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Rural development: toward an integrative policy framework

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Abstract. Rural development is a field of study requiring policy decisions. In a purely market economy, markets determine what is produced and what is consumed. Seldom do we permit markets in rural regions to operate completely unregulated. Externalities of rural production systems, public good nature of certain rural infrastructure projects, missing markets for rural amenities, and the importance of the distribution of benefits of economic growth enter into the political process of guiding rural development. Some policy makers view rural development as an end in itself, irrespective of the results on measures of welfare for rural and nonrural populations.

In this manuscript we present a framework for analysis of rural development programs and policies. Markets are defined in terms of structure and regulation. Economic behavior of rural producers and consumers is specified, and ownership of resources is determined by economic class of households. The economic model is a form of regional general equilibrium where prices, quantities, and incomes are endogenous, and changes in welfare are measured by compensating variation.

Results from two studies completed for the state of Oklahoma are presented as examples of applying the rural development policy framework.

1. Introduction

Rural regions of the United States are at a crossroads. Severe rural economic stress during the 1980s (Fuguitt, Brown, and Beale 1989; Deavers 1991; Task Force on Persistent Rural Poverty 1993) resulted, in large part, from fundamental changes in the structure of rural America (Bernat 1992; Fieleke 1994). These structural changes were driven by technical change and global competition. Increasing competition forced real wages in rural areas downward, thus limiting returns to labor resources. This occurred at a time when returns to land were stagnant and capital was flowing to urban areas at a faster rate than to rural areas. These changes ultimately resulted in incomes of rural households diverging from their urban counterparts (Rowley, Redman, and Angle 1991).

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Policy responses to the rural development dilemma of low returns to rural resources and low rural household incomes have taken many forms (Duncan 1992; Brown and Deavers 1989; and Shapiro 1989). More and better information about rural regions has increased awareness of investment opportunities. Direct financial incentives are an attempt to attract capital investment to rural regions (John, Batie, and Norris 1988; Milkove and Sullivan 1987). Development of value-added activities that expand the rural export base have become the focus of many rural development programs (Kraybill and Johnson 1989; Deaton 1991). Commodity support programs for agriculture attempt to maintain active commodity production during periods when global market price is below the cost-based supply function (Tweeten 1986). Cost share programs for agriculture and forestry such as the Conservation Reserve Program or the Forestry Incentives Program provide public funds for farm income and long-term environmental maintenance (Ellefson 1992 pp. 185, 398-400). Tourism is an additional rural development strategy to increase rural incomes and diversify rural economies (Frederick 1993; Gibson 1993; Marcouiller 1997).

The competitive market structure, within which rural economic activity frequently is evaluated, rests on the idea that market equilibrium prices and quantities correspond to a point of maximum welfare and efficiency (Tweeten 1989). Rural development policy, however, increasingly demands a more complete assessment of both market and nonmarket goods produced in rural regions. The latter have been referred to as *missing markets* because market prices generally do not exist (Dinwiddy and Teal 1996 pp. 197-267). Amenities sought by many rural residents (such as open space, scenic beauty, solitude, clean air and water, and others) are rarely traded in the marketplace. The common phenomenon where household members remain in rural areas when returns to household assets could be higher through migration cannot be explained without a broader assessment of both market and nonmarket benefits. The utility derived by rural households includes nonmarket as well as market goods. Implementation of policies based upon measures lacking nonmarket goods assessments often are derailed through the political process. When nonmarket goods are excluded from the analysis, market failure generally is identified as the culprit with the attendant non-efficient monetary prices. The proposed policy solution is to change monetary (market) prices and thus adjust markets for the apparent market failure.

Political choice is an additional means to determine if market-based results are giving the highest social value. The political process may not wait for the identification and estimation of values of nonmarket goods. The political process evaluates market-based results and proposes that different results lead to a higher social value. Policy makers intervene and guide markets to provide the more desirable results. The political process has identified a market failure and acts within its legal jurisdiction to change market-based results.

The challenge in analysis of rural development alternatives is to build on the strong market orientation currently exhibited in the U.S. economy and to identify where (and if) rural market failure exists. The framework of analysis developed in the next section broadens traditional analysis—the competitive market, adjusted for externalities and other apparent market failures, is not necessarily assumed to be the

norm. Results of the current market economy (competitive or otherwise) are compared against what policy makers desire. If the results are not satisfactory, current market failure exists. Market failure includes not only issues of externalities of markets but also issues of distribution and other apparent social motivations. The emphasis is evaluating current market results with more desirable results interpreted through the political process and elected policy makers. It is up to policy makers to identify policy means to refocus the current market economy to achieve desired results. Such an analysis broadens the concept of market failure significantly.

2. Framework of analysis

Rural development is the result of markets, and markets lead to measures of household welfare. In Figure 1 market-based welfare is the result of interpreting welfare of rural households. Measures of the welfare of rural households differ from measures of the welfare of rural regions. Economists have measures of the welfare of households. Measures of the welfare of regions are more subjective. Regions are unable to express preferences, unlike individuals and households. Policy makers express preferences for certain results within rural regions; under certain assumptions, these preferences are an interpretation of social or aggregate welfare.

Markets exist in time and space. Hence, if household preferences are defined through markets, then these preferences are similarly defined in market time and space. Markets operate within a continuum of rural to urban places (open countryside, towns, cities, metropolitan areas); thus, the markets in Figure 1 are determined at a point along this continuum. Rural households are located geographically within the rural to urban place continuum.

We define consumption for a representative household located within the rural region as a bundle of two commodities (q_1, q_2). The remaining analysis holds true even if n commodities and h household groups are defined for the region. The representative household maximizes utility (welfare) when the consumption of the two bundles of commodities is consumed at levels indicated by P^0 in the center box of Figure 1. The negatively sloped straight line in the center box represents the budget (income) constraint, and U^0 represents household utility (indifference curve). Absent from this analysis is the dimension of time. Static equilibrium is assumed with fixed preferences and a constant household savings (foregone consumption) rate.

Consumption of the two bundles of goods for the representative household is determined by the ratio of their prices, income available for consumption, and preferences. Prices are determined in the rural region commodity markets and are influenced by market environment. Market environment is interpreted as market structure and market regulation. Market structure is assumed to be competitive or noncompetitive. Market regulation is determined by policy makers. Market environment is assumed given and fixed in determining commodity market equilibrium in Figure 1. If regional imports are imperfect substitutes for domestic regional production (Armington 1969) and if producers distinguish production for export versus production for domestic regional consumption (de Melo and Tarr 1992), then regional prices are endogenously determined and differ from external prices. This is important for

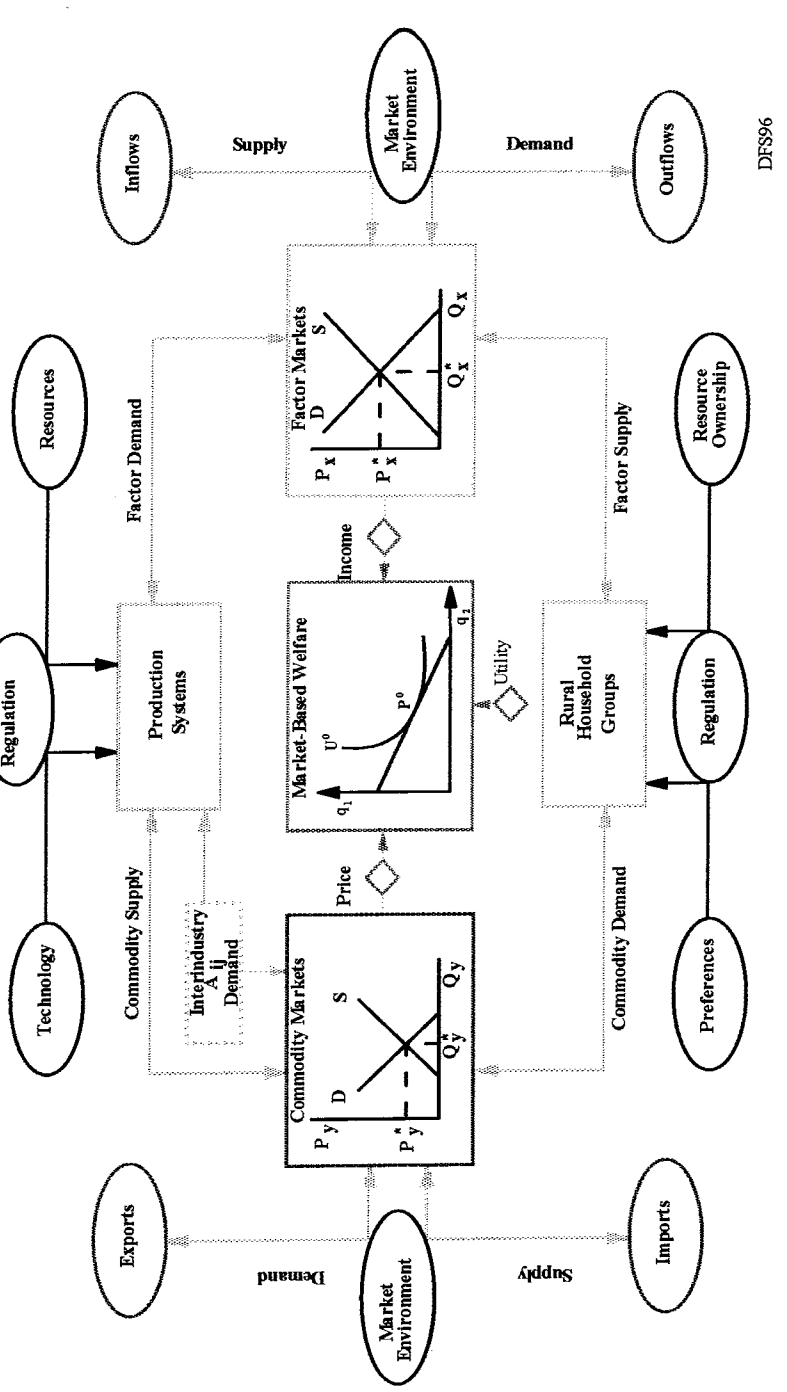

Figure 1. Market-based rural welfare

determining service sector prices because of the local nature of service sector output. Agriculture and manufacturing prices are determined largely in the national and international markets. Parameter data needed for determining commodity market prices include elasticities of substitution in determining regional imports and elasticities of transformation in determining regional exports.

Income is determined for the representative household by prices in the regional factor markets, resource ownership, preference of the household for leisure versus work, and regulation. Regional factor markets determine rates of return to regional resources (wage rates and capital and land rents) and are influenced by market environment. The factor market environment is interpreted as market structure and regulation. Market environment also is assumed given and fixed in determining factor market equilibrium in Figure 1.

Resource mobility (inflows and outflows) and factor supplies are defined for the short run versus the long run. The short run assumes capital and land fixed by sector (and thus fixed by region), but labor mobile between sectors and between regions. In the long run capital is assumed to flow into or out of the region, adding or diminishing capacity within the region's producing sectors. If regional service sector (commodity) output has high elasticities of substitution (domestic product for imports) in household consumption and in production of other commodities, fixed capital in the service sectors has dramatic implications on capital rents in those sectors. Any deceleration in the rural regional economy reduces capital rents in those sectors in the short run and thus reduces gross regional product in the aggregate. Parameter data needed in determining factor market prices include labor migration elasticity, capital migration elasticity, and regional land supply elasticity.

Factor prices are but one component in determining income for the representative household. Resource ownership, labor-leisure trade-off, and regulation are the other components. Household ownership of resources (including labor), and the prices of those resources, determines, to a large degree, how much income is available to the household for consumption and saving. If the household has few resources to take to the market, the household brings home little income (Tweeten 1989). Households, however, also express preferences for consumption through their willingness to give up leisure time for work time and the subsequent earned income. Regulation also is a major factor in determining how much income is available for consumption by households. Policy makers determine amounts of non-earned (transfer) income and household taxation. Resource ownership, preferences, and regulation are initially assumed given and fixed in Figure 1. Evaluation of alternative rural development strategies may change resource ownership and regulation. Parameter data needed to determine household incomes include rates of taxation and savings and income elasticity of labor supply.

Resource demands in factor markets are derived demands from production systems. The rural regional production systems in Figure 1 use resources from the factor markets and intermediate inputs from the commodity markets to produce commodity supplies. Production occurs under specified conditions of technology, resource availability from sources other than the factor markets, and regulation. Under static equilibrium technology is assumed given and fixed. Resources other than those coming

from factor markets include public infrastructure, public research and technology transfer services, and environmental resources (air, rainfall, sunshine). Public investment in infrastructure effectively increases productivities of resources used in production systems. Regulation is specified again by policy makers and limits how production may occur. Technology, public investment, and regulation are assumed given and fixed under static equilibrium. Parameter data needed in determining sector (commodity) outputs include intermediate input coefficients and marginal productivities of factor market resources.

Figure 1 represents a rural region market economy in equilibrium with maximum market-based welfare. Conditions of market environment, technology, preferences, resource ownership, and regulation have been specified and influence the performances of markets. It is a market economy with market-based welfare results. Do these results represent the highest level of social welfare for the rural region? They may or may not.

Market levels (rural region) of the two commodities are measured as Q_1 and Q_2. The transformation of Q_1 into Q_2 in the center box of Figure 2 for the region is represented against a social indifference curve U^P. The transformation function in Figure 2 assumes one variable resource (i.e., labor), all others fixed, in producing Q_1 and Q_2 and a (average) fixed technology. The form of the transformation function (linear, nonlinear) depends on the regional production technology. The market economy, as described for Figure 1, shows consumption of the two bundles of market goods for household group h at price ratio P^0. When consumption is summed across all household groups at the same price ratio, it corresponds to the aggregate regional consumption indicated as point P (with the same price ratio) of the center box of Figure 2. Point P on U^P is inferior to point S on U^s. Point S represents the highest possible social welfare for the region.

How do we know point P, which represents market-based welfare, is inferior to a point such as S? It is inferior if the political process is trying to change current market results. If points P and S were the same, market results would be accepted and there would be no political pressure for change. The existence of a point such as S is hypothetical. Point S on a social indifference curve is generally not measurable, just as a social welfare function is generally not measurable. But if society desires less of Q_2 and more of Q_1 and if society is expressing this through the political process, point S is superior to point P. The limitation of the analysis (or its strength) is that social welfare must be interpreted through the political process. In the Tinbergen economic policy formation model (see Fox, Sengupta and Thorbecke 1966 for a regional economy presentation), preferences of policy makers are substituted for social preferences. Under a representative form of government, the assumption is that if policy maker preferences are not an accurate interpretation of social welfare, with the next election a new set of policy makers will be elected with their expressed preferences.

Results of the center box of Figure 2 show market failure in the context of social (aggregate) choice. The current market (with all of the conditions specified for Figure 1) gives results at point P and the political process desires results of point S. The market economy is content to provide results at point P because it maximizes

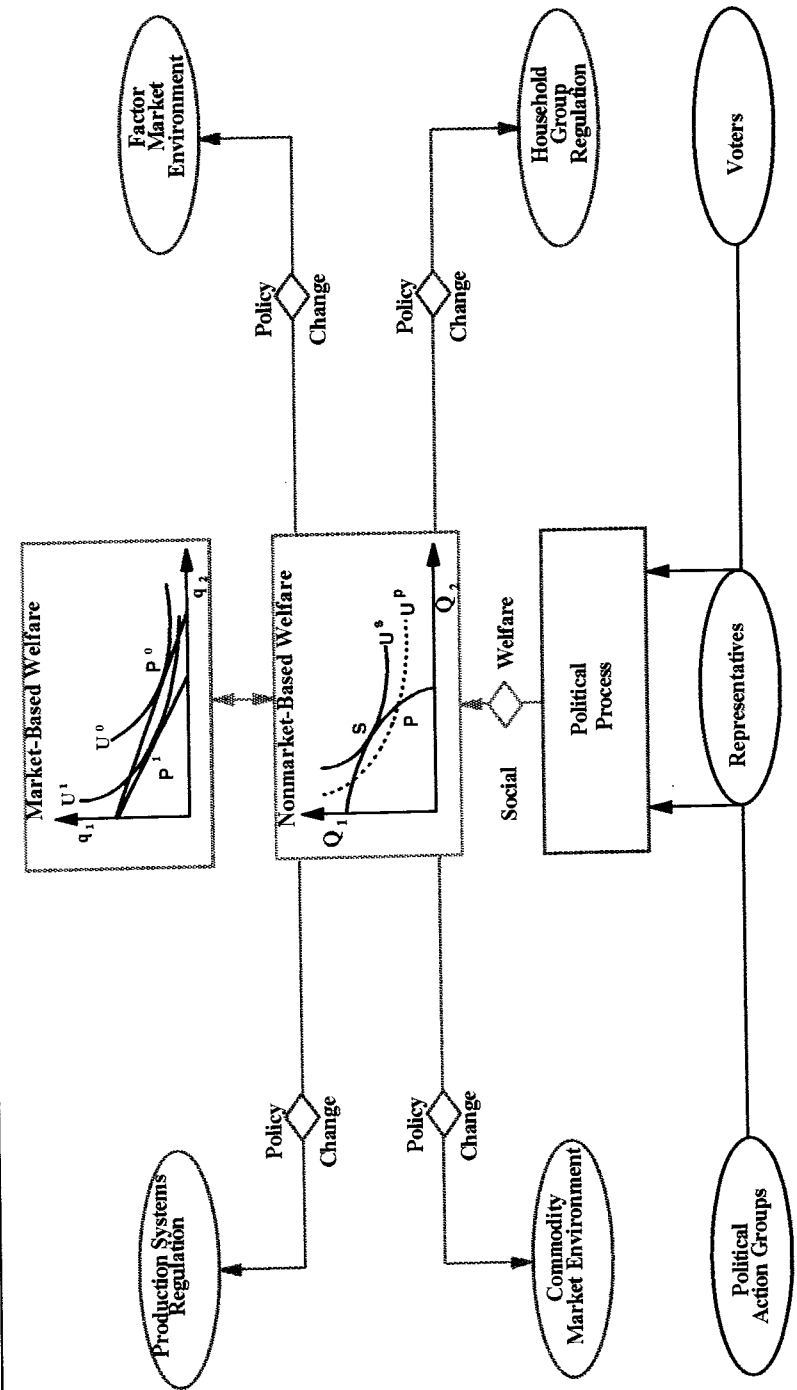

Figure 2. Nonmarket-based rural welfare

market-based welfare of each and every household group with the price ratio of P^0 as shown in Figure 1. Nonmarket-based welfare moves all household groups to the price ratio given by the tangency of the transformation function and the social indifference curve U^S at point S in Figure 2. Because of the assumption of fixed technology in Figure 2, movement from P to S assumes a change in relative prices; Q_2 becomes more expensive relative to Q_1. This may be the result of a tax placed on Q_2 that reduces the amount a representative household in group h may purchase of Q_2 for a given budget constraint. The result of the tax reduces market-based welfare because of the shift from the indifference curve U^0 to U^1 in the top box of Figure 2. Equilibrium quantities of q_1 and q_2 shift with the new price ratio from P^0 to P^1.

Generally less competitive conditions of rural economic opportunities also may identify another form of market failure. Although intervening public policies may be able to ameliorate these discrepancies, their corrective ability depends upon the power of rural politicians who operate within a complex political process. For instance, suppose the rural to urban continuum is defined to include all of the U.S. If Q_1 is defined as the bundle of commodities produced in rural places, Q_2 as the bundle of commodities produced in urban places, and if the transformation function represents a fixed amount of investment distributed between rural and urban places, market results may place us at Point P in Figure 2. The political process suggests a more desirable mix of rural development and urban development as represented at point S, perhaps for legitimate reasons. Legitimate reasons may include the traditional market failure results of underaccounting of social costs of air pollution and population concentration associated with urban development. Market results imply an underinvestment in rural development relative to urban development if policy makers wish to move from point P toward point S. The market economy with its current rates of return to investments in rural versus urban places leaves us at point P. Only by creating incentives for rural development will more investment occur with a subsequent movement from P to S. Undoubtedly this will create dynamic processes such as changing productivities of resources in rural places and changes in technologies. Hence, shifts in the transformation function as represented in Figure 2 may occur. The result of creating more investment in rural places relative to urban places remains the same, however.

Existing markets may not discriminate sufficiently against agriculture as a major contributor to decreased quality of surface and underground water supplies because of the use of chemical inputs. Such water supplies are important as potable water for households and for streams in maintaining fish populations. Q_2 may represent the bundle of agricultural commodities produced in the region and Q_1 the bundle of all other commodities including potable water and fishing trips. By reducing agricultural output (Q_2), nonagricultural output increases on the transformation function. Imposing a tax on agricultural chemical inputs would decrease Q_2 and increase Q_1 when the transformation function is representative of total regional resources. Regulation is another means of controlling the use of agricultural chemicals, although it would be represented as a shift of the transformation function because of changes in technologies of production. The important result of this example, however, is that household groups would be affected differently because of differences in

resource ownership and the results of the various policies on the rates of return to resources. Some household groups will do better, while others will do worse. Aggregate social welfare, as defined through the political process, increases because of the movement from P to S and from U^P to U^S even though some household groups fare worse and some fare better. In the real world of market economies this result is not uncommon.

Other examples can be identified. For instance, the political process may choose to guard against further depletion of health and education services in rural regions. Markets may suggest restructuring such as establishing regional health centers and the regional consolidation of education facilities and services. Markets also may suggest concentration of some retail services among fewer large firms with overall lower (discount) prices. Some rural region policy makers, however, may be uncomfortable with the demise of small retail establishments.

The relationships between Figures 1 and 2 are important. Market environment and regulation are exogenous in determining market-based welfare of Figure 1. Because this result does not give the highest social welfare as shown in Figure 2, policy is used to change regulation in how production systems or households function or to change environments in how commodity and factor markets operate. Policy is used to move market results from point P toward point S in Figure 2. Policy is endogenous in Figure 2 and is the result of the political process (shown in the lower box) and an interpretation of social welfare. When the reasons for market failure are identified, policy is proposed to change regulation and/or market environments such that the next market results move the system from point P toward point S. Alternative policies may be evaluated as they affect market-based welfare and its distribution.

Figures 1 and 2 show the components of a market-based economy. Market failure is the divergence of market-based results from those desired by the political process. It is our opinion that rural development specialists spend too little time analyzing the welfare implications of proposed rural development programs and policies. We often fail to search for apparent market failure. With better methods of analysis, what appears as market failure may be shown to be only a desire to promote rural development independent of measures of welfare change for various household groups. Quantities and prices endogenous in rural commodity and factor markets must be considered. With prices, quantities, and incomes endogenous in rural regions, it is possible to measure changes in household welfare from changes in policy or other exogenous factors.

3. Methods of rural region analysis

Three areas typify much of current rural development analysis:

- Growth in aggregate regional employment or gross regional product are assumed adequate substitutes for measures of change in household group welfare;

- Rural regions are assumed to be price takers from the rest of the world. This leads to the acceptance of fixed price multiplier analysis for explaining expected impacts of various rural development programs; and
- Related to the assumption of fixed prices is the assumption of zero substitution in resource use.

Utility measures for individuals and households are the result of preferences expressed through markets. Similar measures are not available for regions. Policy makers express preferences for regions. Regional policy makers frequently choose preferences (goals) such as maximizing regional employment growth or maximizing gross regional product (GRP) or income. Such goals have little relevance when how they affect the welfare of individual households or groups of households is unknown (Levin 1964). Maximizing employment growth may lead to trading many low paying jobs for fewer high paying jobs. Maximizing GRP may lead to emphasizing a regional structure of large corporate ownership of resources with high regional outflows of factor payments versus a regional structure of local ownership of resources with low regional outflows of factor payments.

An alternative goal is to increase welfare of one or more household groups within the region. Moving from one market result to another market result presumes a welfare change for most, if not all, household groups. To measure this change from a policy or program change, welfare must be measurable. Because utility is not directly measurable, an alternative measure must be chosen.

> An observable alternative for measuring the intensities of preferences of an individual for one situation versus another is the amount of money the individual is willing to pay or accept to move from one situation to another.
>
> Just, Hueth, and Schmitz 1982 p. 10

The two most widely accepted willingness-to-pay measures are compensating and equivalent variations.

Compensating and equivalent variations are welfare measures first proposed by Hicks (1943).

> Compensating variation (CV) is the amount of money which, when taken away from an individual after an economic change, leaves the person just as well off as before. Equivalent variation (EV) is the amount of money which, if an economic change does not happen, leaves the individual just as well off as if the change had occurred.
>
> Just, Hueth, and Schmitz 1982 pp. 10-11

Which welfare measure is employed depends on whether initial prices or new prices are used. The CV measure is based on new prices, and the EV measure is based on initial prices. Information on the distribution of welfare gains and losses among household groups should be useful to policy makers in making judgments on whether this market result is inferior or superior to an alternative market result. In the next section of this paper studies using regional general equilibrium methods show simulated results of changes in welfare (compensating variation) induced by rural development variables.

Prices frequently are assumed given (determined external) to the rural region. In part, this justifies the use of fixed price multiplier analysis of rural development pro-

grams. There is little basis, however, to accept this assumption for all prices (Koh, Schreiner, and Shin 1993). For commodity markets some prices are influenced more by national and international markets while other prices are determined in local and regional markets. The latter markets include most of the service sectors. Thus, if both prices and quantities are determined endogenously for some commodities (sectors) in rural regions, aggregate regional employment and/or income are important to those sectors. Reduced aggregate regional income will shift the demand for service sector output to the left, reduce sector prices, decrease returns to fixed resources in those sectors, and reduce incomes of households owning those resources. There are strong vested interests by households owning service sector resources to maintain or increase aggregate regional employment and income.

Similarly, for factor markets it may not be appropriate to assume infinitely elastic resource supplies for rural regions. Certainly this is not the case for regional land resources. Labor supplies depend upon households' willingness to migrate and upon their willingness to substitute work for leisure. Many factors determine rural regional capital supplies, but those related to prices may be subsumed under the single parameter of a regional elasticity of capital migration (Rickman 1992).

Rural regional analysis frequently assumes zero substitution in resource use. Particularly important is the assumption as it pertains to primary resource factors (labor, capital, and land). Less important is the assumption as it pertains to intermediate inputs (purchases of commodities from other sectors). If resources are not substitutable, they must enter in fixed proportions in the production process.

Rural regional development generally is evaluated for long-run results. Programs are evaluated for how they change comparative advantage of one region relative to another region or regions. Such change requires investments in infrastructure, education, and technology transfers. Most local and regional policy makers, however, operate with shorter time horizons. Agricultural droughts, plant closings, and reduced commodity export prices have more immediate effects on regions and regional policy makers. With less than infinitely elastic regional resource supplies, prices of resources released because of these conditions should decrease and be profitable for other industries (sectors) to employ if resource substitutions can occur. Under conditions of resource substitutions, the effect of fixed price multiplier analysis will overestimate losses in regional employment and gross regional product (Koh, Schreiner, and Shin 1993).

Specification of how commodity and factor markets operate in rural regions is important in measuring results of changes in household welfare and regional aggregates of employment and income from rural development programs and policies. A more general framework is needed than fixed price multiplier analysis. Regional general equilibrium analysis is such a framework. The bases for these models have been developed and are available in the literature (e.g., Robinson, Kilkenny, and Hanson 1990; Kraybill 1993; Koh, Schreiner, and Shin 1993; and others). Prices, quantities, and incomes become endogenous for rural regional economies, and measures of welfare become operational. The next section summarizes two such studies. These studies attempt to operationalize the processes shown in Figures 1 and 2.

4. Measurement of rural welfare change

This section examines two studies of measurement of rural welfare change associated with rural development issues. The first study is a state-level analysis of welfare losses due to agricultural export price decreases in the 1980s. Results explain why state policy makers were anxious to replace regional welfare losses. The second study is an initial effort to show the state economic impacts of potential damages a change in surface water quality may have on sport fishing in Oklahoma. The models are not presented, but are available in references cited.

4.1 Agricultural export prices[1]

Agricultural commodity prices showed a sizable decrease during the mid-1980s and contributed to considerable stress and change in rural Oklahoma. Farm foreclosures and bankruptcies were several times higher than normal for the state. Low agricultural commodity prices and depressed energy prices decreased income and employment levels throughout the state, particularly in rural areas.

A 1982-based price index (1982 = 100) for overall agricultural commodities produced in the state was 89.0 by 1986 (Koh 1991 p. 1). This implies about an 11 percent decrease in export prices of agricultural commodities during a relatively short period of time. In this context, a counterfactual experiment of a 10 percent decrease in export (national) prices of agricultural commodities was simulated for the Oklahoma economy focusing on welfare changes by household income group.

Welfare changes in terms of compensating variation (CV) amounted to a state loss of about $123,702,000 at the 1990 price level (Table 1). Welfare losses equaled $83,525,000 for the high income household group and $51,281,000 for the middle income household group. Low income households showed a slight welfare gain of $11,104,000. The latter is a result of lower commodity prices, particularly for nontradable commodities. When compared to the initial level of expenditure for each household income group, welfare change for high income households was -0.86 percent, middle income households was -0.26 percent, and low income households was +0.10 percent.

Sector outputs, labor demand, and rate of return to capital decreased for the agricultural and services sectors, but increased for mining and manufacturing. Thisimplies that resources flowed from agriculture and services to mining and manufacturing. The wage rate decreased 0.4 percent across the state. Income from all primary factors decreased, with land income decreasing 20.9 percent. About 0.3 percent of the initial labor supply outmigrated because of a decreased relative wage rate. Household income and saving decreased for all household income groups, with the high income group showing the greatest loss.

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[1] This section draws on the models and results presented in Koh (1991) and Lee (1993). The basic regional general equilibrium model is available in Koh, Schreiner, and Shin (1993) but was modified by Lee to include a labor migration elasticity, the labor-leisure relationship, and measures of welfare change. The basic social accounting matrix also was updated to 1990.

Table 1. Welfare changes (CV) from 10 percent decrease in ag export prices, Oklahoma, 1990

Household income group	Welfare change (thousand $)	Percent*
Low income (< $20,000)	11,104	0.10
Middle income ($20,000-$40,000)	-51,281	-0.26
High income (> $40,000)	-83,525	-0.86
Total	-123,702	NA

*Welfare change compared to initial level of expenditures of each household group

Most rural policy makers seek strategies that are short- to intermediate-term. Such strategies have limited success because most rural development issues are structural and require long-term changes in comparative advantage. When Oklahoma lost aggregate income and employment because of the decrease in agricultural prices, policy makers sought to replace the loss as quickly as possible. The strategies proposed were long-term strategies, however. Investments in value-added activities, international trade development, and development of alternative crop and livestock enterprises require long-term commitment—results of such development strategies are not felt immediately. Rural development research has not adequately recognized the differences between proposed development strategies and policy expectations. In part this is because rural development research has not focused on how factor and commodity markets work in rural regions in the short to intermediate term versus the long term.

The regional equilibrium model developed and applied at the state level in this study simulates the short-run conditions for markets by holding land and capital fixed by sector. Labor is assumed mobile between sectors and between regions. Hence, simulation results approach the short- to intermediate-term effects that correspond with expectations of policy makers. Some conclusions and policy implications drawn from the results are:

- The welfare changes to households are marginal compared to the aggregate level of welfare (expenditure). The welfare loss is about $124 million or about 0.3 percent of initial expenditure. The welfare loss helps us understand, however, why policy makers are concerned about replacing the loss in aggregate income and employment for the state. Households would be willing to have policy makers subsidize re-establishment of economic activity if part or all of their welfare loss were restored. In fact, high income households would be more open to a transfer because a higher proportion of their aggregate expenditure was lost compared to middle income households (0.86 percent for high income households versus 0.26 percent for middle income households). Low income households would have little interest in subsidized activity because they experienced a welfare gain from the decrease in agricultural commodity export prices;
- Agriculture and service sectors were affected negatively by the price decrease whereas the sectors of manufacturing and mining were affected positively because composite prices decreased in agriculture and service sectors and increased in manufacturing and mining, thus pulling resources (labor) from the former to the latter. This result implies that

those households involved in agriculture and services would be more willing to have policy makers subsidize re-establishment of economic activity than would the manufacturing and mining sectors;

- Resource owners also have a stake in the re-establishment of economic activity. Land owners had a 20.9 percent reduction in land rents, and capital owners had a reduction of capital rents ranging from 20.9 percent in agriculture to 0.5 percent in services. Those resource owners with the greatest loss would be more willing to have policy makers subsidize re-establishment of economic activity than would resource owners with less loss. Labor compensation was reduced 0.5 percent which, because of mobility between sectors and regions, was significantly less than the losses by land and capital resource owners. Labor that migrated had the lowest loss in resource compensation.

The most critical limit of this study is the untested exogenous parameters adapted from other studies. Most parameter estimates for general equilibrium models have been estimated using national data. Little research has been completed that applies these parameter estimates to regional models. A sensitivity analysis for selected elasticity parameters may give significantly different results in model simulations. Critical parameters of regional general equilibrium models are lacking.

4.2 Sport fishing trip demand[2]

Growth in sport fishing and the associated increase in angler expenditures have heightened the need for understanding how variations in expenditure can affect a regional economy and the welfare of economic participants. In Oklahoma the number of anglers increased 14 percent from 1980 to 1990, compared to a 20 percent increase nationally. Fedler and Nickum (1994) estimate that angler expenditure (trip and equipment) in Oklahoma was $387.3 million or 0.6 percent of gross state product in 1991. The fixed price multiplier impact was estimated to equal $793.5 million in output for all Oklahoma sectors, $202.2 million in job earnings, and 11,606 in employment. But what are the general equilibrium results, when both price and quantity are endogenous, from a change in the demand for sport fishing trips? Such general equilibrium results are important for measuring policy implications of changes in quality of sport fishing and subsequent changes in trip demands.

In Oklahoma agriculture accounts for about 5 percent or $3.3 billion of the $64.8 billion gross state product (GSP) in 1992. Scifres and Osborn (1983) estimate that 15.4 percent of GSP is associated directly and indirectly with agriculture. Natural resource systems provide valuable services in support of agricultural production and sport fishing activities. Boosting agricultural production by applying more fertilizer and other chemical products could affect the quality of water in natural resource systems substantially and negatively impact sport fishing.

This study utilizes information on sport fishing trips and sport fishing expenditures in Oklahoma to measure welfare gains/losses due to a change in trip demand.

[2] This section draws on methods presented in a paper for the Sixth International CGE Modeling Conference (Budiyanti, Schreiner, and Li 1995) and on modeling methods in Lee (1993). Results are from Budiyanti (1996).

Table 2. Resident and nonresident anglers and trips, Oklahoma, 1991

Description	Unit	Resident	Nonresident	Total
Total anglers	1000 anglers	623.3	180.4	803.7
Total trips				
In-state	1000 trips	9410.9	1379.0	10,789.9
Out-of-state	1000 trips	368.7	NA	NA
Total days of fishing	1000 days	10394.0	1686.0	12080.0
Days per trip	number	1.10	1.22	1.12

Sport fishing expenditures were aggregated according to commodity and industry groupings for the state economy. These expenditures by sector (industry) are the inputs of a sport fishing trip production function, while the sport fishing trip output is consumed by the various household groups. In the social accounting matrix (SAM), sport fishing is treated as one of the producing sectors. The compensating variation (CV) welfare measure for households is used to evaluate the regional general equilibrium impact of changing trip demand in sport fishing.

The National Survey of Fishing, Hunting and Wildlife Associated Recreation shows that 803,700 U.S. anglers fished in Oklahoma during 1991, with 10,790,000 angler trips and 12,080,000 angler days (Fedler and Nickum 1994). State residents accounted for 623,300 anglers with 9,410,900 angler trips and 10,394,00 angler days (Table 2). An additional 180,400 anglers were nonresidents with 1,379,00 trips and 1,686,000 days of fishing. The 1991 total angler expenditures of $387,326,000 were distributed as trip-related, equipment, and other and equaled $196,226,000, $59,506,000, and $131,594,000, respectively. This study concentrated on trips and trip-related expenditures and their impacts on the Oklahoma economy and household welfare.

Model experiments focused on decreased trip demands. The premise is that if quality of sport fishing decreases, trip demand decreases. Quality of sport fishing is hypothesized to be associated with number of fish caught per trip. The number of fish caught per trip is hypothesized to be associated with fish population which, in turn, is hypothesized to be associated with water quality. Hence, a decrease in water quality (i.e., an increase in chemical discharge) reduces fish populations which reduces fish caught per trip and thus decreases the quality of sport fishing and number of trips in Oklahoma. Presumably residents and nonresidents have alternative sites at which they can replace their desire for sport fishing. These experiments begin to address the general equilibrium policy implications of the fixed price impact analysis of Fedler and Nickum (1994) for sport fishing expenditures and for cash receipts to agriculture (Scifres and Osborn 1983).

Two scenarios are analyzed: a 10 percent and 50 percent quality tax imposed on the price (cost) of resident and nonresident in-state trips. This increases the cost of in-state relative to out-of-state trips for residents and nonresidents. Selected impact variable data are presented in Table 3. The regional price of resident and nonresident trips increases because of the quality tax. The increase is slightly less than the tax because

endogenous regional prices lowers overall prices and marginally reduces the cost of regional trips. Because of trip substitution, out-of-state trips by Oklahoma residents increase as in-state trips decrease. Total trips decrease because the composite price (weighted in-state and out-of-state prices) increases and shifts demand to other commodities. The proportion of in-state to out-of-state trips depends on the price ratio and the elasticity of substitution. The out-of-state price is assumed to remain constant. The elasticity of substitution between in-state and out-of-state trips is set at 2.0.

Nonresident trips (export demand) is driven by the price elasticity of demand and the quality tax. With a 10 percent unit cost quality tax the number of trips decreases 5.5 percent. With a 50 percent quality tax trips decrease 20.9 percent.

The demand for regional resources (labor and capital) decreases marginally because of the quality tax. This results in slightly lower factor prices. The demand for regional resources is less with the 50 percent quality tax compared to the 10 percent quality tax. Quantity of land is fixed in the model, but land rent is determined endogenously.

The regional wage rate decreases which encourages labor outmigration. The latter depends on the out-of-region wage rate (assumed constant) and the labor migration elasticity. The number of jobs lost to the state is 214 with the 10 percent quality tax and 810 with the 50 percent tax. Migrating labor is expected to retain proportional ownership of other household resources (capital and land); hence, returns to these resources are expected to flow out of the state.

Outmigration of labor receives out-of-region wage compensation of $4,782,000 and other resource compensation of $5,781,000 under the scenario of a 10 percent quality tax. The latter remains part of gross state product but flows from the state as payments to migrating labor. Capital migration occurs because of a lower capital rent in the state. Compensation for this capital outmigration is equal to $2,395,000 with the 10 percent quality tax and $8,927,000 with the 50 percent tax. Total external compensation for resources lost to the state through migration is $12,958,000 for the 10 percent quality tax and $40,386,000 for the 50 percent quality tax.

Regional welfare may be measured by gross state product or household welfare. Loss in GSP with a 10 percent quality tax on in-state fishing trips is estimated at $14,910,000 and $55,670,000 with a 50 percent quality tax. These loses are due to outmigration of resources and lower resource returns (wage rate and capital and land rents).

A more revealing welfare measure is the compensating variation loss to households. This loss is a measure of the income it would take to bring households back to their original level of welfare before the regional general equilibrium effects of the fishing trip quality tax. The distribution of welfare loss by household group is presented in Table 3. On a per household basis, high income households had the greatest percentage loss when compared to the before quality tax income level. Low income households had a higher percentage loss compared to middle income households. The 50 percent quality tax had about four times the percentage welfare loss compared to the 10 percent quality tax.

Table 3. Regional welfare change from quality tax in sport fishing, Oklahoma, 1991

Impact variable	Quality tax		
	0%	10%	50%
Resident fishing trips			
Regional price (index)	1	1.099935	1.499756
Number of trips (1,000)			
In-state	9411	7876	4426
Out-of-state	369	411	585
Total	9780	8287	5011
Nonresident fishing trips			
Regional price (index)	1	1.099921	1.499704
Number of trips (1,000)	1379	1187	728
Regional resources			
Labor (index)			
Quantity	1	0.999843	0.999405
Wage rate	1	0.999829	0.999353
Capital (index)			
Quantity	1	0.999891	0.999595
Capital rent	1	0.999882	0.999559
Land (index)			
Quantity	1	1.000000	1.000000
Land rent	1	0.999879	0.999555
Migration			
Labor			
No. of jobs	NA	-214	-810
Compensation ($1,000)	NA	-4,782	-18,083
Other resource compensation ($1,000)	NA	-5,781	-13,376
Capital			
Compensation ($1,000)	NA	-2,395	-8,927
Total compensation ($1,000)	NA	-12,958	-40,386
Regional change			
Gross State Product ($1,000)	NA	-14,910	-55,670
Household welfare ($1,000)			
Low income (< $20,000)	NA	-3,549	-13,855
Middle income ($20,000-$40,000)	NA	-5,378	-20,885
High income (> $40,000)	NA	-7,629	-29,330
Total		-16,556	-64,070
Per household welfare loss (%)			
Low income (< $20,000)	NA	0.0361	0.1408
Middle income ($20,000-$40,000)	NA	0.0226	0.0876
High income (> $40,000)	NA	0.0481	0.1849

NA - not applicable
Based on Budiyanti (1996)

If a dollar of welfare loss is valued equally across the household income groups, then for all households in the state the welfare loss was $16,556,000 with the 10 percent quality tax and $64,070,000 with the 50 percent quality tax. Policy makers need not make this assumption of equal unit value of welfare gains/losses across household groups. If policy makers do not make this assumption, then they must give relative weights among household groups to specify total social welfare gains and losses.

5. Conclusions

We need better analyses of rural development programs and policies as they impact the welfare of rural and urban households. We need a better and more integrated policy framework in which to perform analyses. We need better analytical models that allow prices, quantities, and incomes to be endogenously determined for rural regions within the rural-to-urban geographic continuum.

This paper broadly outlines such an integrative policy framework based on a market economy with current market results. Households maximize market-based welfare with current market prices and incomes. Policy makers determine whether market results maximize social welfare. If not, policy is proposed and new market-based welfare results are evaluated. We suggest regional general equilibrium as a more inclusive framework in which policy may be evaluated as it effects the welfare of households. More careful specification of commodity and factor markets for the rural region and of opportunity costs of rural resources is needed. Finally, we examine two studies that apply the procedures outlined in the framework of analysis.

Regional general equilibrium methods have not been fully tested in terms of providing accurate results of how rural markets operate. Parameter data are rudimentary and have not been adequately tested in describing conditions and responses of markets in regions of different types and sizes. As data and methods improve, better results of simulating effects of changes in rural development programs and policies may be expected.

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