DISSERTATION

PUBLIC INTEREST VERSUS PUBLIC CHOICE: A WELFARE APPROACH USING CGE ANALYSIS

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY KATHERINE CHALMERS ENTITLED "PUBLIC INTEREST VERSUS PUBLIC CHOICE: A WELFARE APPROACH USING CGE ANALYSIS" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

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This paper derives two contrasting decision-making models from both public welfare and public choice theory to evaluate the benefits Fort Collins, Colorado might expect to receive from differing types of economic development. Using a comparative static CGE Model utilizing highly specialized local data, the effects of five different types industrial expansions are explored as employment is separately increased in each industry by one thousand workers. Each simulation's results are compared against the other by utilizing the two contrasting perspectives developed earlier. The conclusions of each approach are shown through the expected income change for both original and new residents to Fort Collins, labor market conditions as in- and out-migration adapts to increased labor demand, as well as average household tax burdens and taxes collected by the local government.

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Chapter 1

Introduction

As an outgrowth of the federalist shift in the 1980s, communities began luring established companies from other areas and attempting to help existing ones by using a variety of local economic incentives.[1] No matter which type of incentive is used, the underlying premise of such development is that the costs facing the community will be more than offset by the benefits that may accrue in the form of higher rates of economic growth, larger property values, additional employment opportunities for its citizens, and a more stable, diverse economy.

Even though costs are important, because the benefits of development are not equally distributed among the community's residents, they must be evaluated through the lens of the community's definition of distributional equity. In other words, if a program yields inordinately large benefits but they accrue solely to the rich, is the development program worth pursuing? But, does a program have to solely benefit the poor in order to be approved either? The answers to these questions depend upon the community's aversion to an unequal income distribution, reflecting their definition of equity.

Using this perspective, one can argue that any program seeks to increase a community's welfare; however, one cannot uniformly institute a development program for several communities and expect the same effects upon welfare. This result can be

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[1] See Fainstein and Fainstein (1989) for more discussion of this historical trend.

explained by the fact that each community displays heterogeneous characteristics such as population, income distribution, or location which ultimately require incorporating a consideration of this heterogeneity. Therefore, to adequately understand how a community is affected by an economic development program requires a marriage of two fields of economics: public welfare economics' measurement of social welfare with regional science's understanding that locational heterogeneity matters.

Why might two communities facing identical effects on their income distribution reach different conclusions regarding the approval of an economic development program? How exactly are the decision-making mechanisms of the two communities different? Until now, communities who have pursued economic development have evaluated their expected benefits on a case-by-case basis. Communities are largely guessing at the expected benefits they might receive. A question that must be asked is how might a community better evaluate a program's effect upon its income distribution?

Exploring why a program's results might conflict across communities, this research will employ a dyadic model of decision-making, using two approaches to government decision-making. This method of analysis will explain why one community might attempt to attract one industry over another. The two approaches developed here will be labeled Public Interest and Public Choice since each approach embodies a different optimization goal for government decisions. The Public Interest approach takes as its stated goal the maximization of social welfare, however that welfare is measured or evaluated. This methodology will be familiar as the typical perspective taken in public welfare economics, as pioneered by Harberger and Samuelson, among others. To pursue such a goal requires that social welfare must be measured in order to be maximized as noted by Atkinson (1970) and Kolm (1969). In contrast, the Public Choice approach takes the maximization of tax revenue as its stated goal, with some consideration shown for average household tax burdens as well as overall tax incidence. This methodology is similar to the perspective of the Public Choice school of public finance literature, as pioneered by Buchanan and Niskanen, among others. However, it must be noted that the methodology labeled here as Public Choice is *not* intended to be a strict formulation of these ideas, but rather to serve as a foil for the perspective taken by the Public Interest approach.

A prerequisite of the Public Interest approach is the measurement of social welfare. Measuring social welfare can take a variety of approaches; however, the source of difference between these approaches stems from communities' differing levels of aversion to social inequality. In other words, each community has a different perception of what it sees as an ideal income distribution. One community may view a market-derived income distribution as perfectly acceptable while another may prefer to have a completely egalitarian income distribution. The latter community would be said to have a larger social aversion to inequality; therefore, its social welfare function should register this preference. This preference can be strengthened by using distributional weights. By categorizing a population into identifiable groups and assigning each group a different weight according to the project evaluator's preference structure, distributional weights can also show a group's marginal contribution to a community's overall social welfare. In this way, distributional weights directly influence the calculation of benefits.

In contrast, Public Choice seeks to maximize the welfare, not of society in general, but of the governing jurisdiction in particular. The model presented under the Public Choice approach is a self-consciously narrow view taken from traditional public choice literature since its intent is merely to show an alternate perspective to that presented under the Public Interest approach. Use of the Public Choice model does not give any consideration whatsoever to the income distribution that may result from an economic development strategy; rather, it merely examines development's effect upon the tax revenues collected. In this way, the welfare of the local government is explicitly maximized which may or may not result in simultaneously maximizing the welfare of the community.

A common thread of both approaches is a concern for implementing locational heterogeneity, such as population, income distribution, and migration or community patterns. Locational heterogeneity is important because communities are different. It follows then that economic tools which engender comparisons across communities also incorporate those differences. To accomplish this goal, the Public Interest approach uses each community's aversion to inequality to individually determine its distributional weighting scheme. These individualized distributional weights allow each community's unique perspectives on social equity to distinguish themselves from one another. Likewise, each community's own taxation system reflects its own attitudes regarding tax collection and the provision of local public goods, so the Public Choice approach also incorporates a community's characteristics. No matter which approach is used, community differences will be taken into account.

How, then, should such a study be attempted? Due to the interconnected nature of the costs and benefits that must be included in the calculation of social welfare, a computable general equilibrium (CGE) model is the preferred empirical tool. While there have been similar attempts using CGE models to measure the employment gains derived from local economic development strategies, no study to date has attempted to capture this development with contrasting models of government decision-making.

A CGE model highlights the divergent results when economic development is considered, using both the Public Interest and Public Choice approaches. The divergence between the two approaches can be explained by the differing emphasis each approach places upon income distribution and social welfare. Simulations will be undertaken by increasing a sector's employment by 1000 workers for five differing sectors. The sectors affected are the computer manufacturing, manufacturing, high services, retail, and university/junior college sectors. The computer manufacturing and manufacturing sectors were chose to represent traditional sources of growth while the retail sector was chosen because they represent significant sources of sales tax revenue. Finally, the university/junior college sector was chosen because it is a unique and significant sector for the community being considered, Fort Collins, Colorado. The impact on on income distribution, households, tax collection, and in- and out-migration from the community is computed by the CGE model.

The CGE model will indicate whether the expansion of a particular industry results in either increased incomes or increased tax collection by the city, or both. While the increase in tax collection and incomes from such a scenario would suggest that the poor might benefit the most from that type of industrial expansion, the distribution of the incremental increase in income may serve to further exacerbate any existing income inequalities and strongly skew the results. Therefore, if the city considers the welfare of its lowest income residents, it may choose an economic stimulus which fails to maximize income in the aggregate, but rather selectively targets an income group. In contrast, a city may pursue economic development which maximizes tax revenues but leaves its residents worse off than before the expansion.

The Public Interest approach's focus on social welfare is best reflected within a general equilibrium analysis as represented by a CGE model. Similarly, a CGE model allows one to accurately measure how an industrial expansion might affect a community's tax revenues, an important calculation when using the Public Choice approach. However, while identifying how income is distributed across household groups is useful, a CGE model goes further by showing how such income is spent throughout the economy, thereby measuring welfare changes for not only household groups but also firms and institutions. Moreover, this ability to examine an income distribution's ultimate ramifications is a vital analytical tool when examining questions such as those posed previously.

Another consideration to be explored is the inherent tension that exists between a community's current residents and its potential new residents who would move into a city due to economic development. A city must decide which constituency counts when calculating social welfare–does the well-being of the original residents weigh more heavily than the well-being of potential residents? On the one hand, new residents represent increased demand for goods and services, both public and private; however, increased demand can also lead to increased prices for those goods and services. Furthermore, when viewed from the aggregate, an influx of new residents may lessen the tax burden of existing residents, assuming that the community's current level of local public goods provision does not increase in the same proportion as its population. Therefore, when considering which development path to pursue, an important question remains, what are the conditions under which new residents might be welcomed by the community?

These theoretical concerns will be explored within the context of a CGE model developed to simulate the economy of Fort Collins, Colorado. The model considered within this study, consisting of 20 sectors incorporating three labor groups, six household groups and a fully-specified city government (both in taxation and consumption), should provide a strong analytical framework within which to pose and answer these questions. This study's ultimate conclusion is like most studies, in that it is not an absolute; however, it does suggest that an examination of these questions yields significantly different results.

1.1 Outline of the Research

Chapter Two presents the current research level for evaluating regional planning and modeling. The current case study methods are disregarded as too singular in favor of a more universal examination of the ways in which the science should be brought up to speed by incorporating the theoretical work of public welfare economics, specifically the social welfare function and distributional weights, and public choice theory. Finally, the political implications and extensions of this research are presented.

Chapter Three begins by outlining the theoretical basis for CGE modeling. This is done by presenting previous modeling applications, as well as by outlining the underlying logic of Input-Output tables and Social Accounting Matrices. These data organizing methods and tools are then used to construct a CGE model which can explain the theoretical differences between the two approaches as outlined in the previous chapter. Finally, a description of the data and its primary sources is given.

Chapter Four outlines the five simulations that are run using the CGE model and data described in the previous chapter. The results of these simulations are then presented, using both the Public Interest and Public Choice approaches, particularly each approach's optimal selection. The differences between the two approaches, particularly with respect to income distribution and tax revenues, will be explored.

The final chapter presents a considered evaluation of the study's results and an exploration of the limitations of the model. Finally, additional directions for future research and possible model improvements are presented.

Chapter 2

Literature Review

For a government to properly evaluate the benefits resulting from economic development requires a torough examination of several points. The creation of this government decision-making framework necessarily draws upon the strength of past work while addressing its weaknesses. Previous attempts at evaluating economic development's benefits, using both *ad hoc* and cost-benefit analysis methods, are explored within the context of incorporating locational heterogeneity. Ultimately, the weaknesses of this research argue for other methods of analysis, and so attention is given to the work of public welfare economics. The tools it provides, namely compensation tests and distributional weights, allow one to more fully understand the benefits of economic development. Previous work incorporating distributional weights is explored within the context of economic development's evaluation. Subsequently, an alternative decision-making method, which does not include any equity consideration, is developed so that the results of both approaches can be compared. Past research utilizing this perspective is shown within the context of economic development. Finally, such issues as tax competition, election cycles, and competition between communities provide some context for a comparison between these two approaches.

2.1 *Ad hoc* Attempts to Evaluate Economic Development

The research which evaluates economic development from a community's perspective has been largely *ad hoc* at best. To date, no one has created a systematic appraisal method by which any economic development program can be evaluated. As Testa and Allardice (1988) note, "There has not been adequate research to measure the effectiveness of these programs in general for every community." By measuring each community's economic development with a different yardstick, it becomes impossible to make inter-community comparisons; furthermore, if no model exists which can be universally applied, then the efficiency of economic development decisions cannot be adequately explored. If one cannot judge an economic development policy's effectiveness across communities, then one much revert back to the *ad hoc* methodology used earlier. Nor has there has been any empirical consensus that community-directed economic development offers have a significant impact upon a firm's relocation decision. Harrison and Kanter (1978) find that even in spite of this lack of consensus, officials "genuinely believe in the efficacy of business incentives." Communities cannot judge their pursuit of economic development against other communities; however, each community continues blindly to pursue economic development, convinced of its ultimate efficacy.

Therefore, this research is a necessary step in a new direction for this area of research. While some may question the overall efficacy of communities' pursuit of economic development, this research argues that it should not be an uneducated pursuit, that there should be an underlying logic to communities' pursuit of economic development. This research argues that communities should pursue development in a systematic manner, by following a method of their choosing, one best suited to an individual community's characteristics and needs.

There has been significant research presenting the types of local economic incentives packages that are available to communities in a systematic way by analyzing how those packages might be received by interested firms, as well as the ramifications of these different packages' financing upon an individual firm's tax liabilities. For example, Rasmussen, Bendick, and Ledebur (1982) present a systematic model a firm can use to analyze a community's economic development offer, labeling such an estimate the "asset value of assistance." The asset value of assistance is calculated using a universal method which can be tailored to an individual firm. For example, the discount rate used to calculate the incentive package's present value is the opportunity cost of capital method; the authors argue that each firm faces an individual going price of capital which should be used as the firm's discount rate.

The authors also illustrate potential problems such as tax abatement offered by a local government that may result in an increase in the firm's taxable income. This increase serves to augment the federal corporate income tax liability of the firm. In essence, the money changes directions—rather than flowing into local government coffers as the community wants, it flows into the federal treasury (Lewis 2001). These unintended consequences are logically explored and incorporated into a model tailoring its analysis for a firm's individual situation.

In contrast, there has not been a logical model that can be universally applied to all communities like the asset value of assistance model for firms. This absence also means that each evaluation method used is too highly individualistic to allow for a comparison across communities. Therefore, a universally applicable method which also offers the ability of being tailored to an individual community's needs is needed.

2.2 Cost-benefit Analysis

One method which does give an underlying logic to the pursuit of economic development is cost-benefit analysis, where the calculated costs and benefits of economic development are compared. Cost-benefit analysis argues that development should be pursued only when the costs are outweighed by the benefits. The research performed by Bartik (1991) heavily utilizes this method.

Even though Bartik concludes, after examining previous empirical studies, that the empirical evidence attributable to economic development policies is mixed, he argues that most economic development policies do have effects worth considering and urges the further implementation of econometrics to parse out those effects in a conclusive manner. This dissertation attempts to follow that advice by isolating the benefits of economic development to ascertain whether or not economic development is a worthy goal.

In attempting to analyze the efficacy of such programs, Bartik (1990) argues for the use of cost-benefit analysis. By walking through a numerical example, he identifies the benefits of a typical economic development program as increases in residents' real earnings and increases in property income which are offset by the costs of the program itself in addition to the possibility that strong employment growth may lead to a higher cost of living for residents or higher wages and rent for businesses.

Another result which Bartik describes that could be classified as a benefit of economic development, or a cost depending upon one's perspective, is that lower than average unemployment rates can serve to induce others to move or commute into the community thereby augmenting the local labor supply and providing a downward pressure on wages. Marston (1985) estimated that over 13 percent of the population in the United States moved between metropolitan areas, thereby exceeding any possible unemployment differential between those localities. Therefore, only a small percentage of the labor force would need to move to meet any increased demand for labor (Bartik 1991).

A community's income distribution can be affected by what happens in the long run. For example, Bartik (1991) argues that local labor markets can be characterized by *hysteresis*, where a short-run recession or boom can have permanent long-run effects upon a community's unemployment level. It follows that short-run economic growth can create future unemployment significantly lower than previously projected before the short-run boom, a potential result that bears inclusion in a community's decision-making. To do so, the community should measure not only the cost and benefits associated with the extension of a local economic incentive package, it must also consider those costs and benefits over time.

Obviously, there is wide latitude for a model trying to capture all the possible effects of such a program for one community, must less for any community. But the big question remains, are the net benefits of such a program positive? To answer such a question requires a more detailed examination of how the results of economic development will be measured.

Measuring the results of economic development necessarily requires making assumptions regarding the tastes and preferences of community residents. To adequately gauge development's effect upon an individual necessitates an understanding of his or her evaluation of personal utility, something which is heavily dependent upon a person's tastes and preferences. The most basic assumption is that everyone in a community has identical tastes and preferences—a thought that initially appears highly unrealistic.

However, Tiebout (1956) illustrates the conditions under which consumers will self-categorize into groups with identical tastes and preferences for public goods and taxes when local governments provide goods to citizens who can move among distinct communities. If citizens are faced with an infinite array of communities that offer different types or levels of public goods and services, then each citizen will choose the community that best satisfies his or her own particular demands. In essence, individuals effectively reveal their preferences by "voting with their feet." Citizens with high demands for public goods will concentrate themselves in communities with high levels of public services and high taxes, while those with low demands will choose other communities with low levels of public services and low taxes. Competition among jurisdictions results in homogeneous communities, with residents that all value public services similarly. In equilibrium, no individual can be made better off by moving, and the market is efficient. It does not require a political solution to provide the optimal level of public goods.

In a similar vein, even though Bartik argues that economic development's ultimate effects upon a community's well-being can be measured econometrically, Hillinger (2001) argues against using the "econometric approach" to measure welfare and welfare changes, noting that serious objections can be raised against the econometric methodology. Chief among his concerns is that this method of welfare measurement involves the estimation of a system of aggregate demand equations, thereby implying identical and homothetic tastes on the part of consumers.

This concern, while realistic for larger studies, does not carry the same significance for smaller studies. Following Tiebout's logic, it can be argued that a community's residents possess a similarity in tastes and preferences which extends beyond public goods and taxes to other commodities as well.

If a community's residents can be evaluated as having identical tastes and preferences, then should there by any attempt to distinguish residents from each other? Yes, because economic development's benefits are not enjoyed equally by all citizens. Therefore, while it is understood that each resident has identical tastes and preferences, it is not the case that each resident has identical income or welfare levels. When measuring economic development's net benefits for a community, one must also examine to whom those net benefits accrue; in other words, how are the benefits distributed?

2.3 Why Distribution Matters

Brent (1996) uses the term "social CBA" to describe cost-benefit analysis that refers to three broad areas of study: an evaluation of the project's effects on the individuals in the community, acknowledging the distributional effects of the project in addition to the efficiency effects, and recognizing that market prices are not always the best indicators of consumers' willingness to pay. In this way, how the benefits are distributed becomes as important a question as what benefits are created.

However, notables such as Harberger (1971) and Mishan (1976) take an opposing view and argue that distributional concerns should not be included in cost-benefit analysis because such distributional considerations lie outside the professional reach of economists. They argue that the purpose of economics as a discipline is to identify efficiency, a widely-agreed upon concept. Distribution, however, introduces uncertainty into the economist's study of efficiency since there is not an agreed-upon definition of distributional equity to correspond to efficiency. However, this dissertation argues that because economic development can have a persistent effect upon a community's income distribution, distributional concerns should be included in the community's economic analysis. This inclusion is done by incorporating a variety of definitions of equity from Benthamite Utilitarian to Rawlsian social justice, as will be seen later.

2.3.1 Compensation Tests

Since not everyone benefits uniformly from economic development, one must take into account how this unequal distribution of benefits affects the ultimate decision of whether or not to pursue a particular economic policy. Should one argue that if everyone does not benefit uniformly from a project that it should not proceed? This question can be answered using a variety of methods, among them compensation tests and distributional weights. A careful examination of the advantages and disadvantages of each approach is necessary for this research because the benefits of the simulations do not evenly fall upon the residents of the community. Initially, compensation tests appear attractive because they do not assign an explicit marginal social value upon individuals, instead treating them with equal importance.

One of the most widely used compensation tests was created by Kaldor (1939) in reference to Great Britain's repeal of the Corn Laws. For its calculation, his compensation test uses a direct method that examines the question of whether or not those who benefit from the project could theoretically compensate those who would be worse off as a result of the project. If this situation is possible, then one can argue that since the "losers" theoretically could be made as well off as their initial position and that the "winners" would see improvement in their welfare as a result of the project, that it should go forward. Kaldor argues that individuals should be treated equally; otherwise, it is impossible to make an interpersonal utility comparison.

In contrast, the compensation test proposed by Hicks (1940) is a reversal test arguing that the project should be undertaken only if the losers cannot adequately compensate the gainers to prevent the project from going forward. Hicks uses prices as weights in his compensation test because prices give some measure of individual welfare since at equilibrium the slope of the price-line is tangent to the individual's indifference curve. Therefore, the fundamental difference between the two compensation tests is merely a selection of new or old price levels to evaluate changes in utility.

Scitovsky (1941) merged the Kaldor and Hicks compensation tests arguing that the project should be undertaken (or not) only if the results of both the Kaldor and Hicks tests are consistent with each other. By doing so, he manages to maintain the ordinality of both compensation tests without resorting to cardinal measures of welfare. In creating two criteria that resemble Paasche and Laspeyre's quantity indices which utilize two community indifference curves, he notes that the difficulty lies not in comparing averages whose weighting is different but in comparing each to a hypothetical situation which resembles it in weighting but is otherwise identical to the other real situation. By arguing that welfare economics must make the distinction between propositions based upon a fixed quantity of employed resources and those that regard that quantity as variable, he seeks to evaluate economic welfare propositions independently of interpersonal comparisons of utility.

No matter which compensation test is used, clearly if the net benefits are positive, then the winners are able to compensate the losers. Conversely, the losers cannot compensate the winners sufficiently to prevent the development from occurring. Therefore, the economic development project should proceed, even if it results in some people being made worse off while others benefit from the economic development.

It should be noted that these compensation tests also have several problems identified with them. It can be argued that all three compensation tests identify Pareto improvements thereby measuring the efficacy of a project; however, it cannot be argued that they adequately measure the equity of a given project. Ironically, equity is most often criticized for using explicit value judgements. But, by placing a higher priority on efficiency to the exclusion of equity, this method implicitly makes a value judgement. Additionally, the community indifference curves Scitovsky derives for his compensation test violate the transitivity assumption of individuals' preferences so that there can be a common point on two community indifference curves. Most importantly, the actual act of compensation is not a requirement for passage of any of the compensation tests; the compensation is entirely theoretical. According to Mohring (1976), when queried by a young graduate student regarding the compensation test, Paul Samuelson replied, "Compensation isn't paid," and that was enough to disregard compensation test results as measures of economic equity. Therefore, even though the winners could compensate the losers so that they are as well off as they were initially, in reality, since the compensation does not happen, the losers remain worse off than before.

By putting a monetary measure upon the relative gains and losses of an economic project, compensation tests are relying upon measures which attempt to put a monetary value upon an individual's utility change such as consumer surplus, compensating or equivalent variations. Along this vein, Silberberg (1972) and Burns (1973) argue that the money measure of utility is equal to the change in an individual's income minus some aggregate index of price change. While it is useful to express an individual's utility in terms of income, the Marshallian consumer surplus, which is the money metric measure predominantly used for compensation tests, is path dependent. This condition means that its value depends upon the order in which prices change as a result of the economic project. Therefore, while it is important to find a monetary expression of utility, one must also find an expression that is path independent for compensation tests to work reliably.

As an alternative to Marshallian consumer surplus, Hicksian compensating variation is path independent. However, as Boadway (1974) notes, even aggregating compensating variation over a number of individuals and getting a positive number does not guarantee satisfaction of the compensation tests because the result is only reliable for small price changes. There is good correspondence between the results of the Kaldor and Hicks compensation tests if, and only if, there are no price changes as a result of the economic project. Therefore, even if the compensation tests are used, Boadway (1974) notes that the results of such tests are not reliable for situations in which price changes as a result.

So, Boadway argues that if economists cannot rely upon money surplus measures, then they must make cardinal interpersonal comparisons—the very situation compensation tests were attempting to avoid by preserving ordinality. It is for this reason that one must turn to an alternative measure to decide whether or not to pursue an economic development project.

Ultimately, the useful idea of Pareto optimality, as utilized by the compensation tests, is too restrictive to offer an adequate groundwork for normative economics. That is why one must rely more on the concept of a social welfare function, as originated by Bergson (1938) and Samuelson (1947), which provides a means of overcoming the disadvantages of the Pareto criterion. Interpersonal utility comparisons can be incorporated into a social welfare function through the use of distributional weights. Because an economy consists of a variety of individuals and compensation is not made in reality, each individual's income represents a different level of marginal social significance. Accordingly, a change in an individual's income will have a different level of marginal social utility associated with it. It is this difference that distributional weights attempt to capture when they are used in conjunction with a social welfare function.

2.3.2 Distributional Weights

If a community wants to make comparisons across individuals, then a social welfare function is a necessity. As Sen (1977) notes, interpersonal comparisons require cardinal, rather than ordinal, measures of utility. It is through a social welfare function that one can make a rational, mathematical statement that also includes the normative subject of ethics, embodied here by a discussion of equity in income distribution. Therefore, the selection of a social welfare function allows one to express some ethical belief with respect to inequality while still maintaining complete and transitive welfare judgments over alternate social states. In other words, one can use the same social welfare function to express a variety of perspectives regarding inequality, simply by choosing different values to express different aversions to social inequality (as expressed through income).

As Atkinson (1970) notes, the choice of a social aversion to inequality fundamentally boils down to a choice among different income distributions, which he illustrates using the Lorenz curve to show an income distribution's comparison against the line of complete equality. He further illustrates the concept of an equally distributed equivalent level of income, in other words, the level of income per person that, if equally distributed, would give the same level of social welfare as the present income distribution. Similarly, Dalton (1920) argued that a ranking of potential income distributions should satisfy what Dalton labeled his principle of transfers: If a project transfers income d from a person with income y_1 to a person with a lower income y_2 (where y_2 is less than or equal to $y_1 - d$), then the new distribution should be preferred to the original income distribution.

To determine the new income distribution, following Bergson (1938) and Samuelson (1947), the social welfare function (W) used is a function of the vector of utility (U) for all community residents

$$W = W(U_1, U_2, \ldots, U_n) \tag{2.1}$$

where n is the number of community residents, U is each resident's utility level, and W is the overall welfare of the community. Taking the size of residents' utilities as given, it is important to compare alternative distributions of this fixed total. The social welfare function allows one to capture these alternate distributions by capturing a community's value judgments.

The actual value attached to distributional weights depends upon a society's aversion to inequality in its income distribution. The best illustrative example is to examine the two extremes: If a society has an infinitely large aversion to income inequality, then it can be described as ascribing to a Rawlsian Maxi-Min philosophy of social welfare, meaning that it will not do anything which will exacerbate its current income inequality and will only approve projects which improve its current inequality. In contrast, if a society has no aversion to income inequality (in other words, if aversion were equal to zero), then it is ascribing to a Benthamite Utilitarian philosophy of social welfare, meaning that a project can make income severely unequal so long as the gain(s) to the winner(s) is enough to overcome the losses for the unlucky. Theory typically uses the constant marginal utility function since it is analytically convenient and allows for diminishing marginal utility with respect to income. Therefore, in its most elemental sense, the marginal social utility of any individual i is given by

$$a_i = Y_i^{-\eta} \tag{2.2}$$

where a is an individual's assigned distributional weight, Y is the individual's income, and η is a positive constant signifying the elasticity of the social marginal utility function. For a Bethamite Utilitiarian principle, η would be set equal to 0 while for a Rawlsian Maxi-Min, it would be set equal to infinity. As the value of η approaches zero, the value of a_i approaches 1, meaning that every individual in the community has exactly the same social weight as any other. In other words, the weight given to any one person's utility changes is exactly equal to the weight given to any other person's. In contrast, as the value of η approaches infinity, the value of a_i approaches infinity as well, meaning that person's utility changes are given an infinitely large weight in the calculation of social welfare. Any level of social aversion to inequality which is between these extremes of zero and infinity shows that society has some concern for the well-being of the less fortunate, but not to the extent of the Rawlsian Maxi-Min position.

Atkinson (1970) and Kolm (1969) adapt the principle of social aversion to inequality into a set of social welfare function forms; however, the type of social welfare functions they introduce is not defined by the distribution of individual welfare. Instead, they are using income as an indicator of welfare. One problem with this approach is that measures based on individual welfare are equal to those based on individual income if, and only if, preferences are identical and homothetic for all consumers (Mullbauer 1974) and (Roberts 1980). Likewise, Chipman and Moore (1973,

1980) showed that the compensation principle (such as Hicks') provides a valid indicator of social welfare only if measures of individual welfare are identical and homothetic. However, this requirement is not a problem. Because this study's focus is local in nature, it is not unrealistic to assume that the preferences of individuals living in Fort Collins are identical and homothetic since, as Tiebout (1956) argued, individuals tend to "vote with their feet" and live in localities with other individuals who share the same preferences. This requirement means that one can use a representative consumer to model all residents rather than having to incorporate different utility functions into the social welfare function.

In evaluating the overall effect of a policy change, use is often made of the aggregate value of the surplus/loss in a specified population group. This is equivalent to the use of a social welfare function defined as a simple sum of the surpluses, so like a compensation test, it implies no aversion to inequality on the part of the judge. This argument implies that to evaluate the results of an economic development project, one can simply aggregate the new values of income across individuals to determine whether or not a project should be undertaken.

Boadway (1974) has criticized this method with respect to any distributional aspect of policy change. As noted earlier, he argues that simply summing consumer surpluses and disregarding the distributional effects of the policy change are necessary but not sufficient conditions for evaluation, because one does not know to whom the surpluses accumulate. One important conclusion from his argument is that one must make a strong assumption of identical marginal social utility for all individuals in order to sum the aggregate surplus changes as valid indicators of welfare. Without such an assumption, the use of hypothetical compensation as welfare criteria is not a good reason to neglect the actual distribution of welfare.

As an alternative, Boadway suggests imposing value judgments for a given amount of surplus of each income group *before* one adds the surpluses together.

Therefore, another approach is to specify a social welfare function that differs in two ways from the total surpluses/losses. First, the welfare function may be specified in terms of individual utilities, and secondly, the form of the welfare function may allow for some aversion to inequality.

To incorporate these concerns, the Atkinson index of inequity is used. Atkinson (1970) uses a particular social welfare function form that is derived from a family of additive social welfare functions of the form:

$$W = \sum_{n} \frac{1}{1-\eta} (U_n)^{1-\eta} \tag{2.3}$$

where social welfare, W, is equal to the sum of individual utility, U, summed over the n number of individuals in the community. In this case, the parameter η determines the concavity, and thereby the degree of social inequality aversion, shown by the social welfare function. By choosing different values for η, a community can choose from an array of perspectives on social inequity. For example, when η equals zero, the social welfare function merely aggregates all incomes, thereby ranking them the same as the mean, given a constant population.

To expand his analysis, Atkinson then derives his own measure of inequality I to show objectively how unequal income distribution may be which is equal to:

$$I = 1 - \left(\frac{Y_{EDE}}{\mu}\right) \tag{2.4}$$

where Y_{EDE} is the level of equally distributed equivalent income or the level of income per head which if equally distributed would give the same level of social welfare as the present distribution.[1] In other words, Atkinson's measure of inequality is equal to 1 minus the ration of the equally distributed equivalent level of income to the mean of the actual distribution of income. If I increases in value, then the distribution has become more unequal—one would require a smaller level of equally distributed

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[1] The concept of equally distributed equivalent level of income is analogous to the proportional risk premium. For more information, please see (Pratt 1964)

income (relative to the mean) to achieve the same level of social welfare as the present distribution. Conveniently, I also lies between the values of 0 (complete equality) and 1 (complete inequality). This measure does have some appeal. For example, if a given Y_{EDE} yields a value of 0.4 for I, then what is being argued is that if incomes were equally distributed, then one would need only 60% of the present income to achieve the same level of welfare (as measured by a defined social welfare function).

However, Atkinson's measure does not attempt to convey what Boadway argues that it should–that interpersonal, cardinal utility comparisons must be made. To accomplish this prerequisite, distributional weights are required within the welfare function, transforming it into

$$W = \sum_{n} \frac{1}{1-\eta}\, \delta(U_n)^{1-\eta} \tag{2.5}$$

where η is the distributional weight, signifying an individual's marginal social utility. The distribution weight is derived by following Brent (1996) and normalized by comparing income to the mean social income

$$\delta = \frac{Y_i^{-\eta}}{\bar{Y}^{-\eta}} \tag{2.6}$$

where Y_i is an individual's income, $\bar{Y}$ is the mean social income, and η represents the social aversion to inequality index. If one sets η equal to 1 following common convention, then the individual's income is seen as a proportion of the community's mean income. In other words, if an individual only earns one quarter of the mean income, then his or her distributional weight is four times that of someone earning the mean income.

There is another alternative method of deriving distribution weights as outlined by Feldstein (1972). Feldstein uses the "distributional characteristic" of a product to attach distributional weights to a project's output, rather than separately to its costs and benefits. The weights, therefore, form a component of the shadow prices, combining efficiency with distribution. This method is predicated upon the realistic assumption that the poor and the rich in society have different consumption patterns. The consumption of particular goods, like food, housing, and clothing, are then used to weight the utility of particular individuals by identifying the percentage of income a household spends upon each of the goods in question. This proportion is then multiplied by the previously identified distribution weighting schema which is derived from the community's aversion to social inequality. For example, society could be broken into four groups with assigned distribution weights of 9, 6, 2, and 0.5 attached to each group from the poorest to richest respectively, showing society's relative aversion to inequality. Next, the percentage of income spent by each of these income groups upon a particular commodity, say food, is identified as 0.35, 0.30, 0.25, and 0.1 respectively. When the consumption pattern is multiplied by the distribution weight, one finds that those goods which are bought primarily by the poor receive a greater weight than those goods purchased by the richest income group. Likewise, those goods for which the rich spend a larger percentage of their income are discounted.

As can be seen, distributional weights can be formulated using a variety of methods; however, the underlying purpose of all methods is the same. Distributional weights are used to make the relative social value of individuals explicit in cost-benefit calculus. Explicitly placing a value upon someone's welfare allows one to incorporate distributional equity concerns in an objective fashion.

2.4 Developing the Public Interest Approach

Now that a better understanding of how previous research has evaluated economic development, one has a better understanding of the possible difficulties and complications that may arise. With this understanding, one may now turn to the specific details of the contrasting approaches developed by this study. The first approach to government decision-making, Public Interest, seeks to explicitly maximize social welfare by using public welfare concepts such as distributional weights. In contrast, the Public Choice approach seeks instead to maximize the welfare of the local government instead by seeking to explicitly maximize tax revenues.

The Public Interest approach advocated here uses a distributional weighting scale which represents a combination of both Brent (1996) and Feldstein (1972)'s ideas. Here, the consumption patterns of an income group as well as its income relative to that of the community's mean income are used to actually determine the distributional weighting used in the model. Rather than using an *a priori* set of distributional weights like Feldstein, here the consumption patterns contribute to the calculation of the distributional weighting scheme. Likewise, these distributional weights surpass Brent's by including a consideration of individuals' consumption patterns rather than relying solely upon income. The distributional weights used here can be defined as:

$$\delta = f[(1-s) + (0.6s)]\left[\frac{Y_i^{-\eta}}{\bar{Y}^{-\eta}}\right] \tag{2.7}$$

where f is the percentage of a household group's income which is spent on food, s is the percentage of students in a household group, Y_i is the income level of a household group, and $\bar{Y}$ is the community's mean income.

The variable s can be considered a variable that attempts to capture sociological characerstistics of the community being examined. Due to the large number of students in the particular community being considered, it was necessary to incorporate that characteristic into the model. Because students are perceived to be transient members of the poor, their proportion is subtracted from each income group's population. The lowest income groups have the highest incidence of students; however, this is not felt to be a permanent situation for them since it is hoped that they will move into higher income groups upon graduation. Therefore, an attempt was made to capture the non-student members of the lowest household groups, $1-s$, as well as the working students, $0.6s$, where it is an educated guess that approximately 60% of college students are also employed in the economy and therefore earning income.

It should be noted that this method of distributional weighting can be augmented by more products. Food is included here because it closely follows Engel's Law which states that the demand for food is income inelastic. The implications of this theory for the distributional weights means that the larger the percentage of income is spent on food, the larger distributional weight that income group will receive. Obviously, this is an implied value judgment due to the nature of demand for food—the poor will always receive a greater weight than the rich. However, it can also be argued that the rich see a smaller increase in marginal utility for equal increases in income than the poor, so in calculating the marginal social utility of income (the true goal of any distribution weight), the rich should receive a smaller weight than the poor.

Moreover, while the argument can be made that income is not equivalent to utility, Roberts (1980) notes that under certain conditions, income, rather than utility, can be used to determine Atkinson's equally distributed equivalent level of income. Additionally, it can be argued that while changes in real income are not equivalent to utility changes, it can serve as a reasonable proxy and predictor of welfare changes. If an individual's real income increases, then it can be argued that maintaining the original level of consumption will result in a larger amount remaining for the purchase of other goods or to increase the level of consumption of current goods and services. This increased level of consumption will result in an increase in an individual's welfare. Therefore, while it is not an optimal situation, this dissertation will primarily focus upon changes in real income as indicators of individuals' welfare.

2.5 Studies using Distributional Weights

Given such a theoretical basis for the use of distributional weighting schemes, a closer look at the implementation of distributional weights in the literature seems warranted. The underlying nature of the study and its scope seem most determinant in deciding the choice of which distributional scheme is utilized.

One method of determining distributional weights is known as the imputational method. This method argues that the decision-maker cannot make the necessary *a priori* assignment of distribution weights without assistance; therefore, one can look to previous social decisions to ascertain the implicit weights that were used in making the past decision. These weights can then serve as a guide for the current decision-maker facing similar situations. Musgrave (1969) argues that if past decisions are judged "correct," then society can simply let decision-makers continue to specify the distributional weights however they want. But such an argument ignores the large measure of uncertainty surrounding such decisions and Brent (1996) argues that it is the role of the CBA analyst to mitigate the uncertainty by helping the decision-maker articulate what he or she wants. As he notes, "In the context of past decisions, one can firm up one's meaning of equity and thereby set the distribution weights."

To illustrate his argument, Brent (1979) examines railway closure decisions in the United Kingdom to determine the implied distributional weights used in making the choice of which unprofitable railway stations to close and which to continue to subsidize because it was deemed to be in the "social interest." He assumes a cost-benefit analysis with multiple objectives following Marglin (1968). The estimates of the distributional weights were obtained by regressing social objectives defined in the model on the 99 railway closure decisions and identifying the "winners" and "losers." It was discovered that the winners had an implied distributional weight of 1.1 while the loser had a distributional weight of only 0.9. In this way, Brent imputes the policymaker's implicit distributional weighting scheme in an effort to help the policymaker better articulate his or her preferences. Brent's research is not so much an application of distributional weights so much as an effort to isolate them from the remainder of the political decision.

In contrast, Hau (1986) examines a corridor planning model system of Interstate 580 of the San Francisco Bay area, specifically isolating the distributional user benefits of various policy alternatives analyzed under alternative forms of a social welfare function. He outlines an individualistic social welfare function of the Bergson-Samuelson type that explicitly incorporates the relative weight of an individual's preferences in society and then chooses various levels of social aversion to inequality to compare his results. To determine his distribution weights, Hau utilizes the work of Feldstein (1972) and Boadway (1974) in determining the distributional characteristics of a numeraire good i which is then used to determine a weighting scale according to the fractional consumption share of good i by individual k.

Similarly, Small and Rosen (1981) examine the analysis of taxes and subsidies as well as the quality changes in goods and services to show how conventional welfare economics can be modified to handle discrete choice models. By modeling each consumer's maximization of his or her utility with a function that includes a stochastic term accounting for differences in unobservable tastes, the researchers find that the popular probit and logit modeling techniques are well adapted to using Feldstein's method of distributional weighting. In this case, the probability that utility is maximized by choosing good i, Π_i, can be interpreted as a prediction of the fraction of a particular class of consumers who will choose good i. While these researchers do not explicitly choose a distributional weight scheme, the net result is within the spirit of Feldstein's distributional characteristics of commodity consumption and yields results equivalent to an informed choice of distributional weights.

Finally, Loury (1983) uses an *a priori* assumption of social aversion to inequality to analyze the effect of the removal of wellhead price controls in the United States natural gas industry. The efficiency gain from deregulation is measured by a consumer surplus triangle showing the difference between the willingness to pay and the regulated price. Loury argues that with deregulation, quantity will expand and marginal consumer surplus will decline as prices increase.

This increase in prices for natural gas can be perceived as an income transfer from consumers to private shareholders of natural gas, assuming that transfers to the government are neutral. It is also assumed that the ownership of natural gas shares mimics the general income distribution of United States stockholdings which skews the results in favor of higher-income groups.

As a final step, Loury applies distributional weights to the income transfers going to the natural gas stockholders. By assuming that the social aversion to inequality η is equal to 0.5 and using the following equation normalized to the mean,

$$\delta = \left(\frac{a_i}{a_m}\right) = \frac{(Y_i)^{-0.5}}{(Y_m)^{-0.5}} = \left(\frac{Y_m}{Y_i}\right)^{-0.5} \tag{2.8}$$

Loury derives a distributional weight δ for the stockholders of 0.365 which he then adjusts by the number of individuals and families for an implied social cost of 0.316.

It is apparent from a brief review of the literature that there are many different options available for the implementation of distributional weights including those presented here, the imputed method used by Brent and *a priori* method used by Loury, as well as their empirical application. The use of distributional weights allows an economist to discuss distributional issues within the overall context of measuring efficiency gains and losses. Because of the nature of government decision-making, this distributional concern cannot be ignored.

2.6 Developing the Public Choice Approach

As a contrast to the Public Interest method, the Public Choice approach argues that the jurisdiction's governing authority acts as an economic agent in its own right, not merely as an apologist for social welfare. This perspective serves as an alternate viewpoint from the Public Interest model and deliberately harkens to the work done by public choice economists such as Buchanan. However, the Public Choice approach does not intend to strictly adhere to the principles of public choice theory. While such ideas are certainly incorporated into the analysis, the methodology of this approach is not a literal interpretation of public choice theory.

For example, Mitchell and Simmons (1994) note that, as an economic actor, the government does not fit neatly into the model as either a consumer or producer, stating that "Although governments are best thought of as monopolies, it is important to remember that they are rather peculiar monopolies." By making the point that governments are not profit-oriented, Mitchell and Simmons illustrate that governments conduct their fiscal operations differently than a private firm. Therefore, the government can be seen as pursuing goals separate from any increases in welfare generated by a development strategy, by concerning itself merely with the tax revenues generated by the economic development. By focusing on increasing tax revenues as a goal in and of itself, the Public Choice approach disassociates itself from trying explicitly to improve the welfare of current residents. If one accepts this view and economic development is pursued, then it must optimize the local government's best interests, namely increasing tax revenues.

Since the Public Choice method seeks to maximize the tax revenues collected by the community's local government and many communities operate under a balanced budget proviso, maximizing tax revenues necessarily implies that budgets are maximized as well. Illustrating this point, Niskanen (1971) demonstrates that government bureaus will seek to maximize the budget they control by maintaining persistent inefficiency. This requirement implies that local public goods provision should increase as tax revenues increase (ignoring Niskanen's assertions by assuming that there is not an increase in administrative costs). Therefore, the local government can be perceived as directly maximizing its own utility and indirectly benefitting those individuals who receive utility from local public goods (assuming that these individuals receive more benefit than burden of paying increased taxes).

It is important to note that in the same way that a consumer would like to see his or her utility maximized by ever-increasing levels of income as time progresses, so, too, will a local government like to see its utility maximized by ever increasing levels of tax revenues as time continues. In the same way that a consumer becomes used to a given level of consumption, so, too, can a government become used to a give level of tax revenues collected. What this level of taxes equals is open to interpretation. For example, one can take the view the minimum tax revenue amount is simply the subsistence level which the government requires to continue its existence; however, one can also argue that the minimum tax revenue amount is merely the level of taxes which were collected during the previous fiscal year. This interpretation would coincide with community members who derive utility from the consumption of local public goods as well since an increase in tax revenues could be used to provide increased amounts of local public goods (excluding rising administrative costs as the local government grows increasingly larger).

Therefore, the optimization equation for the Public Choice model can be best expressed as:

$$W = f(t_1, t_2, \ldots t_n) \tag{2.9}$$

where t_i is the revenue collected by individual tax i. The city does not get to keep all of the tax revenues it collects; therefore, the payments that are made to county, state, and federal governments must be subtracted from its calculation of welfare, W. This can be expressed as :

$$W = \sum(t_1, t_2, \ldots t_n) - \sum(p_1, p_2, \ldots p_k) \tag{2.10}$$

where t_n represents the individual taxes collected by the local government while p_k

represents all the payments made by the local government to other governmental entities.

The city also benefits from block grants of money from the county, state, and federal governments. To accurately measure the tax revenues enjoyed by the local city government, these payments must be added into the final total as shown thusly:

$$W = \sum(t_1, t_2, \ldots t_n; g_1, g_2, \ldots g_t) - \sum(p_1, p_2, \ldots p_k) \qquad (2.11)$$

in which government's well-being is directly related to the tax revenues it collects and the amount of block grants it receives and indirectly related to the intergovernmental payments that it must make to other governmental entities. The above expression, then, is the final optimization expression for the Public Choice model.

2.7 Studies Using Public Choice Theory

Several researchers have broadly incorporated the Public Choice perspective into their work. The primary purpose of such research was not to evaluate economic development, but rather to define how a government makes its decisions and isolate which variables influence a government's decision-making process. However, one can easily see that the principles of such public choice research mesh easily with the Public Choice approach.

Glaeser (1996) illustrates how local governments respond to the incentives created by taxes. Delving into a smaller subset of optimal taxation literature by Brennan and Buchanan (1978), he explores various ways in which tax structure influences a local government's behavior. For example, the high incidence of local government's using property taxes can be explained through the taxation's role as an incentive.

Assuming that voters can set rules to constrain government behavior and that government operates under a tax revenue-maximizing objective, Glaeser illustrates how property taxes provide local governments with a strong incentive to provide desired amenities to the community. Amenity provision serves to increase property values which in turn increase tax revenues paid to the government; in contrast, a lump sum tax does not provide the same level of incentive as long as housing demand is significantly inelastic. Additionally, Glaeser also finds that property taxes serve to lengthen the government's time horizon since there is no lag between amenity provision and its reflection in property values. The features of property taxation mentioned above, create an environment in which local governments come to rely heavily on the maximization of property taxes.

Similarly, Bhattacharyya and Wassmer (1995) also isolate variables which influence government behavior. Previous models are expanded so that government officials are maximizing an intertemporal objective function which is not constrained by a balanced budget for any particular year. In this way, government officials' responses to past levels of fiscal activity are empirically modeled by using a two-stage optimization procedure. In the first stage, the government chooses a desired mix of revenues and spending which maximize their objective function, which is implicitly influenced by upcoming elections. It is important to note that the desired mix can be different from the observed mix due to uncertainty which officials attempt to minimize by using a control framework in the second-stage of their optimization procedure.

The authors conclude the fiscal decisions of the twenty large U.S. cities examined cannot be considered homogeneous and urge caution in interpreting results from cross-sectional data. One common finding in spite of the locational heterogeneity was that the fiscal decisions made were influenced by timing of mayoral elections, suggesting that government officials were acting as self-interested agents rather than to maximize social welfare.

2.8 Implications of Economic Development

When faced with two opposing viewpoints, one might ask, why does the choice of evaluative method matter? By examining a variety issues a community faces when considering economic development, one will clearly see how the choice of approach matters for a community. This examination will provide a more convincing argument for the superiority of the methods chosen for this study.

2.8.1 Tax Competition

How might a community attract economic development? A chief method of attraction for local communities is the maximization of tax revenues by extending local economic incentive packages. For example, through the abatement of a variety of taxes, a local jurisdiction hopes to increase its collection of other taxes. By temporarily abating property taxes, a jurisdiction may hope to attract additional firms, providing both increased employment and also increased city use tax or city sales tax revenues.

This abatement of taxes is not without its proponents. As Fisher (1996) argues, community residents who own property regard property tax as "the worst tax" in part because of its lump-sum nature of payment and high degree of visibility. Mills (1999) takes this view even further by arguing that "property taxes are the worst administered and most odious taxes we have, and they inhibit real estate development." Additionally, from an equity perspective, property taxes result in an uneven distribution of income among communities, a situation often quoted by reformers of public education who advocate a "Robin Hood" policy of tax revenue re-distribution.

In contrast to merely abating property taxes to lure economic development, Krmenec (1981) notes that municipalities in the United States have diversified their tax revenue base beyond the traditional property tax toward additional forms of taxes and fees, particularly the local sales tax. This motivation is particularly strong in communities which follow *situs* jurisdiction, a policy which allows a portion of the state-collected sales tax to be returned to the general fund of the local government where the sale took place. Thus, Lewis (2001) argues such policies actually encourage communities to pursue a non-optimal level of retail land-use allocation, causing retail sprawl and the desertion of the central city.

Misczynski (1986) pioneered this analysis of local jurisdictions employing land-use regulation as a means to maximize tax revenues. Terming this phenomenon, fiscalization of land use, Misczynski primarily focused his attentions on developer exactions and other fees. However, Kotin and Peiser (1997) further refine Misczynski's term and define it as "the tendency of communities to establish land uses based on the net tax revenues they will generate for the city." Referencing such concerns, Wassmer and Anderson (2001) find that "all else being constant, a poorer community is more likely to zone local land for commercial use for the increased local tax revenue that follows," rather than zoning that land for housing. Therefore, a community which chooses to adopt the Public Choice approach by focusing exclusively on tax revenues to encourage economic development could potentially choose very different development strategies than a community which chooses the Public Interest approach.

2.8.2 The Political Nature of Economic Development

Once the process of government decision-making is understood, one must ask, what are the consequences of such decisions? Therefore, a necessary step is the consideration of the role that political power plays in such a process. A complication of evaluating economic development programs is acknowledging the political relationship that exists between the pursuit of economic development and the election cycle. It is well known that prior to elections, politicians are looking for favorable events for which to take credit. If economic development occurs within a community and augments the employment opportunities for the populace, then the politician can use the situation to their advantage. As Rubin (1988) notes, "economic development practitioners face an uncertain environment in which their ability to bring about economic development is dependent upon factors over which they have little, if any, control."

Therefore, if economic development creates significant increases in social welfare, then the politician is assured of re-election; however, decreases in social welfare mean that the politicians responsible for the development will not be re-elected. A community whose governance is controlled by frequent, public elections may be better served by choosing the Public Interest approach since it explicitly seeks to maximize social welfare. It is important to note, however, that even though some government decision-making processes do not *explicitly* set out to maximize social welfare, the choice to maximize tax revenue can also influence utility and by extension, social welfare, through the provision of local public goods.

2.8.3 Race to the Bottom?

John Donne once noted that "no man is an island unto himself" and likewise, no community exists in isolation; therefore, another challenge in evaluating the ultimate costs and benefits of economic development is addressing the inherent competition between communities in their attempts to secure economic development. For example, a community may inflate the value of the local economic incentives being offered to attract economic development in an attempt to compete against other communities. Ellis and Rogers (2000) argue that communities engaging in such competition may see no long run benefits accruing to their area (and possibly even negative benefits, if faced with a negative sum, rather than a zero sum, game).

For example, a community which attempts to compete through a tax abatement package may ultimately give away all of the expected benefits of higher tax revenues that the community might have enjoyed otherwise. Previously unemployed residents may become newly employed as a result of the development, but those community members not employed directly by the firm may not see a benefit, and may even see a loss of welfare, since the lost tax revenues might have provided additional social services to the community. Additionally, congestion costs may also be generated from the economic development, thereby lowering the social welfare of the community.

This troubling result could perhaps be exacerbated by the prevailing federalist philosophical stance of economic development policies which ensure that such competition *will* continue, so long as there is no over-arching regulatory body overseeing such activities and ensuring that the benefits of economic development are not being competed away. Mattey and Spiegel (1996) rightly point out that, according to economic theory, there are efficiency gains to be had when communities compete against each other; however, Kenyon (1997) also notes that these gains are valid only when the competition reaches a perfectly competitive level. Given the strict requirements for perfect competition that Kenyon identifies, unfettered competition between communities is not likely to lead to an end result that maximizes social welfare for those communities involved.

Ellis and Rogers (2000) identify several powerful reasons for this innate competition between communities, but the most important is the community's perceived business climate, communicated through the incentive package that is (not) offered. Ellis and Rogers argue that such incentive offers serve as a signal of a pro-business climate as well as setting precedent for considering the community as a future relocation target.

These concerns may seem innocuous until one realizes that *every* community wants to be perceived as pro-business, thereby pitting every community against every other in a competitive, non-cooperative situation. As Ellis and Rogers note, once the community decides to offer an incentive package, it enters a prisoner's dilemma within which the community cannot stop competing, even if it wants to. In this way, it may not matter ultimately which approach a community decides to use to evaluate the benefits of economic development since those benefits may rapidly disappear.

Chapter 3

SAM, CGE, and Data

3.1 Previous Studies Using CGE Models

The majority of CGE models are classified into two broad categories: comparative static and recursive-dynamic. Like an Input-Output (I-O) model, a comparative static CGE model does not contain any explicit time dimension; in contrast, a recursive-dynamic CGE model is linked to a separate macro-econometric model to produce a forecast of "business-as-usual." Following a policy change or a project's introduction, the resulting model can then trace out a new time path for the economy. Any diversions from the "business-as-usual" time path are identified as the result of the policy change or project. It is important to note, however, that the data requirements and parameter assumptions are strenuous enough to make such models the exception rather than the rule.

Within these categories, researchers have pursued studies using three different concepts: those models using real data, models using artificial data, and theoretical models using no data at all. Real data CGE models attempting to study economies on a larger regional scale include: Kraybill and Seung (1999) who examine the impact of public investment on the Ohio economy; Hoffmann, Robinson, and Subramanian (1996) who investigate the impact of cuts by the Department of Defense in California; and Jones and Whalley (1989) who construct a CGE including most of Canada. While these models attempt to model the real world, one must also note that these studies rely upon strictly theoretical general equilibrium models as a method of analysis. For example, by using artificial data, Kilkenny (1998) examines a two-region model where transportation costs play a significant role in rural development while Anas and Kim (1996) isolates congestion's role in a city economy's performance. Finally, Pasha and Ghaus (1995) and Brueckner and Kim (2000) also use theoretical general equilibrium models to examine optimal taxation (sales and property) policies for a city.

Additional studies are useful because they provide further insight into model construction and the interpretation of results. For example, Berck, Golan, and Smith (1997) construct a CGE model for the state of California known as the California Dynamic Revenue Analysis Model (DRAM). The authors' primary purpose is to determine whether the net result of a tax rate change is an increase or decrease in collected tax revenues. The authors ultimately conclude that a decrease in tax rates results automatically in higher labor force participation rates, constrained by the extent that any increased revenue from higher participation is counterbalanced by the initial loss of revenues from lowering taxes rates.

More specifically, the authors run simulations designed to analyze the impact of reductions in the Banking and Corporation Taxes (B&CT) and in the Personal Income Tax (PIT). The magnitude of these cuts' effects depends significantly upon both the labor's mobility as well as the overall labor supply. Given the balanced budget constraint, this result is unsurprising. When labor supply becomes more elastic, there is a larger impact upon changes in output and tax revenue. Due to this condition, the authors examine different elasticities of labor and migration, evaluating whether or not the net result of a tax cut would be positive.

Based upon this research, Berck, Golan, and Smith (1997) conclude that a cut in B&CT taxes may be more beneficial for the California economy than a cut in the PIT rates; however, in no variant of the model is the net result of the tax positive. While the size of government is reduced and both tax cuts result in an increase in real economic activity, employment, and investment, due to the PIT's impact upon income distribution, the authors ultimately conclude that a cut in taxes on capital instead may be better for the California economy. Finally, the model shows that if one assumes perfect factor mobility, a tax policy change in California will affect only the size of the economy and not the after-tax wages or returns to capital.

Similarly, Morgan, Mutti, and Rickman (1996) also examine the effects of various tax rate changes upon economic well-being by using a nonlinear six region (Great Lakes, New England-Mideast, Plains-Rocky-Mountain, Southeast, Southwest, Far West), seven sector, four factor general equilibrium model of the United States to assess the viability of policies related to the long run exporting and importing of regional taxes. Particular attention is paid to interregional factor movements and their implications for changes in regional tax revenue and the demand for regional public goods.

To measure such welfare changes, the authors propose two different criteria: examining the welfare of the original residents residing in the region as well as the welfare of the regional residents (including newcomers) after the tax policy change is adopted. For either case, welfare measurement is defined as an increase in consumer expenditure. The authors analyze two policy changes: the substitution of current regional business and household taxes for a non-exportable lump-sum tax (Alternative I) and the substitution of current taxes for a household tax (Alternative II), where substitutions are of equal yield. These substitutions are applied multilaterally, or simultaneously for all regions, and then unilaterally, or one region at a time.

The authors find in both tax scenarios that the Great Lakes region is the major net tax exporter when regions act unilaterally, whether or not labor is geographically mobile. In contrast, when taxes are adjusted multilaterally, economic growth always occurs in the Great Lakes region and so does welfare improvement, the exception being for original residents when labor is mobile. The authors explain these more favorable results for the Great Lakes region by isolating the relatively larger importance of manufacturing, its tax structure, and its debtor status.

For the remaining regions, the pattern of net tax exporting depends upon the alternative tax chosen and factor mobility. In these regions, there is no close relationship between regional growth and the welfare of its original residents. In the lump-sum tax scenario with mobile labor, the Northeast and the Far West are net tax exporters and the welfare of original residents rose; however, value added and welfare of the *ex post* residents residing in these regions decline. Conversely, the three tax importing regions experience gains in output and *ex post* regional welfare, but the welfare of the original residents declined.

In a similar fashion, Hirte (1998) examines whether in a tax sharing and fiscal equalization system, the states in a federal system should obtain the right to levy regional income taxes by utilizing an interregional CGE model. Hirte examines specific characteristics of efficiency such as optimal tax rates, price distortions, and the regional and national welfare effects of different kinds of fiscal autonomy. To do so, he distinguishes between two degrees of fiscal autonomy, no fiscal autonomy at all versus constrained fiscal autonomy.

Ultimately, he finds that there are some distortions caused by the degree of fiscal autonomy via the shadow price of rationing and by the tax sharing and fiscal equalization system via its influence on the refinancing rate of public expenditure. Most importantly, it is discovered that a higher degree of fiscal autonomy is not welfare improving, although admittedly this result is dependent upon the actual institutional arrangements of the tax reform proposed.

Similarly, Kraybill and Seung (1999) attempt to replicate the effects of a reduction in the corporate tax in Ohio. They employ a dynamic CGE structure, by using the results from initial stage as the starting values for the second stage. This iterative procedure allows them to examine the effect of tax policy changes as well as to trace out the Ohio system's response time. Significant aggregate welfare gains/losses are measured as the aggregate percent change over time as compared to the initial calibration value. The estimates of welfare changes are based primarily on the sum of the stream of the present discounted value of the change in per capita expenditures. This model nicely illustrates how capital and labor accumulation are influenced by regional policy as well.

The CGE model used by Gillespie, McGregor, Swales, and Yin (2001) is similar in that it models a regional geographic area; however, rather than focusing on taxes, the authors attempt to evaluate the results of Regional Selective Assistance (RSA) for the Scottish economy. This is done by using a hybrid approach which combines the "industrial survey" and CGE techniques. This modeling approach incorporates regional capacity and labor market constraints, thereby allowing the authors to demonstrate the important role of regional wage setting and migration in determining employment adjustments over time.

The hybrid approach employed by Gillespie, et. al. utilizes a CGE modeling framework that parameterizes data for one region of the United Kingdom, Scotland. This CGE model has three domestic actors, households, corporations, and government, which competitively produce and consume three commodities/activities: manufactures, non-manufacturing traded, and sheltered which is non-manufacturing industries with minimal trade. Also included are also two exogenous external actors, the rest of the United Kingdom and the rest of the world, which balance out the model.

Two alternative hypotheses regarding the determination of regional wages are explored. A national-bargaining labor market closure is presented through which the regional nominal wage is exogenous to the model. This approach is contrasted against a regional bargaining function taken from Layard, Nickell, and Jackman (1991) where the Scottish real consumption wage is assumed to be a function of unemployment and past real wages. The authors find that there are significant variances between the CGE-derived results under either wage determination method and those generated by the government's mixed Keynesian/I-O approach to measure the system-wide impacts of RSA on assisted areas, particularly where there is imperfect competition in regional labor markets.

Additionally, it should be noted that while there have been hundreds of CGE models assembled and used to analyze public policy at both the national and international level, there have been relatively few at the regional level. Regional CGE models are similar in design to the national and international models, but they do exhibit some major differences as summarized in Berck, Golan, and Smith (1997). First, regional models do not require that regional savings be equal to regional investment. In other words, when local residents save more than local investors want to use, these excess savings flow out of the region, and so too for smaller areas. Secondly, regional economies trade a large share of their output; therefore, trade is a more important attribute in the regional setting. The third difference noted is that regional economies face larger volatile immigration flows than nations, so migration is a larger factor for economic growth in a regional economy model compared to the national model. The last difference is that regional economies have no control over monetary policy. As a result, in regional models, taxes are interdependent through deductibility from income constrained by local regularities.

Since CGE models are used to simulate changes in economic welfare, one of the most significant critiques for CGE modeling concerns the underlying assumptions imposed on the "economy" by the functional forms chosen to represent it. It should be noted that almost all studies use the following underlying assumptions with respect to the production function: constant return-to-scale, neutrality of technological change, and profit maximization in perfectly competitive markets. However, the measured impact of technological and factor market changes varies considerably between these studies. Thus, one can see that despite restrictive assumptions, the models still possess the ability to display unique behavior.

An additional critique of CGE research is the absence of a concern for equity. While welfare has been a primary evaluative tool for many of the previous models' results, it is surprising that none have utilized the tools presented by public welfare economics, such as distributive weights, or even a simple compensation test. It is questionable whose welfare is being measured since there is no delineation between those with high incomes and the poor. As this research will show, it is not an incredible step to incorporate an equity consideration into the model's resulting income distribution.

Many applied general equilibrium models tend to fall into either of the following two categories: use of single period optimization assumptions or use of the CGE structure in a discrete sequential manner to model dynamic processes. Consequently, Harris (1984) work is considered by many as the first successful and compelling general equilibrium model to disregard the status quo of constant returns to scale and perfectly competitive markets by incorporating both imperfect competition and increasing returns to scale (IRS). His work centers on a small open economy and formulates for the first time the modeling of IRS using the dual approach. Since Harris's work, imperfect competitive general equilibrium models have been extensively used, especially in trade liberalization issues.

While imperfect market structures characterizing the output of a production system have been the major focus of the majority of theoretical and empirical work, market imperfections related to the factor (input) side of the production system remain unexplored. Monopolistic competition and oligopolistic competition, for example, have been extensively applied to trade models because the international trade focus of most national CGE models imply that factor market imperfections are of less concern: i.e., how strong is the case for monopsony modeling when commodities are traded nationally and internationally? This perspective is not the case, however, when examining smaller areas with such models.

Therefore, this approach in modeling increasing returns to scale has been infrequently used by those modeling CGE simply because of the indeterminacy of results under increasing returns to scale. Kilkenny (1998), however, argues "when factor markets are geographically segmented and the pool of labor is limited, factor costs will rise for an industry which is expanding operation, using unexploited increasing returns to scale." Ironically, incorporating increasing returns to scale into CGE models is most appropriate when considering small-scale CGE models of smaller regions and cities. It is in this way that the existence of an optimal output level is obtained.

Nevertheless, while it is true that CGE analysis can seem like a black box, that charge could be levied against almost any mathematical or econometric analysis. CGE models are fundamentally theory with numbers and therefore subject to the current state of the theory used to create them. Adequately explaining issues of a mostly static nature such as the impact of trade, fiscal policy, factor flows, the distribution of income between regions or factors, and the distribution of employment among sectors, CGE models are not proficient at examining the causes of growth and the dynamic welfare effects of changes over extended periods, although one must note that few models are. Therefore, while the CGE models described previously may adequately capture the various effects of economic development both in terms of prices, flows, output, input, and welfare, few have attempted to model differing approaches to government decision-making.

The previous research using CGE models has made great strides in some areas; however, there are still aspects of CGE research which could benefit from the incorporation of new techniques. As has been outlined above, previous research using CGE models have narrowed their focus by examining the effects of policy changes upon a region, rather than a nation or state. Moreover, previous CGE models have incorporated a consideration of welfare into their evaluation of policy changes, particularly tax policy changes. Some research has even separated the evaluation into two consumer groups, the original residents and the regional residents-incorporating the new residents who migrate into the region as a result of the simulation.

These are all beneficial additions to CGE modeling; however, there are still changes which should be made, thereby expanding the model's economic analysis further. This research incorporates specific tools of the public welfare and public choice schools to develop a dyadic evaluative technique. The same CGE model results can be evaluated from two alternate perspectives, the Public Interest and Public Choice approaches. In developing the Public Interest approach, equity concerns are also incorporated. Through the application of distributional weights, the model's results can now be analyzed with a consideration for who receives the benefits and who bears the costs of economic development. This step is unique in CGE literature.

3.2 The Logic of a SAM

Utilizing a textbook definition of an economy, CGE models are general equilibrium models that include utility maximizing consumers and profit-maximizing producers whose decisions determine the demand for goods and supply of labor, and the supply of goods and demand for primary factors and intermediate inputs, respectively. A CGE model also includes regional and international trade. Furthermore, government is a separate sector collecting taxes and tariffs, setting exchange rates, and providing transfers, subsidies, and services. Equilibrium prices are determined by market-clearing conditions balancing supply and demand. It is because all domestic supplies, demands, prices, and income are determined simultaneously within the model that it can be labeled "general equilibrium". It is "computable" since the model solves empirically for all endogenous variables in a highly nonlinear system of simultaneous equations (Berck, Golan, and Smith 1997).

Because organizing data is necessary first step in constructing a CGE model, one's attention must now turn to using a social accounting matrix since the traditional approach to CGE model data organization is the construction of a social accounting matrix (SAM). A SAM may be considered as an extended Input-Output (I-O) table showing each transaction flow as disaggregated into its two components, price and quantity. In contrast to an I-O table, both the price and quantity components fluctuate in response to an economic stimulus, since each component is driven by different factors. Although a SAM begins with an I-O table, additional steps such as including factors and institutions, thereby capture more completely the overall workings of the economy.[1]

In contrast to a CGE model, a SAM merely demonstrates a snapshot of the economy at one particular point in time. In this way, the structure of a SAM is consistent with the U.S. National Income and Product Accounts (NIPA). By treating producers as "transforming" goods for delivery, exports are viewed as a delivery from the rest of the world rather than going through the commodity account. This step has the advantage of making the commodity account in a SAM measure the total supply of goods to the domestic economy. Therefore, each cell in a SAM can be perceived as representing the value of an economic interaction between the model's actors, strictly limited to producers, households, the government, the capital account, and the rest of the world. Furthermore, there are only three types of transactions that can take place between these actors: market transactions of goods and services, voluntary or involuntary transfers, or financial transactions as captured in the capital account. In contrast, a CGE model contains only flows since it has no assets, money, interest rates, expectations, or dynamics.

The SAM captures these transactions in a square matrix consisting of a row and column for each economic actor in the economy. Each entry in this matrix identifies an exchange of goods and services purchased by one sector from another sector for itself. The entries along a row in the SAM show each payment received by that particular

[1] For more information regarding Social Accounting Matrices, please see (Stone 1986).

sector; therefore, summing the data across the row gives the total of payments made to that sector. The entries down a column in a SAM show the expenditures made by a particular sector. Likewise, summing the data down a column yields the total expenditures of a sector. Figure 3.1 presents the general SAM structure as used for this project.

Receipts ⇓	Payments ⇒					
	Commodity (1)	Factors (2)	Households (3)	Governments (4)	World (5)	Total (6)
Commodity (1)	Intermediate Inputs		Consumption & Investment	Consumption	Exports	Total Commodity Output
Factors (2)	Value Added				Foreign Value Added	Total Factor Income
Households (3)		Distribution of Value Added	Savings	Transfer Payments	Foreign Transfers & Savings	Total Institutional Income
Government (4)	Use and Sales Taxes		Income and Property Taxes	Inter-Gov Transfers		
World (5)	Imports					Total Imports
Total (6)	Total Commodity Outlay	Total Factor Outlay	Total Institutional Expenditures		Total Exports	Gross City Product

Figure 3.1: The Partial SAM

In the SAM's upper left quadrant is the I-O component, outlining all the commodities that an industry demands from the other sectors, also known as intermediate demand. Moving further down each industry column, one next encounters factor demand. It should be noted here that a factor of production is a stock that generates a flow of services used in the production of goods and services. In a SAM, value added is distributed through the factors of production to the household owners of factors. The treatment of value added is important since factor markets define many results of a CGE model and its ability to reflect reaction to policy changes. Use, property, and sales taxes paid by the each sector to the government are isolated next. The vertical sum of these components represents the domestic supply for a particular industry in dollar terms. Finally, the expenditures made by an industry sector for imports are located in the bottom row.

In a similar fashion, the household column represents the allocation of household income to consumption, savings, and tax payments. First, households demand commodities from the private sector and housing services; next, households allocate savings and finally pay taxes on total earnings. The corresponding household row represents income flowing to households from the sources of income (land, labor, and capital), government transfers including social security, and outside remittances. All other columns and rows are interpreted in a similar manner.

3.3 CGE Models

Now one must turns one's attention to the CGE model itself. For the majority of CGE models, firms or producers are assumed to be profit-maximizers, who operate within competitive markets. In this way, profit maximization dictates how firms act to minimize costs. Factors are assumed to be generally responsive to price changes. It is assumed that households maximize utility through their consumption decisions, by responding to price differences across goods and services. Finally, prices adjust in the goods, services, and factor markets to equate demand and supply.

In this way, by strengthening the theoretical basis of modeling and enabling an examination of a wider set of policy issues, CGE models represent an augmentation upon I-O and SAM models. Through its incorporation of factor and commodity substitution into the structure of production and demand, a CGE model remains consistent with modern neo-classical economic theory. Essentially, a CGE model consists of a system of Walrasian equations, each representing the clearing of factor and commodity markets resulting from the optimizing behavior of economic agents and institutions. Prices, endogenous to the model, adjust until factor and commodity market equilibrium conditions are satisfied, consistent with endogenous factor incomes. With their endogeneity, these calculations allow the CGE model to examine factor flows such as commuting and linkages of community consumption, both areas impossible under either an I-O table or a SAM.

A necessary next step is that the Walrasian equations must exactly reproduce the data from the SAM. This exact reproduction of the base year data means that the CGE model is now calibrated. Only after the model is calibrated can it but used to simulate an economic response to changes in policy variables relative to that base year.

It is for this reason that a CGE model is better suited to addressing any implications for efficiency and equity of alternative public policies since the underlying assumptions are more tenable and the results more tractable. The flexibility of various specifications of the CGE model can accommodate a wide range of policy variables and adjustment periods. By using relative factor prices and allowing factor substitution, a CGE model can generate a more accurate evaluation of the impact of government policies upon factor markets and, most importantly for this research, upon the distribution of income among community households. Additionally, if one assumes that factor endowments are fixed, then the relative efficiency of community factor utilization can also be compared within the CGE framework.

3.3.1 The Modeled CGE Equations

Now that a careful reader understands the nature of CGE models and the advantages it represents in more fully modeling the impact of economic development, one must now examine the model in greater specificity. In the CGE model used for this research, households receive income from firms and buy products from either domestic or foreign firms, identified as those located outside Fort Collins, Colorado.

The underlying logic of consumer behavior in the CGE Model is that consumers act to maximize their utility while subject to their budget constraint and the price level, both determined by the model itself. To solve out for the price level faced by each household group, the model uses the following equation

$$p_h = \frac{\sum_{i \in I} p_i \left(1 + \sum_{g \in GS} \tau^c_{gi}\right) c_{ih}}{\sum_{i \in I} \bar{p}_i \left(1 + \sum_{g \in GS} \tau^q_{gi}\right) c_{ih}} \tag{3.1}$$

where c_{ih} is household consumption for all industries across all households, p_i is aggregate price rate across all industry sectors, τ^c_{gi} represents consumption sales and excise taxes across all industries, and τ^q_{gi} is the average sales and excise tax rates across all industry sectors. This equation argues that the consumer price index facing each household group is a ratio of household consumption, that is adjusted by the sales and excise tax rates multiplied by the price level across all industry sectors, to household consumption, that is adjusted for sales and excise tax rates multiplied by the mean aggregate price in the community.

Moreover, household consumption is driven not just by aggregate price levels but also by household income which the model calculates using the following equation:

$$y_h = \sum_{f \in F} \frac{\alpha_{hf} a^w_h}{\sum_{h \in H} \alpha_{hf} a^w_h} \, y_f \left(1 + \sum_{g \in GF} \tau^h_{gf}\right) \quad \forall h \in H \tag{3.2}$$

where the income accruing to any one household group, y_h, is equal to the income derived from the factors of production (labor, land, and capital) net of an employee's portion of any factor taxes. This figure is then adjusted for each household group by multiplying household income by the ratio of the household group's number of working households to the total number of working households in Fort Collins. It is important to note that this income also includes the income of working households who are commuting to work outside Fort Collins since their income will also determine the ultimate income of a Fort Collins household.

The income derived above is not complete unless one acknowledges that households pay other taxes besides factor taxes, and these additional taxes must be subtracted from a household's income and additional income transfers and non-factor income sources must be included to accurately determine the income a household utilizes for consumption. Therefore, a household's disposable income is equal to the following equation:

$$y_h^d = y_h + \sum_{h \in H} y_h^m a_h^n + \sum_{g \in G} w_{hg} a_h^n - \sum_{g \in G} t_{gh} a_h - \sum_{g \in G} \tau_{gh}^h a_h \qquad \forall h \in H \tag{3.3}$$

where federal personal income taxes and any other household taxes besides personal income tax are subtracted from the household's income after factor taxes have been paid and private retirement income and government transfer payments are added in.

Now that household income and disposable income have been calculated, household consumption can be more fully evaluated. The consumption of any one household group is equal to:

$$c_{ih} = \bar{c}_{ih} \left(\frac{\bar{y}_h^d}{y_h^d} \div \frac{p_h}{\bar{p}_h} \right)^{\beta_{ih}} \prod_{i' \in I} \left[\frac{p_i \left(1 + \sum_{g \in GS} \tau_{gi}^c \right)}{\bar{p}_i \left(1 + \sum_{g \in GS} \tau_{gi}^q \right)} \right]^{\lambda_{i'i}} \tag{3.4}$$

where the new level of consumption for a household group c_{ih} is shown to be a function of the original consumption level $\bar{c}_{ih}$ multiplied by any changes in real income subject to the household's income elasticity of demand, β_{ih}, and any relative price or tax changes across all sectors.

Like households, firms also demand goods and services. This demand by firms, also known as intermediate demand, is characterized by:

$$v_i = \sum_{i' \in I} \alpha_{ii'} q_{i'} \tag{3.5}$$

where intermediate goods, v_i, are a fixed share of production summed across all industry sectors. This equation argues that intermediate demand for an industry is simply the total demand for intermediates from each industry, rather than calculating the intermediate demand as a separate variable for each industry supplying to every other industry. These fixed production shares are determined by the production coefficients of the input-output (I-O) matrix.

Similar to households seeking to maximize their utility, firms act to maximize their profit subject to their production constraints. The model assumes that firms employ land, labor, and capital to produce output which is then sold to households, government, consumers abroad, and other firms at some industry price level. This method of production can be summarized as:

$$q_i = \delta_i \prod_{f \in F} (u_{fi})^{\alpha_{fi}} \tag{3.6}$$

where δ_i is the production function scale, u^d_{fi} is sectoral factor demand, and α_i is the substitution exponent in the production function. Thus δ_i is the scale of production parameter, multiplied across the factors of production raised to the constant factor share exponents which, in this case, sum to one. In other words, the production undertaken in the CGE model is of the Cobb-Douglas type with constant returns to scale. The scale of production parameter is the proxy of factor intensity usage for each sector since the Cobb-Douglas function assumes perfect substitutability across all factors.

Manipulating the production function into the profit function and then taking the first partial derivative, while holding prices and other factor demands constant, then yields the firm's factor demands for land, labor or capital. These demands are equal to:

$$r_{fi} ra_f \left(1 + \sum_{g \in GF} \tau^x_{fig}\right) u^d_{fi} = p^{va}_i q_i \alpha_{fi} \qquad \forall f \in F,\ i \in I \tag{3.7}$$

where r_{fi} is sectoral factor rental shares, ra_f represents an economy-wide scalar for factor rental rates, u^d_{fi} is factor demand, and q_i represents domestic supply. In other words, the marginal benefit of a factor unit, shown by the right hand side, is equal to the net of taxes rate of return across all an industries for a factor. The taxes, which are included in the calculation of labor, include any employer contributions to Social Security, Unemployment Insurance, Workers' Compensation and other such taxes. Similarly, taxes on capital include corporate income taxes and franchise taxes.

Finally, domestic production in Fort Collins is not only for domestic consumers; therefore, one must also calculate the export demand for domestic production. This demand is shown as

$$e_i = \bar{e}_i \left[\left(p_i^d \sum_{g \in GK} 1 + \tau_{gi}^x \right) \Big/ \left(\bar{p}_i^{\,w} \sum_{g \in GK} 1 + \tau_{gi}^q \right) \right]^{\eta_i^e} \tag{3.8}$$

where the new level of export demand e_i is equal to the original level of export demand $\bar{e}_i$ multiplied by the ratio of the new domestic price, net of taxes, to the original domestic price, net of taxes, adjusted by the elasticity of demand with respect to domestic price, η_i^e. This means that an increase in the foreign demand for goods can be traced to higher domestic prices p_i^d.

To accurately calculate the labor force participation, migration, and commuting rates in the economy requires one to determine accurately the level of labor supply. In this model, the domestic supply of labor is expressed in terms of a participation rate: the ratio of working households (a_h^w) to total households (a_h) in the city of Fort Collins. This is a function of the initial participation rate ($\bar{a}$) modified by four factors as shown below:

$$\begin{aligned} \frac{a_h^w}{a_h} = \frac{\bar{a}_h^w}{\bar{a}_h} \Bigg[\Bigg[\left(\frac{\sum_L \left(\frac{r_L^a}{\bar{r}_l^a} \right)}{\left(\frac{p_h}{\bar{p}_h} \right)} \right) \left(\frac{\sum_{Z,L} u_{z,l}^d}{\left(\sum_H a_h^w * \epsilon \right) + CMI} \right) \\ + \left(\sum_L \frac{Exwage_l}{r_l^a} \right) \left(\frac{CMO}{\left(\sum_H a_h^w * \epsilon \right) + CMI} \right) \Bigg]^{\eta_h^{LS}} \left(\frac{\sum_{g \in G} \frac{w_{h'g}}{p_h}}{\sum_{g \in G} \frac{\bar{w}_{h'g}}{\bar{p}_h}} \right)^{\eta_h^w} \Bigg] \end{aligned} \tag{3.9}$$

where the four influences respectively are the change in economy-wide wage rates (r_L^a), the change in household earnings from both in-town and commuting sources

$((a_h^w * \epsilon) + CMI)$, any changes in the proportion of factor demand which might be satisfied by commuting in $(u_{z,l}^d)$, and the change in a household's average transfer payments when not working $(w_{h'g})$. It is assumed that the elasticities are constant for each household but vary across household groups since it is logical to argue that the higher income household groups have lower responsiveness, in terms of their labor supply, to changes in transfer payments than do lower income household groups.

Another way households respond through their labor supply is through commuting into and out of the city. In the CGE model, the number of workers commuting out of Fort Collins is shown by:

$$CMO = \overline{CMO}\left(\frac{Exwage_L}{ra_L}\right)^{\eta_{como}^L} \tag{3.10}$$

where $\overline{CMO}$ represents the original number of out-commuting workers, across all three labor groups, multiplied by the new external wage for out-commuting workers, adjusted by the average wage rate and subject to the elasticity of labor supply for out commuters. This relationship argues that if the external wage for out-commuters increases, then there will be a corresponding increase in the number of workers commuting out of Fort Collins, across all three labor groups, subject to each labor group's elasticity of labor supply.

The final determinant of the labor supply of Fort Collins is the new total number of households which adjusts as the model equilibrates itself. The total number of households is determined by:

$$\begin{aligned} a_h = \bar{a}_h \pi + \bar{a}_h^{in}\left(\frac{\bar{a}_h\, p_h\, y_h^d}{a_h\, \bar{p}_h\, \bar{y}_h^d}\right)^{\eta_h^{yd}} \left(\frac{a_h^n\, \bar{a}_h}{a_h\, \bar{a}_h^n}\right)^{\eta_h^u} \\ - \bar{a}_h^{out}\left(\frac{a_h\, \bar{p}_h\, \bar{y}_h^d}{\bar{a}_h\, p_h\, y_h^d}\right)^{\eta_h^{yd}} \left(\frac{a_h\, \bar{a}_h^n}{a_h^n\, \bar{a}_h}\right)^{\eta_h^u} \qquad \forall\, h \in H \end{aligned} \tag{3.11}$$

where the new total number of households is a function of the initial number of households $\bar{a}_h$ augmented by the natural rate of population growth π, in addition to the effect of net migration or the number of out migrating households $\bar{a}_h^{out}$ subtracted from the number of new migrant households $\bar{a}_h^{in}$. Net migration is itself a function of the overall "attractiveness" of Fort Collins, as measured by any changes in real after-tax earnings and employment prospects.

The final economic agent in the model is government. The government is an exogenous agent in the model, in that it chooses a set of policies to allocate available funds among a specified number of priorities. The funds available to the government:

$$\begin{aligned} y_g = & \sum_{i \in I} \tau_{qgi}^x v_i p_i + \sum_{i \in I} t_g^x e_i p_i^d + \sum_{i \in I} \tau_{gi}^m m_i p_i^w + \sum_{i \in I} \sum_{h \in H} \tau_{qgi}^x c_{ih} p_i + \sum_{i \in I} \tau_{qgi}^x c_{in} p_i \\ & + \sum_{i \in I} \sum_{g' \in G} \tau_{qgi}^x c_{ig'} p_i + \sum_{i \in I} \sum_{f \in F} \tau_{gi}^x r_{fi} r a_f u_{fi}^d + \sum_{g' \in G} \sum_{f \in F} \tau_{gi}^x r_{fg} r a_f u_{fg'}^d \\ & + \sum_{f \in F} \tau_f^h y_f + \sum_{h \in H} \tau_{hg}^h a_h + \sum_{h \in H} t_{gh} a_h^w + \sum_{g \in GX} b_{gg} \qquad \forall g \in G \end{aligned} \tag{3.12}$$

are shown as a function of the sum of sales taxes collected on domestic consumption, in addition to taxes on factor payments, taxes collected from households, and intergovernmental transfers. All tax rates are calculated by identifying the ratio of the actual tax revenues collected across all sectors and households to the total income flows across all sectors and households.

Finally, in order for the CGE model to operate efficiently, there are several assumptions that must be implemented through the closure equations. These include that markets clear, agents behave optimally, production takes place under constant returns to scale, no excess demand exists for any good, every producer earns zero economic profit, and consumers do not exceed their budgets.

The model chooses to maximize state personal income SPI:

$$q = \sum_{h \in H} y_h + \sum_{h \in H} \sum_{g \in G} w_{hg} a_h^n + \sum_{h \in H} y_h^m a_h^n \tag{3.13}$$

which is the sum of earned income and transfer payments (both from the government and personal retirement accounts). It is important to note that state personal income is not the same as household income or disposable income in that taxes are not included in its calculation.

Additionally, it is assumed that the labor market clears so that the number of workers per household across all six household groups added to the number of workers commuting into the city as shown below:

$$\sum_{h \in H} (a_h^w * \varepsilon) + CMI_L = \sum_{i \in I} u_{Li}^d + CMO_L \tag{3.14}$$

is equal to the sum of the factor demand added to the number of workers commuting out of the city. A similar process follows for the capital market:

$$u_{K,i}^s = u_{K,i}^d \tag{3.15}$$

where the supply of capital is equal to the factor demand for capital. Likewise, the land market follows a similar pattern:

$$u_{La,i}^s = u_{La,i}^d \tag{3.16}$$

where the supply of land is equal to the demand for land.

Perhaps most importantly for the model is the assumption that domestic supply is equal to the sum of domestic demand and net exports as shown below:

$$q_i = x_i + e_i - m_i \tag{3.17}$$

where DD is domestic demand and defined as:

$$x_i = v_i + \sum_{h \in H} c_{ih} + \sum_{g \in G} c_{ig} + c_i^n \tag{3.18}$$

where v_i is intermediate demand for goods and services, c_{ih} is domestic consumption, c_{ig} is government consumption and c_i^n is domestic investment. This assumption is the same as the macroeconomic assumption that $Y = C + I + G + NX$.

3.4 Data Description

While theoretically a CGE model displays many advantages over other modeling types, it is important to remember that a model is only as good as the data it uses. This is particularly true of CGE models as the data requirements for parametrization are extensive and have a considerable impact on the overall quality of the final analysis. To this end, what follows describes the data used for parameterize the model.[2]

3.4.1 Employment and Wage Data

The data used to show employment and wages in the CGE model of the city of Fort Collins, Colorado was collected by the Colorado Department of Labor and Employment which delineates this data into the number of workers in each sector as well as the wages paid to those workers. This data is culled from two principal sources: the ES-202 survey and the unemployment insurance (UI) survey.[3] A distribution of employment and wages is created by combining the ES202 and UI data, thereby making the data useful for CGE modeling purposes. The data is further refined by adding estimates of commuting into and out of each city, which is obtained by re-parameterizing a gravity model with Census time-to-work data. The net result of such efforts is that the distribution of employment and wages' impact on the factor markets can be evaluated under a wide range of scenarios. Although ES-202/UI form a nearly complete database, government entities such as school districts and the like are not included and must be accounted for separately.

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[2] For a more detailed description of the data used in the model, please see Schwarm and Cutler (2003).

[3] Theoretically, every private employer is required to supply this information and this data is collected on a town-by-town basis. In addition, every worker in the private sector has a UI number, which allows the state to track the individual wages earned by that worker for every quarter. Thus, the state can identify the firm which employs each worker. Social security numbers appearing more than once identify multiple jobholders.

3.5 Households

Because households have two primary roles, they are an important variable to also be considered. First, they provide the direct consumption of goods and services from the productive sectors. Second, some proportion of the households provide labor to the productive sectors for which they, in turn, receive income.

To best examine households' first role, the expenditure patterns of the six household groups requires combining two sources of data. IMPLAN provides estimates of economic activity at the city and county level across the United States while the U.S. government provides its own estimates of household expenditures in the Consumer Expenditure Survey (CES). The combination of these two sources provides a good representation of consumer expenditures for the city of Fort Collins, Colorado.

The modeling of the housing market presents some difficulties since it does not produce output like the other private sectors; however, owning a house provides a service in terms of meeting the needs of a family. Therefore, the housing sector was fashioned with two perspectives in mind. First, that like any other expenditure, households do make annual payments for their mortgage or rent. And, again, housing provides a service to homeowners. Combining these two perspectives shows that a relationship exists between what households pay for their home on an annual basis and the services that they obtain from the property provide for a more complete analysis of the housing market.

Since households can either spend their income on consumption or save it, household saving is another important variable to be considered. Household savings can be divided into two components. The first form of savings is non-voluntary savings which are automatically allocated to social security or some other form of retirement; the second method includes any savings made in addition to the required retirement savings. In this CGE model, it is assumed that only the two richest household groups, (HH5 and HH6), enjoy enough income to have any positive savings.

Finally, one comes to the last piece of household expenditures—federal and state taxes. In this case, each household must pay personal income taxes to the state and federal governments. The household groups also makes expenditures for property tax. Lastly, each household group will also spend its income for services provided by the city such as recreation, the arts, and fines among others. These other revenue vehicles are lumped together in the model.

The income flowing to households is derived from several different sources, the most primary being labor income. In addition to these monies, households also receive income from social security, retirement, and the appreciation of homes and investments. The model takes all of these sources into consideration. The resulting flows of labor, land and capital income are then distributed into the six different household groups. This distribution procedure relies not only on census data but also upon some estimates provided by the state demographer of Colorado concerning the distribution of household income. At this point, the number of multiple income-earning households present in the model is also determined, yielding the job correlation matrix which outlines the number of wage earners per household.

The calculation of household expenditures across sectors requires not only the distribution of expenditures but also the level of those expenditures. Distribution patterns were estimated using a combination of IMPLAN data and the Consumer Expenditure Survey (CES). Both of these data sources offer levels of expenditures across household groups, but these data need to be reconciled with the level of estimated labor, land and capital income as estimated by the model. Any additional wealth which supports household expenditures, for example, stocks and outside remittances, is also used to obtain consistency between household expenditures and household income.

3.6 Capital and Land

The Larimer County assessor's office maintains records of the use of each parcel of land in the county, particularly since property taxes differ across commercial and residential parcels. Included in each parcel are data on acreage and the market value of the structure (capital) on the parcel; therefore, very good data can be obtained for value-added in the profit maximizing sectors. Data is also collected on personal capital (computers, production lines, among other categories); however, this particular data presents accounting concerns, given its link to depreciation values.

Similar data are also available for residential properties. Because the county collects data on market values for the acreage and the house on each parcel, these values can be used to compute the housing expenditures for the six household groups. In the CGE model, homes are divided into three categories which are determined by prices. Finally, there is also a sector for multiple unit housing.

3.7 City and County Data

Finally, the data collected from a local government for a city, town, or county includes employment and wages, non-labor expenditures for city services and the range of taxes collected by the local government. The city of Fort Collins was divided into five categories: the police department, the fire department, the transportation department, city administration, and finally, library, parks, and recreation. Employment and wages for each of these departments were collected as well as the non-labor expenditures made by each department.

Combined with the revenues derived from businesses and individuals, governmental transfers, revenues, and financial gains on investments were grouped in the CGE model under the category labeled General Revenues. Any additional revenues generated from public utilities and public facilities, particularly Special Revenue

Funds and Enterprise Funds, were identified and then divided among the appropriate sectors.

The school district presented the most interesting challenge to the CGE model. Some school districts are responsible to the residents outside of Fort Collins, and Fort Collins itself is split between districts, so it can be difficult at times to determine the appropriate school district. The problem is compounded since the accuracy of school district information is doubly important due to the size of the entities. Despite these issues, employment and wage data, as well as non-labor expenditures, for school districts were determined and included in the model.

The information gathered for the city of Fort Collins stems from several sources, including county, city and school district audits, planning departments, and personnel departments. The revenues for the city of Fort Collins came from a variety of sources as well, chief among them being property taxes. One of the principal difficulties encountered was separating the property taxes paid by businesses from those paid by households; however, this step was accomplished by using the tax information supplied by the county assessor's office and the city of Fort Collins. Furthermore, many of these sources were also used to calculate sales and use tax revenues, as well as charges for services, fees and other payments made by the residents and businesses in Fort Collins. It is important to note that for several of these revenue sources, one must isolate the funds collected from business interests from those collected from local residents.

Lastly, one must consider the fact that for the government of the city of Fort Collins, the same type of data required of private firms is also necessary. Typically easily obtained from city computer databases, labor and material expenditures are required and ideally are categorized by the type of service provided. However, unlike private firms, the types of revenue sources and the amounts of revenues are also needed, and these are most useful when they are linked to functional categories. For example, taxes collected for schools are specifically related to education; fees for parks and recreation are related to local services in that area, etc. Luckily, much of this information is reported in the certified annual financial reports (CAFR), when they are available; thus the researcher should consider the CAFR as the primary initial data source for most government information.

3.8 The Fort Collins CGE

Given the data described above, a CGE model of the Fort Collins economy can be organized in the following manner. The following categories presented Table 3.1 below outline the basic structural divisions of the CGE.

Table 3.1: The Sectors and the Economy

Profit Maximizing Sectors(1-18)	
1) Agriculture services	11) Communications
2) Agricultural production	12) Wholesale
3) Agricultural processing	13) Retail
4) Low services: hair, cleaners, etc.	14) Finance, insurance & real estate
5) High services: legal, medical	15) Electricity
6) Construction	16) Water
7) Manufacturing	17) Lodging
8) Mining	18) Restaurants
9) Computer Manufacturing	
10) Transportation and Utilities	19)Education
Housing Market	**Public Sectors**
HS1 < $120,000	1) Local Utilities
$120,000 < HS2 < $200,000	2) Local City Government
$200,000 < HS3	3) State and Federal Governments
Household Groups	
HH1 < $10,000	
$10,001 < HH2 < $19,999	
$20,000 < HH3 < $39,999	
$40,000 < HH4 < $49,999	
$50,000 < HH5 < $69,999	
$70,000 < HH6	

There are 18 profit-maximizing productive sectors in the Fort Collins economy which supply goods and services to the six household groups, the three public sectors and export to the rest of the world. In addition, the model contains a description of four housing sectors which are also profit-maximizing and are included the productive sectors. The productive sectors are supported by land, capital and three separate divisions of labor as shown in Table 3.2.

Table 3.2: Factors of Production

Capital Stock	**Land**	**Labor**
K = Buildings and factories used by the productive, residential and public use.	L = Land used by the productive, residential and public use (acres).	\$20,000 < L1 \$20,000 < L2 < \$50,000 \$50.000 < L3

The sectoring scheme presented above provides an initial ordering of the Fort Collins economy as dictated by the CGE model. The Public Interest and Public Choice approaches outlined in Chapter Four will utilize this ordering to show the responses of the Fort Collins economy to five simulations mirroring different types of economic development.

3.8.1 Types of Taxes Collected

There are several types of taxes that are also included in the CGE model of Fort Collins, Colorado. Specifically, there are eight types of taxes collected by the local government in the model. These taxes are presented in Table 3.3. Several of these are federal taxes; however, the local government does not enjoy the benefits of their collection. These include the social security tax collected on all labor groups, the federal personal income tax, and the federal corporate income tax.

The local community does enjoy the benefits of several other taxes. These include the city sales tax which is collected only on the retail, lodging, eating, lower services, transport/utility, and university sectors. The city net value tax is collected only from the manufacturing sector. The city use tax is paid only by businesses for some intermediate goods since their use is perceived as final use. Finally, the city has additional revenue mechanisms, grouped together under the title "Other Revenue Vehicles" or ORV. These represent local fees for permits and licenses as well as other miscellaneous uses. It is important to note that the city also enjoys county property tax revenues, but these are only a fixed proportion of the overall tax revenues collected by the county.

Table 3.3: Types of Taxes Included in the CGE Model

Federal Taxes	**County Taxes**	**Local Taxes**
Personal Income Tax	County Property Tax	City Sales Tax
Social Security/FICA Tax		City Use Tax
Corporate Income Tax		City Net Value Tax
		City Other Revenue Vehicles

3.8.2 Intergovernmental Transfers and Block Grants

The CGE model also captures several additional stylized government features of Fort Collins, including transfers between differing levels of government. Most importantly, the property tax revenues collected by the county are transferred to the city to finance the primary and secondary education. Additionally, block grants-in-aid from the federal government are used to pay for federal mandates. It is important to note that while these transfers are important for the overall budget and balance of the government entities in the model, they are fundamentally proportional distributions in nature, and thus exogenous to the Fort Collins economy. Because of this fact, there will be little discussion concerning these transfers in the following chapters.

3.8.3 Students and Food

Finally, due to the large number of students in Fort Collins, Colorado, it was necessary to incorporate that characteristic into the model. The lowest income groups have the highest incidence of students; however, this is not felt to be a permanent situation for them since it is hoped that they will move into higher income groups upon graduation. Therefore, an attempt was made to capture the non-student members of the lowest household groups, $1 - s$, as well as the working students, $0.6 * s$, where it is an educated guess that approximately 60% of the students living in Fort Collins, Colorado are also employed in the economy and therefore earning income. This consideration is not explicitly incorporated into the CGE model itself, but rather into the creation of a distributional weighting scheme which will be applied to the model's results.

Chapter 4

The Simulation Results

4.1 Initial Descriptive Statistics

The differences between the Public Interest and Public Choice approaches are illustrated through five simulations which show the effects of an industry's expansion upon the economy of Fort Collins, Colorado. Using the Public Interest approach requires each simulation's results are judged by the welfare effects upon the city's original residents and the total number of residents after the simulation. In contrast, the Public Choice approach examines each simulation's effect upon the average tax burden facing each of the six household groups. As will be ultimately shown, one must conclude that the choice of development pursued does indeed depend upon which method the community uses to evaluate economic development's benefits.

However, before one can begin to examine a simulation's effects upon the city, one must first understand the initial situation facing the city. The city of Fort Collins has attributes that make it unique for a city of its size; these are explained by several factors. Some of these attributes are summarized in Table 4.1.

An examination of Table 4.1 reveals that the city of Fort Collins has 16,787 residents (or 15.9% of the total population) whose incomes are less than $5000 a year. This fact can be explained by the large number of students attending Colorado State University located in Fort Collins. Also, of the 105.000 residents of Fort Collins, only 64,281 are employed. The total population includes not only university students but also retirees since Fort Collins is a popular site for retirees as well. Additionally,

Table 4.1: Summary Statistics of the City of Ft Collins

Statistic	Value	% of Total
Total Population	105,000	
< $5000	16,787	26.12%
$5k - $10k	8,884	13.82%
$10k - $20k	11,102	17.27%
$20k - $30k	10,114	15.73%
$30k - $40k	6,160	9.58%
$40k - $50k	4,042	6.29%
$50k - $70k	3,839	5.97%
$70k +	3,353	5.22%
Total Employment	64,281	
Commuting Out	14,647	
Commuting In	15,240	
# in HH1	3,491	8.70%
# in HH2	5,197	12.95%
# in HH3	8,972	22.36%
# in HH4	2,981	7.43%
# in HH5	8,595	21.42%
# in HH6	10,883	27.13%
Total # HH	40,119	
Total City Revenue (Mil $)	87.38	
Gross City Product (Mil $)	2331.72	

as the largest town in northern Colorado, Fort Collins also draws a significant share of its labor force from the surrounding towns in the area as evidenced by the 23.7% of total employed workers who are commuting into the city. Finally, when individuals are divided up into households, it becomes apparent that the population of Fort Collins is skewed to the upper end of the income distribution since household groups 5 and 6 (HH5, HH6) number 19,478 of the 40,119 total number of households in Fort Collins (or 48.5%).

The combined effects of the characteristics mentioned above more fully reveal themselves through a Lorenz curve analysis of the income distribution of Fort Collins. Lorenz curves are meant to show any deviation from a truly equal distribution of income. This is accomplished by first calculating the cumulative frequency distribution of a truly equal income distribution where, for example, the bottom 40% of the population earn 40% of the total income and so on. The line of true equality in Figure 4.1 demonstrates this income distribution. Fort Collins's income distribution is shown in

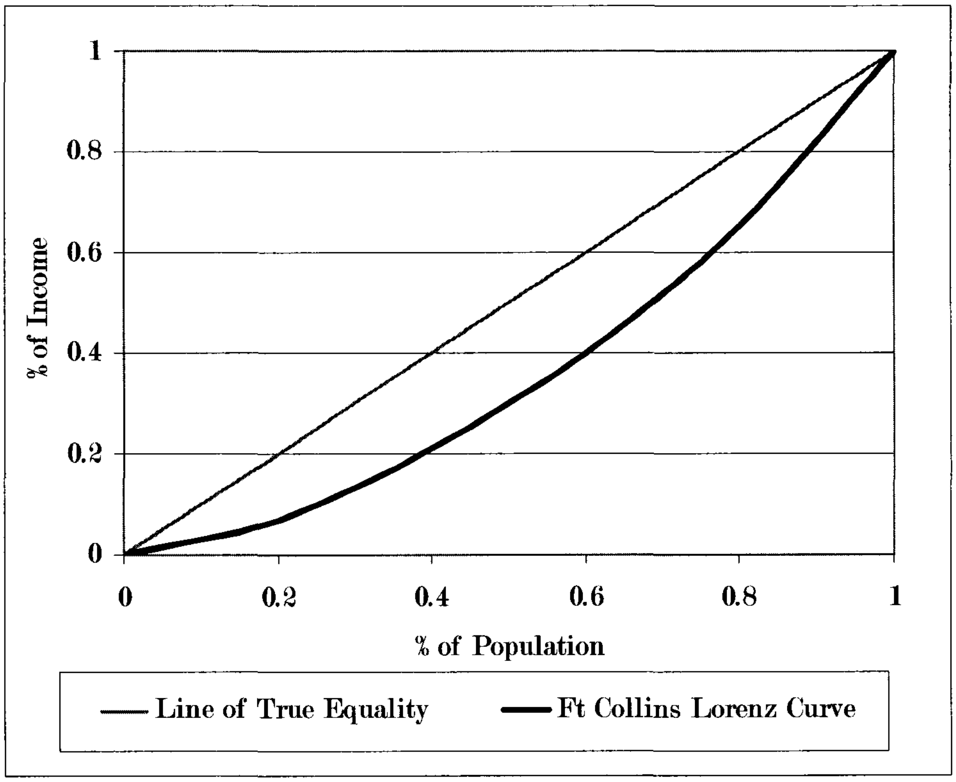

Figure 4.1: Lorenz Curve for Fort Collins

contrast to such a line of true equality. One may note that since the income distribution of Fort Collins is not egalitarian, its Lorenz curve will necessarily deviate from the line of true equality as shown in Figure 4.1. However, its income distribution is not as unequal as it could be which would be shown with a Lorenz curve further skewed to the right-hand quadrant.

Each quintile has an equal number of households in it, roughly 8000, and as shown by Figure 4.1, is skewed toward those with higher incomes. Specifically, the bottom quintile only earns 6% of the total income in Fort Collins while the top quintile earns 35% of the income; however, the remaining three quintiles earn a significant portion of the income (14%, 19%, and 25% in order of income respectively), though not to the same extent as the richest quintile.

When examined by household groups rather than quintiles, one can see the same picture. The poorest household group (HH1) earns only 1% of the total income in Fort Collins while containing 8% of its households. In contrast, the richest household group (HH6) earns almost half (47%) of Fort Collins's income but contains only 27% of its households. It is important to note that this household group is also the largest as a percentage of the total number of households.

4.2 Description of Five Simulations Run

The potential net benefits calculated by the Public Interest and Public Choice approaches are explored through each of five simulations, modeled using a CGE of the city of Fort Collins. These simulations are meant to mirror the impact of 1000 new workers in five different productive sectors of Fort Collins. A high wage sector represented by computer manufacturing, two medium wage sectors proxied by manufacturing and high services, a low wage sector represented by retail. Computer manufacturing and manufacturing are sources of economic development, traditionally supported by economic theory such as economic base analysis.

However, if one assumes a well-developed economy, retail and high services may provide significant additional engines for further economic growth. Particularly in northern Colorado where there is strong competition for sales tax revenue collected from retail sales, the retail sector is likely to be viewed as an attractive source of economic development. Additionally, high services and retail in Fort Collins have developed similar characteristics to traditionally export-oriented sectors, like manufacturing. As Fort Collins grows larger, it has become a "destination-city" for those from the surrounding towns and southern Wyoming seeking varied retail and service consumption opportunities; therefore, an expansion of the retail or high services sectors results in an increase in money flowing into the Fort Collins economy without the demands of additional households.

Likewise, since the university/junior college sector is a large and unique component of the economy, further analysis was deemed important to investigate an increase in the size of this sector. While it may be more realistic to model a decrease in the size of the university, for uniformity, an equal expansion of 1000 jobs was performed. It is interesting to note that there has been expressed interest in exactly how the Fort Collins economy is affected by the presence of a university by both the university itself as well as the state government of Colorado. Among its unique characteristics, the university not only offers employment for highly skilled labor but also steady employment for lower skilled labor. An examination of these five scenarios hopefully captures a broad range of realistically viable economic development proposals.

4.2.1 Execution of the Simulations

It is important to inspect the equations used to implement the simulations. The following equation, previously introduced above as equation 3.8, describes the process of exports for the model:

$$e_i = \bar{e}_i \left[\left(p_i^d \sum_{g \in GK} 1 + \tau_{gi}^x \right) \Big/ \left(\bar{p}_i^w \sum_{g \in GK} 1 + \tau_{gi}^q \right) \right]^{\eta_i^e}$$

where e_i is the amount of exports in sector i, where i is indexed over the productive sectors presented in the table above, $\bar{e}_i$ is the base value of exports, p_i is the domestic price across sectors, $\tau_{gk,i}$ are sectorally indexed range of taxes indexed by gk (local, state, and federal taxes), $\bar{p}_i$ is the world price for exports, and η_i^e are negative export elasticities.

To execute the simulations for the manufacturing, computer manufacturing, high services, and university/junior college sectors, the value of $\bar{p}_i$ was increased to simulate the effect of an increase in the external demand for these sectors. In other words, while these sectors experienced no real change in the actual production of the goods and services they produce, these four sectors encountered either increased demand by consumers outside Fort Collins or saw external conditions, affecting their availability. The net effect is that products produced by these sectors were seen to possess greater value compared to goods produced outside the city of Fort Collins.

In contrast, the retail simulation was performed differently from the others. Even though retail's exports have anecdotally been perceived as increasing, there is still a portion of retail sold locally; therefore, to create an expansion of 1000 new jobs in the retail sector, capital stock must also be increased. To capture an increase in the local supply of retail, the capital stock used by retail was also increased. The importance of this action can be best seen in the following equations:

$$n_i^k = \bar{n}_i^k \left(\frac{r_{k,i}}{\bar{r}_{k,i}}\right)^{\eta_i^k} * \left(\frac{u_i^d}{\bar{u}_i^d}\right)^{\eta_i^k} \tag{4.1}$$

$$u_{k,i}^s = \bar{u}_{k,i}^s \left(1 - \delta_i\right) + n_i^k \tag{4.2}$$

where $n_{k,i}$ represents the investment across the productive sectors , $r_{k,i}$ is the rate of return to capital, $\bar{r}_{k,i}$ is the base value, u_i is domestic supply across the sectors, $\bar{u}_i$ is the base value, η_k^i are elasticity values, $u_{k,i}^s$ is the capital stock across the productive sectors, $\bar{u}_{k,i}^s$ is the base value, and δ is the depreciation rate. Investment is a function of its rate of return and domestic supply while the capital stock is a function of investment and the depreciation rate.

The retail simulation is meant to show the implementation of a new shopping center which would increase $\bar{n}_i^k$ for retail, resulting in an increased capacity for retail within Fort Collins. This additional capacity, in turn, will lower retail prices which causes the local consumption of these goods to increase. The presence of this new shopping center will also attract consumers from outside Fort Collins; therefore, an increase in the export price of retail is also increases to show the increased attraction of Fort Collins's retail sector for the surround area.

4.3 The Public Interest Approach

As the Public Interest approach explicitly seeks to maximize the social welfare of Fort Collins, it becomes important to examine specifically to whom the benefits of economic development accrue. Therefore, this approach will separate the population of Fort Collins into the original residents of Fort Collins and the final population of Fort Collins after the economic development has been undertaken and in-migrants have been included. It is assumed that the original residents are those individuals who would make the initial decision whether or not to pursue economic development, and which type of economic development would best maximize social welfare. Since these individuals want to maximize their *own* social welfare, they evaluate their welfare, and not the welfare of eventual new residents into Fort Collins; while the original residents may be the ones making the economic development decision, once the expansion is undertaken, they are no longer the only ones affected by that decision. Therefore, to gain a greater understanding of how the expansion will ultimately affect the Fort Collins economy, one must also examine the effect upon new residential households as well.

4.3.1 Derivation of Distributional Weights

While an emphasis on the original residents is an essential component of the public interest approach, an important extension is examining the choice of a society's social aversion to inequality. The initial value for the community's aversion to inequality will be equal to 1.0, as per Squire and der Tak (1975). It is important to note that this value does not imply that there is no aversion (where $\eta = 0$), merely that there is some consideration for the poor. From this initial starting position, the community's aversion is modeled as a geometric expansion and contraction so as to simulate varying levels of social aversion to inequality. These values are designed to emulate different types of social welfare functions and are shown in 4.2 below:

Table 4.2: Social Welfare Function Weights

Value of η	**SWF Type**
0	Benthamite Utilitarian
0.125	
0.25	
0.5	
1.0	Weighted Utilitarian
2.0	
4.0	
8.0	
16.0	
∞	Rawlsian Maxi-Min

At its lowest extreme, if the aversion to social equality equals zero, then the exponential process will cause both incomes in Equation 2.6 to equal one for each household group, effectively giving each household group the same social weight of 1.0. When considering Table 4.2's range of social aversion, both incomes are constant and the only changing variable is the value given to η itself. Thus, as the aversion to social equality approaches its uppermost extreme, infinity, the value of the distributional weight will be driven by the comparison of an individual household group's income to the mean income. For example, if η is equal to infinity and the mean income equals 1.0, and a particular household group's income is 0.5, then the resulting distributional weight will be far larger than if a household group's income is greater than the mean income, say equaling 2.0. Therefore, under these conditions, the only way to increase social welfare is by increasing the welfare of the least fortunate (lower income household groups) since the distributional weights applied to the most fortunate are effectively zero.

Values assigned for η are inserted into Equation 4.3 thus determining the distributional weighting scale associated with each level of social aversion to inequality

$$\delta_i = f[(1-s) + (0.6s)] \left[\frac{Y_i^{-\eta}}{\bar{Y}^{-\eta}} \right] \tag{4.3}$$

where i equals each of the six household groups, and $\bar{Y}$ is the mean income in Fort Collins, f is the proportion of household income spent on food both at and away from home, s is the percentage of students in each household group, and η is the social aversion to inequality. It is important to note that this is essentially the distributional weighting formula derived in Chapter Two, equation 2.7. This formula utilizes the city's mean income as well as the mean income of each of the six household groups, the values for Fort Collins are presented in Table 4.3 below.

Table 4.3: Mean Incomes Across HH Groups

HH Group	**Income**
HH1	$16,328.95
HH2	$25,977.53
HH3	$32,531.99
HH4	$42,295.44
HH5	$40,409.42
HH6	$71,451.01
TOTAL	$43,243.59

When examining the table it should be noted that the definitions of each household group are based upon earned income alone. The mean incomes shown in Table 4.3 are the gross income earned from the three factors of production in addition to government transfer payments, subtracting out retirement payments since the focus is concerned only with working households.

When the values for η in Table 4.2 and the mean incomes per household group and the mean income for Fort Collins in Table 4.3 are inserted into the distributional weighting formula Equation 4.3, the distributional weighting scheme which results is shown in the following Table 4.4. As one can see, the distributional weight, δ, given to the poorest household group (HH1) grows significantly larger as Fort Collins's aversion to inequality grows which is shown here by geometrically larger values for η. This means that as Fort Collins increasingly abhors inequality in income, a dollar given to a household in HH1 will mean increasingly more to the community's overall social welfare level than a dollar given to a household in HH5 or HH6.

Table 4.4: Distributional Weighting Scheme

	δ when η equals:							
	0.125	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	0.105	0.121	0.163	0.293	0.946	9.885	1079.6	12876321.9
HH2	0.130	0.146	0.182	0.283	0.690	4.080	142.9	175206.4
HH3	0.108	0.114	0.129	0.163	0.261	0.672	4.4	194.2
HH4	0.111	0.113	0.118	0.128	0.152	0.212	0.4	1.6
HH5	0.108	0.107	0.104	0.099	0.089	0.072	0.047	0.020
HH6	0.090	0.084	0.072	0.055	0.031	0.010	0.001	0.000

Following the discussion of Feldstein's commodity weighting method in Chapter Two, one can also see that the larger the proportion of income that a household group spends upon food consumption, f, the larger the resulting distributional weight as demonstrated in Equation 4.3. This relationship follows Engel's Law and serves to re-enforce the larger distributional weights being given to the lower household groups.

It is important to note, however, that these two effects are mitigated somewhat for the lower household groups by the large percentage of students present, s, since this low-income is perceived to be a temporary status for them. Therefore, only the percentage of student households who are assumed to be working ($0.6s$) in the economy is added to the percentage of the household group not composed of students $(1 - s)$.

4.4 Simulation Results

Each simulation has varying effects upon the Fort Collins economy. These effects can be viewed through one of two lenses–the Public Interest or Public Choice approach. The results of each simulation remain the same, but the evaluation of them differs, depending upon which approach is taken. Therefore, the conclusions that one draws must be considered in light of whether Fort Collins chooses to adopt the Public Interest or the Public Choice approach.

4.4.1 Public Interest–Original Residents

The original residents of Fort Collins earn income from the three factors of production: land, labor, and capital. Determining the proportion of each simulation's new income that accrues solely to the original residents requires examining each of these processes in turn.

To begin, one should first examine the income generated by capital. The simulation's expansion will cause a general increase in the demand for the capital in Fort Collins, which is held by the original residents, so one must first multiply the growth rate in the rental rate of capital against the original amount of capital in the city for every sector and housing services group. However, the expansion will also cause an increase in Fort Collins's capital stock beyond its initial value, and some of this new capital is also owned by the original residents. To account for this situation, the amount of new capital, multiplied by the new rental rate for capital and summed across all the productive sectors and housing services groups, must also be added to the initial capital stock owned by the original residents. The sum of these two types of capital is then multiplied by the final returns to capital.

Once this step is taken, one has calculated the total income that stems from capital across all the productive sectors and housing services groups, and from both the original and new levels of capital. This monetary value must now be adjusted so that only the income enjoyed by the original residents is left; therefore, this value is multiplied by the number of original residents as a percentage of the total number of new households in Fort Collins as a result of the simulation's expansion.

This results in the total income from capital that is enjoyed by the original residents of Fort Collins; however, this number now needs to be decomposed into each of the six household groups. This is accomplished by multiplying the value calculated above, by capital income earned as a percentage of the total capital income which goes to each household group.

Since land factor income is treated in a similar fashion within the CGE model, the steps taken to calculate the income accruing to original residents is measurable similar to that from capital.

Calculating labor income enjoyed by original residents follows a different pattern from that described above. The growth rate in wages for all three labor groups is multiplied by the original income level to determine the new level of wages across the city. This income is then decomposed into the six household groups. For example, the lowest household group (HH1) only has workers from the lowest labor group (L1), but HH2 has workers from both L1 and L2. This decomposition is carried out for all six household groups.

Therefore, to calculate any additions to income accruing to the original residents as a result of the simulated expansion, one must sum together the income generated by capital, land, and labor.[1] This resulting change in income will vary across each of the fives simulations. These distributions are summarized in Table 4.5 below.

Each cell in Table 4.5 shows the end results of the above calculations, namely the additional nominal income from land, labor, and capital that accrue only to the original residents of Fort Collins. Shown in each column is the incremental increase

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[1] The CGE model can calculate other variables besides income, such as gross city product or exports.

Table 4.5: Unadjusted Add'l Income to Original Residents (Millions $)

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.182	0.074	0.231	0.127	-0.041
HH2	0.811	0.200	0.921	0.528	-0.139
HH3	1.343	0.993	1.254	0.918	1.359
HH4	0.491	0.401	0.463	0.342	0.546
HH5	1.588	1.694	1.742	1.178	1.202
HH6	2.992	7.157	2.653	2.345	3.512
TOTAL	7.407	10.519	7.263	5.438	6.438

in income for each household group that would be generated by each simulation; therefore, summing down each column yields the total increase in income for the original residents of Fort Collins. A comparison of the totals across the bottom row shows that an expansion of the retail sector would give the original residents of Fort Collins the most nominal income, followed in order by computer manufacturing, manufacturing, high services, and university/junior college.

One may note that the expansion of the retail sector had the largest increase in unadjusted nominal income to HH1 and HH2. The median household group HH3 as well as an upper income group HH5 saw the most benefit from an expansion of manufacturing, while expanding the university/junior college sector increased HH4's income by the largest amount. Even though household group HH4 contains the smallest number of households in Fort Collins, it can be argued that these workers comprise the backbone of the university staff. Finally, the richest household group, HH6,would benefit most from an expansion of the computer manufacturing sector.

An underlying aspect of the changes in income outlined above is a comparison of the relative changes in labor supply and labor demand that drive the changes in labor income. The growth rates in wages paid to each labor group across all five simulations are presented in Table 4.6. These numbers show that when manufacturing expands by 1000 workers, the increase in the demand for labor caused by the industrial expansion

Table 4.6: Growth Rates in Economy-Wide Wages across Labor Groups

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
L1	1.36%	0.14%	1.53%	0.85%	-0.48%
L2	0.86%	0.4%	-0.08%	0.39%	1.55%
L3	0.54%	3.66%	-0.05%	0.44%	0.86%

is greater than the resulting increase in labor for each of the three labor groups. This result becomes apparent due to the wage across all labor groups increasing. The increase in workers can be attributed to both an increase of in-commuters as well as an increase in new households, bringing more workers into the economy. This pattern is repeated for both of the computer manufacturing and high services sectors which all realize an increase in wages across each labor group.

In contrast, the retail sector sees a decline in the growth rate of wages for labor group 2 and 3, thereby implying that an increase in labor supply due to new households moving into the city and any increase in in-commuters is more than offset by an increase in labor demand created by the industrial expansion of the retail sector. Similarly, the university/junior college sector also sees a decline in wages for labor group 1, for arguably the same reasons as the retail sector.

These forces can also be seen in the changes of the number of commuting workers and households converting from nonworking to working. Computer manufacturing has the largest increases in the number of households converting from nonworking to working, the largest increase in the number of new households moving into Fort Collins and the largest number of in-commuters. This means that computer manufacturing increases labor supply the most which exerts a downward pressure on wages, other than for its 1000 new workers added as part of the expansion, who are expected to fall into the HH6 category.

When these figures are adjusted for any increases in prices as a result of the sectoral expansion, the results become even more intriguing. The original total income of original residents, adjusted by the original CPI, is subtracted from the total new income received by the original residents, adjusted by the new consumer price index (CPI) which yields the real additional income that is enjoyed by Fort Collins's original residents. These increases in real income, calculated across all five simulations, are shown in Table 4.7.

Table 4.7: Distributionally Unadjusted Real Income to Original Residents

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.104	-0.029	0.213	0.085	-0.090
HH2	0.396	-0.322	0.868	0.308	-0.383
HH3	0.312	-0.307	1.188	0.379	0.742
HH4	0.032	-0.155	0.489	0.114	0.276
HH5	0.344	0.024	1.874	0.549	0.471
HH6	0.252	3.101	3.005	0.920	1.868
TOTAL	1.441	2.313	7.637	2.355	2.883

The wealthiest household groups (HH5 and HH6) generally see the largest welfare increases in terms of real income across all five simulations. Even so, one must note that the retail simulation provides the original residents with the largest increase in real income by far while computer manufacturing provides the least new income. This result can be explained as a result of the decline in real income suffered by original residents in household groups one through four by an expansion of computer manufacturing. Interestingly, an expansion of the university/junior college sector also results in a decrease in real income for the lowest two household groups. Since real income falls because prices are rising faster than income, one can presuppose that the income earned by lower household groups is not growing as quickly as the CPI changes they face. This situation could be the result of a smaller increase in demand for lower-skilled labor or smaller growth rates for the returns to capital and labor owned by these household groups. When income is translated into real terms, one sees a previously obscured result: the poorest original residents of Fort Collins are now worse off than their initial situation before the expansion of computer manufacturing or the university/junior college sectors.

4.4.2 Public Interest–Distributional Weights

Since two of the simulations result in at least one household group (HH1) being made worse off as a result of a sector's expansion, the question now posed should be if these expansions should ever take place? Is the diminished welfare of the lowest household group offset by the increased welfare of the higher household groups? In other words, would such a situation pass a Kaldor-Hicks compensation-type test?

A preliminary examination of the numbers presented in Table 4.5 suggests that the increased welfare of the upper household groups would indeed offset any decrease in real income for the lower household groups; however, what these tests do not take into account is the city of Fort Collins's aversion to social inequality. Can Fort Collins be so averse to the unequal income distribution that would result from expanding computer manufacturing or the university/junior college sectors that it would choose not to undertake these simulations at all? Moreover, the simulation that would result in the highest increase in real income to original results, expanding the retail sector, would cause the largest increase in income to the wealthiest households, thereby exacerbating an already unequal income distribution. Does this simulation still remain an optimal choice if a community's aversion to social inequality is strengthened?

To answer these questions, an index of social aversion to inequality and distributional weights must be used to closely examine the simulation results presented previously. The results of each simulation will be examined in turn. In Table 4.8, the additional real income accruing to the original residents as a result of an expansion of the manufacturing sector is examined through a comparison of various social aversions to inequality which result in differing distributional weighting schema.

Table 4.8: The Effect of Social Aversion to Inequality upon Simulation Results

Manufacturing Simulation			**distributionally adjusted income when η equals:**						
	Incr Inc	**0.125**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	0.104	0.011	0.013	0.017	0.031	0.099	1.032	112.719	1344428.6
HH2	0.396	0.052	0.058	0.072	0.112	0.273	1.616	56.583	69382.4
HH3	0.312	0.034	0.036	0.040	0.051	0.082	0.210	1.387	60.609
HH4	0.032	0.003	0.004	0.004	0.004	0.005	0.007	0.013	0.050
HH5	0.344	0.037	0.037	0.036	0.034	0.031	0.025	0.016	0.007
HH6	0.252	0.023	0.021	0.018	0.014	0.008	0.002	0.000	0.000
TOTAL	1.441	0.160	0.167	0.187	0.245	0.497	2.892	170.719	1413871.7

One sees here that as the city's aversion to unequal income distribution increases, as shown by its selection of a η value, the weight given to the lowest household groups grows larger as one would expect, given the distributional weight scheme outlined in Table 4.4. However, since all the household groups experience an increase in real income as a result of a manufacturing expansion, there is not a point at which the simulation becomes unfavorable.

Similarly, the income results from an expansion of the high services sector, shown in Table 4.9, follows the same pattern. Here, too, there is no point at which the simulation becomes unfavorable to the original residents since no one is made worse off than before the expansion.

Table 4.9: The Effect of Social Aversion to Inequality upon Simulation Results

HighServices Simulation			**distributionally adjusted income when η equals:**						
	Incr Inc	**0.125**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	0.085	0.009	0.010	0.014	0.025	0.081	0.844	92.135	1098915.0
HH2	0.308	0.040	0.045	0.056	0.087	0.212	1.255	43.946	53886.1
HH3	0.379	0.041	0.043	0.049	0.062	0.099	0.255	1.684	73.618
HH4	0.114	0.013	0.013	0.013	0.015	0.017	0.024	0.047	0.181
HH5	0.549	0.059	0.059	0.057	0.054	0.049	0.039	0.026	0.011
HH6	0.920	0.083	0.077	0.067	0.050	0.028	0.009	0.001	0.000
TOTAL	2.355	0.244	0.247	0.256	0.293	0.486	2.426	137.839	1152875.1

In contrast, there are two simulations in which the lower household groups do see a decrease in their welfare as a result of the sector's expansion. The results of one of these, expanding the computer manufacturing sector, are presented in Table 4.10. For this simulation, only two highest household groups, HH5 and HH6, see any increase in real income. As the value of η grows larger, the relative weight placed on the welfare of these two household groups grows smaller; however, the relative weight of the other household groups increases in relative importance.

Table 4.10: The Effect of Social Aversion to Inequality upon Simulation Results

Computer Manufacturing			**distributionally adjusted income when η equals:**						
	Incr Inc	**0.125**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	-0.029	-0.003	-0.003	-0.005	-0.008	-0.027	-0.282	-30.848	-367,931.1
HH2	-0.322	-0.042	-0.047	-0.058	-0.091	-0.222	-1.312	-45.946	-56,338.5
HH3	-0.307	-0.033	-0.035	-0.039	-0.050	-0.080	-0.206	-1.362	-59.526
HH4	-0.155	-0.017	-0.018	-0.018	-0.020	-0.024	-0.033	-0.064	-0.246
HH5	0.024	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.000
HH6	3.101	0.278	0.259	0.225	0.169	0.096	0.031	0.003	0.000
TOTAL	2.313	0.186	0.159	0.106	0.002	-0.255	-1.801	-78.215	-424,329.4

Most importantly, however, the total change in income eventually becomes negative as the diminished welfare of the lower household groups takes on more importance as Fort Collins's social aversion to inequality grows. In other words, the social welfare function resembles more closely a Rawlsian Maxi-Min SWF so that any increase in income for any household group besides HH1 becomes irrelevant to the computation of the community's social welfare. Only by improving the welfare of HH1 will Fort Collins see an increase in its overall level of social welfare. In this situation, if Fort Collins has even a mild aversion to inequality (i.e., where η equals 2.0 or larger), then it will never consider expanding the computer manufacturing sector since it results in a diminished welfare for its poorest household group.

Similarly, an expansion of the university/junior college sector will also result in a decrease in real income for HH1 and HH2 as shown in Table 4.11. It is interesting to note that while only two household groups see declines in their real income with an expansion of the university/junior college sector, those declines are significant enough that this expansion also begins to fail a compensation test at a relatively low level of social aversion when η equals 2.0.

Table 4.11: The Effect of Social Aversion to Inequality upon Simulation Results

UniJC Simulation			**distributionally adjusted income when η equals:**						
	Incr Inc	**0.125**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	-0.090	-0.009	-0.011	-0.015	-0.026	-0.085	-0.889	-97.14	-1158648.7
HH2	-0.383	-0.050	-0.056	-0.070	-0.109	-0.264	-1.563	-54.72	-67106.6
HH3	0.742	0.080	0.085	0.095	0.121	0.194	0.498	3.294	143.994
HH4	0.276	0.031	0.031	0.033	0.035	0.042	0.058	0.114	0.437
HH5	0.471	0.051	0.050	0.049	0.046	0.042	0.034	0.022	0.009
HH6	1.868	0.168	0.156	0.135	0.102	0.058	0.018	0.002	0.000
TOTAL	2.883	0.270	0.256	0.228	0.170	-0.014	-1.843	-148.44	-1225610.9

Finally, one must re-examine the simulation which brought about the largest increase in real income for original residents, expanding the retail sector. Initially the total real income for the city remains relatively unchanged. This result is because the relatively larger increase in real income for the richest household groups, HH5 and HH6, receives diminishing weight as shown in Table 4.12. This decrease is counterbalanced by an increasing weight being placed upon the real income received by the lowest household groups, HH1 and HH2.

Table 4.12: The Effect of Social Aversion to Inequality upon Simulation Results

Retail Simulation			**distributionally adjusted income when η equals:**						
	Incr Inc	**0.125**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**
HH1	0.213	0.022	0.026	0.035	0.062	0.201	2.101	229.432	2736494.0
HH2	0.868	0.113	0.126	0.158	0.246	0.598	3.541	124.006	152057.0
HH3	1.188	0.128	0.136	0.153	0.194	0.311	0.798	5.278	230.704
HH4	0.489	0.054	0.055	0.058	0.063	0.074	0.104	0.203	0.775
HH5	1.874	0.203	0.200	0.195	0.185	0.166	0.134	0.088	0.038
HH6	3.005	0.270	0.251	0.218	0.164	0.093	0.030	0.003	0.000
TOTAL	7.637	0.790	0.794	0.815	0.913	1.443	6.708	359.011	2888783.4

Eventually, as Fort Collins's social welfare function moves toward a Rawlsian Maxi-Min, the distributional weight placed upon HH1 and HH2 overtakes any decrease in total income caused by the smaller distributional weight being placed upon

HH5 and HH6 and one observes that total income begins to steadily increase. Therefore, even though the richest household groups (HH5 and HH6) and HH3 see the largest un-weighted increase in real income, it is the smaller increase distributed to HH1 and HH2 that ultimately drive the calculation of social welfare as η grows larger.

Ultimately, as Ellis and Rogers (2000) note, the question is not whether to pursue a particular type of economic development, but which type of economic development to pursue in an attempt to be perceived as "pro-business." Therefore, one must also compare each simulation against the others to determine which type of economic expansion will result in the largest improvement to the city's social welfare.

Following Squire and der Tak (1975), an initial social aversion to inequality is assumed to be equal to 1.0. With this assumption, one can examine how real income is distributed to each household group for each of the five simulations to best determine which type of economic development to pursue. This data is presented in Table 4.13. Upon close examination, it becomes apparent that for this particular SWF, retail is the optimal choice for original residents because it results in more than triple the real income for original residents of the next highest total income level.

Table 4.13: For η Equal to 1.0, Results of All Five Simulations Compared

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.031	-0.008	0.062	0.025	-0.026
HH2	0.112	-0.091	0.246	0.087	-0.109
HH3	0.051	-0.050	0.194	0.062	0.121
HH4	0.004	-0.020	0.063	0.015	0.035
HH5	0.034	0.002	0.185	0.054	0.046
HH6	0.014	0.169	0.164	0.050	0.102
TOTAL	0.245	0.002	0.913	0.293	0.170

In comparison, if Fort Collins adopted a more utilitarian SWF where each household group had a more equal distribution weight, then the real income enjoyed by each household group would resemble Table 4.14. With the value of η assumed to

Table 4.14: For η Equal to 0.125, Results of All Five Simulations Compared

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.011	-0.003	0.022	0.009	-0.009
HH2	0.052	-0.042	0.113	0.040	-0.050
HH3	0.034	-0.033	0.128	0.041	0.080
HH4	0.003	-0.017	0.054	0.013	0.031
HH5	0.037	0.003	0.203	0.059	0.051
HH6	0.023	0.278	0.270	0.083	0.168
TOTAL	0.160	0.186	0.790	0.244	0.270

be equal to 0.125, retail remains the optimal choice but the ordering of the simulations by total income does change. Here, an expansion of the university/junior college sector becomes the second best choice and high services falls to third. Because the choice of social aversion yields a SWF that more closely resembles a Bethamite/Utilitiarian SWF, the increase in income to HH6 under a university expansion more than offsets any decline in real income to the lowest two household groups.

Table 4.15: For η Equal to 16, Results of All Five Simulations Compared

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	1,344,428.6	-367,931.1	2,736,494.8	1,098,915.0	-1,158,648
HH2	69,382.4	-56,338.5	152,057.0	53,886.1	-67,106
HH3	60.6	-59.5	230.7	73.6	143.9
HH4	0.050	-0.246	0.775	0.181	0.437
HH5	0.007	0.000	0.038	0.011	0.009
HH6	0.000	0.000	0.000	0.000	0.000
TOTAL	1,413,871.7	-424,329.4	2,888,783.4	1,152,875.1	-1,225,610

In contrast, Fort Collins could adopt a more Rawlsian SWF in which the income accruing to the richest households is weighted much less than that going to the poorest household groups. This situation resembles the data presented in Table 4.15 where the larger income totals reflect the much larger distributional weight given to HH1. It is important to note that the results presented in Table 4.15 appear very large for HH1 and HH2 due to the very large distributional weight dictated by $\eta = 16$ as shown in Table 4.4. As would be expected, expansion of computer manufacturing and the university will result in an overall decrease in total income for the original residents, largely because they both see declines in real income for HH1 and HH2. However, for the remaining three simulations resulting in increased welfare, retail still remains the optimal choice for the original residents of Fort Collins.

4.4.3 Public Interest Extended to All Residents

How does this result compare to the optimal choice that would be made if the welfare of all the eventual residents of Fort Collins were considered instead of merely the original residents? Would the optimal simulation choice differ from that chosen by the original residents? These questions can best be answered by examining not the income enjoyed by original residents but rather the total new income created as a result of the simulated expansion. Also of interest is the number of new residents drawn to Fort Collins by the expansion as well as the number of in-commuters employed in Fort Collins but living elsewhere.

A large influx of new residents that are not receiving correspondingly large incomes can actually lead to a decrease in the city's mean income. In addition, depending upon the speed of the city's expansion, the new residents may or may not be welcomed as a boon to the local economy. Particularly wages cannot adjust to keep up with the new increased level of prices caused by the influx of new residents. It is also important to note which simulation will yield the largest number of low income residents vs. high income residents. These results are shown in Table 4.16.

Table 4.16 demonstrates the number of new residents each simulation type would provide to Fort Collins. An expansion of the computer manufacturing sector would provide the largest total increase in the number of new households while expanding the high services sector would provide the least. Interestingly, the computer manufacturing sector also provides the highest percentage of low income households, 23.84% of the total new households created by its expansion while expanding the retail sector would provide the smallest percentage of low income households with only 18.42% of the total new households created by its expansion. The composition of the new households created is important since low income households are perceived as consumers of larger amounts of public goods and services than higher income households; however, under progressive income tax or proportional property tax systems, these households would pay smaller taxes to the local and county governments. Higher income households also demand public goods and services but the public goods consumed are counterbalanced by the higher tax revenues collected from these households. This increase in demand for local public goods and services could potentially cause a strain upon the local government of Fort Collins.

Table 4.16: Number of New Resident Households

	Manuf	**%**	**Cmanf**	**%**	**Retail**	**%**	**HighS**	**%**	**UniJC**	**%**
HH1	105	20.67	242	23.84	86	18.42	66	20.43	76	19.9
HH2	78	15.35	152	14.98	74	15.85	52	16.1	60	15.71
HH3	174	34.25	350	34.48	165	35.33	111	34.37	135	35.34
HH4	24	4.72	43	4.24	23	4.93	15	4.64	18	4.71
HH5	74	14.57	127	12.51	74	15.85	47	14.55	55	14.4
HH6	53	10.43	101	9.95	45	9.64	32	9.91	38	9.95
TOTAL	508		1015		467		323		382	

Similarly, each simulation will affect the number of workers employed within the city of Fort Collins. This feature of the expansion will help determine the new mean income of the city as well. If the expansion pulls workers from the surrounding area rather than relocating households into the community, then the income of Fort Collins will increase by a larger percentage than its population, resulting in an increase in the community's mean income. This situation could ultimately impact the calculation of distribution weights since the mean income of each household group is normalized by the city's mean income. The changes in the number of in-commuters are summarized in Table 4.17.

Table 4.17: Number of In-Commuters

	Manuf	Cmanuf	Retail	HighServ	UniJC
LL1	34	-12	52	23	-24
LL2	33	-7	-6	13	91
LL3	6	120	-2	9	24
TOTAL	73	101	44	45	91

It is important to note that an expansion of the computer manufacturing sector would lead to the largest total increase in the number of in-commuters while expanding the retail sector would lead to the smallest total increase. However, there are fewer lower-income workers commuting into Fort Collins with an expansion of the computer manufacturing sector while there are fewer higher-income workers commuting into Fort Collins if the retail sector expands. It is suspected that the reason behind these decreases is that there are fewer jobs for these in-commuters to fill since it would not make sense to commute into a city without the benefit of employment.

When one does not isolate the welfare of original residents from the welfare of all the eventual residents of Fort Collins (new residents plus the original residents), the optimal expansion choice now changes to favor computer manufacturing; as can be seen, examining the incomes enjoyed by all residents under all five simulations are shown in Table 4.18.

Table 4.18: Total Real Income to All Residents as Result of Simulation

	Manuf	Cmanuf	Retail	HighServ	UniJC
HH1	19.741	20.333	19.364	19.194	19.000
HH2	107.926	108.485	107.228	106.578	105.867
HH3	278.841	283.156	273.602	272.131	274.630
HH4	129.794	130.448	127.823	127.436	128.319
HH5	358.909	363.039	353.079	351.616	352.778
HH6	802.885	837.368	788.587	789.775	792.886
TOTAL	1,698.096	1,742.829	1,669.682	1,666.731	1,673.481

Interestingly, computer manufacturing results in the largest increase in income for all residents of Fort Collins, while the optimal choice of the city's original residents, retail, results in the second smallest increase in income for all residents. This situation makes it apparent that the benefits that stem from expanding computer manufacturing are enjoyed largely by the new residents moving into Fort Collins while the benefits of expanding the retail sector are enjoyed largely by the original residents of Fort Collins. Even when these results are adjusted with distributional weights, the conclusion still holds that while the original residents would choose retail expansion over computer manufacturing, the new total number of residents would instead choose computer manufacturing.

4.4.4 The Public Choice Approach

In contrast to the Public Interest approach, the Public Choice approach seeks to maximize the local government's welfare by optimizing the tax revenues collected by the city of Fort Collins rather than explicitly targeting social welfare as defined by a social welfare function. The tax revenues collected under each simulation will necessarily differ as each sector has different patterns of intra-industry consumption and varying levels of sales to Fort Collins residents.

These differences manifest themselves through a combination of six separate taxes. The initial level of tax revenues and the change in tax revenues collected under each of the five simulations are summarized in Table 4.19. Here the city's general fund (CYGF) is the sum of all tax revenues after subtracting out payments to federal, state, and county governments. The city of Fort Collins receives a fixed percentage of the county property tax revenues (CNPRP) collected by Larimer County, Colorado. Therefore to calculate the general fund total requires including the city's proportion of county property taxes as well.

Upon closer examination, it becomes apparent that an expansion of computer

Table 4.19: Changes in Tax Revenues Collected

		Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
	Initial	Change	Change	Change	Change	Change
CYORV	33.395	1.469	2.703	0.560	0.476	0.603
CYUSE	7.696	1.107	1.742	0.315	0.136	-0.013
CYSTX	38.200	1.095	1.737	2.821	0.398	0.543
CYNVT	0.100	0.012	0.005	0.001	0.000	0.000
CYPRP	6.940	0.122	0.187	0.070	0.045	0.046
CYGF	86.343	3.806	6.375	3.767	1.054	1.180

manufacturing results in the largest overall increase in tax revenues while an expansion of high services results in the smallest overall increase. This result is consistent with what was discovered using the Public Interest approach as high services consistently ranked last or next to last under that ordering as well. Therefore, using the Public Choice approach to evaluate the benefits of economic development, the city of Fort Collins would best maximize its welfare by choosing to expand the computer manufacturing sector.

Given the increased competition in northern Colorado for sales tax revenue, it is interesting to note that the optimal selection using the Public Interest approach, a retail expansion, would collect the largest sales tax revenues of any of the simulations. However, one should remember that the sales tax is inherently regressive in that each household pays the same amount in taxes, regardless of the household's income level. In other words, a sales tax of $1,000 is a greater percentage of a household's income in HH1 than in HH6. Therefore, if the city government decided to pursue maximizing a particular type of tax revenue such as sales taxes, then the Public Choice approach would advocate pursuing a type of economic development that could be perceived as regressive and perhaps exacerbating the existing income distribution.

To better understand how an expansion in any of these five sectors might affect such issues, one must first calculate the average taxes collected per household to better illustrate the tax burden faced by the average household in Fort Collins. If the city's tax revenues increased but its population remained constant, then the average taxes collected per household (the perceived tax burden) would increase; in contrast, if tax revenues and the population increased in the same proportion, then the average amount of taxes collected per household would remain constant as perceived by the original residents.

From the public policy maker's perspective, it could be argued that the tax burden faced by the average household in Fort Collins should remain approximately the same; otherwise, the original residents of Fort Collins may perceive their welfare diminishing. Table 4.20 illustrates each household group's share of the overall taxes collected across each simulation. As might be expected, the higher income household groups shoulder a relatively large proportion of the overall tax burden; however, it should be noted that HH3 also pays a significantly larger proportion than the lowest two household groups across all simulations.

Table 4.20: Household Group's Share of Tax Revenues Collected by City (Mil of $)

	Initial	**Manuf**	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	7.513	7.978	8.412	7.941	7.685	7.708
HH2	11.185	11.703	12.054	11.702	11.341	11.360
HH3	19.309	20.291	21.007	20.285	19.624	19.680
HH4	6.416	6.667	6.815	6.669	6.473	6.481
HH5	18.498	19.232	19.655	19.246	18.671	18.692
HH6	23.422	24.262	24.753	24.261	23.582	23.600
TOTAL	86.343	90.132	92.697	90.105	87.376	87.522

However, Table 4.20 does not give a completely accurate picture of the tax burden since the number of households within each group varies and thereby affects the results presented. This concern can be addressed by examining growth rates which allow one to make comparisons across simulations, as seen in Table 4.21. Notice that for the high services expansion, the tax burden's impact is fairly evenly distributed across the highest and lowest two household groups while the majority of the burden is shoulder by HH3. The tax burden under a university/junior college expansion follows a similar pattern. In contrast, the remaining three simulations see the higher income household groups shouldering a larger proportion of the tax burden.

Table 4.21: Growth Rate of Household Group's Tax Burden Across Simulations

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.54%	1.04%	0.50%	0.20%	0.23%
HH2	0.60%	1.01%	0.60%	0.18%	0.20%
HH3	1.14%	1.97%	1.13%	0.36%	0.43%
HH4	0.29%	0.46%	0.29%	0.07%	0.08%
HH5	0.85%	1.34%	0.87%	0.20%	0.23%
HH6	0.97%	1.54%	0.97%	0.19%	0.21%
TOTAL	4.39%	7.36%	4.36%	1.20%	1.37%

Interestingly, the lowest household group under an expansion of the computer manufacturing sector sees a higher tax burden than HH2. This result corresponds with the conclusion found using the Public Interest approach when HH1's real income was seen declining with an expansion of the computer manufacturing sector. In this sense, an expansion of computer manufacturing cannot be perceived as beneficial to the least fortunate households in Fort Collins, no matter which evaluation method is used.

4.5 Alternative Simulations and their Results

4.5.1 Increasing Domestic Production for Export

The five simulations attempted here represent only one alternative method of stimulating the Fort Collins economy. For this research, each simulation explicitly increased employment in the targeted industry by 1000 workers. This expansion was created by an increase in the world price for each targeted industry, causing domestic production in Fort Collins to also increase. This added production requires increased demand for labor, resulting in 1000 additional jobs.

However, there are alternate methods of increasing employment in Fort Collins. Rather than increasing the world price for each of the five industries, one could instead increase domestic production for export instead. This approach might be perceived as desirable since increasing the world price could potentially result in This approach might be perceived as desirable since there is a low probability that the world price would increase without the domestic price in Fort Collins also increasing, particularly since Fort Collins is a small player in the overall world economy. When domestic production for export is increased to cause employment in the targeted industry to increase by 1000 workers, one finds that the ultimate conclusions of the Public Interest and Public Choice approaches do not change. Indeed, the incremental additions in income to the original residents produced by either simulating the world price or domestic production for export are very similar as shown in Table 4.22. For either simulation type, under the Public Interest Approach, the original residents will choose to increase the retail industry.

Table 4.22: Additional Real Income to Original Residents as Result of Simulation

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.104	-0.029	0.203	0.085	-0.09
HH2	0.396	-0.321	0.789	0.308	-0.383
HH3	0.312	-0.307	0.843	0.379	0.741
HH4	0.032	-0.155	0.293	0.114	0.275
HH5	0.345	0.024	1.304	0.549	0.471
HH6	0.253	3.1	1.743	0.92	1.867
TOTAL	1.442	2.312	5.173	2.356	2.883

Similarly, when the incomes of the new residents moving into Fort Collins as a result of the simulation are considered, the two simulations also produce similar results. These results are presented in Table 4.23. As can be seen, when all the residents are considered using the Public Interest approach, the simulation type does not matter, since an expansion of the computer manufacturing industry results in the largest increase in income.It is important to note that the average incomes for each of the six household groups does not change with the simulation type; therefore, the distributional weighting does not differ between the two simulations.

Table 4.23: Total Real Income to All Residents as Result of Simulation

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	19.74	20.333	19.321	19.194	19
HH2	107.926	108.485	106.892	106.579	105.867
HH3	278.84	283.155	272.393	272.132	274.629
HH4	129.793	130.447	127.451	127.436	128.319
HH5	358.907	363.038	351.881	351.617	352.778
HH6	802.881	837.363	786.314	789.778	792.884
TOTAL	1698.087	1742.822	1664.253	1666.736	1673.476

In a similar manner, the type of simulation does not yield differing results when using the Public Choice approach. As is shown in Table 4.24, the computer manufacturing sector still results in the largest increase in the city's general fund (CYGF) when compared to the other industries. Hence, the choice of whether to increase the world price of an industry or to increase domestic production for export does not appear to unduly influence the ultimate conclusions of either the Public Interest or Public Choice approaches.

Table 4.24: Changes in Tax Revenues Collected

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
CYORV	1.47	2.7	0.52	0.48	0.6
CYUSE	1.11	1.74	0.33	0.14	-0.01
CYSTX	1.1	1.74	2.96	0.4	0.54
CYNVT	0.01	0	0	0	0
CYGF	3.79	6.35	3.86	1.03	1.18
CNPRP	0.98	1.51	0.46	0.36	0.37

4.5.2 Increasing Employment by Equal Percentages

Another way to increase employment for a particular industry is to increase employment by an equal percentage of workers, rather than by an equal number. This particular method allows for an easy cross-industry comparison since one is examining an equal percentage's effect; however, this method is influenced by the initial size of the industry's employment level. The initial employment level of each of the targeted sectors is shown in Table 4.25. The high services sector has the largest number of workers employed across each of the three labor groups, followed by the university/junior college and manufacturing sectors. Computer manufacturing employs the fewest individuals while the retail sector employs approximately 500 more workers to make it second smallest in terms of employment. Increasing each sector's employment by 10% would require a range from 846 new workers in the high services sector to only 378 more workers in the computer manufacturing sector.

Table 4.25: Initial Employment Level

Industry Sector	**L1**	**L2**	**L3**	**Total**
Manufacturing	2932	2462	613	6007
Computer Manufacturing	340	1247	2197	3784
Retail	3641	474	93	4208
High Services	4968	2559	932	8459
University/JC	675	4633	1089	6397

As one might expect, the varying number of newly employed workers caused by such an expansion have very different effects from the previous two simulations through which an equal number of workers was added to each sector. The effect of a 10% increase in employment upon the income of the city's original residents is presented in Table 4.26. The large number of new employees in the high services sector contributes to a large increase in additional income for the city's original residents, but surprisingly, the increase in original resident's income is larger with an expansion of the university/junior college sector. This result can be traced to the employment pattern of the university/junior college sector since over half of the sector's workers are in either labor group 2 or 3 while the high services sector employs the large majority of its workers in labor groups 1 and 2.

Table 4.26: Additional Real Income to Original Residents as Result of Simulation

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	0.061	0.052	0.149	0.22	0.163
HH2	0.532	0.424	0.844	1.103	0.86
HH3	0.53	0.409	1.134	1.448	1.921
HH4	0.134	0.068	0.401	0.495	0.67
HH5	0.555	0.525	1.682	2.137	2.433
HH6	0.812	1.835	3.907	4.662	5.836
TOTAL	2.624	3.313	8.117	10.066	11.884

Interestingly, when the focus is widened to include the city's new residents as a result of each expansion, the results are identical to the other two simulation types explored above. The additional new income accruing to all the residents of the city is shown in Table 4.27. The income generated for all the city's residents is again highest with an expansion of the computer manufacturing sector, even when the industry's employment is only expanded by 10% of its initial level. The lowest income generated by an industrial expansion is again retail which matches the results of the other two types of simulations as well.

Table 4.27: Total Real Income to All Residents as Result of Simulation

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
HH1	19.243	19.12	18.938	19.095	18.849
HH2	106.493	105.909	105.863	106.256	105.381
HH3	273.818	272.468	270.403	271.29	271.804
HH4	128.256	127.657	127.039	127.219	127.503
HH5	354.1	352.959	350.454	350.926	350.777
HH6	792.391	799.392	783.588	787.839	787.304
TOTAL	1674.301	1677.506	1656.286	1662.625	1661.618

When distributional weights are introduced into the evaluation using the Public Interest approach, the preferred industrial expansion varies by the city's level of social aversion. When the choice of social aversion is 1.0 or lower, then the higher incomes generated by the university/junior college sector's expansion overshadow any income gains brought by the increased employment of the lower income household groups under the high services sector. However, once the city's level of social aversion climbs, the income accruing to the lower income household groups becomes sufficiently large to overcome the income of the higher income household groups. This situation results in a change in the preferred industrial expansion from the university/junior college sector to the high services sector.

From an alternate perspective, the Public Choice approach, there are also differences between increasing employment by an equal percentage as opposed to an equal number. The taxes collected by the city under each industrial expansion are summarized in Table 4.28. As one can see, the city's general fund is largest when the manufacturing industry expands its employment by 10% of its original level, followed closely by computer manufacturing. The smallest increase in tax revenues occurs when the university/junior college sector's employment is expanded by 10%, a reversal of the preferred expansion under the Public Interest approach.

Table 4.28: Changes in Tax Revenues Collected

	Manuf	**Cmanuf**	**Retail**	**HighServ**	**UniJC**
CYORV	0.82852	0.90083	0.24519	0.39651	0.38002
CYUSE	0.61692	0.55185	0.10996	0.11047	-0.0103
CYSTX	0.62498	0.59693	1.05581	0.33195	0.34198
CYNVT	0.00717	0.00153	0.00031	0.00014	-0.0003
CYGF	2.13787	2.10753	1.44534	0.85918	0.73976
CNPRP	0.56472	0.50849	0.2893	0.30195	0.23144

As has been shown, the method of simulation, provided that it results in an equal change in the number of workers employed, does not have much effect upon the simulation's results. Increasing an industry's employment by 1000 workers by increasing domestic production for export yields the same results as shown earlier when employment was increased by increasing the world price for a given industry. Furthermore, when evaluated using the Public Interest approach, one sees that the original residents see larger welfare gains from an expansion of the retail industry while all the city's residents would see larger welfare gains from an expansion of the computer manufacturing industry. Similarly, the Public Choice approach finds that the city's tax revenues are increased the most by an expansion of the computer manufacturing sector.

In contrast, when each industry is increased by an equal percentage of its original employment level, the results are driven by each industry's original employment. The large number of workers overall in the high services sector yields the largest increase in workers; however, the largest increase in original residents' incomes stems from the difference in employment patterns among the industries. While the high services industry does employ the largest number of workers, the computer manufacturing and university/junior college sectors employs the largest portion of workers in labor groups 2 and 3. Thus, the largest increase in original residents' incomes comes from an expansion of the university/junior college's employment by 10This pattern of employment also drives the distributionally adjusted incomes as well since as the city's social aversion climbs, the higher incomes brought by the university/junior college sector are overshadowed by the incomes earned by the lower household groups with an expansion of the higher services sector.

Therefore, the sensitivity of the research's conclusions does not depend upon the how the expansion is created, but rather depends upon the number of workers included in the expansion.

Chapter 5

Conclusions and Extensions of the Research

The above analysis demonstrates the advantages and feasibility of using contrasting decision-making models to calculate the benefits to a community from economic development. In Chapter Two, an examination of the literature revealed that concepts from public welfare economics, namely distributional weights, can have important impacts on regional economics. Specifically, a distributional weighting scheme which utilizes a community's heterogeneity, as expressed through its social aversion to inequality, is developed and presented as the Public Interest approach. A contrasting approach drawn from the public choice literature, the Public Choice approach, does not incorporate specific heterogeneity in its focus upon development's effect upon tax revenues.

The examination of economic development's effect upon a community is best performed with a CGE model. Chapter Three briefly reviews the CGE literature to show that general equilibrium modeling best shows the differences between the two approaches developed in Chapter Two. Of particular interest is the CGE model's ability to differentiate between a community's original residents and the eventual new residents who migrate in as a result of the economic expansion. The general advantage of the CGE model is further enhanced by the unique, highly localized data used which makes the model used particularly apt for examining these issues.

Finally, Chapter Four used the CGE model described in Chapter Three to evaluate, by using the two decision-making methods developed earlier, the effect of five separate industrial expansions upon the city of Fort Collins, Colorado. The results reveal significantly different outcomes between the two approaches, particularly in the selection of what type of economic development a community should pursue. This, dyad of decision-making models has an important place and potential role to play in policy consulting and economic impact analysis. There are many issues that communities face that are unique and the decision-making method that a community adopts should be constructed in a way that captures that fact. Both approaches used in this study can aid the policy maker at the city or town level in making policy decisions by providing a clear process through which the economic benefits from development can be examined more closely. There is a clear need for this type of analysis since cities will continue to pursue economic development and will continue to need a method of evaluation. The methodology outlined above provides such a basis for sound analysis.

5.1 Social Aversion Indicators

When choosing the appropriate index to capture a community's aversion to an unequal income distribution, there are several factors that must be considered, chief among them the initial income distribution facing the community. If a significant proportion of its population is of lower income, then it can be argued that a city would have a higher aversion to social inequality in its evaluation of economic development projects. An economic development project that would exacerbate an already unequal income distribution would not be considered a favorable outcome. Conversely, if a community enjoys a relatively equitable income distribution, then it might have a lower aversion to social inequality. In this particular case, one must ask if the equitable income distribution is naturally occurring or is the result of strenuous redistribution efforts on the part of the community itself. To perform this comparison, there are several measures traditionally used to capture income inequality. These include, but are not limited to, Atkinson's Inequality Index, the Lorenz Curve and its related Gini coefficient, Robin Hood indices, as well as Theil's Entropy Index.

Another possible indicator of a community's social aversion to inequality is the composition of its public spending. A community which spends a higher proportion of its income on public goods, goods which arguable are disproportionately enjoyed by lower income residents, can be accurately characterized as one choosing a higher level of social aversion to inequality, compared to a community which does not spend an equivalent level of income on its lower income residents.

One method that can be utilized to ascertain this comparison is the minimum requirements method. Using this approach, one community would be labeled as the median in its provision of local public goods for the poor for communities of its relative size and related characteristics; this level of provision would be considered the minimum level required and would correspond to a social aversion to inequality where η equals 1.0. Having defined the comparison level, an individual city's local public goods provision is then compared to the provision level of the median city as shown

$$MRR = G_i/G^* \tag{5.1}$$

where MRR is the minimum requirements ratio of local public goods provision, G_i is the individual city's local public goods provision, and G^* is the median city's local public goods provision. If an individual city's provision was greater than the median city's provision, then its MRR would be greater than 1.0. Likewise, a community whose local public goods provision is less than the median would see an MRR of less than 1.0. In this way, the social aversion to inequality is tied to the city's MRR. There is obviously some subjectivity in the social aversion index choice on the part of the analyst; however, these variables can be perceived as indicators of an appropriate social aversion choice for an individual community.

5.2 Extensions

While the model's results are not inconsistent with the theoretical framework presented, there is room for improvement. A logical extension to consider would be an *ex ante* determination of distributional weights which are then incorporated into the model. This step implies that the CGE model would be augmented with a particular distributional weighting scheme and the model's results are then directly influenced by that scheme. This greater level of specificity would provide results more closely tailored to a city's individual demands; however, it would not provide for the array of results made possible by the wide choice of distributional weight as the model currently exists. It could be argued though, that an individual city would already have a specified social welfare function and would not need an array of results for an SWF that does not closely match its perceived aversion to inequality.

Unfortunately, the CGE model used only yields a short-run approximation of the expected benefits from economic development. As Bartik (1991) points out, however, current economic development can permanently alter a city's long-run economic development through hysteresis. Therefore, a CGE model that can mimic the long run implications of an economic development decision would be of great assistance to the city in terms of making that economic development decision.

Additionally, communities do not pursue economic development in a vacuum; therefore, the possible interrelationships between communities are an area that should be explored as well. Due to the increasing mobility of capital and labor, communities must now consider the possibility of capital flight and labor flows in their taxation decisions. A community's unusually high tax on capital or another community's enticingly low capital tax rate can lead to capital outflows and a diminished development potential.

Both models would provide a more realistic evaluation of any benefits from economic development if they included a constraint that linked their optimization strategies to the behavior of other competing communities. Firms can be seen as having a demand for income generated within a community's jurisdiction which is inversely related to the "price" in the form of tax liabilities paid to the government. There are several factors which can influence the elasticity of this demand such as the size of the government in question. The larger the government entity in question, the more difficult it becomes to move out of its jurisdiction. Since many communities are relatively small compared to state and national governments, this size differential puts communities at a disadvantage in their pursuit of tax revenues.

Another consideration is the mobility of the resources in question. The greater the resource's mobility, the more responsive the resource owner is to increases in "price" in the form of higher tax liabilities. Capital has become increasingly more mobile as transportation costs have decreased. These lower transportation costs are largely attributable to both advances in technology and attempts at de-regulation, thereby triggering competition and raising the overall level of efficiency. Additionally, the size of capital required for production has become smaller. For example, computers and information technology have lowered the total costs of capital by making it lighter and smarter. Finally, advances in communication have also increased capital's mobility by making it easier and faster to move capital than ever before.

In such an environment, the owners of capital could move it across communities (states and even countries) to take advantage of lower tax rates. Theoretically, equilibrium could be recognized as when capital ceases to follow lower tax rates. The rate of return before- and after-tax should be equal across communities. In reality, there will still be some barriers to movement and there will still be some tax differentials; however, there will be faster adjustments as any distortion is amplified so that capital can take advantage of the differential.

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