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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 per year, which are mailed out in the spring and fall.

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Rangeland Economics, Ecology, and Sustainability: Implications for Policy and Economic Research

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Introduction

“Economic research in range management is concerned with management decisions by people in relation to the goals they desire. ... Questions and decision making are conditioned by the economic and social environment of our society.” (Cook and Stubbendieck 1986, p. 183)

This observation of the role and context of economic research on rangelands has not changed over the years. Yet, rangeland economic research and policy needs have not been systematically examined since Cook and Stubbendieck (1986). Our purpose is to consider what the future rangeland research needs are for economic and policy analysis. In this examination, the scale of analysis is extremely important. Often the policy questions affect firms, communities, regions, or the nation as a whole and change over time.

Basic Rangeland Economic Models

A central premise of traditional rangeland economic studies is that private ranchers will choose to apply an improvement practice out of enlightened self interest (Sayre 2004). Similarly, for policy analysis, the profit motive is assumed to determine the adjustments that will be made as policies change. The quantitative analysis starts with the individual firm as the basic unit of analysis. A typical ranch is defined for a particular area and is developed through either expert panels or surveys of livestock producers. Impacts are imposed upon this model ranch to determine how it would react if it behaved as a profit-maximizing operation. With this approach, we find the profit-maximizing mix and quantity of products that should be produced, the best way to produce those products, and the effect on profits. As land use policies and prices change, ranchers are assumed to adjust their production strategies and resource use so as to maximize profit.

With that in mind, many of the same research needs identified in Cook and Stubbendieck (1986) remain today. While progress has been made in many areas, in order to answer policy and economic questions there are both theoretical and data issues to resolve. For a profit maximizing or cost minimizing firm, economics can provide some insights into the decisions to be made. While we know that most ranchers are not profit maximizers in the economic sense (profit is not the most important decision criterion), they can generally be assumed to prefer more income to less, holding everything else constant (Gentner and Tanaka 2002, Torell et al. 2001). In order to determine what ranchers should do as policies and conditions change, or perhaps more important “what they will do,” there are three basic sets of data that are required: (1) input prices, (2) output prices, and (3) basic ecological, biological, and physical data along with knowledge and assumptions about the motivations of land users.

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Input Prices

Input prices are generally the most straight-forward data to obtain. As long as we can identify what inputs are required to produce an output, finding a market price equivalent is generally not difficult. Further, because much of the input for rangeland improvements and management strategies are incurred early in the planning process, prices of these inputs are usually known with more certainty than output prices.

Output Prices

Market and non-market output prices are what economists are most concerned about. Determining market prices is normally a matter of determining the location and time of the market for which you are seeking prices for a given product or service and finding the appropriate reporting service.

Non-market goods and services provided from rangelands are generally much more difficult to value. Techniques have been developed over the years to estimate these non-market values with two common approaches being the travel cost and contingent valuation methods. Each has its own set of assumptions, constraints, and limitations. Some question whether these non-market resource values are both comparable to market prices and applicable to broader areas than where they were estimated. The debate centers on whether survey respondents provide reliable estimates of the value of non-market goods and services, given that the public has little or no experience with purchasing such goods. Critics note that for a variety of reasons, respondents' stated intentions may not equal true willingness to pay. Observers have noted that respondents may not carefully consider personal budget constraints when stating willingness to pay bids. Bids may reflect individuals' interest in contributing to a worthy cause rather than their true value for the resource in question (Carson 2000).

Basic Ecological, Biological, and Physical Data

There exists a large body of research regarding the implications of different management practices on the ecology, biology, and physical environment of rangelands. While each study provides more information, from an economic modeling and policy perspective, they are not always helpful. The information most useful for economic analyses is in the form of a functional relationship rather than replicated studies of a control and a treatment. Development of these functional relationships requires many treatment levels over time to quantify the desired relationships. There are some basic issues in that trade-off. The most important trade-off is related to the statistical validity and accuracy of an experiment. Normally time and money are limited for any given study so the trade-off is more treatments versus more replications. Economists generally prefer more treatments while ecologists usually prefer more replications. From a policy and management perspective, the question is not always whether to do something or not (the all-or-nothing dilemma), but rather at what intensity should it be implemented.

Looking to the Future

As we examine future research needs of rangeland economic and policy analyses, there are several core areas where our understanding must improve. Economists have historically used profit maximization as the explicit goal of decision-makers in economic models. There has been work done in many areas that indicate profit is not the primary or even secondary motive of ranch ownership. Instead, lifestyle and the way-of-life are the top motivating factors (Gentner and Tanaka 2002; Torell et al. 2001; Sengupta and Osgood 2003; Torell et al. 2004). This is especially true in ranching where average rates of return on investment have historically been low compared to other investment alternatives. Because we know that people do invest in ranching and choose to accept these lower returns, there have to be other criteria that are valued. We assume that ranchers prefer more money to less, but with other more important objectives they will not always choose the alternative that gives

them the most money. This does not mean that economic models are not useful in the decision-making process. It does mean that the results must be interpreted carefully.

Public land managers may not even consider profit as a decision criterion when they are making allocation choices. Economics can still play a role in defining the relevant costs and benefits from each alternative that the decision-maker can weigh. The problem for nonmarket goods and services is when subjectivity can enter into the decision process. Nevertheless, economics can provide useful information to these decision-makers, but it has to be interpreted in context with other priorities.

As an alternative to traditional quantitative methods for range economics research, Sayre (2004) highlights that in some cases qualitative research tools may be most appropriate. Qualitative research is much more subjective than quantitative research and mainly uses individual, in-depth interviews and focus groups to collect data. Through interviews of land users, we might identify the range of adoption rates for new technologies, why rangeland conditions are in their current state, thresholds where significant change in rangeland uses would be expected, and how alternative rangeland users are likely to adjust to a particular policy change. The qualitative research could also be used to assess the goals and objectives of land users and how those users indicate they would respond to altered land use policy.

With that as background, the areas we see as needing further research include: (1) decision-maker motives and how they relate to actual management decisions and actions, (2) ecological, biological, social, political, and economic relationships, and (3) how different human and geographic scales affect the results. Each of these areas will have different levels of importance depending upon the policy question being asked.

Decision-maker Motives

Research in this area needs to focus on both the private and public decision-maker. In both cases, we need a better understanding of the objectives each one is striving to attain. Once we know those objectives, we must understand how decisions are made and actions are implemented as land users and managers try to achieve their individual goals. It is only then that we can begin to incorporate that decision process into our economic and policy analysis models.

If ranchers list "lifestyle" as the most important reason for buying a ranch, does that impact the management decisions of the ranch? For example, riparian area management has been an issue for several years and is likely to continue into the future. One alternative may be to herd cattle away from streams or to fence them off. From a purely profit maximizing position, we can determine which choice should be made. The rancher may be asked or expected to incur the herding costs but the resulting benefits of improved riparian habitat accrue to the public and recreational public land user. The rancher may opt not to herd animals because of the lack of personal benefits, because of time constraints or because it does not fit the lifestyle being sought. Or, they may choose to herd the animals because the idea of being out on horseback all day is appealing, regardless the profit consequences. In either case, the profit-maximizing choice is altered by these noneconomic motives.

Similarly, the private and especially the public land manager may have other criteria that need to be considered when making allocation decisions. Even if all the relative values for inputs and goods and services were known, different decisions may be made based on alternative management objectives. As an example that highlights the growing importance of other management objectives, and also the deteriorating evolution of the economics of many traditional range improvement practices, net present value analysis for many rangeland improvements indicates they are not economically justified based on the traditional comparison of added costs versus added livestock returns. This situation has existed for many years (Smith and Martin 1972). Yet, private individuals and land agencies have spent millions of dollars implementing these apparent "uneconomical range improvement practices." In some cases the expectation is that other non-quantified resource values that are desired by society, such as enhanced

watersheds, water flows, improved wildlife habitat, and rangeland health, justify the private expense and the additional expenditure of cost share dollars (Lee et al. 2001). In other cases the improvement is implemented knowing the economics of the improvement is dismal but a brush and tree infested landscape is not desired by the resource manager. This recognition of "other resource values" was made by Hyder and Sneva in 1956 (p. 34) with the statement: "The economics (sic) of brush control must be determined by the amount of forage and meat products gained; however, the principal objective in brush control should be an upgrade in range condition."

Ecological, Biological, Social, Political, and Economic Relationships

The Sustainable Rangelands Roundtable (SRR 2003) has been identifying criteria and indicators to help determine if rangelands are being managed sustainably. The indicators are the basis for data sets and the suite of indicators should tell us something about the criterion. One of the issues that the economists involved with the project have had with identifying the indicators and their associated data sets is that we do not know the relationships between economic indicators and other ecological and biological relationships and indicators. There are some economic indicators that are fairly straightforward such as the value of the livestock products coming from rangeland, while there are a whole suite of indicators where the linkage to sustainability is not so clear. In this last suite of indicators, we believe that they might be related to rangeland sustainability, but we are not sure of the relationship. For example, employment is one measure of economic and social health of a community, but does it relate to what people are doing to or on the land and how does that relate to the environment?

The basic research needs for evaluating sustainability fall into two general categories. First are the basic relationships between inputs and outputs. Generally, economists need outputs that are relevant to what society wants or needs. These can be traditional commodity-type outputs or environmental variables. For meaningful economic and policy analysis, the data need to come from a variety of treatment levels. Stocking rate studies are a prime example. If a study has a control and one or two stocking rates to examine either the response of the vegetation or the cattle, that gives us some information within the bounds of no grazing to whatever the highest stocking rate was. If we can define the functional relationship between stocking rate and outputs and environmental variables of concern, we can develop economic and policy models to help the manager determine optimal stocking rates for their objectives.

Second, the relationships between economic and environmental variables need to be identified and studied. We need to know how economic variables affect the environment and how environmental variables affect the economy. On one hand, we get environmental goods and services from the land that benefit people. On the other hand, how well the economy is doing affects what happens to the land. If a business is going bankrupt because they cannot sell enough products or obtain inputs at a reasonable cost, then they are not likely to invest in improving the landscape. If, as an example, a public land rancher has to continually reduce herd size because of allotment reductions, their ability to make management changes or invest in range improvements is significantly diminished.

Understanding key economic and ecological relationships across the West will be difficult. Each community is different in terms of its economic, social, and political make-up and each exists in a different environment. Research should seek to identify the key variables to measure and how those measurements can be combined to provide decision-makers with relevant information.

Spatial and Temporal Scales

We need to account for measures of scale in time and across space, and determine how these scales affect important variables. On the human side, we go from individual to communities to regions to the nation. We also go from an individual business to the industry as a whole. On the geographic scale, we are concerned about differences between local areas, regions, and nations. In each case, we need to know how the different economic variables can be measured, how each can be interpreted, and how

important each variable is to the decision-maker. Time has always been important in economic analyses, but when changes to rangeland ecosystems take decades, how time fits into decisions becomes even more important.

From a policy perspective, ideally we would desire to start at the smallest unit of analysis and aggregate to higher levels. What we do not know at this point is whether this is possible using various sampling schemes or whether the results truly mean anything. The question is if a measurement at one scale is related to the measurement taken at another scale and how that relationship can be modeled and used.

Conclusion

We have briefly examined some of the pressing needs for future rangeland economics and policy research. While the needs expressed in Cook and Stubbendieck (1986) are still important, the issues facing rangeland economists today are not the same as they were in the 1980s. The relative values of rangeland outputs have changed. Today's questions focus on whether rangelands are being managed for economic, social, and ecological sustainability. The current paradigm is that if any one of these systems is not being managed sustainably, then the system as a whole will tend to break down over time.

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Evolving Conservation Easement Markets in the West

Dana L. Hoag, Chris Bastian, Catherine Keske-Handley, Don McLeod, and Andrew Marshall¹

Introduction

Why do farmers and ranchers donate conservation easements? No one really knows because nearly all of the literature about conservation easements focuses on the people and entities that buy easements rather than on the landholders that sell them (Marshall 2002). Only a handful of studies have addressed sellers' motives and no empirical studies have looked at both buyer and seller motives simultaneously.² How can markets be efficient when there is more information about buyers than sellers? We are learning a great deal from the literature about why a land trust forms and what it wants to purchase, but we know very little about why one landowner sells an easement while another just gives it away for free.

Conservation easements (CEs) are a very popular way to create a market for the amenities that private lands have to offer, such as open space and wildlife habitat. A CE is an agreement that extinguishes the current (and typically all future) landowners' development rights for the parcel in question. The transaction is usually brokered by another entity, which we will simply call a trust. Trusts are supported by private donations. They are often assisted by an array of government funding, which is provided since land trusts protect public goods on private lands. With few exceptions, land trusts are 501(c)(3) organizations, which allow the donors to qualify for tax benefits.

It seems obvious that public policy to fund CEs would benefit both the community and landowners. However, there are many ways that the market or the government can corrupt social or private objectives. Many studies have looked at market efficiency related to society's willingness to pay (WTP) for CEs. We are launching a study that will focus simultaneously on WTP and on landowners' willingness to accept (WTA) a perpetual conservation easement. By looking at both the seller and buyer simultaneously, we can begin to understand how each values the many attributes that a given parcel of land can provide and presumably improve future markets. For simplicity, we distinguish between how buyers and sellers value these attributes. For buyers, we use the term public interest values (PIVs) to reflect the public's interest in enjoying the amenities a private parcel has to offer. For sellers, we use the term private amenity rents (PARs) to describe those attributes that generate rents to landholders.

To return to our question about why some landowners donate CEs, the answer is to protect PARs. Landholders place values on the same things that trusts are trying to purchase, and in the case of a donation, are willing to provide the "public" good at their own expense. Landholders do not place easements necessarily for the public good, but the outcome is the same regardless because of the complementarity between private and social interests. Ignoring PARs will lead to inefficient markets. A farmer, for example, might donate what he or she could have sold. Likewise, a trust might pay more than required by a competitive market, especially when they purchase easements that would have been donated anyway.

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² In the interest of brevity and because so many before us have already summarized the literature, we refer anyone interested in details that we do not cite to one of the following: Gustanski and Squires 2000; Marshall 2002; Hellerstein et al. 2002; or NRCRD 2004).

Consider for example a land parcel that has a market value of \$10 million, but would be worth only \$2 million based on its agricultural productivity. A trust would have to pay \$8 million for the development rights if a landowner's PAR = 0; that is, if the owner placed no value on the amenities as such, he or she would have to be fully compensated for the lost value from an easement that restricted development. On the other hand, we can observe that for many people PAR is not zero because they donate easements without fully recapturing the depreciated value through tax breaks. Even people that sell their easements are usually not fully compensated (Hoag et al. 2002)³. At the extreme, the PAR can exceed \$8 million, in which case a landowner would be willing to place an easement without any compensation. Depending on the value of the PAR, a trust should expect to pay between 0 and \$8 million for an easement. However, markets cannot be efficient if the PIVs are more readily known than PARs. Either the buyer will overpay or the seller will accept too little.

Our intention is to demonstrate that PARs should be explicitly accounted for in CE markets. CEs are particularly important in the West and there are limited funds to purchase them. It is important to improve efficiency wherever possible. CE markets need to evolve in the future to include PARs as part of an overall solution to make CEs socially efficient. We proceed with a brief discussion about CEs and the CE market literature. We present a simple illustration to demonstrate the impact of ignoring PARs and conclude by prescribing more research about PARs and their importance to CE markets.

Growth in Demand for Conservation Easements in the West

Growth and development in the West is a concern because it threatens values like wide open spaces that draw people to the West in the first place. Utah, Colorado, and Idaho experienced population growth rates of 28 to 31 percent between 1990 and 2000 (U.S. Department of Commerce, 2001). In particular, previously remote counties containing national forests, national parks, mountains, and lakes are experiencing surges in population, as are counties with a more traditional agricultural/ranching based economy. Selected mountain counties in Wyoming and Colorado grew between 15.1 and 39.8 percent in the same time period. Individuals moving into western wilderness counties tend to be better educated, have professional occupations, higher incomes, have lived previously in more populated areas and are seeking amenities such as improved climate, recreation, scenery, and environmental quality (Rudzitis and Johansen 1989).

Conservation easements are the fastest growing means of land preservation. A comprehensive survey conducted in 2003 on land preservation indicated that nationally nearly 9.4 million acres of land were under conservation easements (Land Trust Alliance, http://www.lta.org/census/census_tables.htm). Easements are particularly important in the West given our concerns about growth and development. The Rocky Mountain region, for example, has had a growing flow of legislation that facilitates conservation easements during the past five years. A Resources for the Future study notes that the southwestern states of Arizona, Colorado, New Mexico, and Utah have increased their protected land by more than 1,600% in the past decade (Albers, Ando, and Kaffine 2004).

³ Compensation for a donation can be very complicated, depending mostly on state tax laws, donor income, and clever lawyers. For example, in Colorado, a donor would be eligible for a Federal deduction of the depreciated value and a state tax credit of up to \$260,000. Tax liability, however, usually limits tax savings. Federal exemptions can be carried over but are subject to a limit based on adjusted gross income. In Colorado, the credit can be sold and therefore retained if a donor lacks a sufficient amount of tax liability. Furthermore, the Joint Committee on Taxation is looking into abuses of easements for tax savings and has proposed that substantial limits be imposed (Options to improve tax compliance and Reform tax expenditures. Report No. JCS-02-05, Joint Committee On Taxation, January 27, 2005). The point is, tax savings may offset some financial losses for donations, but landowners do not recover all of their losses. Therefore, a donor is financing some of the public good value when they donate an easement.

Conservation Easement Markets

Open markets provide efficient quantities of privately demanded goods; however, private lands provide an array of amenities with public good attributes that are typically unpriced in land markets. Agricultural producers face two pressures that can create disincentives to provide public amenities such as open space. Coyler (1998) characterizes these pressures as the push caused by unfavorable incomes in agriculture leading farmers to quit operations and a pull caused by rising land values due to development causing producers to sell land and realize large capital gains. This failure by normal market transactions results in socially inefficient patterns of resource use. The inability of the market to compensate landowners for producing publicly demanded amenities creates an environment that causes excessive conversion of agricultural lands to residential development. This effectively drives a wedge between desired (optimal) levels and actual quantities of agricultural lands and the amenities they provide. Conservation easements provide a way to market non-market amenities, but inefficiencies can still be manifested in the market structure when the market is very thin (Fausold and Lilieholm 1999; Anderson and King 2004).

Economic literature about CEs has emphasized the public's general preferences and potential non-market values for desired amenities (Hellerstein et al. 2002) and on market failures (Anderson and King 2004). Economic literature, however, suggests that agricultural land also derives part of its value from an additional non-consumptive use rent for the landowners (i.e., PARs). Stewart and Libby (1997) advocate that landowners derive an intrinsic enjoyment from the location or quality of land. This type of value represents a non-market or personal value that landowners claim as attractive for agricultural land ownership. In addition, Rowe, Bartlett, and Swanson (2001) show that personal motivations ranked much higher than market factors (including non-agricultural rents) for maintaining agricultural land-uses in two rural Colorado counties.

In a Northeastern U.S. landowner conservation easement survey, Elconin and Luzadis (1998) inquired about donor motivation and satisfaction from conservation easement placement. They concluded that motivation for placement was primarily triggered by personal attachment to the land, sense of altruism, and commitment to stewardship. Their lowest levels of satisfaction were observed in tax and financial matters. The authors did note that successive or second generation landowners were less satisfied and would change their conservation easement if given the opportunity. A Colorado landowner study by Marshall, Hoag, and Seidl (2002) found similar results. A targeted sample of Colorado landowners was surveyed regarding their satisfaction with conservation easement placement. Results indicated that "maintaining agricultural land-use" was the most realized goal. Alternatively, expected financial goals were the least realized in the end. Thus, motivations for land protection stemmed more from tenure with less regard to financial improvements. Landowners that considered but chose not to place a conservation easement also cited inadequate financial compensation as their primary reason for not placing a conservation easement.

Despite the importance of seller values, the research community prefers to focus on CE buyers as evidenced by these typical titles: "Farmland Protection: The Role of Public Preferences for Rural Amenities" (Hellerstein et al. 2002) and "What the Public Values about Farm and Ranch Land" (NRCRD 2004). Furthermore, individual studies about market efficiency also appear to place less emphasis on sellers. For example, Anderson and King (2004) looked at efficiency in an experimental setting. They found that private incentives alone predict CE decisions because landowners in the game did not value public goods. Yet they did not use real landowners. Participants that represented landowners were given information about taxes, future opportunity to sell into development or other uses, agricultural uses, and two types of altruistic uses, one providing natural amenities to other community members and the other to avoid shifting a tax burden to other community members. The assumption was made explicit that PAR amenities are of zero value to the landowners. Participants in the experiment could not possibly know how much value an actual landowner might place on agricultural heritage and other PARs because these are personal matters that are deeply tied to a person's bond to a particular land parcel.

Fausold and Lilieholm (1999) suggest that appraisers only have a vague guess about the actual value of an easement and can significantly under- or over-estimate the “true” market value. Part of the problem with the thin market for CEs is that both the buyer and seller value multiple attributes for the same piece of property in different ways. In the case of an economic use, the highest and best use wins out. In the case of PIVs and PARs, different management scenarios can provide varying amounts of each attribute at the same time. In theory, a market would be created for the attributes, not bundles that accompany the land and management system. In practice, however, communication in the market is poorly developed, making it difficult to provide information about multiple property attributes to both buyers and sellers in a meaningful way (NRCRD 2004). It is not uncommon to hear a producer talk about placing an easement for agricultural preservation to someone that thinks they are buying open space. They are not always the same thing, leaving plenty of room for future conflicts. Moreover, the CE market can be characterized as having high search costs for both buyers and sellers, further exacerbating the market’s ability to discover the appropriate amenity values.

An Illustration

Surveys suggest that the public has a variety of reasons for protecting farmland (Hellerstein et al. 2002) and open space. Table 1 summarizes PIVs protected by land trusts in 2000. Two observations should be immediate. First, many of these PIVs overlap with each other and second many overlap with private amenity values.

Table 1. PIVs protected by U.S. Land Trusts.

	% of Land Trusts Protecting		% of Land Trusts Protecting
Land PIVs Protected		Land PIVs Protected	
Wildlife habitat	76.6	Historic and cultural	46.2
Forests	70.5	River corridors	35.3
Open space	69.5	Ranch land	34.3
Watersheds	64.3	Mountains	34.3
Wetlands	60.4	Hillsides	33.8
Scenic views and roads	55.7	Lakes	32.9
Ecosystems	55.2	Urban Land	28.9
Farms	51.0	Prairies	27.6
Greenways	50.3	Archeological sites	25.7
Recreation and trails	49.0	Deserts	15.8

Source: Adapted from J.A. Gustanski, Land Trust Interviews (1996-98), as quoted in Gustanski and Squires 2000 (p. 21).

If a land trust had the tools to do so, it would differentiate all of the attributes and not pay twice for any that overlap. But this would be impossible in practice. So instead, trusts seek out the attributes they are interested in and ignore the variables that are irrelevant to them. Of course, these irrelevant variables might be very relevant to someone else. Marshall, Hoag, and Seidl (2002) asked owners of land parcels that had conservation easements on them to identify what they thought the public was buying. Open space was significant to all of the landowners. However, these landowners put a very high value on protecting agricultural values and relatively low value on providing endangered species habitat, which is opposite of how the public would probably weight these amenities. When asked about what they wanted to protect, the landowners ranked agricultural viability above improving financial position or reducing estate taxes. Interestingly, many but not all of the PIVs that land trusts usually seek to purchase were not fully maintained by the easements, demonstrating that PIVs and PARs do

not perfectly overlap. When individuals that had entered into an easement were asked about what had been achieved by their easements, all indicated that land use (agricultural protection) was maintained. However, open space was significantly protected on just 80 percent of the properties in the survey and the environment improved on only 70 percent.

The discussion above is meant to demonstrate that every land parcel and management practice produces PIVs and PARs. Therefore, a producer may be willing to sell an easement, or donate it, to "purchase" his or her PARs in perpetuity. Some of these amenities are public goods that would be supplied without government or other financial incentives.

Consider a landowner's decision to convert farmland to non-farm use. Land is held in an agrarian state until another higher valued use like urban development overcomes current agrarian rents. Basic economic and appraisal literature (e.g., Plantinga and Miller 2001; Tegene, Weibe, and Kuhn 1999; and Capozza and Sick 1994) states that today's fee-simple price of convertible agricultural land equals the capitalized and discounted agricultural rents up to an optimal date of conversion plus thereafter capitalized and discounted urban rents, less a one-time cost of conversion. This implies that, if a landowner were to place an easement extinguishing the right to develop his or her property, the only remaining value would be the pure capitalized agricultural value. However, land with such restrictions is routinely sold at prices higher than justified by agricultural productivity (Hoag et al. 2002). Part of agricultural land's value is generated from a non-market rent component that creates agricultural land-use value by the presence of its own natural amenities or some combination of personal factors that a landowner captures with private agricultural land ownership (PARs). This non-market rent holds agricultural land as attractive to own, control, or gain value from the land itself. As such the market price of agricultural land does not reflect a landowner's reservation price containing any non-market rent component.

In summary, the fee-simple market price of agricultural land today incorporates four components: (i) the present value of captured agricultural rents up to conversion and lost thereafter, (ii) the present value of capitalized PARs up to conversion and lost thereafter, (iii) the present value of capitalized future urban rents after conversion and (iv) the present value of constant capital conversion costs incurred with urban use. Finally, since market-based appraisals are unable to distinguish the PAR component, conventional appraisal estimates for conservation easement valuation are overstated in the presence of any landowner capitalized PAR.

Concluding Comments

The market for conservation easements can be characterized as those wishing to purchase development rights, usually agents representing organizations such as land trusts, and those wishing to sell development rights (landowners) agreeing on easement attributes and price. There is no organized market exchange where many buyers and sellers can discover prices for conservation easements, as is the case with many agricultural products. Thus, price discovery occurs in a private negotiation. This type of market institution creates potential risks and costs for both buyers and sellers as compared to other trading institutions. As we have demonstrated above, the potential for overestimating potential amenity rents for landowners using traditional appraisal techniques is high. Specifically, we have shown that landowners' private amenity rents (PARs) partially overlap with public interest values (PIVs) on land that has multiple amenities. Ignoring the PARs could overvalue the easement and lead trusts to overpay for easements, or for producers to underprice easements placed on their land. It will also lead the market to prematurely predict conversion.

As the demand for amenities provided by conservation easements grows, so do the opportunities for economists to contribute to the efficiency of this evolving market. An area for making the greatest contributions right now seems to be studying the seller side of the market. Particularly, research regarding landowners' willingness to accept values for public amenities provision, preferences for easement program attributes, and preferences for benefit vehicles such as tax breaks versus outright

payment would all make a significant contribution. Another area that seems fruitful is that of understanding intermediaries' (such as land trusts) preferences in purchasing and providing conservation easements. Information provided about the market for easements could reduce search costs and matching risks, improve bargaining positions of sellers, and increase the overall efficiency of conservation easement markets.

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The Mexican Cattle and Beef Industry: Demand, Production, and Trade

Derrell S. Peel¹

Introduction

To understand the potential for Mexican cattle and beef trade in the coming years, it is necessary to consider the Mexican beef cattle industry from a historical perspective as well as in the current economic environment. The following comments provide a brief overview of the Mexican cattle and beef industry and the evolving U.S.-Mexico cattle and beef trade relationship.

Mexican Beef Cattle Production Environment and History

Since the last half of the 19th century, the Mexican beef cattle industry has consisted of two, nearly separate, market components. Beef producers in the arid and semiarid northern third of Mexico have largely focused on the production of calves for export to the United States. European beef genetics have been widely used in the region, beginning with imports of Hereford cattle and continuing with today's popularity of Angus and Brangus along with several continental breeds. For the most part, the young steers are exported to the United States while the heifers are used in the fledgling Mexican feedlot industry to produce quasi-U.S. style fed cattle.

The central and southern regions of Mexico, consisting of the temperate inland areas and the tropical and semitropical coastal areas, have historically produced grass-fed beef for the Mexican domestic or "national" market. These regions include a diverse group of small, mostly subsistence producers, who sell a small amount of beef in local markets, as well as dual purpose producers that use dairy-zebu cross cattle to produce both milk and beef. Grass finishing operations, located mostly along the gulf coastal region, assemble larger groups of grazing cattle until they are mature at 30 to 40 months of age to be slaughtered directly off of pasture. In earlier years, most cattle were shipped live from pasture finishing to urban centers, such as Mexico City, to be slaughtered in plants in and around the city and sold in nearby fresh markets. More recently, slaughter plants have been located in production regions with chilled carcasses shipped to urban markets.

Beef consumption in Mexico historically evolved as two very distinct markets. There has been a small feedlot industry in Mexico since the post-WWII period, located mostly in a belt across northern Mexico from Monterrey, Nuevo Leon, to Hermosillo, Sonora. These feedlots primarily fed the heifer mates of the steers exported to the United States. The fed beef was mostly consumed in northern Mexico, a region known for steaks and grilled meats. U.S.-style steak cuts have been popular in this region for many years. The animals were fed in feeding operations which resemble U.S. feedlots (although slightly less intensive), and produce a roughly Select quality beef carcass.

In contrast, the majority of Mexican consumers in the national market utilized grass-fed beef that was mostly consumed as thin-cut meats utilized in a variety of moist heat cooking methods. Beef was more likely to be cut in a European style and U.S.-style steak cuts were much less common. There is little quality differentiation in the traditional beef markets, although beef from an old cow might be noted in the market place as "average" as opposed to "superior" for a three to four year old grass-fed bull. It is important to remember that cow beef in Mexico was mostly consumed as muscle cuts rather than as ground beef.

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Change Drivers in the Mexican Beef Cattle Industry

The Mexican beef cattle industry has seen tremendous changes in the last decade. As a result the industry is in the midst of fundamental restructuring and continues to change rapidly. The biggest source of change in the Mexican beef industry is the evolving nature of Mexican beef demand. Growing population and incomes along with continued urbanization of Mexico is resulting in increasing demand for beef and other meats. What is less generally recognized, is that Mexican consumer preferences for beef quality and type are also changing.

Mexican consumers have very rapidly developed a preference for fed beef in recent years. The preference is not for U.S.-style fed beef, which is finished to a much higher degree than is preferred in most of Mexico. Mexican consumers prefer meat from younger animals that were finished in a semi-intensive system. This beef has a small amount of white or cream-colored fat rather than the yellow fat typical of grass-fed animals. This Mexican-style fed beef is not only different than U.S. fed beef, but is also distinguishable from the more highly finished fed beef historically produced in northern Mexico.

U.S. fed beef typically comes from a European-cross steer fed for 140 to 170 days. Northern Mexican fed beef is from a similar European-cross steer fed for 120 to 135 days (or more likely a heifer fed for 110 to 125 days). The new style of Mexican fed beef typically consists of zebu-dairy cross bulls (rather than steers) fed supplement on pasture or a less concentrate-intensive feedlot ration for 45 to 100 days. Although these are different products, they can and do substitute in the marketplace, certainly more readily than grass-fed and grain-fed products substitute. Another trend in Mexican beef markets is reduced demand for cow beef. The fed beef from younger animals is highly differentiated from cow carcasses, which tend to have yellow fat and dark, coarse textured meat. Although hamburgers are becoming more popular in Mexico and more cows in the future will be used for grinding, it is possible that Mexico could become a surplus cow beef market.

Concurrently and inseparably with the beef demand changes described above is a widespread revolution in food retailing in Mexico. Mexican and foreign-owned large supermarket chains are increasingly important in most Mexican cities. Many remote rural villages still utilize local fresh meat markets; however, neighborhood meat shops in cities are being displaced by modern supermarkets. Meat marketing in most of Mexico is still carcass-based but the growing presence of supermarket chains facilitates product specialization as more popular products in various markets can be supplemented with imported boxed beef.

The Evolving Mexican Beef Cattle Industry

Several trends are implied by the changes described above. One trend is a changing set of beef production systems throughout Mexico. Fewer cattle are finished on grass or on grass only. In the tropical and semi-tropical regions there is more use of pasture-based supplementation systems to produce a minimally finished animal that is 6 to 12 months of age younger than traditional grass-fed animals. Animals from these regions are being marketed as feeder animals to other regions for feedlot finishing. Decreased use of forage for finishing animals increases the potential to increase cow-calf and stocker production in these regions. In some areas where dual-purpose cattle have predominated, there is now more use of European breeds as a terminal cross to enhance beef quality. In many regions, disease, pest, and climate challenges of the tropical production environment still favor the use of hardy zebu genetics in cows.

Since most feedlots and feed grain production in Mexico are located in the northern part of the country, growing demand for fed beef in the national market may lead to a different pattern of regional cattle and meat flows. Cattle that were previously grown and finished in the same regions before moving directly into urban meat markets are now moving into other regions for feedlot finishing before slaughter. This means more cattle are moving from south to north. Feedlots in the northern part of Mexico that

previously fed northern, European-cross heifers and some steers for northern markets are now feeding more zebu-cross bulls and heifers for the national market.

Increased interregional movement of cattle and economic integration means there is more need for market information across regions. Additionally, regional animal health issues are viewed differently with increased interregional movement of animals. The northern states, with a strong motivation to maintain animal health status for export purposes, must now engage with other regions to achieve zoosanitary objectives. Most recently, improved quality of cattle from central Mexico is also increasing possibilities for exports of cattle from that region. The United States continues to maintain animal health guidelines that restrict direct cattle exports from many Mexican states. The economic integration of regional cattle markets in Mexico means that country will be more motivated to address animal health issues on an integrated national scale.

The regional integration of cattle and beef markets in Mexico has also promoted development of infrastructure. More federally inspected packing and processing facilities, as well as enhanced refrigerated storage and transportation capabilities, are developing in many regions. However, the economic scale and degree of concentration of these facilities is likely to remain much smaller than in the United States. Mexico currently feeds ~1.5 million head annually in feedlots distributed across several smaller centers of feedlot production. This spatial distribution of cattle feeding is consistent with the current situation of several smaller packing plants rather than a few large packing plants. In Mexico, the internal efficiencies of large plants are quickly offset by higher assembly costs of fed cattle. Although new roads are improving transportation of both fed cattle and meat, Mexico is a very mountainous country and transportation is difficult and expensive. The feeding industry will continue to employ a wide variety of domestic feed and by-product resources and will utilize imported grains only to a limited degree, mostly seasonally and when grain market conditions are favorable. By-product feeds are proportionately more important in the Mexican cattle feeding industry than in the United States. The wide variety of by-product feeds used in Mexico includes citrus and sugar processing residuals, brewing and distilling by-products, leftover bread, tortillas, and tortilla chips. These provide an important and economical source of feed for the beef industry. Mexican cattle feeders make extensive use of molasses in feedlot rations.

Only in recent years has the Mexican beef industry utilized non-forage feed resources to any large degree. This means that the Mexican beef industry is relatively new to competing with other livestock industries for feed resources. Food demand in Mexico is growing rapidly, and in the face of significant limitations in arable land and water for crop production. Increased livestock production in recent years has meant more feed demand for poultry, pork, dairy, and beef production. The beef industry's use of concentrate feeds is relatively new, and the result is a very dynamic economic environment for Mexico's crop and livestock sectors.

Mexican Cattle and Beef Trade

Mexico has exported calves to the United States for many years. The level of calf exports has increased recently, averaging just over one million head annually since the mid-1980s. Mexican imports of U.S. beef also have increased in the past few years. As a result, Mexico has become a net importer of cattle and beef overall and one of the United States' most important beef export customers. The United States dominated the Mexican imported beef market for many years, but Canada has been very successful at increasing its share of the Mexican market. Canada is likely to be an even larger exporter of beef to Mexico in coming years. There is the possibility that beef from Argentina or Brazil, the quality of which may actually fit the Mexican beef market more closely than U.S. or Canadian beef, could be a significant presence in the future.

Relative to the United States, Mexico historically has been a lower value market for both cattle and beef. However, in recent years, beef carcass values in central Mexico have averaged very close to U.S. market values. Despite this equalization of meat values, the nature of Mexican cattle production

systems makes calves worth relatively less because of the forage-intensive nature of Mexican beef production. The result is that even when carcass beef values are essentially equal in Mexican and U.S. markets, Mexican calves will tend to be worth more in the U.S. system where they can be redirected into intensive grain feeding. Mexico is therefore likely to keep exporting calves to the United States. However, there will be times when the domestic Mexican market will be relatively more attractive, and northern Mexican producers are beginning to pay more attention to domestic marketing possibilities while maintaining their focus on calf exports.

There are several dimensions to the dramatic increase in Mexican beef imports in recent years. First, Mexico has been deficit in total beef production. Rapidly growing domestic beef demand (due to increased population and per capita consumption), as well as drought and financially-induced herd liquidations, have created shortfalls in Mexican beef production relative to demand. Additionally, there has been an even larger shortage of fed beef due to the changes in Mexican consumer preferences for beef. Although U.S. fed beef is different than Mexican fed beef, it will substitute, especially when priced competitively.

Mexico is responding to the increased demand for grain-fed beef and reduced demand for grass-fed beef; however, needed changes in production systems will continue for many years. Producers, especially in the tropical and semitropical regions, are slowly developing different attitudes toward marketing feeder cattle to northern regions for feedlot finishing rather than grass finishing and direct marketing into urban centers. In some instances where producers have accepted the need for more intensive production systems there is a tendency to want to develop feedlot infrastructure locally rather than market cattle to other regions. Although the economic feasibility of some semi-intensive finishing systems (e.g., pasture based supplementation systems) have yet to be fully evaluated, cattle finishing in the tropical regions is unlikely to be viable. Tropical and semitropical regions have difficult environmental conditions and producers there would have to rely heavily on imported feed sources.

Another source of imported beef demand in Mexico relates to the issue of product mix. The Mexican beef market, like that of most countries, does not produce a set of beef products that exactly matches consumer preferences. Thus there are relative shortages of some parts of the carcass and relative surpluses of other parts. The joint product nature of beef production is a major driver of beef trade in Mexico, as it is in most major beef trading countries. Since Mexico is still a carcass-based market, there is relatively little differentiation of carcass primal and subprimal values. Thus, even when average beef carcass values in Mexico are equal to U.S. values, cuts that are lower valued in the U.S. market, such as chucks and rounds, may be very competitively priced relative to Mexican carcass values. The fact that carcass parts are more highly differentiated in value in the United States relative to Mexico has led to considerable misunderstanding. This situation contributed to the recent dumping charges brought against the United States after inexpensive U.S. chucks and rounds flooded the Mexican market. Some Mexican producers believed that low values of end meats was indicative of overall U.S. carcass values and must therefore constitute dumping because values were clearly less than production costs.

Summary

In the long run, Mexico has considerable opportunity to increase self-sufficiency in beef production. However, Mexico continues to face difficulties in producing fed beef because of limited feed resources and growing competition between food and feed production in Mexican agriculture. Growing demand for fed beef in Mexico suggests opportunities for more development of cattle feeding in Mexico. However, viable feedlot production in Mexico involves a difficult balance of regional market integration, use of non-forage feed resources, and inevitable but minimal use of imported feed grains. Mexico is unlikely to develop large-scale feedlot and packing sectors like those in the United States and would not likely be competitive if it tried to do so. However, most Mexican feedlot operators began as meat companies and later entered into cattle feeding. These individuals have deep insight into the Mexican meat industry, and even though meat demand is evolving rapidly, have the ability to successfully

respond to changing market conditions. The subtle but significant differences in consumer preferences for Mexican fed beef as opposed to U.S. fed beef means that Mexican cattle feeders cannot and should not try to mimic U.S. production systems. On the whole, Mexican cattle feeders can be competitive only by recognizing the need to produce a less finished product in a less intensive production system.

There will continue to be considerable trade to improve beef product composition in both the U.S. and Mexican markets. Mexican preferences for Select products and end meats are highly complementary with U.S. preferences for Choice products and middle meats. This complementarity may make Mexico a strategically more important, albeit lower valued export market (per unit of product) than high valued export markets characterized by demand characteristics similar to those of the United States (e.g., Japan). Mexico has the potential to become an exporter of cow beef and some specialized high value products but is likely to remain a net importer of beef overall. Mexico will likely continue to exploit its comparative advantage in cow-calf production and export calves to the United States, while the United States will likely continue to exploit its comparative advantage in cattle feeding and meat processing and export meat to Mexico.

There is great opportunity for sustained long-term trade in Mexican cattle and beef in the global market. The United States has an obvious advantage in location but must develop and maintain Mexican markets against the inevitable competition from Canada and potential competition from South America.

Measuring Net Benefits Resulting from University-Industry Collaboration: An Example from the New Mexico Chile Task Force

Jay M. Lillywhite, Jerry Hawkes, and Jim Libbin¹

Introduction

As universities face increasingly tight operating budgets, their need to justify expenditures on both basic and applied research is increasing (Oehmke, van Ee, and Ledebuhr 2000; Boyle 1997). At the same time, businesses face increasingly competitive business environments. For many, innovation is the key to productivity and survival. Universities and industries are joining forces to meet their respective needs, forming formal and informal collaborations (Scott et al. 2002).

Analysts and policy-makers are becoming more interested in examining and understanding the relationships between academic research and economic activity. One area of growing interest is the measurement of net benefits generated through these relationships. To accurately measure the return to industry-university collaboration, researchers must consider all associated returns and costs (both direct and indirect). Benefits that may accrue from collaborative efforts include: (1) new scientific information, (2) increased educational opportunities for students, (3) new networks and stimulating interactions, (4) expanded problem-solving capacity, (5) new methodologies and technologies, (6) new firms and (7) expanded social knowledge (Scott et al. 2002).

Valuing all direct and indirect benefits and costs associated with collaborative efforts is difficult, if not impossible. This paper outlines a methodology that can be used to measure one source of economic benefits -- the development of a new technology. The paper uses as an example a mechanical vegetable thinner developed through the collaborative efforts of the Southwestern chile pepper industry and New Mexico State University (NMSU).

Background

Acknowledging that industry leaders and participants possess a unique understanding of their industry, NMSU's College of Agriculture and Home Economics adopted a task-force approach to working with the state's industries. The task forces² are teams composed of industry and university professionals who work on industry-identified problems and challenges. The teams' interdisciplinary nature has led to a holistic research and development approach. The work conducted by the task forces has, in general, had wide support from stakeholders. Teams working within the task-force framework are working with a strong sense of purpose (Schickedanz 2005).

The New Mexico Chile Task Force was created in 1998 in response to economic difficulties facing the chile pepper industry. Members come from industry and academia and have varied backgrounds in agricultural science and production, business management, communications, and engineering. Task force members identify and implement procedures and technologies that will help the chile pepper industry remain viable in the face of increasing pressure from foreign-produced chile. One of the technologies developed by the task force is a mechanical vegetable thinner that may help chile growers reduce their production costs.

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² There are four College of Agriculture and Home Economics task forces: The Range Improvement Task Force, Water Task Force, Chile Task Force, and Wine Task Force.

The mechanical thinner was developed by engineers at NMSU's Manufacturing Technology and Engineering Center (M-TEC), under the leadership of the Chile Task Force. It selectively thins vegetable crops using computer-controlled, hydraulically operated knives that swing across rows in a back-and-forth motion to eliminate unwanted plants. Using NMSU Cooperative Extension cost and return estimates, Lillywhite et al. (2005) estimate that net returns attributable to cost savings generated from mechanical thinning adoption could be as high as \$49 per acre.

Analysis

To estimate the net returns associated with mechanical vegetable thinner development, benefits and costs from three areas were examined (figure 1). These areas are benefits to chile growers (consumer surplus), benefits to the mechanical thinner manufacturer (producer surplus) and associated indirect costs and benefits to other chile industry stakeholders. As indicated above, a number of indirect costs and benefits may be associated with a particular project. Relative to indirect costs and benefits, we followed the work of Schmitz and Seckler (1970). We accounted for indirect costs associated with hand labor displacement as a result of mechanical thinner adoption by assuming those costs are equal to lost earnings.³ While we recognize other benefits and costs (e.g., networking), we do not explicitly account for these benefits or costs in this analysis.

Consumer Surplus Estimation

Based on previous research by Lillywhite et al. (2005), we used present value estimations of per-acre cost savings to estimate a representative grower's willingness-to-pay for a mechanical thinner. Willingness-to-pay was estimated by calculating the mechanical thinner price that would just drive the present value of annual savings attributable to the thinner to zero. This price or willingness-to-pay point was assumed to represent a point on the grower's demand curve for the mechanical thinner. Differences in savings have a direct relationship with a grower's willingness to purchase a thinner. A primary determinant of annual savings, and thus the estimated willingness-to-pay level, is the number of acres over which the thinner is operated. A grower with 500 acres of chile (with an approximate per-acre savings of \$49) would be willing to pay \$119,425 per four-row thinner. The same grower with 400 acres (per-acre cost savings of approximately \$48) would be willing to pay only \$107,628 per four-row thinner. By arranging growers by descending chile acreage (and thus arranging growers by descending willingness-to-pay estimations), we can approximate the market demand curve for a mechanical thinner. Each of these willingness-to-pay points represents a point on a particular grower's demand curve. The market demand for the mechanical thinner can be estimated by repeating the willingness to pay procedure for each chile producer (i.e., horizontally summing individual grower demand curves). Figure 2 depicts New Mexico chile farmers' estimated demand curve for the mechanical thinner.

Figure 1. Steps in Net Benefit Estimation

1. Estimation of Consumer Surplus
 - Estimate present value of cost savings using Extension cost and return estimates.
 - Estimate thinner price resulting in zero present value of cost savings.
 - Repeat for acreage categories.
2. Estimation of Producer Surplus
 - Estimate producer surplus as a percentage of sales.
3. Estimation of Indirect Social Costs (Lost Labor)
 - Estimate labor cost using custom labor rates.
 - Diminish annual labor costs as displaced labor is absorbed into economy.

³ Schmitz and Seckler (1970) approximated consumer surplus by examining cost savings related to adoption of the mechanical tomato harvester. In this analysis, we directly estimate consumer surplus by estimating a representative grower's willingness to pay for the thinner. Additionally, we provide estimates of producer surplus that may accrue to the thinner manufacturer.

The methodology described above was used to estimate the New Mexico chile industry's market demand for the mechanical thinner. Using NMSU cost and return estimates (Hawkes et al. 2004)⁴, cost savings and corresponding willingness-to-pay estimates were generated for a representative grower. These cost savings and willingness-to-pay estimates were projected to all growers within New Mexico using a 1997 USDA National Agricultural Statistics Service (USDA-NASS 2000) acreage categorization of New Mexico chile pepper farms.⁵ The USDA-NASS data categorized 447 New Mexico chile farms within 21 different acreage levels (1 to 25 acres, 26 to 50 acres, . . .). Midpoints were used to estimate the average acreage within each category. These averages were then used in developing annual cost savings. Table 1 provides annual cost savings estimates and the present value of the savings (using a 15-year life and a discount rate of 6.5%).

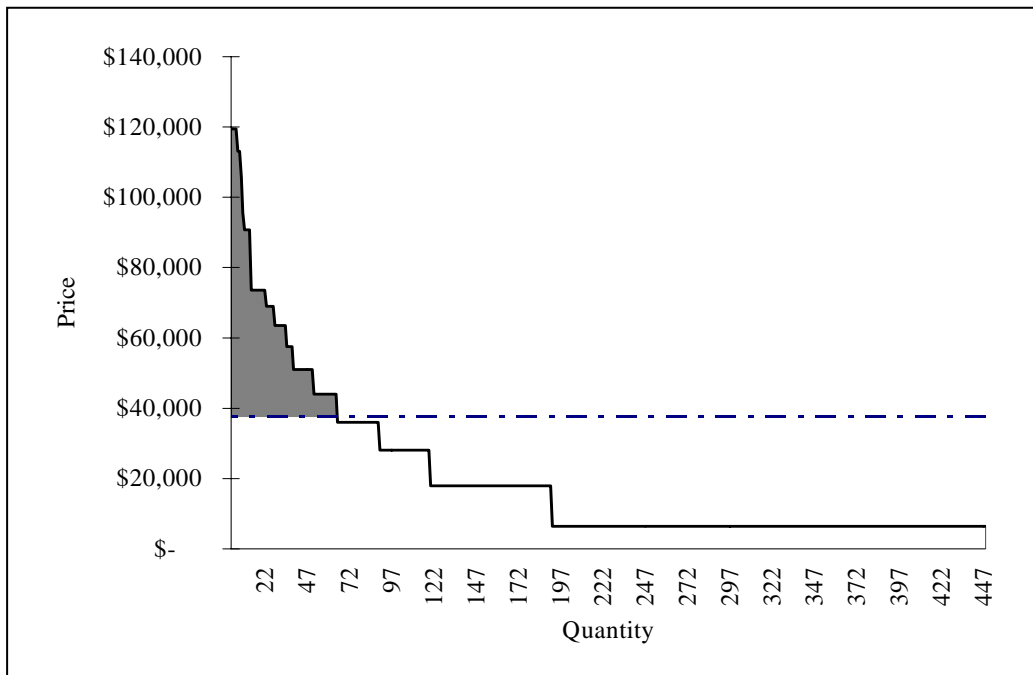


Figure 2. Consumer surplus for four-row mechanical chile thinner (price equals \$37,525).

The NMSU thinner was available commercially for the first time in Spring 2005. The initially agreed upon retail price for a four-row thinner was \$37,525.⁶ Using this estimated price and the demand curve derived above, potential consumer surplus generated by the development of the NMSU mechanical chile thinner is estimated at \$1,822,013.

Producer Surplus Estimation

Without knowing specific manufacturer cost information, it is not possible to accurately determine producer surplus associated with the mechanical thinner. A simple producer-surplus estimate can be made by assuming constant marginal costs of production (an assumption that is reasonable given the likelihood that a limited number of thinners will be produced (63 thinners estimated above, based on

⁴ Readily available cost and return estimates and the underlying framework associated with those estimates provided by NMSU Extension were of great help in developing the net benefit estimates presented here.

⁵ A breakdown of farms by chile acreage for the 2002 Census of Agriculture was not available.

⁶ The price at which initial commercial machines would be sold was a factor in NMSU's selection of a qualified manufacturer.

NMSU cost and return estimates) and that the thinner product line will be a supplement to the manufacturer's other equipment production.⁷

We used an estimated 5% return on net sales as a measure of producer surplus⁸. If all Chile producers deemed "willing-to-pay" actually purchased the thinner, the producer surplus would be \$118,204.

Indirect Social Costs

To estimate the net benefits to society from mechanical thinner development, an accounting of costs associated with displaced labor must be made. For purposes of this analysis, costs of displaced labor are limited to hand laborers' lost income.

The NMSU cost and return budgets used to calculate individual grower willingness-to-pay estimate that a representative grower spends \$70 per acre for contracted hand thinning. Using only farms and acreages where previous calculations showed that growers would be willing to purchase the thinner at the suggested retail price, the thinner would be adopted on approximately 13,342 acres. Multiplying this acreage level by \$70, we estimated the total annual value of lost hand-thinning wages to be \$933,940.

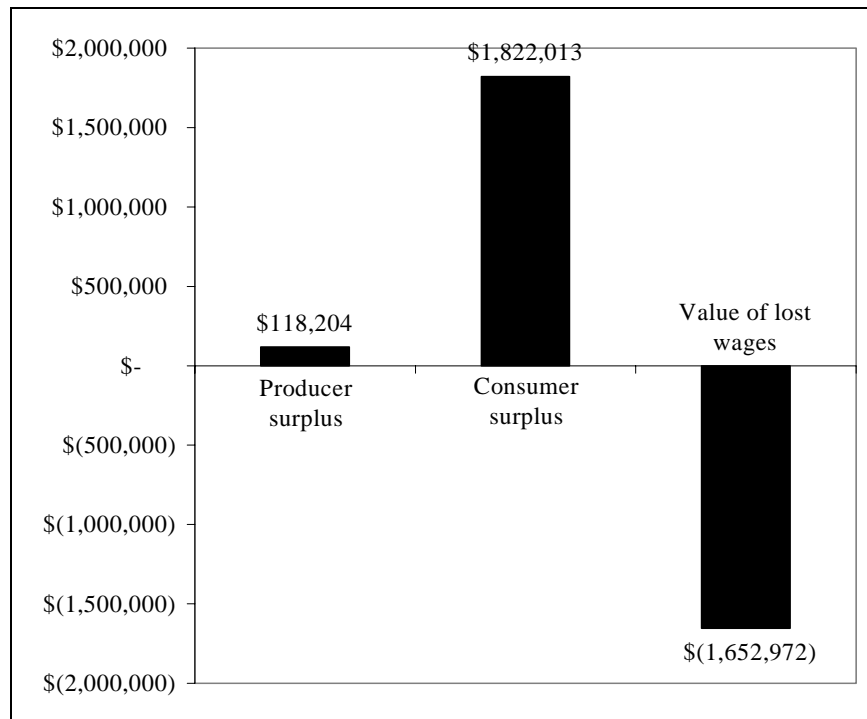


Figure 3. Components of estimated net benefits

The annual cost of lost labor is expected to decrease over time as displaced workers find other employment opportunities.⁹ For this analysis, the decrease is estimated at 50% per year for the study's

⁷ The particular manufacturer chosen to build the mechanical thinner also produces specialized rock crushing equipment and has excess unused floor capacity in a facility recently purchased by the firm. It also is likely that the firm has some degree of excess labor capacity.

⁸ As a point of reference, John Deere has averaged a 5.5% return on net sales over the last 10 years (John Deere 2004). We recognize that adoption of the thinner will occur over time, suggesting the need to discount surplus measures. Additional work related to estimating adoption rates and timing are underway.

⁹ The assumption of decreasing labor costs appears reasonable as there are currently unfilled positions in many of the state's Chile processing facilities. While some positions may require skills not possessed now by field workers, the workers eventually could acquire the skills needed.

15-year horizon. That is, over the 15-year horizon, we decreased the total value of lost hand-thinning wages by 50% annually. The present value of lost hand-thinning wages is estimated at \$1,652,972.¹⁰

Net Benefits

Using estimates of consumer surplus, producer surplus and the present value of lost hand-thinning labor wages, we estimated the net social benefit to the development of the mechanical thinner to be \$287,245 (producer surplus = \$118,204, consumer surplus = \$1,822,013, and value of lost wages = \$1,652,972). Net social benefits are approximately equal to initial research and development costs, estimated to be between \$250,000 and \$300,000.¹¹ It should be noted that this analysis estimated benefits and costs for chile produced only in New Mexico. Impacts resulting from adoption by Texas and Arizona producers, who are part of the regional chile industry, were not included.

Conclusions

Analysts and policy-makers are increasingly interested in measuring net benefits generated through industry-university relationships. A comprehensive measure of net benefits requires examination of a variety of benefits and costs associated with the collaborative relationship (e.g., value of increased educational opportunities for students). Quantifying many of these benefits (or costs) in economic terms is difficult. This paper demonstrated an approach to measuring a specific benefit resulting from industry-university collaboration, that of new technology development.

The example used in the paper is that of the collaborative effort of the Southwestern chile pepper industry and NMSU to develop a mechanical vegetable thinner. Using the concepts of consumer surplus, producer surplus, and externalities (e.g., lost labor), we estimated the net benefit attributable to mechanical thinner development to be \$287,245, approximately equal to the initial research and development investment costs. Additional work needs to be done to account for adoption and diffusion rates associated with the thinner and incorporate present value calculations based on adoption.

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¹⁰ Schmitz and Seckler (1970) assume an infinite life for displaced labor. Oehmke, van Ee, and Ledebuhr (2000) restrict lost earnings for displaced labor to one year.

¹¹ Herbon, R. 2005(March 1). Personal communication.

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Table 1. Cost savings for representative New Mexico chile pepper farms.

Category	Average Acreage	Number of Farms	Annual Savings	Present Value of Savings	Willingness to Pay
1 – 25	13.0	257	\$ (1,545.98)	\$ (15,481.23)	\$ 6,636.47
26 – 50	38.0	72	(234.27)	(2,345.91)	18,110.63
51 – 75	63.0	30	1,095.30	10,968.12	28,279.10
76 – 100	88.0	25	2,278.39	22,815.44	36,204.61
101 – 125	113.0	14	3,597.97	36,029.51	44,162.65
126 – 150	138.0	12	4,892.76	48,995.34	51,122.22
151 – 175	163.0	4	6,231.75	62,403.79	57,650.43
176 – 200	188.0	7	7,581.94	75,924.38	63,619.25
201 – 225	213.0	5	8,942.22	89,545.98	69,099.11
226 – 250	238.0	9	10,233.66	102,478.27	73,739.52
276 – 300	288.0	4	13,350.50	133,689.81	90,816.16
301 – 325	313.0	1	14,766.53	147,869.70	95,640.12
376 – 400	388.0	1	18,468.08	184,936.42	105,773.02
426 – 450	438.0	2	21,314.86	213,443.64	113,196.67
501 +	501.0	4	24,714.45	247,486.62	119,546.50

Table 2. Return on manufacturer sales (Assuming 5.5%).

Category	Average Acreage	Number of Farms	Manufacturer Return on Sales
101 – 125	113.0	14	\$ 26,267
126 – 150	138.0	12	22,515
151 – 175	163.0	4	7,505
176 – 200	188.0	7	13,133
201 – 225	213.0	5	9,381
226 – 250	238.0	9	16,886
276 – 300	288.0	4	7,505
301 – 325	313.0	1	\$1,876
376 – 400	388.0	1	\$1,876
426 – 450	438.0	2	\$3,752
501 +	501.0	4	\$ 7,505

Poverty in the West: Changing Fortunes from 1990 – 2000

Mindy S. Crandall and Bruce A. Weber¹

Introduction

Living in poverty - having income that is inadequate to cover expenses for basic necessities - remains a problem in the United States. Poverty has many causes, and thus poverty rates vary by race, ethnicity, educational attainment, age, family structure, and region of the United States. Children who grow up in poverty are substantially less likely to graduate from high school or college, limiting their future opportunities (Schiller 1998). Governmental and nongovernmental organizations have attempted to reduce poverty and its negative effects, although the proportion of the national budget dedicated to poverty-alleviation programs remains small.² The daily struggle of those in poverty to stay fed, clothed, and housed, continues to grind individual spirits as well as bodies.

The number of people in poverty and poverty rates have been estimated by the Census Bureau since the mid-1960s, using a consistent – though often criticized – poverty threshold.³ The ‘poverty line’ is an inflation-adjusted threshold value (varying by family size and composition) of the annual income thought to be adequate to meet basic necessities. Those whose incomes exceed that line are not poor; those below are poor. For a family of four with two children in 2004, the income threshold was \$19,157.

The Current State of Poverty and Recent Changes Across the United States

Data have consistently shown that the likelihood of being in poverty increases for those who are African-American, Native American, or Hispanic (to name the major minority groups); those who have less education; children; and those in single-parent families. Regionally, the South has long held the dubious distinction of having the highest, and most persistent, rates of poverty. The Economic Research Service of the USDA has classified counties as “persistent poverty” if they have had poverty rates of at least 20% in every decennial census since 1970: 386 counties were considered persistent poverty in 2000, with over 70 percent (280) of those being non-metropolitan, Southern counties (Joliffe 2004). The South is still the region with the lowest real median income at \$39,823 (DeNavas-Walt, Proctor, and Mills 2004).

However, there are reasons to be concerned about other regions as well. Poverty rates declined nationally between 1990 and 2000, but two regions experienced increases in poverty rates over the same time period. The Northeast rate increased but remained below the national average. The poverty

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² Most income-transfer programs (both cash and in-kind benefits) provided by the government fall into one of two categories: means-tested, for which you must be poor or low-income to qualify for assistance; and event based, for which you qualify based on certain events, such as losing a job or turning 65. Annual Federal spending on the major welfare income transfer programs in the late 1990s was over \$800 billion (Schiller 1998). During this period, the major “event-based” social insurance program Social Security (not including Medicare) was 1.5 times the size of all the welfare (means-tested) programs combined.

³ The poverty threshold was originally determined by multiplying the cost of the USDA Economy Food Plan for households of different sizes/composition by three (since food expenses in the 1950s were one-third of the average family’s total expenses). Many criticisms of the poverty measure focus on this methodology and on the absence of interarea cost of living adjustments.

rate in the West rose from 12.7% in 1990 to 13.7% in 2000, bringing the West above the national average, and the West and South closer in terms of poverty rate (figure 1)⁴.

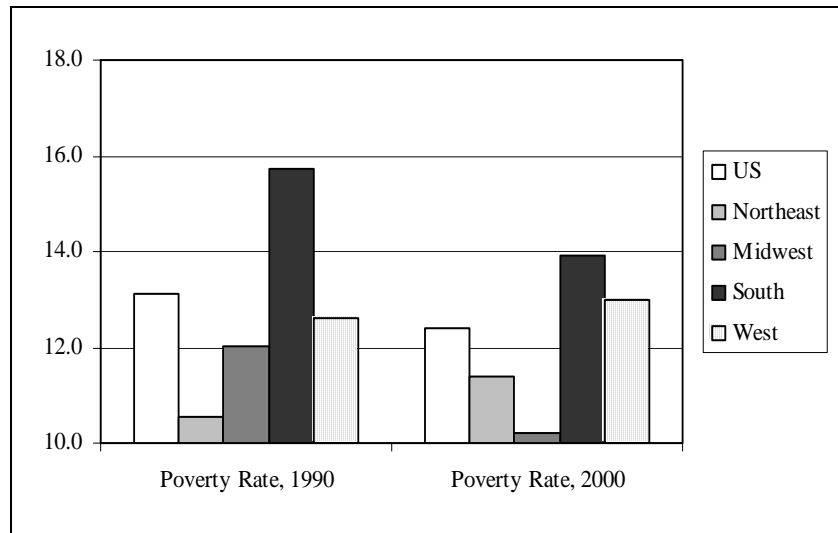


Figure 1. Poverty rates by region (%), 1990 and 2000.

The 1990 average tract poverty rate for the United States was 13.9%. This rate is significantly higher than the 12.7% average poverty rate for western tracts. High poverty tracts in the West – those with poverty rates of at least 30% – were predominantly in Native American reservations, in agricultural and extractive-industry areas, and central cities (black areas of figure 2; central city tracts are shown as points that are larger than actual size)⁵. Low poverty areas, those with rates below 10% (shown in gray), are scattered throughout the West.

A different picture emerges by 2000. The average change in poverty across the United States between 1990 and 2000 was a decline of 0.44 percentage points. In comparison, the average change for western tracts was an increase of 0.53 percentage points. Displayed in black in figure 3 are areas with increases at least one standard deviation above the mean for the region, or increases in poverty of at least 6.51 percentage points. As in the rest of the nation, significant declines were seen over the decade of the 1990s in areas that were high poverty at the beginning of the period. In contrast, increases were seen in much of California's Central Valley, the semi-arid agricultural and ranching regions across the West, and in town centers. Given that cost of living differences are not built into the poverty estimates, this trend suggests that incomes have not grown as fast in the West as in other regions, and/or that household sizes have increased faster than incomes in the West.

⁴ Unless stated otherwise, data are regional aggregations from the U.S. Census Bureau short form and long form data gathered in 1990 and 2000. Income is for the previous year (1989 and 1999).

⁵ Tracts are areas of 2,000 to 8,000 people, delineated following each census, and defined by population characteristics. In urban areas they approximate neighborhoods. In rural areas they are larger and more heterogeneous, but more homogenous than counties. Our threshold of at least a 30% poverty rate for high-poverty tracts is an attempt to capture both the homogeneous urban poor tracts as well as the more heterogeneous rural tracts. The research discussed below of urban tracts uses a more stringent value of 40% for identifying high-poverty tracts, while the USDA-ERS (as discussed previously) uses a threshold rate of 20% to capture high-poverty counties.

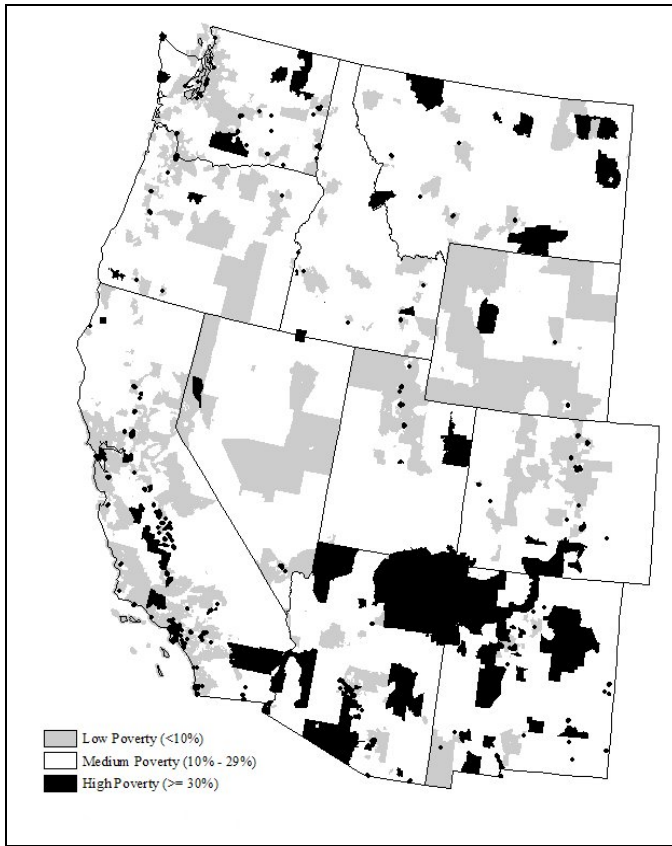


Figure 2. Tract poverty rate, 1990.

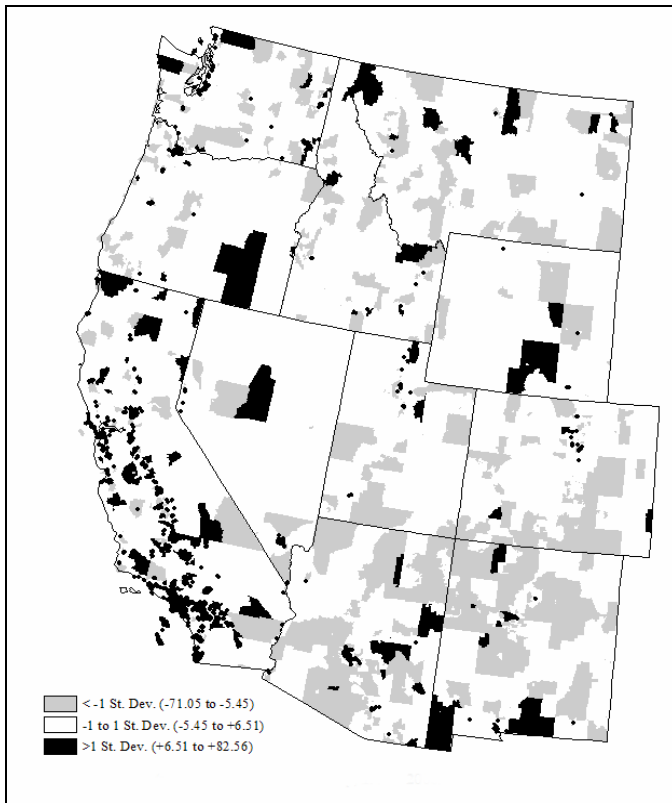


Figure 3. Percentage-point change in poverty: 1990 – 2000.

The Geographic Distribution of High Poverty Areas: Increased Spread of Poverty in the West

The increase in poverty in some areas would not be as worrisome if it were only a sign of neighborhoods becoming less economically segregated - if it were a sign of convergence of poverty rates among neighborhoods, with rates decreasing in higher-poverty areas and increasing in lower-poverty areas as a result of migration from one to another. Indeed, some researchers have found a nationwide decline in the concentration of poverty (the percentage of the poor in a given city or region that reside in high poverty tracts) in metropolitan census tracts between 1990 and 2000 (Jargowsky 2003; Kingsley and Pettit 2003). The steepest declines in number of high poverty tracts were in the Midwest and South. In the West, as seen in Figures 2 and 3, there was some convergence as tracts in the Southwest that had high poverty rates in 1990 saw large declines in poverty and many low poverty tracts in 1990 saw increases in poverty rates. But in the West, this is occurring within the context of increasing poverty, with the number of high poverty tracts increasing over the period and the number of people who reside in high poverty areas in the West rising by nearly 300,000, to 1.6 million. By 2000 there were over 8 million individuals living in poverty in the West.

The increases in poor tracts are of concern as there is evidence that neighborhoods matter: that living in a very poor neighborhood has an additional negative effect on social and economic outcomes, even after controlling for demographics (Jargowsky 1997). The “neighborhood effect” of living in a high poverty area may be due to limited opportunities for residents in terms of education and employment, a “ghetto” culture, and/or a lack of role models and positive social networks. This effect may be particularly harmful to children, who are unable to migrate away from such conditions, and who are accumulating much of their human capital.

There is another type of “place effect” that may hinder poverty reduction: the effect of being in a “poverty pocket” (Crandall and Weber 2004). We have attempted to determine the effect of being in a “pocket” of poverty – and thus the effect of “neighboring high poverty neighborhoods” – on changes in a tract’s poverty rate. Pockets of poverty are agglomerations of high poverty tracts, whose concentration may exacerbate problems and obstacles found in poor neighborhoods. To determine the extent to which any given tract was in a pocket of poverty, the proportion of each tract’s immediate neighbors with poverty rates of at least 30% was calculated for both 1990 and 2000. The change in adjacency to poor tracts over the decade mirrors the overall poverty changes. Nationwide, there was a decline in the adjacency to high poverty areas signaling a shrinking of poverty pockets. In the West and the Northeast, however, there was an increase in the proportion of tracts with high poverty neighboring tracts (figure 4), an expansion of high poverty pockets. Crandall and Weber (2005) found that, other things equal, poverty rates declined more slowly in tracts with higher proportions of adjacent high poverty tracts.

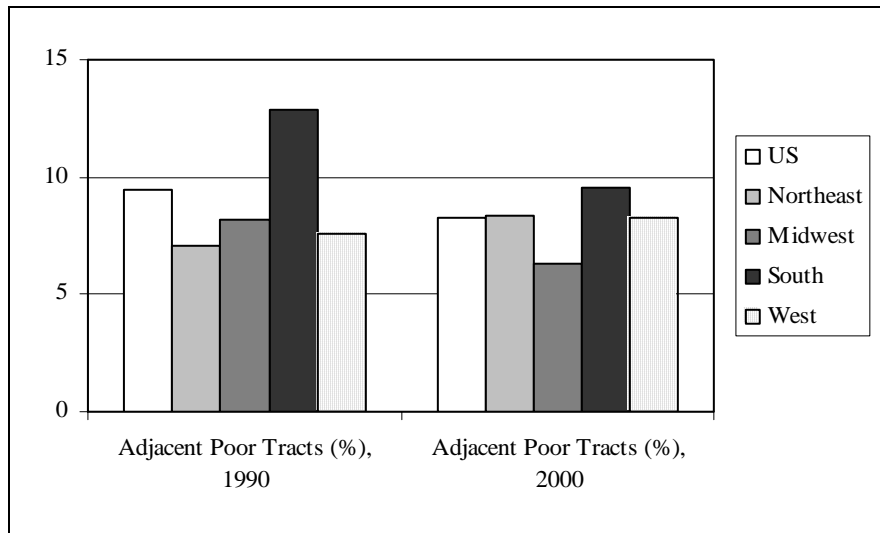


Figure 4. Adjacency to poor tracts by region (%), 1990 and 2000.

What Affects Poverty and Poverty Change?

Conventional wisdom holds that increases in job growth and in educational attainment are critical components to reducing poverty, while increases in the number of families at high risk of being poor increases poverty (for example, those with limited English, large families, or single-mother families). Those of ethnic or racial minority groups experience much greater poverty rates than non-Hispanic whites (table 1).

Table 1. Poverty rates by race, 2000.

	U.S.	Northeast	Midwest	South	West
White alone, Non-Hispanic	8.1	7.3	7.5	9.1	8.2
African-American/Black alone	24.9	23.7	26.0	25.5	21.5
Native American/Alaska Native alone	25.7	24.8	26.9	20.6	28.6
Asian alone	12.6	14.4	13.0	11.5	12.1
Native Hawaiian/Pacific Islander alone	17.7	22.4	14.8	16.2	17.8
Other race alone	24.4	29.0	19.6	24.2	24.0
Two or more races	18.2	20.9	18.7	18.4	16.5
Hispanic, any race	22.6	26.1	18.2	22.8	22.2

Studies of poverty rates and dynamics in relation to key demographic and economic variables have partly been motivated by concerns that increases in job growth no longer led to large declines in poverty during the 1990s (Blank 1997). Recent multivariate research has examined the empirical determinants of poverty changes across the United States at both the tract and county level (Crandall and Weber 2005; Rupasingha and Goetz 2003) with mixed results. In Crandall and Weber (2005), the effect of recent county employment growth was statistically significant in explaining tract-level poverty rate changes, but the effect was not large - a 0.02 percentage-point additional decline in poverty for a one percentage point increase in employment growth. Furthermore, the higher the proportion of the population with a college education in 1990, the greater the tract-level poverty declines during the 1990 – 2000 period. In Rupasingha and Goetz (2003), on the other hand, neither county job growth nor the share of population with a college degree were significantly related to county poverty rate reduction.

Why Don't Job Growth and Education Seem to Reduce Poverty in the West?

Between 1990 and 2000, the West was the only region to experience both significant employment growth (figure 5) and increases in poverty. Even given the observed weakening in the relationship between employment growth and poverty declines, this is a surprising outcome, suggesting that there may be countervailing demographics and/or an unfavorable earning distribution in the new jobs. The other region with an increase in poverty, the Northeast, had far less employment growth.

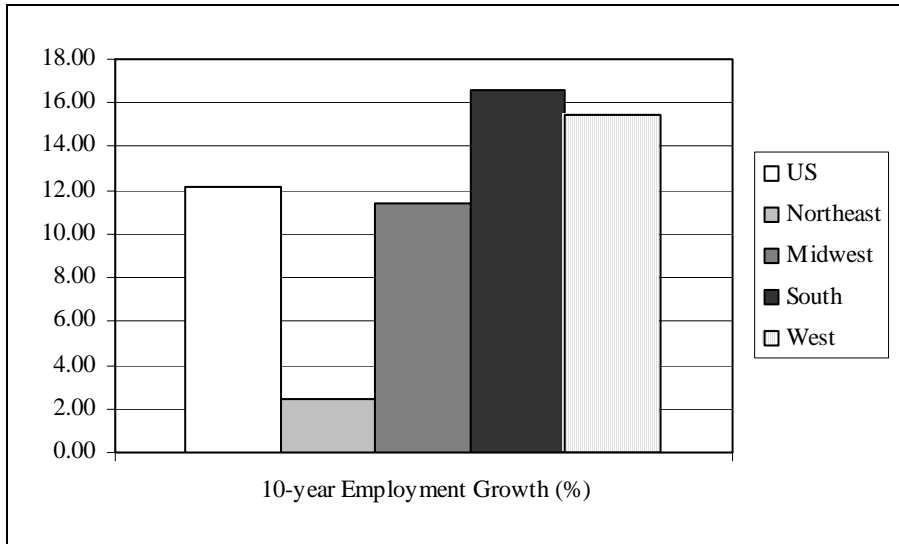


Figure 5. Employment growth by region between 1990 and 2000.

Education has been shown to be an important part of the poverty-reduction picture. Yet again, a factor expected to lower poverty - rising educational attainment - was not associated with poverty reduction over the last decade in the West (figure 6).

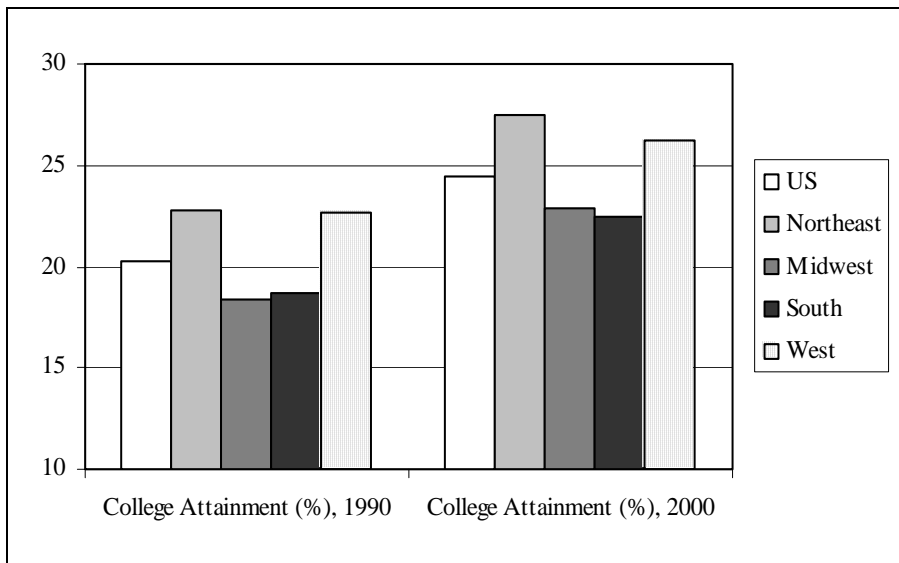


Figure 6. Adults age 25 or older with at least Baccalaureate Degrees, 1990 and 2000.

Part of the reason why job growth and rising education in the West aren't resulting in lower poverty rates may be found in the dynamics of population movements in response to changed opportunities. Migration of both poor families and non-poor families has the capability to affect poverty rates in an area. Nationwide research of cross-county moves indicates that not only did the working-age poor and non-poor migrate at the same rates between 1985 and 1990, their migration tended to reinforce the existing poverty rate in both origin and destination counties – the non-poor migrating to non-poor areas while the poor are migrating to poor ones (Nord 1998).⁶ Nord (1998) also found that the “push and pull” factors motivating migration differed between working-age poor and non-poor. Poor families were more likely to respond to areas with higher proportions of low-wage (presumably entry-level or low-skill) jobs, while the migration of the non-poor was motivated more by county occupational structures and natural amenities.

Although Nord's was a national study, migration is probably playing a role in the shifting geography of poverty in the West. The increases in poverty in much of the agricultural lands in the central California valleys along with the decreases in high-amenity counties of the Intermountain West between 1990 and 2000 may be due to these preferential streams. Clashes between residents and farm laborer immigrants in border states, as well as between residents of historically resource-based economies and higher-educated, environmentally minded newcomers in mountain states, are playing out in political battles (Power and Barrett 2001). Migration in the West, as measured by the proportion of residents in 2000 and 1990 who lived in another county or state five years prior, is slightly higher than other regions and the nation as a whole, but declined slightly by 2000 (table 2)⁷. However, the percentage of residents in the West who were born in a foreign country is much higher than other regions.

Table 2. Migration by region, 1990 and 2000.

	U.S.	Northeast	Midwest	South	West
Percent in other county 5 years prior					
1990	19.0	14.8	17.1	21.4	21.4
2000	18.1	13.9	17.2	20.7	18.4
Percent Foreign Born					
1990	7.9	10.3	3.6	5.4	14.8
2000	11.1	13.5	5.5	8.6	18.6

It might be tempting to conclude from table 2 that immigration in the West is the main source of recent increases in poverty. However, research exploring the connection between immigration and poverty in California and New York found that the greater declines in poverty rates among immigrants relative to the declines in natives overcame any increased poverty rate due to their rising share of the population (Chapman and Bernstein 2003). Their analysis indicated that poverty rates would have been only slightly lower between 1994 and 2000 if immigration rates had remained constant. It's possible that some of the increase in poverty is due instead to a greater increase in service occupation jobs in the West than in any other region, jobs that are likely to be most attractive to low-skilled workers of any ethnicity (table 3). The large increase in professional jobs that occurred over the period may be an indication that we are indeed seeing a bimodal demand for workers of both high-skills and education

⁶ Two reviewers pointed out that this appears to be at odds with earlier discussions of recent decreasing concentrations of the poor in high-poverty areas. During the 1980s, poverty did indeed concentrate, in contrast to the 1990s during when was a deconcentration nationwide. The relationship of migration to poverty rate changes may have changed.

⁷ This decline is in part a result of more individuals commuting across county lines rather than moving across county lines to accept new jobs. The proportion of workers in the United States crossing county lines to go to work has steadily risen from 10% in 1960 to 21% by 1990 (Renkow 2003). Renkow's econometric results for North Carolina between 1980 and 1990 indicated that between two-thirds and four-fifths of labor supply adjustments to new employment opportunities were accounted for by changes in commuting flows.

along with low-skills and education. In fact, Chapman and Bernstein (2003) note that New York and California saw larger-than-average increases in inequality over the period. Overall declines in wages for low-skilled workers can increase poverty even while it fuels job growth.

Table 3. Job growth by occupation, 1990 – 2000.

	U.S.	Northeast	Midwest	South	West
Management, professional, and related, % Change	30.0	22.3	31.3	33.4	30.8
Change in number of jobs	13,113,149	2,028,874	3,140,576	4,896,988	3,046,711
Service, % Change	20.7	15.0	16.2	23.9	25.1
Change in number of jobs	3,981,030	561,152	729,045	1,591,242	1,099,591
Sales and office, % Change	-6.1	-18.6	-6.1	-0.8	-3.3
Change in number of jobs	-2,097,008	-1,248,361	-502,309	-94,483	-251,855
Farming, forestry, and fishing, % Change	-198.3	-250.3	-347.6	-194.4	-109.7
Change in number of jobs	-1,887,200	-218,970	-647,467	-635,619	-385,144
Construction, extraction, and maintenance, % Change	-6.9	-26.7	-13.2	2.7	-2.5
Change in number of jobs	-841,825	-535,531	-367,901	127,300	-65,693
Production, transportation, and material moving, % Change	9.3	0.2	15.5	8.2	10.4
Change in number of jobs	1,772,164	5,717	848,103	553,560	364,784
Change in total number of jobs	14,040,310	592,881	3,200,047	6,438,988	3,808,394

Conclusion

Although low incomes and persistent poverty are not as prevalent in the West as in the South, the picture of recent poverty changes in the West is discouraging. Poverty rates and the number of high poverty areas increased, with any attendant negative effects. Overall poverty increased despite significant job growth and increases in education between 1990 and 2000.

Other measures of hardship besides poverty also suggest disadvantage in the West compared to other regions. The poverty measure doesn't capture the high levels of material hardship in the West, where rising housing costs in settled areas and the remote nature of much of the land create difficulties for families. Recent research by Miller and Mosley (2004) compared material hardship rates by region in an attempt to more accurately capture cost of living differences and the working poor. Their measure of material hardship captures those families living in crowded houses, those with incomplete plumbing or kitchen facilities, those without a phone, and those paying more than 30% of their income in rent or mortgage⁸. By this measure, the West had the highest proportion of families experiencing material hardship, at 27.1%. The South had the second highest rate (21.6%), while the Midwest was the lowest (15.3%).

⁸ They excluded families with middle incomes living in high-housing cost areas (i.e., a middle-executive living in downtown San Francisco) in an attempt to limit the study to those truly in what is commonly perceived as hardship.

Are increasingly lower wages for low-skilled workers reducing the effect of rapid job growth on poverty reduction? Has the souring of the relationship between job growth and poverty reduction been particularly harmful for our region? Does having a college education result in a lower wage premium in the West compared to other parts of the country, or are people with more education simply happier to accept lower wages in exchange for natural amenities? What role does migration play in influencing poverty rates? How does migration (both from and to the West) change poverty, based on the educational levels, family size, and poverty condition of the working-age families who migrate? To what extent is the poverty rate understated, given the higher prevalence of material hardship in the region? Although research has furthered our understanding of poverty and poverty dynamics, it is clear from this discussion of recent changes in poverty that there is much work to be done if we want to truly understand why poverty increased and to develop poverty-reduction programs that can work in the unique environment of the West.

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