review revealed 115 indicators of best practice integrated river basin management. The majority of the indicators emanate from studies and experiences that cite successful implementation methods to improve governance at the basin level. The basin management performance indicators described in Table 1 are a selection of those derived from this review and were chosen because of their relevance to water allocation, water use efficiency, mission accomplishment, conflict resolution and social welfare. These form key performance indicators (KPIs) of basin governance. The intention is that these indicators form the basis of effective natural resources management in U.S. river basins where there is an emerging crisis due to water shortages and potential overuse.

Table 1. Key performance indicators of integrated, adaptive basin governance for water allocation decisions in basins of hydrological uncertainty.

Benchmark Criteria	**Indicator Implementations**
1. Coordinated, adaptive decision-making	1. Decision-making is consensual and coordinates across sectors in the basin 2. Decision-making optimizes water use amongst competing demands and allocations are realized according to real-time information about resource availability 3. Roles and responsibilities of stakeholders in decision-making are specified and understood 4. Decisions are reviewed and improvements made when new information becomes available
2. Reduction in water allocation conflicts	5. Public involvement processes are effective: provide for joint decision-making and conflicts are resolved
3. Achievement of mission goals	6. Objectives are specified and achieved through feasible options in a river basin management plan
4. Functioning information management system	7. The information management system reports on condition and trend in basin water resources
5. Water use efficiency	8. Evidence that water use has produced higher returns from less water
6. Stakeholder welfare	9. Evidence of improved well-being among basin residents resulting from water allocation decisions

Source: Adapted from Hooper (2006)

The first group of indicators (1 to 4, benchmark 1) refers to the ability of the basin's social decision system to coordinate between sectors to achieve societal goals through a consensus-based approach to decision-making. The sectors include agriculture, industry, environmental requirements, and domestic and recreation users.

Decision-making is frequently conflict-laden and the decision system can be aided by optimization procedures, using real-time information. This process requires transparency, accountability, and specificity about the roles and responsibilities of each stakeholder group. The challenge for the social decision system is to be able to respond to new information which emanates from many sources (such as the impacts of natural catastrophes (drought), new legislation, political pressures, demands from pressure groups, and technological improvements in water use and the capture and provision of resource information). The ability of the social decision system to achieve this is a hallmark of its adaptability. Mature organizations are characterized by their adaptability, quickly responding to new information and making more effective decisions in the face of new knowledge (Comfort 1999; Hooper 2005).

The ability of the social decision system to resolve conflicts is a second benchmark. This is characterized by an effective, workable public involvement program which facilitates dialogue and consensus. The prime outcome of the social decision system in the basin is the third benchmark: its ability to achieve mission goals. These are important as they address the primary goals of water use and conservation in the basin; mission goals provide leadership direction in addressing common concerns.

The function of an information management system is a fourth benchmark and is important as it supplies knowledge to the social decision system and improves its ability to be a learning, adaptive organization; information needs to be accessible, appropriate to the setting and updated. The fifth benchmark is an efficiency measure: evidence that the social decision system has generated land and water use practices that produce higher economic returns per unit water volume. The sixth benchmark refers to improvements in the social welfare of the basin community which can be directly related to improvements in the water allocation decision system. This benchmark is challenged by the way water allocation decisions can produce both negative and positive welfare outcomes, i.e., winners and losers in prior appropriated systems. So care is needed to develop an indicator which can capture the types and the degree of impacts of well-being in the basin community.

Data Sources – User Preferences

Much of the data needed to measure the indicators can be assembled from secondary sources, including published reports of river basin organizations and performance reviews of water resources systems. However, these data are often scarce, especially where there is no formal river basin organization and/or in basins where most of the water sharing arrangements are based on informal practices or formal rules such as a river basin compact that spells out the sharing mechanism for water resources.

Data on water user preferences have considerable potential to measure the effectiveness of each of the table's governance indicators. User preferences indicate the degree to which stakeholders in a water allocation decision system are satisfied with the performance of the decision system's process and/or its outcomes. User preferences are a valuable tool in public involvement and have been used to inform natural resources policy in many settings (Priscoli and Homenuck 1986; Saleth and Dinar 2004). These preferences, the human judgments regarding the current state of a basin compared to where it should be, reveal what stakeholders want in comparison to the current status of the economic, social and biophysical environments. This distinction raises the question: What kind of correlation is there between human and nature-centered indicators? Will enacting basin management policies based on one also produce high marks (low marks) on the other? Short term political decisions typically ignore ecological values, and ecological criteria are often politically unacceptable. We separate changes in the biophysical and economic condition of the river basin, called state of the environment reporting, from the performance assessment of basin governance.

To address these issues, one method for developing a human preference based set of basin governance indicators is described. We apply that framework to a basin for which we describe a method to evaluate effectiveness of an adaptive, integrated approach. That performance evaluation is based on stakeholder preferences for basin performance indicators as well as their preferences for the basin's system for implementing management decisions.

Application to the Rio Grande Basin

In the Rio Grande Basin, water is over-appropriated, and demand for water grows while supplies of acceptable quality are constrained by drought and climate change. The basin consists of 615,100 km^2 and extends over three states (Colorado, New Mexico, and Texas) and northern Mexico (Figure 1). It is currently in its seventh year of drought, and reservoirs are at historically low levels. Continuing through

2006, agricultural and municipal river diversions have been sharply curtailed; low flows threaten endangered species. A central policy challenge is the design and implementation of plans that efficiently and fairly allocate the basin's water supplies. One special challenge is the derivation and measurement of aggregate indicators of stakeholder welfare associated with drought and with various measures for coping with drought. This challenge points to the importance of linking basin preference patterns by individual stakeholders to overall basin indicators that could function as measures for successes and failures.

Figure 1. Location of the Rio Grande Basin in the southwestern United States.

The challenge presented by the benchmarks in Table 1 is to apply them to a river basin operating under a well-enforced trans-boundary water-sharing compact, namely the Rio Grande Compact. Interstate compacts present a unique scenario in U.S. water and international water management. They operate under tight rules of engagement among each involved state, in which the rules are enforced by the federal government. While each compact has unique features, each compact specifies roles and responsibilities of the affected states as well as specifying water sharing arrangements. Hence, understanding the effectiveness of a compact will provide important insight into water resources management among participating players. Furthermore, knowing stakeholder preferences for water resources management in a compact-run basin may influence how the river management options stated in a compact can be managed to become more congruent with changing basin stakeholder preferences.

The 1938 Rio Grande Compact between Colorado, New Mexico and Texas was ratified by all three states and by the U.S. Congress. It is the most important institution for interstate water allocation in the Upper Basin, the area shown in the map. The Compact provides that a set percentage of changing river flow is allocated to each state, essentially maintaining water allocations among the three states that existed prior to 1929. The foundation of the Compact is a set of supply indices specifying the proportion of inflows from one state delivered to the downstream state. For example, Colorado may use varying percentages of its total runoff measured at the Del Norte, Colorado stream gauge, from 40% at high flows to 80% at low flows (Booker et al. 2005).

The achievement of the benchmarks described in Table 1 suggests a small number of critical factors determine basin management effectiveness (Saleth and Dinar 2004). The benchmarks shown in Table 1 are the key performance indicators. The indicator pattern that can be assembled from values assigned to each of these benchmarks is the aggregation of group preferences regarding the basin's performance. The development of the indicator pattern is the first task of a proposed study based on this paper. We therefore propose to identify the dimensions of stakeholder preferences for: (1) The effectiveness of the nine governance indicators in Table 1, and (2) The efficacy of different water resources management options in the basin under the Compact.

The first task will be developed using preferences generated in stakeholder workshops where they identify what have been the best elements of each of these nine items. Stakeholders will be asked to identify and agree to common measures of collaborative decision-making, conflict resolution, mission achievement, information use, water use efficiency and welfare. Knowing these measures, it will then be possible to develop and use a rating scheme in which the stakeholders provide their evaluation of how the social system has performed for each measure.

The second task is achieved using stakeholder preference scores for policy options summarized by the development of a basin-wide optimization tool to maximize water-related benefits in a river basin (Booker and Young 1990; Ward and Lynch 1996). Recent work (Booker et al. 2005; Ward et al. 2006) developed and applied a basin-wide optimization model to the Rio Grande basin and showed how total system benefits can be increased over historical benefits. This increase in system benefits can be achieved by exploiting complementarities between agriculture, municipal and industrial uses, recreation uses and instream flow requirements for endangered species.

The performance indicators selected for this paper include a range of total basin-wide stakeholder preferences for economic, social and ecosystem benefits. Total economic benefits are commonly measured in dry regions for judging the success of a basin’s water allocation decisions. Total economic benefit, sometimes referred to as the economic efficiency objective, presents the advantage of being a metric of considerable importance and interest in policy debates. It has the disadvantages of ignoring the distribution of those benefits as well as ignoring many important non-economic social goals. The particular policy proposal for which economic benefits in the Rio Grande Basin are judged for this paper is a proposal in which additional carryover storage at the Elephant Butte Reservoir is established for use in dry years.

Under the current method of operating the river (Law of the River), the scheduled full release for the Rio Grande Project on U.S. lands downstream of Elephant Butte Reservoir (see map) is 790,000 acre-feet per year. However actual historical releases to these lands fall considerably with reduced water available in Rio Grande Project storage at the reservoir. These releases are shared by three U.S. users: Elephant Butte Irrigation District agricultural users in New Mexico, El Paso area municipal and industrial (M&I) users, and El Paso area irrigated agriculture (Table 2). While not explicitly stated in the Rio Grande Compact, the method of sharing this water allocates 57% to New Mexico lands and 43% to Texas lands, based on proportions of historically irrigated acreage.

Table 2. Long-run average annual drought damage mitigation from alternative institution, by state, location, and user ($1000s).

Alternative Institution:	**Carryover Storage--Reduce Elephant Butte Releases in Full Years by 25,000 Acre-feet Per Year for Use in Drought**						
Drought Scenario:	**1942-1985 Historical Inflows (1.40 million acre-feet per year**						
	Colorado	**New Mexico**				**Texas**	
	San Luis Valley Ag	MRGCD Ag above Albuq.	Albuq. M&I	MRGCD Ag below Albuq.	EBID Ag	El Paso M&I	El Paso area Ag
	($1000s per year)						
Average annual economic drought damage mitigated	0	(112)	(18)	(35)	(35)	(425)	(8)
Average annual recreation drought damage mitigation, summed over 5 Basin reservoirs: Heron, El Vado, Abiquiu, Cochiti, Elephant Butte	84						
Average annual economic drought damage mitigation totaled by state	0	(200)				(433)	

Notes: Results of the drought damage mitigation are reductions in economic losses, expressed as positive numbers. Negative numbers are in parentheses, which mean that the mitigation is negative. A negative mitigation means that total economic benefits for that user are lower with the carryover storage institution than with the baseline Law of the River.

The institutional change considered for this policy analysis would reduce the historical release by 25,000 acre-feet per year, using the concept of a savings account. Current water release is reduced with the intent of putting additional water in the project storage savings account. The effect of increasing storage by 25,000 acre-feet in wetter years is to make more water available for use in drought years, when project storage would have otherwise fallen to critically low levels had the stored water summed over previous years been unavailable.

This proposed carryover storage would slightly reduce water use in full years, when its economic value at the margin is small, leaving the saved water instead in Elephant Butte Reservoir. In dry years this accumulated saved water would be available for beneficial use, when its economic value at the margin is higher because of its considerably greater scarcity. However, unlike ordinary bank accounts, Elephant Butte Reservoir pays negative interest in the form of nearly 10 feet of evaporation per year. So reducing wet year releases by 25,000 acre-feet per year contributes to less than 25,000 acre-feet available for future use, since a small amount of it will evaporate.

Table 2 shows the impact on long-run average annual economic drought damages brought about by the carryover storage management institution for coping with drought, described above. Additional details on the motivation for and measurement of these benefits at the basin scale are in Booker et al. (2005). The economic damage gained or lost is the basin indicator metric used for this analysis. However, we propose to identify non-economic benefits, articulated as user preference scores, and incorporate them in the model too.

Policy Implications

Results of the basin-wide optimization model described above integrate economics, hydrology, and institutions at the basin scale. The model provides a powerful tool to identify integrated river basin management options and to inform national and regional water policy debates. Varying scenarios can be created and after the model is developed it can be run to identify different benchmark conditions. This can be used to characterize a landscape of preference scores. A short list of potential criteria include: (1) maximum support (e.g., maximum 'yes' votes), (2) maximum economic benefits subject to hydrologic and institutional constraints as summarized in Table 2, (3) maximum ecological performance, (4) maximum recreation benefits, (5) maximum municipal benefits, and (6) minimum dissent (fewest 'no' votes). When tested over a range of sites and with known hydrological data, institutional constraints, and economic values of water, various drought-coping policy measures can be identified and the above basin indicators can be applied, which flag where effort can produce the most socially-preferred drought-coping measures.

Results of the modeling exercise whose results are described above are based on a basin-wide economic benefits optimization model. However, other approaches to improving the basin's governance can be imagined, including a survey of stakeholder preferences. Results of any systematic common denominator evaluation of the performance of a basin's governance can be interpreted as a number of new governance indicators, or replications of the proposed indicators shown in Table 1. That is, the results can then be compared and contrasted with the stakeholder preferences scores for the KPIs, which allows for modification of the KPI criteria to represent preferred governance achievements.

One benchmark for water resources management is how the total social performance of existing or proposed water use patterns can be maximized across competing interests, and among stakeholders with different values. An important question is whether or not different water allocation scenarios can be developed which reflect this maximum social efficiency of use and how effectively the decision system of the basin and its stakeholders have adopted these optimal solutions. High adoption rates, based on practices developed by measurable and testable economic analysis, are an important step to verifying good governance in a basin, which would be recognized as having higher governance indicator values. The successful application of modeling results to difficult and challenging water conflicts increases the likelihood of implementing programs indicated by the modeling exercise as producing success. Additional activity can productively identify the range of intended adoption behaviors of resource managers, agencies and other water stakeholders, both with and without the existing rules, such as those specified by the Rio Grande Compact. An important activity is to identify the actual and predicted behaviors of individuals, organizations, and water users with respect to specific policy options considered.

This research offers a diagnostic on the problem of river basin management in a specific setting: testing performance indicators which have been identified, refined and applied, based on stakeholder preferences towards an existing or proposed institution. Our example evaluates the effectiveness of the Rio Grande Compact by tracing through the implications of altering its water allocation rules.

Conclusions

This paper describes a method by which stakeholder preferences can be incorporated into a basin-scale modeling system which determines a range of scenarios for managing drought, and compared the modeling results with stakeholder preferences for nine indicators. This work in progress will require considerable testing, experimentation, and implementation. When tested over different sites and with known hydrological data, institutional constraints, and economic values of water, various drought-coping policy measures could be identified and basin indicators could be developed which flag where effort can produce the most socially-preferred drought-coping measures. Success in the development of these basin indicators based on stakeholder preferences will provide water policy makers with a

useful resource to inform decision-making. Development of this information is important in managing the impacts of drought, where water supply and institutional constraints increase pressures to find workable solutions to manage a scarce resource.

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Lessons Learned from Developing and Offering a Web-Based Course on Futures and Options

Larry D. Makus[1]

Introduction

Distance education technologies are becoming more widely used in baccalaureate and post-baccalaureate programs in both the private and public sectors. Several land grant institutions in the western region are giving consideration to (or are actually offering) off-campus agribusiness-oriented degree programs using a variety of distance education technologies, including web-based coursework. Examples include the University of Idaho (UI) with an off-campus undergraduate agribusiness degree program in Idaho Falls[2] and Kansas State University's Master of Agribusiness program.

Web-based instructional technologies seem to have distinct advantages relative to other distance education delivery alternatives, especially regarding delivery cost and accessibility. If properly designed, web-based courses can be accessed at just about any location, and are conducive to sharing coursework across institutional boundaries. Although the economics literature has discussed online courses (see Vachris 1999 or Brown and Liedholm 2002 for examples), there has been limited discussion about issues related to developing and delivering web-based instruction within the agricultural economics profession in the western region. The primary objective of this article is to share one instructor's experience developing and delivering a web-based course on a common topic for agribusiness-oriented degree programs (futures and options). Secondary objectives are to suggest some other possible applications of similar web-based courses, and encourage some additional sharing of information on issues related to web-based courses.

Course Description

The course (AgEcon 489) is a web-based course designed around the WebCT platform[3] and is offered for two credits each spring semester at the University of Idaho. To coincide with a 16-week semester, the course is comprised of 16 learning modules (Week 0 is a course orientation, and Week 15 is a course summary and final review). Each module must be completed over a designated one-week period beginning Monday at 8:00 am and ending Sunday at 11:55 pm. The learning modules are typically composed of four lectures averaging about 15 minutes each, and are presented using a narrated Powerpoint format. Each weekly module is supported by a weekly threaded discussion activity. Two questions, based on issues relevant to the week's lecture material, are initially posted by

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[1] The author is Professor, Department of Agricultural Economics and Rural Sociology, University of Idaho. Appreciation is expressed to the two anonymous reviewers for their helpful comments on this article. Development of this course would not have been completed without the assistance of Educational Communications, College of Agricultural and Life Sciences, University of Idaho.

[2] The University of Idaho's Agribusiness program in Idaho Falls is currently seeking permission from the Idaho Higher Education Board to discontinue the program. Reduced enrollments after BYU Idaho (formally Ricks College) began offering four-year degree programs, and reductions in departmental teaching resources are the primary reasons for eliminating the program.

[3] WebCT is a commercial product providing a platform for organizing web-based courses. Two common platforms are WebCT and Blackboard, which have recently merged. At the UI, WebCT has been purchased and is maintained at the university level.

the instructor. As suggested by Greenlaw and DeLoach (2003), "interpretive questions" are used to encourage critical thinking in the student responses. Additionally, a one-hour chat session is offered at two separate times during the week. Chat sessions are used to provide students the opportunity to ask questions about homework assignments, lecture materials, and administrative details associated with the course. Questions from students are generally limited, and most of the chat session time is used for class discussion. Subject matter questions are directed to a specific student, and the class then discusses the answers provided.

Both discussion formats are required and evaluated for both quantity and quality as part of the course grade (10% of the final grade). All prior weekly lectures, discussion sessions, and chat logs can be revisited at any time during the course. However, all graded activities must be completed during the designated one-week time period.

Non-graded student assignments include a weekly homework (a key is provided for self-grading the homework), and a self-graded fun activity (typically a crossword puzzle to encourage terminology development). The only consistent weekly graded activity is an online quiz the students may take up to three times, with the highest grade recorded. Weekly quizzes are composed of 10 questions (four-option multiple choice) randomly drawn, with replacement, from a bank of 50 questions. Weekly quizzes are automatically generated, monitored, and graded in the WebCT platform and represent 30% of the final grade. Extra credit assignments are offered three times during the semester, and submitted using the WebCT assignment submission procedure.[4]

Other graded activities include an eight-week futures trading activity using an online futures trading simulation (TradeSim), a paper explaining the student's futures trading strategy, and two proctored examinations (a midterm and final). The trading activity accounts for 10% of the final grade, and the proctored examinations account for 50%. Other than supervising the proctored exams, the course is entirely web-based and offered to on- and off-campus students.

Course Development

Development of the course was initiated in the fall and spring of 2002/03 while the instructor was on sabbatical leave. Three web-based courses focusing on distance education (all three are offered by a major online learning network), were completed by the instructor in the fall of 2002. The courses focused on planning and design of a web-based course (Boettcher and Conrad 1999; Draves 2002; and Horton 2000). Planning and design of the course structure were completed by late fall of 2003, supported by a significant time commitment (see Table 1) from a web-design specialist from the college's Educational Communications department.

By early January of 2004 (when the course was initiated for the first time), three weekly modules were fully prepared. Although the instructor has taught futures and options as part of an undergraduate marketing course for several years, this was a new course focused entirely on futures and options. Thus, the development process involved a new course as well as a web-based course. This becomes important in the forthcoming discussion of the time required for course development. The remaining 13

[4] One reviewer questioned whether the course was designed around WebCT's capabilities, or if the course was designed and WebCT was able to incorporate all of the learning activities. The course was designed recognizing WebCT as the supported and available delivery platform, therefore the learning activities were adjusted to fit. Learning activities are similar to what this instructor would use in a traditional course (weekly quizzes, class discussion, a written paper), and all can be accommodated using WebCT with some obvious adjustments such as quiz format and lack of a proctor during online quizzes. Perhaps the issue cannot be clearly addressed except to recognize that any choice of learning activities has to adjust to the delivery format, whether traditional or distance. So the issue may really be about the degree of adjustment.

course modules were completed as the course was being offered for the first time in the spring of 2004. Each weekly module involved: 1) putting together the week's outline of activities; 2) creating and narrating the Powerpoint slides for the four lectures; 3) writing a 50-question test bank from the week's lecture material; 4) developing the homework with a separate answer key; and 5) producing the fun activities and printable handouts. For the initial course offering, all activities associated with converting files to the necessary format and placing these files into the WebCT platform were done by the web-design specialist. Most of the homepage and navigation material is programmed in html, the narrated Powerpoint files are converted for web presentation using media software[5] and other materials are in Word or pdf format.

Development time for the course was significant. Table 1 provides a summary and comparison to a traditional course. Initial planning and design of the course, and developing the first module (Week 0) consumed about 175 hours of instructor time, and 50 hours of web-designer time. Developing the additional weekly modules varied from 25 to 40 hours of instructor time, depending on instructor familiarity with the week's content. An existing textbook on futures and options was used (Purcell and Koontz 1999). Course content follows the textbook (covering chapters 1-5, and 7-12), with examples being more Pacific Northwest focused. The average amount of instructor development time is estimated at 32 hours for each weekly module. Web-designer time for converting the files and placing materials on the WebCT platform was about six hours per week. To give some perspective, the author estimates planning time for a new undergraduate course with a good textbook to be about 80 hours of initial planning and development effort. Additionally, about 15 hours of preparation time per week would be expected.

Table 1. Initial design, preparation, and maintenance time for distance course compared to author's estimate of a similar traditional face-to-face course.

Instructor:	**Distance Course**	**Traditional Course**
Initial Design (total hours)	175	80
15 Weekly Modules (avg. hours/week)	32	15
Weekly Maintenance (3rd semester)[a]	5	4
Web Designer:		
Initial Design (total hours)	50	
15 Weekly Modules (avg. hours/week)	6	
Weekly Maintenance (3rd semester)	0.25	

[a] Weekly maintenance does not include preparation time before the semester begins, which is about the same for both courses (15 hours). Weekly maintenance time does not include delivery time for either course, which is about 3-4 hours for both course formats.

Course Maintenance and Delivery

The third offering of the course occurred in the spring 2006 semester. Annual updates are necessary, but require less time with each offering. When the course was initially developed, examples often included a specific date that was mentioned during the narration. Using current and specific dates adds a sense of relevance to examples. In a regular course, the effort required to include (and subsequently update) current dates is generally considered a worthwhile effort. However, updating the narrative on a series of Powerpoint slides takes significant effort. Altering the narration of single slides is difficult, and the entire lecture often needs to be redone. Several lectures had to be changed and re-narrated when the course was offered the second time. Text changes (such as dates) can easily be inserted in the

[5] The specific program used is Impatica. The program is easy to use, and relatively inexpensive to purchase for the basic version. Narrated Powerpoint files are very large, and Impatica is used to compress the files and provide a video-style delivery format (stop, start, pause, go back one slide, etc.).

narrated slides if not specifically discussed in the narration. Although this requires time, the process is much less time consuming than re-narrating the entire presentation. During the second offering, care was taken not to mention specific dates in the narration. For the third semester, course maintenance required about 15 hours before the semester started, and about five hours for each weekly module.

The instructor (clearly not a computer wizard and born well before the computer generation) is now able to complete virtually all the file maintenance with limited technical help. Files that need continuous updating for the course are primarily in Word and pdf formats. Narrated lectures are edited as Powerpoint files, and then converted to a media presentation format. Most of the homepage and navigation files for the course (which need limited updating) are html files. The instructor's lack of html programming skills means that efforts to edit these files occasionally go awry, and technical assistance is required to correct the mistake. There are several programs that edit html files that could be used. However, the original programmer used fairly complex web pages and conversion would take a significant amount of time.

Course delivery involves preparing for and conducting two one-hour chat sessions per week, updating and responding to the discussion board, and responding to student emails. The two chat sessions per week meets the different time availabilities of both on-campus and off-campus students, and keeps the chat sessions under 12 students per session. The discussion board questions are posted at the beginning of each week, and the instructor monitors the discussion board daily. Instructor responses to discussion board comments are posted as appropriate, and a wrap-up for the week's discussion questions is posted at the end of the week. Students email the instructor with questions and issues related to the class, and three emails are sent to students each week as reminders of what is going on in the course. Two proctored examinations are prepared and given during the semester. Total time for course delivery (separate from course maintenance) is estimated at four hours per week.

Student Performance and Course Evaluations

Class size has been relatively small, but seems to be growing. Fourteen enrolled the first semester the course was offered (11 completed), 16 enrolled with 12 completions for the second offering, and 19 students enrolled with 16 completions for the third offering (spring 2006). For the 11 students completing the course the first semester, the grade distribution was: A=4; B=2; C=4; and D=1. The grade distribution for the second offering was: A=6; B=3; and C=3. The third semester had a grade distribution of: A=3; B=7; C= 5; and D=1. Grade point averages for the three semesters were 2.82, 3.25, and 2.75, respectively. These average GPAs are within the range for a traditional upper-division course taught by the instructor, although 3.25 is certainly at the upper end of that range.

A pre-test and post-test procedure is used for the course. During Week 0 of the course, students are required to take an on-line examination using 20 randomly drawn multiple-choice questions from a test bank of 130 questions. During Weeks 14 through 15, students take a post-test involving 20 questions from the same question bank. Pre-test averages for the three semesters were 50.5%, 52.5%, and 42.7%, with post-test averages of 78.8%, 82.5%, and 85.3%, respectively. Thus, the percentage point increase in performance was 28.8 for the first semester, 30.0 for the second, and 42.6 for the third offering. A comprehensive study comparing traditional and online class performance in MBA statistics and managerial economics courses was conducted using data from the University of Wisconsin-Whitewater. Although pre- and post-test scores were not the focus of the analysis, averages reported for both suggest similar levels of improvement in both courses (Anstine and Skidmore 2005).

Customized on-line student evaluations are required for all courses offered by the UI, with two generic rankings assigned to all classes (overall instructor and overall course) on a four-point scale. Instructor rankings for the two offerings of AgEcon 489 were 3.8 and 3.6 for the two offerings, respectively, with the overall course rankings at 3.6 and 3.8. Departmental averages for all courses during the same semesters were: spring 2004 = 3.6 for instructor and 3.6 for course; and spring 2005 = 3.6 for

instructor and 3.6 for overall course. Course evaluation data for similar-sized upper division courses and for the spring 2006 course are not unavailable at this time.

Future of the Course

The course is being improved based on the experiences from previous offerings. Some of the lectures are too long (up to 25 minutes), and need to be shortened. Fifteen minutes is likely a good target for lecture length.

Chat sessions are an effective and enjoyable forum for discussion, but need to be well structured and limited to about 12 students. Review questions need to be more carefully developed before the chat session starts, and the questions need to be designed to both reinforce critical concepts and stimulate additional discussion. Putting more effort into developing appropriate questions to better engage students would improve learning from the chat sessions. Threaded discussion boards have also been effective for this course, but more effort needs to be focused on developing appropriate questions and assessing the quality of student postings. Current evaluation is primarily focused on quantity, and better assessments of quality are possible and important to encourage critical thinking as suggested by Greenlaw and DeLoach (2003).

Both discussion formats (which are a part of the course grade) suffer from a timing problem, because students tend to do most of the course work toward the end of the week (generally Saturday and Sunday). As the course is currently structured, chat sessions are Thursday and Friday, and students have likely not covered all of the week's material before the chat session. Perhaps moving the chat session to the forthcoming Monday or Tuesday after the week closes on Sunday could improve the caliber of student input. A similar problem exists for the discussion board, since students tend to post their comments over the weekend. The instructor then responds on Monday morning, after the week is essentially over. Making the posting deadline Friday at noon seems like the logical solution to this issue. However, students may not be prepared to make good discussion comments about the week's material by Friday. Since both discussion venues represent a small part of the final grade, increasing the importance of and upgrading the evaluation of both discussion formats may improve the quality and level of student participation.

Plans are to continue offering the course for the near future. The off-campus programs offered by the UI are currently being reviewed, and may be discontinued. If the course serves only on-campus students, then a traditional face-to-face course seems more likely. The web-based course takes more time than a traditional course, and is less favorably received by on-campus students than a traditional course. Two possibilities are being considered for expanding utilization of the course. The subject matter is of interest to a traditional extension audience and other agribusiness professionals. Thus, the course may be re-designed and offered as a non-credit educational opportunity for extension audiences or as continuing education credit for professional organizations.

Sharing the course with agribusiness programs at other educational institutions seems possible. Many programs are experiencing resource constraints, especially with regard to teaching resources, so exploring opportunities to share resources makes sense. Institutional barriers to sharing courses exist, but such sharing has been done between Idaho (UI), Washington (WSU), and Oregon (OSU), albeit with both successes and challenges (Anderson, Makus, and Fanno 1998).

Lingering Lessons from the Experience

The instructor's initial fear that this whole idea was a potential technological disaster waiting to happen was without foundation. The technology is manageable, even if you are computer challenged. Assistance will likely be needed during the initial course development, but the need for help is limited during additional offerings of the course. Students take surprisingly well to computer-delivered instruction, and have not expressed any major frustrations with the technology. The course seems to

work well even for those students with low speed internet access. The technology appears to be exceedingly reliable, and surprisingly tolerant regarding the abuses of a novice. A major technology failure has not occurred in three semesters of offering the course.

The process has the potential to be an effective way to deliver educational content to students. The instructor has become a believer as a result of this experience, and is impressed well beyond initial expectations. The course can be improved, the technology is changing rapidly, and students (on-campus and off-campus) are becoming more receptive. Student learning takes place, the process is more enjoyable than one might expect, and there are opportunities to extend such courses to other audiences. Web-based instruction at the university level will likely continue to grow in the future, and all disciplines should be prepared to respond.

If the course were used only for on-campus delivery, the time required for development and delivery is prohibitively high. Based on this experience, the time commitment approaches twice what it would take for a traditional face-to-face course for development time. Delivery and maintenance times are similar. Thus, if a more efficient way to deliver courses for on-campus students is the goal, web-based courses may not be the answer. However, if there is a need to serve off-campus students or share course offerings between campuses, web-based instruction may be an excellent approach.

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