China and World Wheat Markets:
Assessing Supply, Demand, and Trade in China

by Scott Rozelle and Jikun Huang

The future role of China in world wheat markets is a compelling and important issue for producers in California and the rest of the US. Some analysts have estimated that China will continue to demand large quantities of imported wheat. Others have forecast that China will gradually move to a position where domestic supply will meet the nation's demand for wheat.

Such strong views on this topic may be somewhat surprising since previous studies of China's wheat supply, demand, and trade have ignored factors that determine production, consumption, and importing behavior. Here we examine the effects of China's income growth, urbanization, and market development on its wheat demand. We also study the effects of technology, agricultural investment, environmental trends, and institutional innovations on China's wheat supply. Together, these factors will determine if China becomes self-sufficient or continues to be the world's largest importer.

Annual Grain Production and Utilization in China

Total wheat production in China rose to 99 million metric tons (MMT) in the early 1990s, making China one of the largest producers of wheat in the world. China uses over 95 percent of its wheat for direct food consumption and only 4 percent for feed.

The average resident in China consumes 85 kilograms of wheat per year. However, rural residents consume 90 kilograms per person on average whereas urban residents consume only 67 kilograms. South Korea is the only country in which per capita consumption is larger than in China.

Unlike other East and Southeast Asian countries, China produces most of the wheat it consumes, relying on imports for only 10 percent of its wheat needs. In contrast, Japan and Korea import over 90 percent of their wheat needs. However, China's wheat imports account for 10-15 percent of world wheat trade.

Sources of Demand Growth

Recent changes in the urban economy have made urban consumers almost entirely dependent on markets rather than the government for their food needs. Therefore, prices and income changes will largely determine future urban consumption. Income growth rates in China are among the highest in the world and

Flowing Toward Markets: California Water in 2000

by Richard E. Howitt

In his novel *East of Eden*, set in the Salinas valley in the 1920s, John Steinbeck describes the essential nature of water in California before the development of reliable water supplies.

> *"I have spoken of the rich years when rainfall was plentiful. But there were dry years too, and they put a terror on the valley. There would be five or six wet and wonderful years when there might be nineteen or twenty-five inches of rain, and the land would shout with grass. Then would come six or seven pretty good years of twelve or sixteen inches of rain. And then the dry years would come. The land cracked and the springs dried up and the cattle listlessly nibbled dry twigs. Then the farmers and ranchers filled with disgust for the Salinas Valley. Some families would sell out for next to nothing and move away. And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."*

While our ability to control water supplies has greatly improved, our ability to remember the variations in California water is as shortsighted as ever. With the increase in water demand and political and economic restrictions on developing additional supplies in the traditional manner, the need for a more adaptable and responsive method of allocating water in the state is pressing. California's complex economy operates on flows of energy, information, and water. These industries are "network" industries because each requires a collectively supplied network to connect supplies and demands. Over the past fifteen years market innovations in the energy and information industries have made them more responsive to changing demands and technologies. Similar market innovations can be modified and applied to California's water industry where currently the main allocation mechanism is political pressure on the local, state, and federal levels. Politically allocated water resources tend to be rigid since they reflect preferences at the time the project was initiated, but do not adjust to the rapid changes that are an integral part of the California economy. California's water situation is similar to a person who, used to having substantial cash reserves in his checking account to pay off credit cards, suddenly finding that he has to juggle one credit card against the other to balance the cycle of expenditures. California has used up all the excess capacity developed in the water industry and now has to evolve a more flexible and responsive water allocation system to match the inevitable climate cycles described by Steinbeck. Market systems are the most promising allocation system for this purpose, but they have to be tailored to the idiosyncratic aspects of the existing water system.

Increasing Water Scarcity and Complexity

The scarcity value of water in California has increased over the past fifteen years. There has been a steady growth of urban and industrial demands and an additional new and significant environmental demand for water. Despite this growth in demand there have been no new physical sources of water supply constructed during the past sixteen years. Part of the reason for the halt in constructing water projects is that the lowest cost sources of water storage and transportation have been developed. Developing new supplies by building additional water projects would require substantial increases in water costs.

Figure 1. Options for Increasing Water Supply

1. Conjunctive Use - Developable Yield
2. Supplies from Local Water Projects
3. Land Fallowing - Level 1
4. Land Fallowing - Level 2
5. Conjunctive Use - Active Recharge
6. Land Fallowing - Level 3
7. Land Fallowing - Level 4
8. Urban Wastewater Reuse
9. Surface Storage
10. Urban Conservation
11. Agricultural Conservation
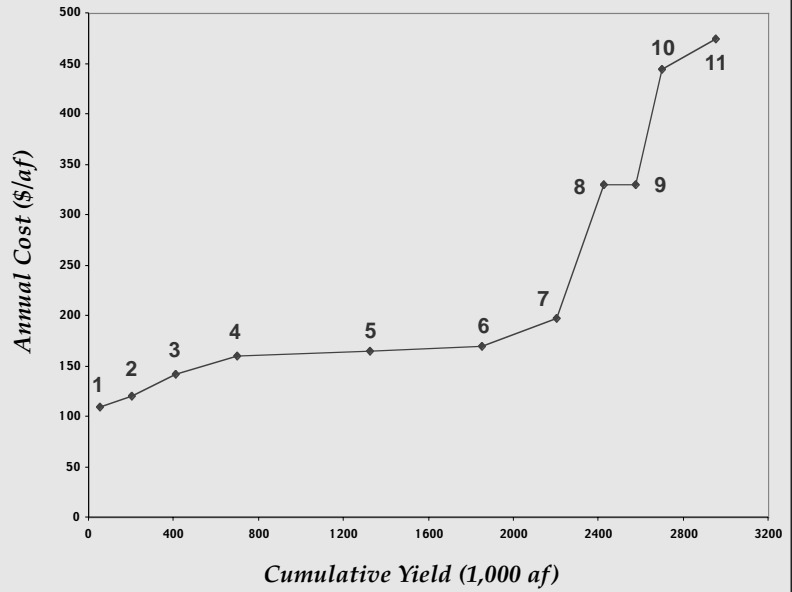
Source: Least-Cost CVP Yield Increase Plan, October 1995
US Dept. of Interior Bureau of Reclamation, Mid-Pacific Region, Fish and Wildlfe Service.

Figure 1 shows cost per unit of past water development and compares costs and quantities from alternative supply methods. The construction costs of traditional surface storage shown at point 9 in Figure 1 ($325-425/acre foot) are more than twice those for land fallowing or using underground aquifer capacity for storage ($175/acre foot). A more important reason for increased water scarcity is the growing political power of environmental water interests, which is based on public awareness and concern. Initially, environmental interests blocked development of new water projects. More recently, the major emphasis has shifted to developing alternative water allocation mechanisms. There is an interesting irony in that environmental groups that are largely concerned with issues outside the market system are among the strongest proponents of a shift to water markets.

A second force driving the flow to water markets is the growing complexity of water allocation in the state. The primary function of a market price is as a signal of relative value. Traditional water projects with fixed allocations had no need to measure the relative scarcity values of water, and used water pricing solely as a cost recovery mechanism. In the absence of a water market, this pricing approach has led to the current patchwork of water prices where the cost of water may vary tenfold between different providers. The future water industry will need to respond to changing technology, climate, and demands by reallocating the existing supplies in a way that does not penalize existing users or preempt their future development. In the allocation of all other resources, market systems have shown the ability to stimulate innovation and respond to complex

and changing demands. This is not to say that water markets are a "magic bullet" that can be easily applied to California's complex and convoluted water system. However, water markets can be defined that will stimulate the efficient properties of market pricing while also considering the special third-party and environmental aspects that are important to water use.

Environmentalists advocate using market prices for water allocation because they believe that distorted pricing of a resource leads to bad environmental outcomes. Prices are a signal of the value and scarcity of a resource that is hard for most users to ignore. A correctly functioning market operates in a way that impersonally reflects the technology, scarcity, and values of those trading in the market or those who have the option to trade. A water market can adjust to changing climate, technology, and tastes by offering voluntary incentives and compensation to those who currently use water to adjust their use and values to the changed situation. In short, markets provide an alternative supply of water from the voluntary reallocation of the existing supplies. The operation of three Emergency Drought Water Banks by the State Department of Water Resources in 1991, 1992, and 1994 attest to the ability of market incentives to stimulate a supply of water even under severe drought conditions.

More recently, there have been sales agreements between water agencies and a pilot study of electronic water trades between groups of individual water users. As in energy, transportation and information industries, change cannot be directed from above by

large agencies, but must be stimulated on the individual level. A market system that provides the individual incentives and financing for technical change and reallocation is the only mechanism able to efficiently motivate the individual water user.

Bay-Delta Sticker Shock

When you visit a car lot, the last thing the salesperson wants to discuss is the lump sum price of the car. This is to avoid "sticker shock" that can kill the deal if the customer actually knows what he/she is spending. Currently, the largest negotiations in the water industry are over the restoration of the San Francisco Bay-Delta region. Negotiators in the Cal-Fed process, as it is termed, have the difficult task of crafting a compromise between the main competing water interests of agriculture, urban areas, and the environment. While the final slate of alternative solutions have not yet been announced, current estimates of the cost of one of the three alternatives range between $10 and $14 billion. Depending on the level of federal funding, this translates into the substantial cost of $750-1100 per California family of four, a cost that will probably produce water project sticker shock. The main reason for these very high costs is that while the supply cost of water reflects market and construction realities, demands are still politically defined. The outcome of the resulting sticker shock will be in the form of demand modification by market prices.

Market Efficiency versus Local Equity

Market solutions should be as simple as possible. Additional restrictions or taxes on trades drive a wedge between supply and demand prices and reduce market efficiency. However, given the broad public interest in water rights and some projects, water market solutions cannot ignore the effect of trades on third parties. Reaction to the drought water banks of the early 1990s has taken the form of local ordinances restricting the extent and types of water transfers. Conversely, rigid ordinances impose a hardship on local individuals who can sell water without imposing costs on the community. A more flexible solution is to allow water sales and require a simple severance tax on sales to compensate for legitimate public third-party effects. Similar severance taxes on logging are levied by counties that contain public forests. There are precedents in the land market, which operates quite efficiently with similar third-party effects that are kept within socially acceptable levels by local zoning and compensation based on standard values. Local determination of third-party impacts without a veto power will lead to the gradual development of

water trades. Studies show that the amount of water that needs to be traded to bring supplies and demands into balance for the next twenty years is quite modest. Trading 8-10 percent of the existing water at market prices will simultaneously satisfy current shortfalls and curb the growth in demand. There is a wide range of water rights and uses, and since only a small proportion need be traded it seems sensible to "do the easy ones first" and develop different procedures if the need to trade water grows.

Potential Market Solutions

Two types of adjustments are required to balance California's water supplies and demands: long-term shifts in average supply to address technological and demand changes, and short-term reallocations to minimize the social impacts of California's inevitable and recurring droughts. Long-term trades require investment in changed technology for water use and some permanent shifts in water use. Current studies emphasize using depleted ground water aquifers for storage and the voluntary fallowing of low-value agricultural crops to free up tradable water. In addition to these sources, considerable investment in water transportation facilities may be required to enable markets to function with greater reliability. Spot markets and market agreements that come into force only under dry or drought conditions can satisfy short-term drought demands. In addition, the three components of water supply—water rights, storage, and transfer— could be partially de-coupled to increase the flexibility of reallocations.

Given future changes in the California economy, including radical changes in agriculture due to biotechnology innovations, a requirement for California's continued development is to have a water allocation system that is as responsive and adaptive as energy and information systems. California water should become a market commodity, and as such be allocated by prices that reflect its current scarcity rather than recover the costs of past political allocations. The challenge to those involved in all aspects of the water industry is to adapt the current system to market efficiencies while acknowledging the potential for equity impacts.

Richard Howitt is a professor in the ARE department at UC Davis. Dr. Howitt can be reached by phone at (530)752-1521 or by e-mail at rehowitt@ucdavis.edu. You can also visit his Web page at http://www.agecon.ucdavis.edu/Faculty/Dick.H/Howitt.html

As Goes Microsoft, So Goes The Computer Industry

by Thomas W. Hazlett and George Bittlingmayer

Sen. Ron Wyden (D., Ore.) is credited with the observation that competition is much too important to be left to the market. The Clinton administration seems to agree, as evidenced by its recent massive antitrust lawsuit against Microsoft. But has anyone bothered consulting the market to find out whether it agrees with the politicians?

As a matter of fact, we have. In the Microsoft antitrust case, Mr. Wyden's maxim is testable. Thanks to a nearly decade-long interest in the question of Microsoft's market power by both the Federal Trade Commission and the Department of Justice, we have a historical trail of enforcement actions against the maker of MS-DOS and Windows. By examining how the stock prices of various computer companies react to such events, we may actually observe an unbiased forecast—provided by investors playing for their own financial success—of the likely impact of antitrust actions against Microsoft in promoting economic efficiency.

It is obvious that any sort of antitrust action taken against Microsoft will hurt its shareholders. Thus Microsoft stock-price reactions flag those antitrust actions investors take to be serious threats to Microsoft.

Vested Interest

Whether these actions are likely to improve efficiency in computer markets we may glean from the stock-price reactions of other computer companies. They have a vested interest in seeing Microsoft behave more competitively. Such an outcome would lower the cost of software while expanding the size of the market for companies producing complementary products such as chips and peripherals. Moreover, it would clear the path for rival software firms to compete successfully with Microsoft. These companies are now supposedly constrained by Microsoft's exclusionary tactics. Alan C. Ashton, president of WordPerfect, told The Wall Street Journal in 1992: "Microsoft's sway over operating systems and applications puts everyone else in the industry at a disadvantage. They are a threat to everybody in the industry."

To gauge how investors reacted to announcements of federal antitrust action against Microsoft, we identified all articles breaking news on this subject in The Journal from 1991 through 1997 (54 in all). During this period the FTC investigated Microsoft for monopoly abuses, but deadlocked on seeking prosecution of the company in 1993, whereupon the Department of Justice quickly intervened with a new investigation of its own. That process created a 1994 consent decree concerning Microsoft's marketing—which Judge Stanley Sporkin in 1995 tossed out as insufficiently strict. Later that year, the US Court of Appeals for the District of Columbia Circuit overruled Judge Sporkin and reinstated the consent decree. In October 1997, the Justice Department alleged that Microsoft had violated the decree, a claim that is still being litigated.

Here's how we measured the effects these events had on stock prices: Around the dates of these events—specifically, a three-day window beginning on the trading day prior to the appearance of the article—we examined the abnormal stock returns experienced by Microsoft itself and by a broad index of 159 computer companies. (We included every hardware and software firm listed in Hoover's Guide to Computer Companies that was publicly listed and operated primarily in the computer sector, excluding Microsoft, weighted each firm equally in each of nine computer industry segments, and then weighted each industry segment equally when estimating aggregate industry returns.)

We divided the events into "positive," "negative," and "ambiguous" news categories. (A positive story was one that would tend to help Microsoft, by announcing a withdrawal of enforcement action—say, the circuit court overruling Judge Sporkin.) If investors expect antitrust intervention to increase competition, then the returns to Microsoft shareholders (subtracting out marketwide effects) should be negatively correlated with the returns for the rest of the computer sector.

Microsoft—*continued from page 5*

Average Abnormal 3-Day Stock Returns Around Microsoft Antitrust Events, 1991-97

	Pro-enforcement actions (n=29)	Anti-enforcement actions (n=8)
Microsoft	-1.2%	+2.4%
Computer Industry (159 companies excluding MS)	- 0.6%	+1.2%

When Microsoft takes a negative hit, the computer index should blip up—and vice versa.

The actual results, however, came out strongly the other way, as shown in the table above. Unsurprisingly, when Microsoft receives good news, its stockholders experience average market-adjusted returns of 2.4% (per each of eight events). But the news is also good for the industry as a whole, which sees average returns of 1.2% over the same dates. (Both returns are significantly greater than zero at standard levels of statistical inference.) During negative event windows (29 in total), Microsoft stockholders incur average returns of minus 1.2% per event, while the non-Microsoft computer portfolio declines 0.6%. (Again, both are statistically significant.)

The returns for a few companies—including Netscape, which is leading the charge for the recent antitrust enforcement actions—do exhibit some positive reaction during antitrust event windows, thus helping to explain why such companies would lobby for sanctions. Yet the overall conclusion is inescapable: As goes Microsoft, so goes the computer industry.

The movement of the market, when the Justice Department announced its latest action against Microsoft, appears to fit the pattern we found. Microsoft stock declined 3.8%. Compaq—Microsoft's biggest customer—saw its share price drop 3.5%, while both Intel and the Nasdaq computer sector index were down 1.2%.

The evidence strongly suggests that Wall Street does not see federal antitrust action against Microsoft as a solution to whatever monopoly power it may possess. Customers want operating-system software that works, and upgraded software that works better—sooner rather than later. The rest of the industry prospers when consumers are able to plug their products into friendlier, more functional computers. Disrupting the release of new Microsoft products due to legal action can upset the entire sector. It is significant that the Justice Department's antitrust actions increased the uncertainty surrounding the introduction of both Windows 95 and Windows 98, unsettling large segments of the computer industry.

California was one of the twenty states which joined the US Department of Justice's antitrust suit against Microsoft. Many of Microsoft's fiercest industrial competitors—among them Netscape, Sun, and Oracle—are headquartered here and have a substantial political presence. Overall, Silicon Valley's software sector is decidedly hostile to their rival from Redmond. But much of the state's computer manufacturing sector believes it stands to lose from prosecution of Microsoft.

Intimidating Shadow?

The recent letter sent to the Justice Department by 26 computer company CEOs—including the leaders of Intel, Compaq, Hewlett-Packard, Dell, and CompUSA—should give the antitrust enforcers pause. The companies whose names appear on that letter stand to benefit monetarily from actions that would make operating system software better, cheaper, more reliable, more open to innovation, and easier to use. The techie trade press has derided these executives for lining up behind Microsoft as evidence of Microsoft's long, intimidating shadow.

But investors in global capital markets stand in broad daylight. Their verdict is compelling because they are fearlessly independent wealth maximizers, and they have—over seven years—also lined up solidly behind Microsoft and against federal regulators. The smart money is shorting the government's case that antitrust enforcement will promote competition and enhance consumer welfare.

Ask the ARE Faculty

WHAT WILL BE THE IMPACT OF A NEW GUEST-WORKER PROGRAM IN CALIFORNIA?

On July 23, 1998, the US Senate approved S2337, the Agricultural Job Opportunity Benefits and Security Act of 1998 (AgJOBS) on a 68-31 vote as an amendment to the $33 billion Commerce-Justice-State Department appropriations bill. The Clinton administration expressed "strong opposition" to AgJOBS, and AgJOBS faces an uncertain future in the House.

The AgJOBS program would provide for an "alternative program for the admission of H-2A workers." The H-2A program admitted about 15,000 legal nonimmigrants to be employed in farm jobs in FY97, including several hundred sheepherders in California. AgJOBS is based on a new type of employment service, a "registry" that includes the names of legally authorized workers willing to do farm work. Farmers would notify the registry if they needed workers. If the registry had insufficient US workers, farmers would receive permission to have admitted and then employ H-2A workers. Under AgJOBS, US and H-2A workers would not have to be provided with free housing, as under the current H-2A program.

The AgJOBS H-2A program is very employer-friendly, and could be expected to dramatically increase the number of workers with H-2A visas employed in California agriculture. Currently, some 800,000 to 900,000 individuals work for wages on California farms sometime during a typical year; peak employment is about 400,000 in September. An estimated 40% of these farm workers are not authorized to work in the US.

If legal workers were available roughly at the same cost as currently unauthorized workers, as might be the case under the AgJOBS H-2A program, there may in 1999 be several hundred thousand AgJOBS H-2A workers in California, including currently illegal workers who receive H-2A visas.

Phil Martin, ARE Professor

WHERE DO YOU SEE BEST OPPORTUNITIES FOR GROWTH IN CALIFORNIA'S ORGANIC PRODUCTION?

The greatest opportunities for growth in organic agriculture are probably in meat and poultry. The labeling of meat and poultry comes under the jurisdiction of the Federal Safety and Inspection Service (FSIS), which is part of USDA. They are in the position of approving requests for the labeling of meat and poultry sold in the United States. To date, FSIS has denied all requests to use the label organic or certified organic on meat and poultry, essentially locking livestock producers out of the burgeoning organic market. The rational has been that until the Organic Foods Production Act of 1990 (OFPA) is implemented, there are no national standards for organic production and, in particular, no definition of organic livestock from which to make a ruling. Therefore, when the rules are established from OFPA, the opportunities thus far unavailable to livestock producers will open up. Obviously, this will also create a demand for organic feed.

Karen Klonsky, Extension Economist

Submit your questions for the faculty to:

Julie McNamara
ARE Update Managing Editor
Telephone: (530) 752-5346
FAX: (530) 752-5614
e-mail: julie@primal.ucdavis.edu

China—*continued from page 1*

will sharply increase food demand. However, increased urban incomes are likely to have larger effects on the demand for livestock products and feed grains than on food grains.

In most Asian countries wheat consumption would be expected to rise as populations shift from rural to urban areas. However, this may not be the case in China because per capita wheat consumption in rural areas is so much larger than in urban areas. The urban population in China increased from 19 percent of total population in 1980 to 28 percent in 1992. This migration pattern is expected to continue. Since rural demand currently exceeds urban demand, China's future migration is expected to dampen wheat consumption.

Sources of Supply Growth

One-time institutional changes contributed to the high growth in wheat production enjoyed by China's agricultural economy in the early 1980s. But technology was important in the early reform period and was responsible for most of the growth in the agricultural economy in the late 1980s and early 1990s. Today in China, new varieties dominate wheat-producing areas. Investment in agricultural research in the past stimulated growth and is the key to maintaining strong supply growth.

Investment in agricultural infrastructure, especially irrigation, also boosted China's agricultural growth in recent decades. Since the early 1950s, China has increased its irrigated area from 18 percent to 50 percent of cultivated area. However, annual irrigation investment has been stagnant since the late 1970s.

China's Wheat Economy in 2000 and 2020

Based on our economic simulation model, per capita wheat consumption in China should crest in the late-1990s. Starting from a 1995 baseline of 85 kilograms, per capita wheat consumption is projected to remain constant over the first fifteen years of the twenty-five-year forecast period. Per capita wheat consumption declines to 82 kilograms in 2020 (Table 1, row 1). Total wheat demand continues to increase through 2020 mainly because of population growth.

Aggregate wheat consumption is projected to reach 138 million metric tons (MMT) by 2020 (Table 2, column 7). Wheat consumption rises about the same percentage as for rice, China's other staple food grain, but increases by much less than for feed grain consumption.

Projections of wheat production in China indicate that wheat output will increase more slowly than

Table 1. Projected Annual per Capita Wheat Food Consumption under Alternative Income Growth Scenarios in China, 1996–2020

Alternative Scenario	Per Capita Wheat Food Consumption (kg)			
	1995	*2000*	*2010*	*2020*
Baseline				
National Average	85	85	85	82
Rural	92	94	96	97
Urban	67	68	69	68
Low Income Growth				
National Average	85	84	83	80
Rural	92	93	95	95
Urban	67	68	68	67
High Income Growth				
National Average	85	86	86	83
Rural	92	95	98	98
Urban	67	69	69	68

Note: Base year is 1995. Source: Authors' estimates.

wheat consumption in the 1990s (Table 2, columns 1 to 3). In the year 2000 domestic wheat output is predicted to reach 110 MMT, only about 10 percent more than the early 1990s (99 MMT). However, the gap between wheat output and consumption is expected to narrow after 2000 (Table 2, columns 4 to 9). The increase in production is predicted to largely be a result of the resumption of investment in agricultural research.

The predicted annual growth rates for production and consumption in the late 1990s imply an initial rising deficit in wheat. Wheat consumption rises at about 1.6 percent per year, 1.28 percent from population increases and 0.32 percent from rising per capita wheat consumption, while wheat production grows at only 1.3 percent per year. After wheat imports rise somewhat in the late 1990s, imports fall back to their current levels by 2010 and approach zero in 2020 as supply increases and demand slows (Table 2, row 1, columns 6 and 9).

Alternative Projections

The sensitivity of the results to changes in the underlying forces driving the supply and demand balances is evaluated by altering baseline growth rates for variables including income, population, and investment in technology (Table 3). Lower population growth rates would reduce wheat demand by only 8

MMT (from 138 MMT to 130 MMT) in 2020 compared to the baseline with wheat imports completely disappearing (Table 2, row 2). Higher population growth rates would lead to increased imports of about 15 MMT in 2000 and imports would remain positive through 2020 (Table 2, row 3). Income growth, investment rates, price and market liberalization simulations are similar to the population growth rate simulations (Table 2, rows 4 through 7). Since expenditure elasticities for wheat are low, import demand for wheat rises but does not explode with rapid income growth. This outlook stands in stark contrast to aggregate grain import demand, which varies sharply with the assumed income growth rate because the income elasticity of demand for livestock and the indirect demand for grain are much higher.

Continuing high levels of grain imports in China can be expected only if there is a continued decline in the growth of agricultural investment and if the government does not respond with countervailing policy measures as import levels rise. Agricultural research and irrigation investments have recovered in recent years and when grain prices rose in response to tightening grain supplies, government policy makers responded with promises of greater investments in agriculture. Most of the investments have been targeted at irrigation, but improvements in the operations of research institutes have also been announced.

Table 2. Projections of Wheat Production, Demand, and Net Imports (million metric tons) under Various Scenarios with Respect to Population, Income, Technology and Price Policies, 2000–2020

Alternative Scenario	2000			2010			2020		
	Demand	Production	Net Imports	Demand	Production	Net Imports	Demand	Production	Net Imports
Baseline	123	110	13	132	122	10	138	137	1
Low pop growth	121	110	11	128	122	6	130	137	-6
High pop growth	125	110	15	136	122	4	144	137	7
Low income growth	122	110	12	130	122	8	137	137	0
High income growth	124	110	14	134	122	3	140	137	3
Low investment rate	123	108	15	132	118	14	138	129	8
High investment rate	123	111	12	132	126	6	138	144	-6
Protection of domestic production[a]	123	111	12	130	123	7	135	139	-4
Liberalizing wheat market[b]	123	111	12	130	123	7	135	139	-4

[a]*Real wheat prices will keep level with 1995 over projection period.*
[b]*Real wheat prices will decline (with a growth rate of -1%) more than the world trend (with a growth rate of - .5%) in order to bring China's domestic wheat market prices close to the world prices.*

Source: Authors' estimates.

China—*continued from page 9*

Table 3. Important Factors Affecting the Supply and Demand for Grain and Rice in China's Economy, 1958-1992

Year	(1) Urban Income per Capita	(2) Rural Income per Capita	(3) Market Development Index	(4) Ratio of Urban Population	(5) Agriculture Research Expenditure	(6) Irrigation Expenditure
1958	n.a.	n.a.	n.a.	16	165	3053
1965	n.a.	n.a.	n.a.	18	357	1314
1970	n.a.	n.a.	n.a.	17	401	3256
1975	229	101	21	18	700	4526
1980	372	167	31	19	791	3209
1985	490	298	42	24	1078	2016
1990	593	306	45	26	808	3006
1992	778	319	46	28	977	5527

Notes and Sources: (1) and (2) are from ZGTJNJ (1980–1993) and are measured in real 1985 yuan. (3) is from Huang and Rozelle (1995) and measures the proportion of food purchased by rural households in consumption markets. (4) is from UN. (5) and (6) are in real 1985 million yuan and are from SSTC. (7) and (8) are in real 1985 million yuan and are from MRWEP.

Several factors may mitigate the decline in wheat import demand. For example, currently the intense rice-wheat and wheat-maize rotations in most of the nation's wheat-producing areas require large quantities of labor and may not be conducive to mechanized planting and harvesting. As wages increase, pressures will rise to search for labor-saving cropping patterns. With higher demand in the future for feed grains, farmers in some areas may choose to move to single season corn, a trend which if pervasive enough could reduce China's domestic wheat supply and increase its demand for imports.

Conclusions

China is unlikely to import increasingly larger volumes of wheat in the near future. In fact, the most likely scenario is that China's wheat imports will fall by 2020. China could very well become self-sufficient in wheat within 25 years. However, there are scenarios under which China would continue to demand large volumes of wheat, especially if the structure of cropping patterns changes drastically or if the government is unable or unwilling to create its own new technologies to increase the wheat supply. Importing new wheat production technologies from other parts of the world provides China a viable alternative to developing its own. The most significant difference between our predictions and the predictions of others is in the nature of the demand for wheat-product in China, which will not have very high demand growth in per capita terms even as incomes grow and which will decline in importance as the rural populace begins its inevitable move to the cities. Taking all factors into consideration, it does seem unlikely that China will become a much bigger wheat importer in the coming decades.

Despite poor prospects for bulk wheat exports to China in the future, there may still be opportunities for California wheat farmers to take advantage of the "China Market." Increasingly sophisticated urban consumers with changing tastes and preferences will be demanding a wider variety of higher quality wheat products. Imports can supply pastry-quality flour, hard pasta wheat, and a variety of processed and unprocessed wheat goods. Some California wheat producers have already adopted varieties allowing them to capture niche markets in other countries around the world. Given the size of China's consumer base, establishing a presence in a small corner of a new market could be a lucrative new channel for California agricultural exports.

Scott Rozelle is an associate professor of agricultural and resource economics at the University of California, Davis. His current research focuses on the economics of development and production economics. To obtain additional information on this subject, contact Dr. Rozelle at (530) 752-9897 or through e-mail at rozelle@primal.ucdavis.edu. Jikun Huang is a research scientist at the Center for Chinese Agricultural Policy in Beijing, China.

ARE Faculty Profile

Professor Hoy Carman became a member of the faculty of ARE at UC Davis in 1967, after two years service as a captain in the US Army. Born and raised on a ranch in northeast Oregon, Hoy received his B.S. and M.S. degrees in agricultural economics at Oregon State University. He completed his Ph.D. in agricultural economics (1964) from Michigan State University where his dissertation examined and measured factors associated with economies of size for Michigan apple-packing plants. While on the ARE faculty, Hoy has served as associate dean in the College of Agricultural and Environmental Sciences (1983-1986), and chair, Department of Agricultural Economics (1989-94). He also worked as an economist for Farmers Markets, Inc., while on leave from the department.

Dr. Carman's main fields of interest include agricultural marketing, marketing orders and agreements, managerial economics, and the economic aspects of taxation. His research publications in these areas include over 100 entries. Recent and ongoing research focuses on the various economic impacts of government-sponsored agricultural marketing programs, with emphasis on marketing orders and commodity commissions. Hoy has participated in studies of the impacts of quantity controls (including prorate and reserves), quality controls, and advertising and promotion programs. Some of the commodities covered include apples, citrus, almonds, avocados, kiwi fruit, walnuts, and prunes. He was one of four members of an Economic Research Service, USDA-sponsored study team that developed performance criteria for evaluating Federal Marketing Order programs. He also offered expert testimony and helped prepare a brief of *Amici Curiae* for the California attorney general in the *Glickman vs. Wileman Bros.* First Amendment case against marketing order advertising programs. A highlight of this latter activity was the opportunity to attend the US Supreme Court hearing, where both sides presented their oral arguments.

Hoy also has had an ongoing interest in the impacts of federal income taxes on agricultural investments (see *ARE Update*, Spring 1998). He has prepared numerous publications on the topic of taxes and testified before Congress on the subject. He recently pulled together his and others' research on the impacts of income taxes on agricultural firms in a book, *U.S. Agricultural Response to Income Taxation*, published by Iowa State University Press in late 1997.

Professor Carman teaches popular and large-enrollment courses in the department's managerial economics program. These include courses in both

Hoy F. Carman

undergraduate and graduate agricultural and managerial marketing, microeconomics, production management, and case problems in management.

Hoy is a frequent participant in international activities including a Fulbright Research Fellowship to New Zealand, bi-annual invited lectures at the Mediterranean Institute in Spain, and joint research projects. He is a member of several professional organizations and his biography can be found in *Who's Who in America*.

Visitors to Hoy's office are able to view several limited-edition art prints, selected by his wife Pat, that provide a strong clue about his outside interests in hunting and fishing. He does early morning rice field research on duck behavior each fall and winter, an activity that many colleagues view as bordering on "just about crazy." He is a serious elk hunter who owns some timber and pasture land adjacent to the family ranch that assures he will draw a tag each year. He has enjoyed much better than average success on his annual trips to the ranch, located just north of Wallowa, Oregon. He also has a relatively new fishing boat that he plans to use more in the future than he has been able to in the recent past.

Dr. Carman can be reached by telephone at (530) 752-1525 or by e-mail at carman@primal.ucdavis.edu. His publication list can be accessed through his Web page at http://www.agecon.ucdavis.edu/Faculty/Hoy.C/Carman.html

Agricultural and Resource Economics Update

Visit our Web site at:
www.agecon.ucdavis.edu

UNIVERSITY OF CALIFORNIA, DAVIS

Dept. of Agricultural and Resource Economics
University of California
One Shields Avenue
Davis, CA 95616
#0205