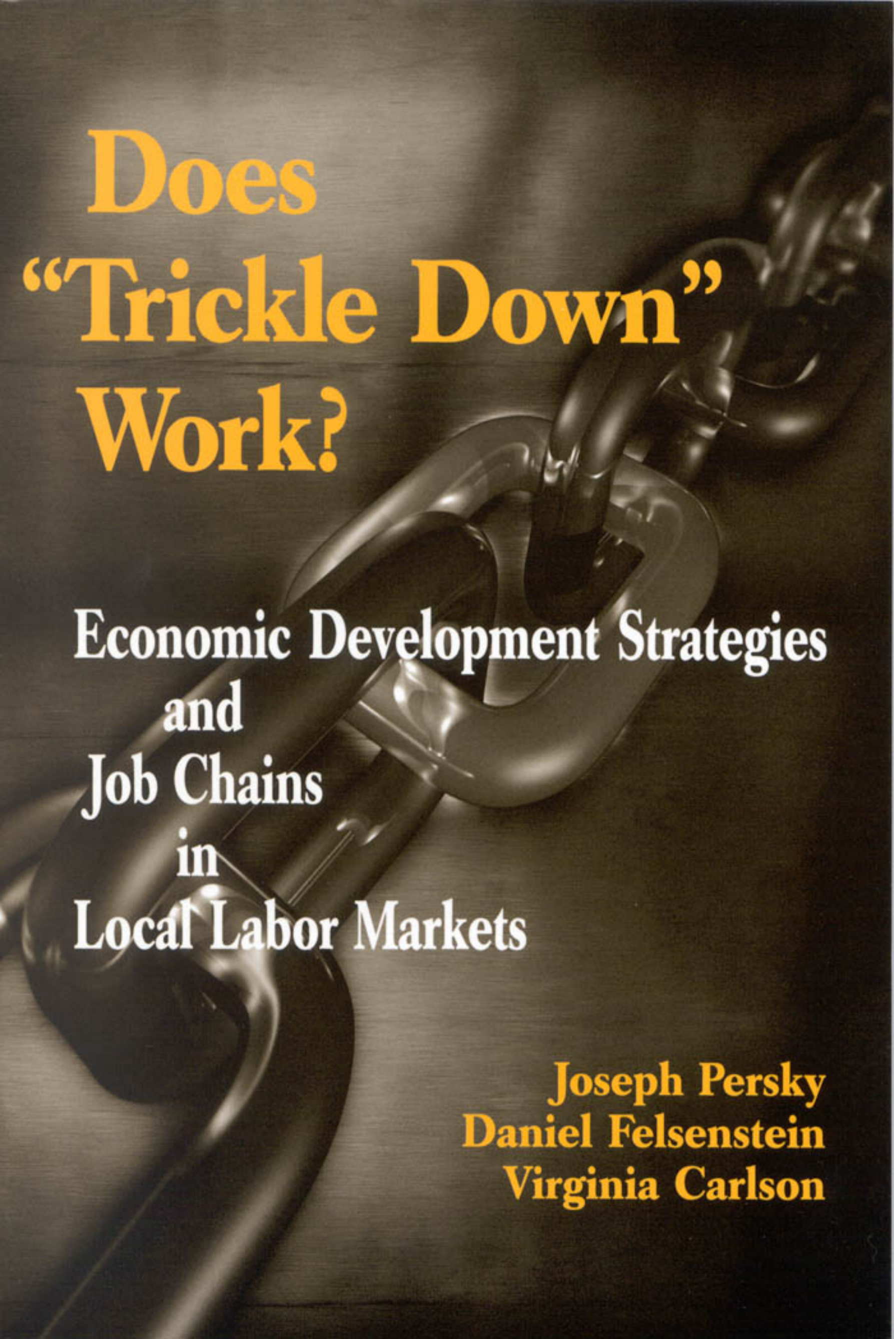

Does "Trickle Down" Work?

Economic Development Strategies and Job Chains in Local Labor Markets

Joseph Persky
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Acknowledgments

This effort grew out of our real world frustrations in measuring costs and benefits of economic development projects. Our work with Wim Wiewel on the Chicago Economic Development Evaluation Model in the early 1990s first alerted us to the need for both new theory and new empirics in the measurement of labor's opportunity cost. That project and the impact model that it spawned increased our awareness of the gap between the demands for showing the real value of economic development projects and the hands-on tools available for effecting such evaluations. It also brought to our attention the need for more rigorous *ex ante* (prospective) evaluation techniques. Hitherto these had been characterized by overly optimistic, and often simplistic, approaches conducted on a short time frame and with a hair-string budget. These frustrations with the then state of the art were the main catalyst for this volume.

The University of Illinois at Chicago (Great Cities Institute and Department of Economics) has supported this project in a number of ways as has Hebrew University. Together, they have greatly facilitated our geographically challenged collaboration. Both institutions provided the resources and facilities that allowed for reciprocal trans-Atlantic visits, long-distance phone calls, and the need for face-to-face contact when electronic communication proved insufficient. The ideas presented here have been aired in various stages of their evolution, and we thank the participants in four or five Regional Science Association meetings and a number of seminars on three continents for their comments and input.

We are most grateful to the W.E. Upjohn Institute for Employment Research for backing this project. Timothy Bartik and Randall Eberts have long-standing interests in many of the labor market issues discussed here, including the central question of whether trickle down works. Their comments have been most useful throughout. Four anonymous reviewers helped us fine-tune much of the analysis and generally contributed to a more coherent product. They and Kevin Hollenbeck at the Upjohn Institute alerted us to the need for striking a happy balance between the analytical demands of a volume such as this and the requirement for keeping it as practitioner friendly as possible. This was a challenge that we hope we have met. But, of course, neither they nor any of our other colleagues should be blamed for our ongoing obsession with job chains.

1

Introduction

SURFACE RIPPLES AND VERTICAL CHAINS

Jobs, jobs, jobs. Across the country, state and local economic development programs have promised to deliver jobs. It may seem self-evident that more jobs are better than less; yet, one can be sympathetic and still ask what a job is actually worth. Who gets new jobs in an area? Wouldn't many of those workers be employed anyway? To what extent do benefits spill over to others in a community? Do gains trickle down to improve the welfare of those most in need?

These are basic questions. Answering them requires both solid theory and well-calibrated empirical estimates. Too often these questions are simply left unaddressed. More often they are answered in only vague terms. Yet, these are crucial issues for evaluating job creation efforts. Gross job counts tell us very little about the efficiency of job generation. In fact, "head counting" can be highly misleading, celebrating high levels of turnover while saying very little about the gains that actually stick in the local economy.

The purpose of this volume is to explore a new framework for evaluating economic development projects. This framework, *the job-chain approach,* makes far more transparent both the potential justifications for economic development subsidies and the very real limitations that surround such activities. It also allows us a more accurate account of job creation and avoids many of the criticisms that accompany the "numbers games" often associated with economic development evaluations. Charlatan estimates only undermine the credibility of economic development programs, thereby bolstering the inherent reluctance of local officials to submit their programs to evaluative scrutiny.

Economic development projects create new jobs. Each new job can generate a job chain if and when it is filled by an employed worker who leaves behind another vacancy. In turn that vacancy may attract a worker from yet a third job and so on down the chain. Chains can be long or chains can be short. Chains end when an unemployed worker, someone previously out of the labor force, or an in-migrant to the labor market takes a vacancy. Fundamentally we claim that the proper evaluation of an economic development project requires an accounting of the welfare gains made along the various job chains generated by that project.

Job chains are the mechanisms for observing and measuring "trickle down." Attempting to answer the "Does Trickle Down Work?" question yields substantially more than a simple numerical estimate of how low-income workers are affected by typical economic development programs. The job-chains model developed in this book presents new insights into local economic development evaluation and strategy.

In the first instance, the job-chains model revisits and reinterprets the concept of the job multiplier. Standard employment multipliers focus exclusively on horizontal multipliers—increasing demand for locally produced goods and services. The job-chains model alerts us to the existence of vertical multipliers—links that work through job vacancies created by job changers. The method for estimating job-chain length is similar in spirit to conventional input–output analysis. Thus, the analytic roots of this volume should not be foreign to informed practitioners, policymakers, and researchers. What is new, however, is the application of this analytic framework to understanding labor market dynamics.

Second, the job-chains model forces a reconsideration of the welfare value of employment creation. The benefits of job creation come from the job chains that are initiated in local labor markets. This volume develops an intuitive technique for evaluating those benefits. The mechanics of job chains result in these benefits spreading more broadly across the local population than the original new jobs that created them.

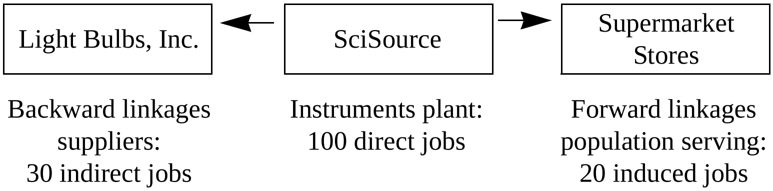
Third, adopting a job-chains perspective affords new insights into labor market dynamics. On the one hand, local employment growth has often been viewed as initiating a mechanistic process whereby a pool of workers is matched to a pool of jobs. In these accounts scant attention is given to the role played by prices in general and wages in particular. Alternatively, pure market models of wage adjustment, whereby new jobs promote the emergence of a new price structure and markets clear quickly, often present an overly sterile picture of what is essentially a dynamic choice process in which workers actively build career paths and firms explore a range of options in training, promoting, and recruiting labor. The job-chains model complements these approaches by introducing individual preferences and behavioral probabilities into job choice.

The job-chains approach is likely to be of utility to a range of audiences in the economic development community. For the practitioner, the job-chains model presents a powerful tool for assessing the opportunities and constraints of subsidizing job creation. For the policymaker, adopting a job-chains perspective sheds new light on many time-honored policies for promoting economic development, such as targeting, industrial recruitment, and people-based strategies. For the researcher, accounting for trickle down when evaluating job creation presents a series of analytical challenges that can be met within the framework of the job-chains model.

MULTIPLIERS IN PRACTICE: A HYPOTHETICAL CASE STUDY

To clarify the central issues, consider the following case study, a hypothetical example drawing on our experiences in the city of Chicago. A major scientific instrument manufacturer, SciSource, already has two plants in the Midwest but none in Chicago. The company approaches the city with a proposal to build a small production facility which will specialize in a new type of spectrophotometer. This plant is expected to employ 100 workers. SciSource has hired a consultant who calculates that using a job multiplier of three (as long suggested by the Illinois Chamber of Commerce), every new job in SciSource will bring two more jobs to the city. The city in turn consults with its own economic development staff, who use the U.S. Department of Commerce's Regional Input–Output Modeling System (RIMS II) to reach the conclusion that SciSource's claims are substantially overstated. A more appropriate multiplier would be 1.5. Both of these estimates are traditional horizontal multipliers (Figure 1.1).

Figure 1.1 Horizontal Multiplier


Light Bulbs, Inc.
SciSource
Supermarket Stores
Backward linkages suppliers: 30 indirect jobs
Instruments plant: 100 direct jobs
Forward linkages population serving: 20 induced jobs

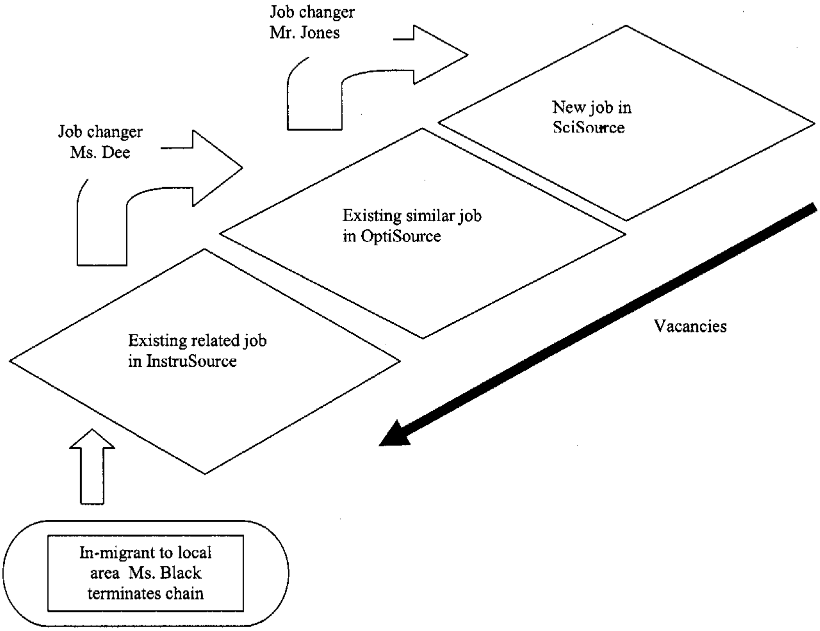
The traditional horizontal multiplier includes in addition to new direct jobs in the new facility, new indirect jobs in supplying businesses and new induced jobs in those businesses providing goods and services to workers with more wages to spend.

Horizontal multipliers trace linkages through product demands. Of the additional 50 new jobs, the city's planners are expecting 30 to be created in local firms that supply inputs to SciSource, firms like Light Bulbs, Inc. in Figure 1.1. These new jobs in suppliers are called indirect jobs. The planners also expect to see 20 new jobs in various retailing and service sectors that meet the consumer demands of the new workers at SciSource and its suppliers like Light Bulbs, Inc. These induced jobs are in Supermarket Stores and similar local firms.

Even as the horizontal multiplier demand ripples out through various businesses, there is a second vertical job-chains multiplier at work below the surface. Many, indeed most, of the new jobs at SciSource, Light Bulbs, Inc., and Supermarket Stores will be filled by workers already employed in Chicago. Thus, a high-skilled job at SciSource may attract John Jones, who currently holds a similar job at OptiSource. OptiSource doesn't compete with SciSource in the product market, but both firms hire in the same labor markets. Mr. Jones changes jobs. Now, OptiSource must fill the vacancy that Mr. Jones has left behind (Figure 1.2).

OptiSource searches and hires Ms. Mary Dee. Ms. Dee currently holds a less-well-paying job at InstruSource, another firm in the city. Again, InstruSource doesn't compete with either SciSource or OptiSource in their product markets, but it hires similarly trained workers. InstruSource hasn't expanded recently and Ms. Dee hasn't been able to advance there, even though she is qualified for the next job up the ladder. In switching to OptiSource, she, like Mr. Jones, has left a vacancy

Figure 1.2 Job Chains and Vertical Multipliers


Job changer
Mr. Jones
New job in
SciSource
Job changer
Ms. Dee
Existing similar job
in OptiSource
Vacancies
Existing related job
in InstruSource
In-migrant to local
area Ms. Black
terminates chain

behind at OptiSource. Will this job changing go on forever? Not likely. At some point a vacancy in the chain will be filled by someone who doesn't currently hold a job in the area. In Figure 1.2 this occurs when InstruSource hires Ms. Sara Black, who has just moved to Chicago from Indianapolis. From the vantage point of the local labor market, the chain ends here.

The new job at SciSource has led to a total of three workers being hired in the city as vacancies opened along the chain. Every new job created in the traditional horizontal multiplier process gives rise to this type of vertical multiplier. A new job at Light Bulbs, Inc. sets off a vertical chain, as does a new job at Supermarket Stores. But, the evaluators of the SciSource project have little basis on which to estimate these chain impacts and no way to measure the total size or distribution of the economic gains to the various types of participants. Nor can these evaluators give assurances that the new high-skilled vacancies at

SciSource and other local companies will trickle down to low-skilled workers.

BUILDING TOOLS FOR JOB-CHAINS ANALYSIS

The hypothetical example of employment tremors generated by a new job at SciSource implies a particular worldview of the labor market, one with a measure of slack (underemployment/unemployment) and a fairly rigid wage structure. If most workers are fully employed at or close to their maximum productivity, then much of the movement in job chains can be characterized as mere "churning." In such a world, economic development projects would be unlikely to generate substantial benefits. For movement along job chains to take on significance, the labor market must be characterized by substantial involuntary underemployment or unemployment. Only in such a world does creating jobs stand a chance of yielding substantial welfare payoffs.

Chapter 2 presents the economic mindset that underpins this entire book: an economy where wages are relatively rigid and labor markets are less than perfect. The existence of slack in the labor market means that policies and incentives for job creation can amount to more than a zero-sum game of displacement. Subsidies can create real opportunities without supplanting existing economic activity. The chapter makes the case that the real world unfortunately very much meets these fundamental conditions. A dynamic market economy necessarily generates persistent and inefficient underemployment. Opening vacancy opportunities to workers along job chains promises both efficiency gains and welfare improvements as workers move up to fuller employment and higher wages. Accepting the premise of inherent underemployment (except in periods of exceptional prosperity), it follows that demand-side policies can lead to real economic development. This is true not just at the macro level but at the local level as well. In local markets, labor supply is generally considered highly elastic. Markets can readily call on the unemployed, new entrants, and in-migrants when conditions pick up. The availability of this labor also explains why wages can remain relatively rigid. Thus, as our focus increasingly narrows, from macro level to local level to firm level, employment changes or shocks will result in less and less wage adjustment. The slack inherent in the market allows workers to move up and increase their personal welfare without creating pressure on firms to adjust rigid wage structures.

The traditional approach to project evaluation, impact analysis, usually counts jobs or payrolls without seriously considering the economic welfare they generate. In Chapter 3 we review the variations of this technique, including recent efforts to combine it with aspects of cost–benefit analysis. We highlight the limitations of impact analysis as currently practiced, singling out key issues that are handled inadequately. These issues include unsatisfactory treatment of the counterfactual situation in which the economic development project did not exist, the all-or-nothing nature of much impact assessment, failure to incorporate endogenous change generated by an economic development project, and the failure to recognize the interrelatedness between efficiency and distribution. In order to obtain a broad-brush view of the current state of impact assessment, we synthesize a large corpus of studies and find that the absence of any standard evaluation method leads to considerable noise in the estimates of program efficiency.

Chapter 3 also considers extensions of impact studies meant to measure the distributional consequences of economic development projects. The hypothetical case study presented earlier in this chapter is expanded according to the current state of the art. However, even this augmented exercise in impact analysis still treats the counterfactual in a perfunctory manner and cannot provide very much insight into welfare and distributional effects. These shortcomings have serious implications for both economic development valuation and practice. In the absence of an adequate underlying model, much evaluation is reduced to stocktaking, and practice is left uninformed about exactly what kind of jobs to promote and to whom they should be promoted.

In Chapter 4 we go on to construct the basic job-chains model, drawing on insights from welfare economics. The primary local gain arising from economic development projects will be realized by individuals moving up toward full employment and high wages. Evaluation of the project will need to account for the welfare gains triggered as new vacancies open up and a ripple-through effect is set in motion. The job-chains model outlined in this chapter describes the mechanics of chain creation and the three basic measures of chain operation: chain length, efficiency effects, and distributional outcomes. Much effort is expended in identifying the chains themselves. If we had direct data on job chains we could avoid much of this exercise. For example, housing researchers who use a chain approach can fairly easily collect data on how a new house generates a chain of moves in a community. Unfortunately, we have no chance of identifying specific jobs in the way a housing researcher can identify a specific housing address. Under the circumstances we must build our model from data on individuals and not jobs. The most relevant data concern job moves. For any given type of vacancy, we can determine the proportion of the workers filling that type of vacancy drawn from other job categories, the unemployed, out of the labor force, and in-migration. If these proportions are stable we can, in effect, construct average job chains for each original type of vacancy. These averages draw on the matrix tools of Leontief input–output analysis and supplement Leontief-type models by introducing a probabilistic element to estimating the length of chains. Once average chains are defined, it is a relatively easy matter to define measures of welfare efficiency and distributional impact.

Chapter 5 applies this approach to job chains to make real estimates of the three measures. The basic data source for our empirical efforts is the Panel Study of Income Dynamics (PSID). The key findings here support the notion that chains starting with higher-skilled jobs are longer, but they are relatively less efficient than those starting from mid- and low-skilled openings. Chains starting with higher-skilled workers generate lower levels of welfare per dollar of direct wages and do little for those most in need. Invariably they are truncated by in-migrants and only rarely do they reach down to the lowest income groups. Different specifications of opportunity costs of labor do not seem to alter these results. The chapter revisits the hypothetical case study presented earlier and reestimates its economic development effects using the job-chains model rather than the standard treatment of impact analysis. The results show that the imagined project (a scientific instruments plant) simulated in the case study creates substantial numbers of mid-level jobs with some modest trickle-down impacts for the lowest skill groups. Juxtaposing this with a second hypothetical case study (a management consultancy firm) which directly provides the local economy with primarily high-wage jobs results in more limited job multiplier effects, lower welfare gains, and a very marginal trickle-down impact. We can thus conclude that the trickle-down impacts of job chains are often limited. Economic development projects must be carefully designed if they are to reach those most in need.

A number of extensions of the basic model are presented in Chapter 6. The first of these compares boom and bust years. Intuitively, we expect local economic development activity to expand in recessionary times. An increase in the supply of (unemployed) labor will induce changes in the welfare and distributional impacts of an economic development project. Our basic estimates, however, are hardly affected by years of expansion and contraction. Chains originating in high-wage jobs are likely to be truncated before reaching the lower groups in both boom and bust.

A second comparison is across geographical divisions of the country. Again, we find very few deviations from our basic estimates of welfare gain. While the broad regional aggregates used here may be concealing local patterns, we are not convinced that these local differences can be discovered in currently available data sets on job changes. Achieving greater spatial detail with these limited data inevitably reduces measured labor flows and increases noise.

We also make a comparison between net job growth in services and manufacturing. While the latter does seem to promote more trickle down, this would seem to emanate from its concentrated wage distribution in the middle of the earnings hierarchy and not from any greater internal mobility in manufacturing. This finding may seem surprising as internal promotion ladders are often perceived as major vehicles for promotion in the manufacturing sector. Our findings cannot support this view. Finally, we consider internal (within-firm moves) versus external (between-firm moves) job chains. Our estimates indicate the importance of between-firm moves for improving the lot of those at the lowest levels of the job hierarchy. Within-firm promotional opportunities would seem to favor the higher-wage groups.

In Chapter 7 we return to the fundamental questions of policy. Where do our theory and empirics position us with respect to long-standing debates over economic development policy? In particular, what do they imply about the trade-off between equity and efficiency and the debates of people versus place prosperity, industrial recruitment versus indigenous development, and manufacturing versus services? For example, in the efficiency versus equity debate, the job-chains perspective suggests that the traditional distinction between these two concepts may be too sharply drawn. Because of the existence of underemployment and unemployment, especially among the less skilled, improving efficiency also means improving equity. A further example relates to the debate over employment in the city center versus employment in the suburbs. The traditional view pits suburban employment centers as expanding at the expense of contracting inner city employment. A job-chains approach, which emphasizes interconnectedness in the labor market, suggests that suburban employment growth could in fact create employment opportunities for inner city residents (as suburbanites who previously commuted work closer to home and open up vacancies in the city).

The chapter then addresses the central theme of this volume: does trickle down work? As suggested above, the answer is a cautious and reserved, “Yes, but not very well.” The policy implication of this central finding is that job chains in the real world do not promise an alternative to well-constructed and direct policy instruments for targeting the lower reaches of the jobs hierarchy. Finally, the chapter concludes with a proposal for more “chain-wise” thinking in the evaluation of economic development. Much is currently possible, although practical progress is contingent on political as much as technical considerations.

2

Labor Markets and Trickle Down

State and local economic development policy has long suffered from an overly ambitious agenda. It is just too easy to sell an enticing vision—to promise far more than can reasonably be delivered. A metropolitan development program that promises to increase regional economic activity, strengthen the fiscal position of local governments, and lay the basis for ratcheting up the urban hierarchy advances goals that are readily endorsed by mayors, utility executives, office magnates, and newspaper editors. These local stakeholders all have a strong interest in seeing their town prosper. Moreover, they argue with considerable sincerity that the gains of growth will be widely shared in the community, and that, in effect, people prosperity will follow their vision of place prosperity.

Despite much research, it remains doubtful that urban and regional economists, geographers, and planners possess a body of knowledge and tools effective enough to seriously aid such a growth coalition. For years academics have debated the roles of business climate, agglomeration, clustering, and a long list of related factors in promoting regional growth. This work remains useful and suggestive, but it is far from definitive.

Hence, when practitioners have attempted to build local economic development policies around this or that currently fashionable theory, their efforts have most often failed. Bringing highly limited resources to finance well-publicized but inevitably marginal policies, they could hardly have expected otherwise. The quest for growth has strong and influential supporters, but it almost universally produces disappointing results.

For the most part, local and state economic development efforts fail to meet their central goal of higher local growth. But, on occasion, most notably when state and local agencies combine to implement a carefully designed and narrowly focused policy of selective subsidies, they do produce real benefits to local residents. These benefits are seldom on the scale envisioned in the glossy press releases. They are too small to raise the region's growth rate, but they are significant nevertheless. If development agencies take care to meet the "but-for" condition (i.e., avoid projects that would be undertaken by the private sector in the absence of a subsidy), benefits can be large in comparison to the public project costs.

Since growth effects of such subsidy programs are slight, these benefits are not likely to include the grandiose increases in land rents and institutional quasi-rents envisioned in the most ambitious plans. Rather, the real benefits of these subsidies most often appear as modest increases in the jobs and wages available to workers in the community.

Putting forth this rather innocent-looking proposition, that subsidies can open better jobs to local workers, raises a set of surprisingly fundamental questions about the nature of labor markets at national, local, and establishment levels. Do such markets work efficiently, or do they regularly leave workers involuntarily underemployed? If markets are highly efficient, public subsidies to firms could hardly do workers much good. Under such circumstances, stimulating the expansion of targeted firms can only reallocate resources including labor, with no real gain in production. If there is no slack in the labor market, expansion of subsidized firms simply implies the contraction of other firms. If some workers are involuntarily underemployed and some are involuntarily unemployed, however, well-designed state and local business subsidies can create new job vacancies without destroying existing jobs. Where labor markets are less than perfect, economic development subsidies can create real, if modest, opportunities for workers. As workers move up to better jobs, they more fully use their skills and capacities. These workers produce more and earn more.

How much slack exists in labor markets? Casual empiricism suggests that, with the possible exception of the very peak of the business cycle, many workers are involuntarily unemployed and even more are working below their abilities. This commonsense proposition lies behind a whole range of evaluative techniques in urban and regional economics. It also forms the basic starting point for our job-chains approach.

UNDEREMPLOYMENT AND LABOR MARKETS

Modern labor markets interact with a constantly changing array of firms. In turn, these firms prosper or decline based on their acumen in managing human resources against a background of rapidly developing technologies and uncertain demand. For much of the twentieth century, economists debated the extent to which this turbulent environment generates persistent underemployment. We can hardly hope to resolve, or even to fully review, these debates here.[1] However, theoretical and empirical work in the last 25 years has increasingly linked macroeconomic issues of investment and aggregate demand to labor market imperfections.

Much investment is competitively targeted to undercut existing producers by embodying superior technologies into new capital.[2] This creative destruction keeps labor markets in a more or less constant state of “churning.” Estimates of the magnitude of churning suggest that it can account for two-thirds of all worker flows (Burgess, Lane, and Stevens 1996). Churning means that displaced workers will be hunting for new jobs even as new firms are sprouting up. Since matching is not instantaneous, a more or less steady level of unemployment will characterize most labor markets. This background level of unemployment reduces the costs of firm entry by making labor recruitment easier.

Supporting this general view, recent work on employment flows suggests a surprisingly high level of year-to-year growth and decline across firms in the economy. For example Leonard (1996, pp. 39–40) summarized his earlier analysis as suggesting that, in an average year on gross measurements, new job creation runs 13.8 percent and job destruction runs 11.0 percent. Disaggregating to the establishment level produces even higher rates. Here Leonard found that growing establishments average 30 percent employment growth in a year of growth, while their declining neighbors average 21 percent decline.

Creative destruction generates a steady background of firm births and deaths—expansions and contractions that can be identified as a major source of involuntary unemployment. Unemployment reduces recruitment costs and reinforces labor discipline. Skilled workers under these conditions will usually face not the threat of unemployment but the reality of underemployment.

It is difficult to imagine a definition of underemployment without reference to formal or at least informal job structures. The concept of underemployment implies a mismatch between workers and jobs. Of course, the simplest theories of the firm make no mention of jobs as distinct from workers. In the last decade, however, a range of research agendas on personnel economics (Lazear 1999), assignment models (Sattinger 1993), and the theory of the firm (Camacho 1996) have launched a general reconsideration of older institutionalist themes (Doeringer and Piore 1971) concerning the relation of jobs and workers.

In the traditional theory of the firm, the firm may hire different types of labor as defined by their skills and other elements of human capital, but common experience makes clear that workers are in fact hired for specific jobs. Once jobs are defined, it is not difficult to define underemployment. A worker fully capable of carrying out a higher-level job but only able to find employment at a lower-level job is underemployed.

Given these concepts, a labor market with involuntary unemployment is likely to also experience considerable underemployment. Except for a few bottleneck jobs where the supply of appropriate labor is less than the number of slots, most jobs will be oversubscribed in the presence of the general shortfall of demand. This result is further guaranteed by the more or less osmotic character of much on-the-job learning. Of course, employers will attempt to grade applicants, but often the distinctions they make will be of little or no real significance. Presumably then, we will commonly observe a situation in which many of the incumbents holding jobs at a given level will be capable of holding jobs at the next highest level.

Where labor market dynamics follow this script, we expect a large degree of wage rigidity. Wage differentials play a key role in identifying jobs. Wages define rewards and threats for most of the labor force. While these wages might vary in response to long-run secular shifts, employers alter wages at their peril in the short or middle run. Such tinkering can easily upset workers and interfere with morale.[3] The evidence suggesting substantial wage rigidities in the U.S. economy continues to accumulate (Bewley 1999; Campbell and Kamlani 1997; Krueger and Summers 1988).

Putting these pieces together, what are the macroeconomic effects of more or less steady growth on the careers of individual workers? If we caricaturize these various forces we would expect most workers over the years to move up some distance through internal job hierarchies. Their ascents would, however, be punctuated by extensive periods of underemployment.[4] Some of these would be the result of sluggish growth in their own firms, while others might follow on defensive moves between firms. Most importantly for our own work, the bulk of labor market adjustments are not made by changes in market-clearing wages. Rather, contracting or slow-growing firms add to the underemployed and unemployed, while expanding firms draw on this very pool of workers.

This view of labor market dynamics suggests a substantial role for national policies aimed at stimulating aggregate demand and reducing underemployment.[5] However, our primary concern here is not to appraise national macroeconomic interventions, but rather to evaluate state and local subsidies to business. At the state and local level, questions of underemployment are further complicated by the persistent interregional migration that characterizes the U.S. labor market.

If the nation is experiencing normal growth, even rapid growth at the metropolitan level can remain noninflationary as workers can be recruited from other communities. The workers come not to achieve marginally higher wages, but rather to achieve employment more consistent with their skills. These mobile workers make more because they move out of underemployment, not because wages are higher in their new region. Employment growth—not wage differentials—consistently correlates with migration in the United States.

This ready flow of labor further reduces the pressure on local employers to adjust rigid wage structures. Eberts and Stone (1992) showed the strong persistence of metropolitan wage differentials, with a 10-year correlation of 0.8. By contrast, metropolitan area unemployment rankings vary substantially over time, their correlation falling to zero in a decade.

Not surprisingly, the elastic supply of labor to regions has often been cited as support for using economic base models and regional input–output analysis, with their heavily demand-oriented dynamics. Regional modeling efforts of various types have repeatedly found that net job growth in a region is accompanied by substantial population growth through migration.

The argument made here suggests that if a broad regional development initiative were undertaken in a single metropolitan area, considerable gains might well be achieved as unemployed and underemployed workers obtained jobs closer to their full capacities. However, the state and local commitment to finance such broad efforts is not forthcoming in most regions. Rather, as suggested above, cities and states will continue to subsidize relatively modest efforts in job creation. Whatever the case for larger national or regional programs, these more modest projects will remain the hallmark of economic development efforts.

How do these relatively small-scale projects relate to the broader theoretical themes developed here? As we move from nation to region to individual project, the case for focusing on nonwage adjustment processes becomes sturdier and sturdier. At the level of a single establishment, even traditional theory grants that employment changes have virtually no impact on market wages.

It seems highly reasonable that, in a sizable metropolitan labor market, the ripples set off by the expansion of an individual firm can be handled through some combination of in-migration and the recruitment of local workers in situations currently below their full capacities. This doesn’t mean that every new job must go to such a worker, only that on net a reallocation is possible without any significant decline in productivity. The slack in the system is more than enough to accommodate the growth of a single enterprise.

As such, the primary welfare gains attributable to state or local public subsidies of firms will take the form of individual workers moving up toward fuller employment and higher wages. The description and evaluation of the welfare gains generated by small-scale economic development projects should logically focus on the nature of this recruitment process for new vacancies and the ripples it produces in the labor markets. This is the task we undertake in Chapter 4. That chapter develops a welfare economics approach to job chains. These efforts are undertaken with the hope of informing the evaluation of isolated local economic development projects. However, the same techniques can be used for larger projects at the national or regional level when and where the political will exists to undertake them.

TRICKLE DOWN AND ECONOMIC DEVELOPMENT

As suggested in the introduction, our central interest concerns the extent to which traditional economic development activities trickle down toward less-skilled workers. Our own work builds on the type of persistent underemployment and involuntary unemployment discussed in the last section. It is useful at this point to consider the broader literature on trickle down in this context. Again, we approach these questions at the scale of the nation, metropolitan region, and project.

We start with the intuitive proposition that more rapid national growth and development reduces national poverty. The growth of the country in the post–World War II period has often been held up as evidence supporting this claim. As noted by Cutler and Katz (1991), the traditional explanation for this phenomenon has been the type of upgrading discussed by Okun (1973). Anticipating much of the recent developments in the theory of imperfect labor markets, Okun held that general growth reaches deep into the skill hierarchy, pulling many out of unemployment and raising the job opportunities facing those otherwise caught in the lowest wage jobs. At least for the period up to 1983, Cutler and Katz (1991) found considerable evidence for the Okun argument.

A simple conclusion has often been drawn from the traditional relationship between growth and poverty: trickle down works. If growth rates can be increased through public intervention, then such policies also provide a means of addressing poverty and low income. The trickle-down strategy especially recommends itself on the grounds of political palatability. While working to raise the average income of all, growth policies promise to give extra help to those at the bottom.

The trickle-down thesis has been challenged from the start.[6] The challenges gained support from the work of dual labor market theorists (Dickens and Lang 1985; Doeringer and Piore 1971) and the segmented labor market school (Edwards, Reich, and Gordon 1975). The basic argument put forward by both these approaches emphasized the impenetrability of the barrier between primary and secondary labor markets. More rapid growth might tighten primary markets, but secondary markets with their large overhang of unskilled workers would remain largely disconnected from the growing prosperity.

In the 1960s and 1970s, such speculations were most often put forward as explanations for African-American poverty. By the 1980s, they seemed to have a broader sweep. The much noted widening of the national income distribution after decades of increasing equality signaled for many a breakdown of traditional upgrading mechanisms (Cutler and Katz 1991) and launched a debate that continues to this day.

A major theme of this debate has concerned the extent to which a shift in demand in favor of higher-skilled workers has worked to reduce the relative wages of lower-skilled workers (Juhn, Murphy, and Pierce 1993). Presumably such a shift would also work to limit traditional flows up the job hierarchy and thus narrow the scope of trickle down. Bernhardt et al. (2001) seriously addressed this hypothesis with their analysis of two cohorts of white males from the National Longitudinal Survey. The first cohort entered the labor market in the mid 1960s, while the second entered in the late 1970s and early 1980s. Bernhardt et al. found more than a doubling (from 12 to 28 percent) in the proportion of these workers who by age 34 can be described as "chronic low-wage."[7] While this increase is most striking for those with a low level of education (high school degree or less), the proportion of chronic low-wage workers doubles for those with some college education (10 to 25 percent) and still increases for those with college degrees. The authors emphasized that higher education provides "protection" against the low-wage trap, but it is no ironclad guarantee as inequality in outcomes has grown. Structural changes in the economy, especially that between manufacturing and services, have also contributed strongly to these results. In addition, Bernhardt et al. faulted new management strategies, which reduce on-the-job training opportunities for less-skilled workers as their jobs are outsourced or given to temporary workers.

Suffice it to say, recent developments in the U.S. economy have strengthened doubts concerning the effectiveness of trickle down as a strategy to aid low-wage workers. However, those doing research at the state and local level have seriously questioned this interpretation of national statistics.

Empirical evidence at the local level (Topel 1986) suggests that, while wages for skilled workers across the country tend to equalize, there may be substantial differences in wages for unskilled workers.

This finding is consistent with lower intermetropolitan migration rates for the unskilled. These observations imply, in turn, that tightening of the unskilled labor market in a metropolitan area may be achievable through general growth at the regional level. However, they also suggest high elasticities for the supply of higher-skilled workers through interregional migration and hence limitations on the upward mobility of the less skilled. A world of this type remains consistent with the traditional case for a connection between growth and poverty reduction, but it raises questions concerning the extent of upward mobility that can be expected at the local level.

Recent work by Bartik (2001) supports this traditional interpretation. Bartik found that growth in regional mean family income produces significant reductions in poverty.[8] Earlier, Bartik (1996) demonstrated that metropolitan area employment growth reduces inequality as incomes for low-wage workers grow faster than those of higher-income residents. From these regional data, Bartik concluded that the trend toward increasing inequality through the 1980s and most of the 1990s had its sources not in the character of growth per se, but in other changes in the economy.

Janice Madden (2000) also found support for the relation between employment growth and poverty reduction at the metropolitan level. Breaking down employment growth by wage level, she found that new middle-level jobs reduce inequality and poverty at the fastest rate. This last result perhaps suggests that at least some otherwise low-income households are able to best move up through obtaining middle-level jobs.[9]

The metropolitan data argue that the much reported death of the relationship between growth and poverty reduction may be greatly exaggerated. Poverty falls in rapidly growing metropolitan areas. Nevertheless, even these more optimistic results point to the conclusion that metropolitan growth alone cannot solve regional or national poverty problems. As Bartik (2001) suggested, state and local economic development may help the poor disproportionately, but the overall effects on the poor remain quite modest. In his view, a major attack on poverty requires programs specifically targeted on increasing the demand for low-skilled employees.

How do these theoretical and empirical arguments play out at the level of an individual development project? We can reasonably expect that some unskilled jobs will provide employment for the otherwise unemployed or those out of the labor force. These are real gains. Less sure is the extent to which new mid-level openings provide significant opportunities for upward mobility. From the discussions above, we have reason to suspect that gains from such mobility will be limited, but we really can't answer this question without serious empirical work.

CONCLUSIONS

The supply characteristics of the labor force play a crucial role in establishing the potential for national long-term growth. A more skilled labor force holds out the promise of greater productivity and higher living standards. For the individual the incentives to invest in human capital are obvious. Better-educated workers earn higher wages and generally have better working conditions. Governments at all levels devote major resources to supplement these incentives with subsidies for public and private education. But, no matter how well trained the labor force, many, perhaps most, workers remain underemployed, if not actually unemployed. If economic development programs have a claim on the public fisc, that claim rests on such widespread underemployment.

In its strongest form, the argument describes the national economy as subject to considerable churning and rigid wages. Together these common phenomena hinder the workings of the labor market. Except in the most dramatic booms, equilibrium leaves many people underemployed. Under the circumstances, real economic gains can be achieved by increasing the demand for labor. Apart from a few bottleneck skills, labor supply for most job grades will generally be available as openings are filled from the ranks of the underemployed. This supply will be forthcoming even in the absence of wage increases. Such observations suggest a role for national policies aimed at raising the level of investment and labor demand. Questions of financing and potential crowding out must also be the subjects of serious planning. If the basic theoretical insights are strong, however, the argument for undertaking and maintaining national economic development initiatives remains a persuasive one.

We hardly expect our brief analysis in the last several pages to settle the long-standing debates over the demand-side role of federal governments in national development. However, as noted above, these same observations weigh even more heavily at the state and local level. Here supply of labor is acknowledged to be highly elastic by virtually all researchers. In addition to the underemployed, local markets can draw on in-migrants from other parts of the country. Especially where equilibrium unemployment rates are high, the case for state and/or local intervention becomes quite compelling. New job openings are likely to improve the economic welfare of workers, especially those moving from local unemployment and underemployment.

Many state and local areas talk glowingly of their economic development efforts. However, these remain rather modest in scope. An expansion may well be warranted. Even in the absence of such an expansion, these modest efforts, if well conceived, can make genuine improvements in the economic welfare of both the workers directly employed and those who benefit from the spreading effects of the new demand.

These observations still leave unresolved the extent to which state and local economic development subsidies generate a trickling down of benefits to those most in need. That some trickle down will occur is certain, but its magnitude remains unsure, indeed, hardly explored. Yet, almost all programs at the state and local level claim to be addressing the hardships of the unemployed and working poor. Claims of this type abound, but evidence remains scarce. Indeed, the standard tools for evaluating economic development projects have virtually nothing to say on the matter. We will review these techniques in the next chapter before proceeding in Chapter 4 to build an alternative evaluation approach on a stronger theoretical base.

Notes

1. However, see Appendix A for a more formal introduction to these theoretical issues in the context of endogenous growth theory.
2. Efforts to reintroduce (Schumpeterian) concepts of creative destruction into endogenous growth theory (Aghion and Howitt 1998) have generated interesting

results, including a “natural rate” of unemployment. See Aghion and Howitt (1998) for a review of models that pick up on this aspect of aggressive competition.

3. This key observation on wage rigidity again goes back to Doeringer and Piore (1971), who noted that personnel managers are less likely to respond to changes in market conditions with wage changes than with variations in the recruitment efforts.
4. There is a slight difference between our emphasis on underemployment and Bartik’s (1991) discussion of hysteresis. The latter emphasizes human capital acquisition after promotion, while the former puts more stress on its acquisition before. Undoubtedly, the real world presents a mixture of both.
5. The focus of such policies would be to reduce the “natural” or “frictional” rate of unemployment, not to fight business cycles. See further discussion in Appendix A.
6. The start goes back long before Okun. In one form or another, the trickle-down position appears in the works of Adam Smith, John Stuart Mill, and Alfred Marshall in the nineteenth century. It was disputed by Frederick Engels, Karl Marx, and Henry George.
7. The authors defined a worker as chronic low wage if he has a permanent hourly wage of less than $11 in 1999 dollars.
8. Bartik used 21 states or state groupings as regions and individual region-years as data observations. His sample starts in 1967 and extends to 1997.
9. Madden (2000) also emphasized the role of demographic variables such as household composition that strongly modify the impact of metropolitan earnings distributions on metropolitan income distributions and poverty.

3

The Problem with Impact Analysis

Counting Everything, Valuing Nothing

Cities and states have engaged in expensive programs of subsidizing business with only a very imperfect understanding of the social value of those programs. When evaluation has been done at all, it has most often taken the form of simple impact analysis—an adding up of new payrolls and taxes. Even assuming the new jobs can be traced to the public subsidies involved, standard impact assessments can hardly answer the most telling criticisms of local economic development efforts—that they bring jobs to those who don't need them, to highly skilled workers who already hold jobs.

As its name suggests, impact analysis is concerned with identifying and measuring the effects of a particular economic development project or program. These effects generally are quantitative estimates of income or employment change in a given area arising from a particular economic stimulus. This stimulus can take the form of new private investment or public assistance through business subsidies, tax incentives, or regulation. To a certain extent, impact analysis represents a "before" and "after" exercise in taking stock. The analyst establishes the current or baseline situation and then measures the gross change arising through the introduction of the new project or program. Much effort is expended in judiciously counting outcomes (e.g., new jobs or new incomes) that are immediately equated with program "benefits." However, the social valuation of these outcomes (who benefits from program effects and just how much better off they are) is invariably ignored. On the program cost side, a similar blind spot can be noted. Impact analyses tend to measure and account for all direct program costs, but they often overlook the value of the economic costs, which are represented by the opportunities foregone as a result of allocating resources to the project in question rather than to an alternative use.

The above features are characteristic of impact analysis, irrespective of the particular analytical approach used. In general, there is no standard method or benchmark for impact analysis and the level of analytic rigor varies from study to study. The texts that have attempted to assemble the tools of impact analysis generally present a smorgasbord of methods rather than attempt to define state of the art or best practice in the field (Bendavid-Val 1991; Blair 1995; Davis 1990; Levin and McEwan 2001). While the impact analysis toolbox can offer a variety of methods, such as economic base analysis, Keynesian (income-expenditure) analysis, shift-share or trend analysis, and simple input–output models, all efforts are ultimately concerned with counting and measuring and much less with valuing.

Cost–benefit analysis provides, of course, a systematic framework for enumerating social costs and benefits and for extending impact analysis from a purely counting exercise to one that estimates the value of the project or program to society. Such analysis involves making some assumption as to the alternative state of the world in the absence of the economic development initiative. The evaluation therefore calls for a "with" and "without" the project perspective, which is very different from the "before" and "after" accounting that characterizes impact analysis (Waters 1976). Opportunities foregone and counterfactual states are much harder to establish accurately. Ripple through and multiplier impacts can be traced quite easily, but alternative uses for the resources allocated to a project are less intuitive, less visible, and much harder to estimate.

In a cost–benefit framework, social benefits are represented by estimates of producer, consumer, and government surpluses. Social costs are generally taken as the opportunity costs of the capital invested in the program. The tools of impact analysis are, however, very rarely extended in order to cope with issues of evaluation. The cost–benefit model therefore remains apart from the impact analysis approach. "What if" scenarios that form the backbone of impact analysis stop short of full-blown evaluation.

The cost–benefit approach to program evaluation also has its limitations. Little attempt is made in most cost–benefit models to incorporate issues of equity and distribution. In addition, cost–benefit analysis generally assumes a closed economy with full employment. While benefits can be captured as economic surpluses generated, the problem arises on the cost side. Traditional cost–benefit analysis treats labor as a cost to be remunerated. However, assuming a closed economy with full employment means that any labor market movement must immediately cause reverberations somewhere else. New incomes will thus displace old incomes; new output is at the expense of existing output in a tight system. The result is zero-sum economic development.

This picture can be made more realistic by assuming an open economy (with full employment) as the framework for cost–benefit analysis. However, such an assumption has problems of its own. An economic development project to be evaluated under these conditions would be hard pressed to enumerate the benefits, in terms of welfare improvement. The very fact that an economic development project has succeeded in amassing some new economic activity in a given area is still not enough to claim any welfare improvement.

The above limitations point to the need for assuming an open, Keynesian-type economy characterized by involuntary unemployment and underemployment in order to meaningfully analyze the effects of employment creation using the tools of applied welfare economics. The case for using this approach to examine local labor markets was made in Chapter 2. Two important points follow from this characterization. The first is that, given the existence of involuntary unemployment, a new job will be genuinely additional and will create a real increase in production. The appropriate entry for job creation (or the ensuing wages) in such a cost–benefit framework would thus be as a benefit and not a cost (Felsenstein and Persky 1999). The second issue is that, even if we count wages and jobs as benefits and we assume a situation with imperfect and nonclearing labor markets, we still have to take opportunity costs of labor into consideration. Many workers, including the unemployed, have an opportunity cost that is greater than zero. By moving into employment they may forgo other alternatives such as leisure time or government transfers. This cost has to be subtracted from any benefits to be attributed to employment creation programs.

The key issues emerging from the above discussion are the treatment of displaced demand and opportunity costs. Impact analysis has paid moderate attention to the former and virtually ignored the latter. Cost–benefit analyses, while obsessed with the opportunity cost of capital and the choice of a discount rate, pay little attention to the opportunity costs for labor. As we have tried to show, adopting an evaluative framework that assumes an open economy with involuntary unemployment, means that the issue of labor's opportunity cost is too important to ignore.

ISSUES IN IMPACT ANALYSIS

The current state of impact analysis as practiced in the field of local economic development, represents an ad hoc amalgam of tools and methods imported from diverse disciplinary frameworks. Studies range from regional economics (Blair 1995; Davis 1990; Shaffer 1989) to public administration (Levin and McEwan 2001) and social program analysis (Mohr 1988). The use of such wide-ranging methods reflects the absence of any core text or best practice methods, a diversity of analytic sophistication, and the highly fluctuating impacts often reported for similar programs. A case in point relates to the analysis of enterprise zones where different studies of the same projects result in highly divergent estimations of impacts (Boarnet and Bogart 1996; Rubin 1991). Despite this level of flux, a series of core themes emerge that seem to be endemic to all attempts at impact analysis. These themes include the accurate establishment of the counterfactual or "but for the program" situation, the tendency to produce "all or nothing" outcomes, the failure to incorporate the role of endogenous change, and a reticence to recognize the interrelatedness of efficiency and distributional effects in local economic development. We now deal with each in turn.

The Accurate Estimation of the Counterfactual Situation

A major thrust in impact analysis is concerned with the accurate estimation of the counterfactual situation, i.e., the alternative situation that would have existed in the absence of the program or project. This key methodological issue is addressed in a variety of dimensions.

In impact analysis, establishing the counterfactual accurately is invariably part and parcel of the job-counting routine. To arrive at an accurate description of all impacts, the analyst needs to know what employment would have been created in the absence of the project. Pitching the counterfactual (the alternative state of the world) too low means inflating project impacts; pitching it too high means minimizing them. Well-designed impact analyses will attempt to account for this “but for the project” situation using a variety of techniques: control groups, regressions that hold constant the effect of the program, trend analyses, or survey methods asking hypothetical questions as to behavior in the absence of the program. All these efforts, however, are geared toward providing an accurate documentation of impacts with no attention paid to the social value of the project.[1]

Impact analysis is invariably focused on employment and income outcomes. Special care needs to be taken to ensure accurate accounting of jobs attributable to the program. The pitfalls here are many. Good impact analyses will distinguish between: direct and indirect jobs/incomes, new and retained jobs/incomes, part- and full-time jobs/incomes, new jobs that displace existing jobs/incomes, and local versus nonlocal jobs/incomes.

Assuming that the above items are accounted for accurately, a further dimension of establishing the counterfactual relates to the consideration of opportunity costs. In addressing alternatives foregone through the use of resources for the present project, the analysis moves from pure accounting to evaluating the social worth of the project. However even here, standard practice in impact analysis and project evaluation does not go far enough. While the opportunity costs of capital are routinely reported in cost–benefit studies, they feature sparingly in impact analyses. Opportunity costs of labor are rarely addressed in either form of analysis.

ALL-OR-NOTHING EVALUATIONS

The all-or-nothing feature is characteristic of attempts in impact analyses to count incomes. The current literature on economic development evaluation is characterized by a broad gulf dividing studies that meticulously count 100 percent of the wages of every new job as a net gain and those that credit only a small fraction of new wages. On the one hand, impact analyses count job and wage creation as output measures of success and expend great efforts in accurately counting jobs generated by a proposed (*ex post*, a completed) project. Markley and

McNamara (1995), for example, in analyzing the economic impacts of a business incubator, went to great efforts to calculate the wages and personal incomes earned by these employees and estimate a cost per job created as a measure of efficiency. Welfare gains in these studies are equated to the increases in personal income generated by new direct, indirect, and induced jobs.

This common approach to impact assessment greatly overstates outcomes because it invariably fails to recognize that many workers at new subsidized facilities would have found alternative employment in the community or outside. The welfare gain to the individual worker from a new job will not in general be equal to that worker's wage. Rather, it will be a much smaller amount, equal to the difference between wages on the new job and the worker's wage in his or her next best alternative. In the extreme case of smooth and perfectly functioning labor markets, these alternative wages will be close to the wage level on a new job. Indeed, this is why, in a fully employed market, wages are not only a private cost to the business but a social cost as well. In the full employment case, wages indicate the value of alternative production given up when a worker shifts to a new enterprise. In such a world, simply counting additional employment may not teach us very much about the efficacy of economic development programs (Courant 1994).

At the other end of the literature spectrum, researchers who are cognizant of the need to include opportunity costs often equate them with "reservation wages" (i.e., the minimum wage acceptable for entering into employment). Empirical estimates of reservation wages of job seekers are generally quite high. Jones (1989) claimed a figure of 90 percent of wages actually achieved. (For lower figures, but still far more than zero, see Hodge [1982] and Sridhar [1996].) These high reservation wages suggest that the actual welfare gains of new local employment are likely to be modest if not negligible.

It would seem that we are left with all or nothing. On one hand, impact studies credit new jobs with all the wages they generate, while the reservation wage studies give those jobs little if any weight. This book suggests that a realistic way out of this "all-or-nothing" dichotomy lies in recognizing that new job formation in real-world labor markets begins a chain reaction that will affect many workers in addition to those who actually obtain the newly created jobs. In a less than fully employed economy, a tightening in the labor market allows underemployed workers all along the line to move up. This theme will be further developed in subsequent chapters. For the moment, we can note that the job-chains perspective effectively bridges the gulf between impact analysis and reservation wage approaches. The worker who gains a newly created job may improve his or her condition only marginally, but in turn other workers find their position improved over their expectations as they move up a job ladder. Admittedly, the sum of all these gains is still likely to fall short of the total new local wages identified as benefits by impact analysis. As so often is the case, the answer lies somewhere in between.

Another variation on the “all-or-nothing” theme that pervades current state of the art impact analyses relates to multiplier calculations. When impact analysis is used as a method for documenting effects of a project, the income or employment multiplier is taken as a key indicator. However, the multiplier only relates to truly additional income or employment in the local economy when there is excess capacity. Otherwise, it just represents a shift from one activity to another as a result of the project with no real net gain. If the project results in the productive use of otherwise unemployed resources, the multiplier represents a net social benefit. The multiplier can thus represent an “all” or “nothing” outcome. Regular impact analysis is incapable of making this distinction. All multiplier effects are considered net gain.

Failure to Incorporate Endogenous Change

Impact analysis acknowledges the interdependencies in the local economy. Much effort is exerted in mapping, documenting, and measuring the effect of exogenous stimuli on local economic activity. As such, it is concerned with short-term and incremental change. It fails, however, to recognize that these short-term and incremental shocks can have long-term effects. In the current state of the art, no provision is made for incorporating cumulative effects, feedback mechanisms, or endogenous change. While an impact analysis (and especially a cost–benefit test of a project) may often incorporate a time dimension, this is invariably for discounting the opportunity cost of the capital resources sunk into the project in order to arrive at an accurate estimate of the present project value.

This situation is especially surprising given that a key justification for much local economic development activity is its “hysteresis effect” (Bartik 1991). The hysteresis metaphor, borrowed from physics, refers to the state whereby a seemingly temporary external force effects permanent change. With the removal of the external force, the previous state does not return. In Bartik’s application of the concept, labor markets are subject to a similar effect. The stickiness of local labor markets means that a lag often exists between job creation and in-migration. Incremental and external shocks to the local labor market (such as local economic development projects or programs) create short-run opportunities for the local unemployed. They accumulate skills, new working habits, and, generally, human capital, which allows them to reposition themselves in the labor market and increase their long-term employment prospects.

While Bartik’s work has been highly influential in providing a rationale for place-based incentives and rebutting the claims that local economic development is a zero-sum activity, his message that short-term and endogenous change can induce long-term effects has surprisingly not percolated through to the practice of impact analysis. Although it recognizes the interconnectedness of the local economy, the current practice of impact analysis ignores the endogenous change that can create local labor market advantage.

Failure to Recognize the Interrelatedness between Efficiency and Distribution

In view of the short-run and promotional character of so many impact analyses, it is little wonder that distributional impacts receive little serious attention. In principle, impact studies acknowledge that economic development projects can have distinct distributional effects, but in practice these are rarely incorporated into the analysis. While part of this stems from the objective difficulty of measuring equity-based outcomes, a more telling reason may be that much impact analysis is undertaken with only the sketchiest knowledge of policy objectives. When these are not made explicit, it is little wonder that the question of distributional outcomes is overlooked.

A subtle point lost on most impact analyses is that efficiency and distributional issues do not stand apart from each other. In fact, they are closely interrelated. A cost–benefit ratio greater than one is commonly taken as an indicator of an efficient use of resources, but this conclusion is specific to a given income distribution. If the income distribution were to change, the value of the cost–benefit ratio would change as well. For example, the economic benefits attributable to a new inner-city manufacturing plant will be greater the poorer the inner-city residents are.

Our work on evaluating business incentives (Persky, Felsenstein, and Wiewel 1997) provides one example of how to include such complementarities. This approach, while informed by a formal cost–benefit model, offers a hybrid method with estimates of both efficiency and income distribution effects. The model adjusts all employment to account for displaced employment, employment taken up by suburban commuters, and "deadweight" employment that would have occurred anyway. This adjusted job count is converted into earnings estimates and distributed across five wage classes. The amount of earnings credited to each of the five classes is adjusted to account for the fact that high earners have higher opportunity costs and other alternatives for earning at a similar level. This opportunity cost adjustment gives the analysis a distributional perspective. Strictly speaking, however, the central issue in these adjustments is one of efficiency and not distribution. The higher weight given to dollar earnings of low-wage workers is the result of an absolutely low opportunity cost for this type of labor rather than any distributional preference. Thus, distribution is addressed but only inasmuch as it affects the net increase in local welfare.

STUDIES AND APPLICATIONS

Substantial literature reviews of economic development programs and their impacts have appeared in some of the best recent analyses of local economic development (Anderson and Wassmer 2000; Bartik 1991; Fisher and Peters 1998). The object of this section is not to revisit that literature or critique its findings. Rather, we present in tabular form a synopsis of what can loosely be termed local economic development "impact analyses" that concentrate on employment effects. All studies, bar two, have appeared in academic peer-reviewed journals. We highlight the primary attributes of impact analysis practice as reflected in the studies.

As can be seen from Table 3.1, the dividing line between projects and programs is very fine. Even when program-type initiatives have been included (such as loan and grant schemes for small business), care has been taken to avoid dealing with large scale regional development initiatives, despite their employment-generating focus. The primary analytic framework for most analyses is either cost–benefit or cost-effectiveness. To an extent, the choice of framework also dictates some of the other analytic attributes of the studies (such as treatment of opportunity costs, demand displacement, and distributional issues). At the project level, there is also very little use of off-the-shelf econometric, input–output, cost–benefit, or fiscal impact models (such as REMI, IMPLAN, LOCI-2; for a review, see Economic Development Administration 1999), except for the generation of parameters that are then used as inputs for impact calculations.

The toolbox of regional economics is also not fully utilized. Trend analyses, time series, and shift-share are used only sparingly and input–output and general equilibrium models are often considered too “heavy” for project-based analysis. The main choice either falls on cost–benefit or cost-effectiveness (accounting) frameworks. This choice further dictates the main attributes of the impact analysis. In the case of cost–benefit studies, opportunity costs of capital are routinely addressed in direct form via the discount rate. Opportunity costs of labor are incorporated much more infrequently. They are simply assumed to be zero in some instances, and the reservation wage is used as a proxy in other instances. The opportunity costs of capital are treated inconsistently (either ignored or proxied by the rate of return on long-term investments) in cost-effectiveness studies, while the labor opportunity cost issue is effectively ignored. Other studies (using econometric estimation methods) use an indirect approach to dealing with opportunity costs, often using control groups or survey responses to proxy for the counterfactual situation. In sum, the issue of labor opportunity costs is sparingly and inconsistently addressed in impact analyses.

Demand displacement, in contrast, has received more attention. Here a variety of estimation options have been used, ranging from author assumptions, survey responses through to location quotients (to measure export activity), spatial interaction estimation, and imported parameters (e.g., regional purchase coefficients) generated by input–output models.

Welfare improvement and distributional effects have been addressed in an equally sketchy manner. Change in local income by income classes and the redistribution of jobs from low- to high-unemployment areas are two simple indicators, but both have been used only infrequently. In many cases gross welfare change is measured and implicitly assumed to generate distributional benefits in its wake.

SYNTHESIZING THE APPLICATIONS

In order to get a broad overview of the current state of impact studies, we use meta-analysis as a descriptive tool for identifying patterns in economic development evaluation results. Meta-analysis is a statistical procedure that involves using empirical studies as individual observations and deriving statistical regularities about the body of literature under consideration on the basis of attributes of the studies themselves (Hunter and Schmidt 1990; Wolf 1986). Used this way, meta-analysis can complement a review of the literature and highlight the main characteristics of the state of current knowledge in a particular field.

Statistical estimation usually involves regressing attributes of the studies (techniques, form of publication, quality, etc.) on some measurable index of outcome reported in the studies. While meta-analysis has been criticized on the grounds of selection bias, over-aggregation of already aggregate studies, and lack of quality control on the choice of individual observations, it has been applied in recent years to reviews of subject areas tangential to economic development. For example, it has been used to synthesize findings from studies in the fields of tourism impact analysis (Baaijens, Nijkamp, and Van Monfort 1998), casino impact evaluations (Rose 2001), tax incentives (Phillips and Goss 1995), and transportation infrastructure investment (Button 1995). In these studies, the dependent variable is usually an outcome or efficiency measure of the study, such as income or employment multi-

Table 3.1 Studies of Employment Effects of State and Local Economic Development Projects

Study	Program	Analytic approach	Treatment of opportunity costs	Treatment of demand displacement	Welfare improvement and distribution measured as
Miller, Gaskins, and Liner (1969)	EDA assistance	Cost–benefit	Capital: rate of private sector return	—	Change in local personal income
Sazama (1970)	Loans and guarantees to industrial firms	Cost–benefit	Capital: discount rates reflecting return on gov. bonds Labor: average unemployment compensation	—	Per-capita income change
Thompson (1983)	Industrial park	Econometric study (time series)	—	Existence of displacement derived from regression results	—
Johnson and Thomas (1984)	New enterprise program – self-employment training	Cost–benefit	Indirect: control group survey responses	Derived from survey responses	Increases in output of the trainees
Willis (1984)	Local authority assistance to business	Cost–benefit (with I–O parameters)	Capital: range of discount rates Labor: zero opportunity cost	—	—
Robinson, Wren, and Goddard (1987)	Local authority assistance to business	Cost-effectiveness (accounting) analysis	—	Derived from survey responses	—

Department of the Environment (1988)	Enterprise zones	Cost-effectiveness (accounting) analysis	—	Derived from survey responses	—
Willis and Saunders (1988)	Development agency	Cost–benefit	Capital: cost of funds to government	Author assumptions	—
Wren (1989)	Regional development grants, regional selective assistance	Cost-effectiveness (econometric) analysis	—	—	—
Howland (1990)	Low interest loans for small businesses	Cost-effectiveness (accounting) analysis	Capital: return on government long-term bonds Labor: survey responses	—	—
Department of Trade and Industry (1990)	Regional enterprise grants	Cost effectiveness	—	Survey responses	—
Johnson and Thomas (1990)	Local tourist attraction – museum	Keynesian multiplier analysis	—	Diversion estimate based on ratio nonlocal to total visitors	—
Krmenec (1990)	Industrial revenue bonds	Econometric study	Indirect: controls pre- and post-employment profiles	—	—

(continued)

Table 3.1 (continued)

Study	Program	Analytic approach	Treatment of opportunity costs	Treatment of demand displacement	Welfare improvement and distribution measured as
Macdonald and Swales (1991)	Local hypermarket	Modified Keynesian multiplier analysis	—	Lower retail prices translated into income and employment change	Real income effects
Monk (1991)	Enterprise boards	Firm survey	Survey response on counterfactual employment situation	Survey response on local sales	—
Rubin (1991)	Enterprise zones	I–O and cost-effectiveness	Survey response on counterfactual employment situation	—	—
Bleaney et al. (1992)	Local university	Keynesian multiplier analysis	Adjustments for in-migrant incomes	—	Local disposable income change
Felsenstein (1992)	Revolving loan fund	Cost-effectiveness (accounting) analysis	Capital: commercial bank long-term interest rates Labor: survey responses	—	—
Loh (1993)	Grants, loans, and government business training	Econometric study	—	—	Per-capita labor growth in taxable property value

Marvel and Shkurti (1993)	Honda Auto assembly plant	Cost–benefit	Indirect: control groups	—	Changes in local government expenditure on education and welfare
Persky, Ranney, and Wiewel (1993)	Import substitution program	Policy simulation model (REMI)	—	Location quotient	Change in local personal income
Hart and Scott (1994)	Small business assistance agency	Cost-effectiveness analysis	Indirect: control group	Estimated on basis of small firms' share in local sales	—
Papke (1994)	Enterprise zones	Econometric study	Indirect: control group	—	Net reduction in unemployment claims
Markley and McNamara (1995)	Business incubator	Input–output	—	—	—
Dowall (1996)	Enterprise zones	Shift-share analysis	Indirect: county-level growth as control	—	—
Boarnet and Bogart (1996)	Enterprise zones	Econometric study	Indirect: control group	—	—
Dewar and Hagenlocker (1996)	Small cities economic development program	Cost-effectiveness (accounting) analysis	Direct: opportunity cost of capital estimated via discount rate	—	Redistribution of jobs to desired areas

(continued)

Table 3.1 (continued)

Study	Program	Analytic approach	Treatment of opportunity costs	Treatment of demand displacement	Welfare improvement and distribution measured as
Sridhar (1996)	Enterprise zone	Cost–benefit	Direct: reservation wage estimates	—	Redistribution of jobs from low- to high-unemployment areas
Gazel and Schwer (1997)	Rock concerts	Input–output	Survey response of local residents	—	—
Harris (1997)	Local university	Input–output	Adjustment in migrants' incomes	—	Local disposable income change
Leven and Phares (1997)	Casino development	Input–output model	—	Diverted spending as a "residual"	—
Persky, Felsenstein, and Wiewel (1997)	Business incentives	Cost–benefit (with I–O parameters)	Direct: income adjustments to account for labor opportunity cost	Regional purchase coefficients (RPC)	Change in local dispersible income by income class
Rephann et al. (1997)	Casino development	Quasi-experimental research design	Indirect control groups	—	Share of new jobs going to local residents
Swales (1997)	Regional selective assistance	Cost–benefit	Labor: reservation ("shadow") wages	—	—
Blair, Schwer, and Waddoups (1998)	Casino development	Econometric estimation	Indirect: control dummies	—	Job satisfaction
Hooker and Knetter (1999)	Military base closures	Econometric model (time series)	Indirect: state growth rate as control	—	Per-capita income change

Lenihan (1999)	Regional development agency grants to small businesses	Firm survey	—	Derived from survey	—
Przybylski et al. (1999)	Casino development	1. Spatial interaction model 2. I–O model	—	1. Survey of patron expenditures 2. I–O generated parameters	—
Felsenstein and Fleischer (2000)	Subsidized loan guarantees for small business	Cost–benefit	Direct: income adjustment for labor opportunity cost using human capital model	Location quotients as indicators of local demand	Change in local disposable income by income class
Gillespie et al. (2001)	Regional selective assistance	CGE analysis	—	Incorporation of capacity, regional wage bargaining, and migration constraints	Change in regional wages

pliers (in the case of tourism and casino studies) or the elasticity of change in local business activity with respect to a change in taxes.

In the analysis reported below, estimates of cost per job are regressed on key features of 20 impact analysis studies (a subset of those reviewed in Table 3.1). Cost per job is a standard output measure of impact analysis. Despite the methodological arbitrariness that often accompanies the creation of this index (Foley 1992), it is an intuitive and easily understood indicator of program efficiency. For the present study, we have standardized cost-per-job estimates to a base of 1996 U.S. dollars. As the dependent variable, we use the natural logarithm of these standardized costs per job. Logarithms better allow for multiplicative, as opposed to additive, effects. All the studies used in the meta-analysis have been collected from published academic literature, thus ensuring a quality control baseline.

The independent variables refer to characteristics of the studies and the methods employed in conducting the impact analysis. We anticipate that studies that account for opportunity costs and demand displacement and incorporate some welfare focus will result in higher cost-per-job estimates. Finally, we also considered a number of characteristics of the programs themselves as control variables. We included the year of each study with the hypothesis/hope that programs have become more efficient over time. Other program variables included whether loans were the primary instrument, whether the effort concentrated on enterprise zones, and whether the subsidy was tailored for a single project (e.g., an auto company).

The results reported in Table 3.2 synthesize into a single equation those factors that are likely to influence the magnitude of reported cost-per-job estimates in impact analyses. As to program characteristics, the variables most consistently related to cost per job are the study year and reliance on loan instruments, both of which show a negative and highly significant effect. With a little manipulation, the coefficients in the table tell us that, other things equal, programs seem to have become more efficient over the sample period at a rate of 12 percent per year. Similarly, programs using loans on average cost 70 percent less per job than other approaches.[2]

Focusing on the key methodological features of impact analysis, two of our variables, the use of opportunity costs and adjusting for demand displacement, displayed the expected positive coefficients.

Table 3.2 Synthesis of Economic Development Studies: Efficiency Measure—Cost per Job[a]

Independent variable	Coefficient	*t*	*P*
INTERCEPT	11.29	16.64	0.00
OPP[b]	0.80	1.98	0.07
DISP[c]	0.42	1.27	0.23
WELF[d]	–1.25	–2.84	0.01
LOANS[e]	–1.26	–2.57	0.02
YEAR[f]	–0.12	–0.87	0.00

NOTE: Adjusted $R^2 = 0.63$.

[a] Dependent variable = log cost-per-job estimates (1996 prices).

[b] Opportunity costs = 1 if modeled, = 0 otherwise.

[c] Displacement costs = 1 if modeled, = 0 otherwise.

[d] Welfare measures = 1 if modeled, = 0 otherwise.

[e] Loans = 1 if program primarily loans, = 0 otherwise.

[f] Year = starts with 1 in 1969.

Evaluation studies that take opportunity costs and displacement into account generally find higher costs per job, although, given the small sample size, the coefficients lack strong statistical significance. Studies taking account of opportunity costs find average costs per job more than twice as high, while consideration of displacement raises cost per job about 50 percent. Somewhat surprisingly, studies which took notice of welfare based measures found lower costs per job, indeed about 70 percent lower. [3]

Without claiming these particular results as definitive, we conclude that they support an important suspicion. The heterogeneity in evaluation methodologies has contributed considerable noise to estimates of development program efficiency. Studies using different methodologies cannot be easily compared. When comparisons are made between such studies we must pay serious attention to the likely effects of alternative methodologies.

THE LIMITS TO EXISTING APPROACHES

To appreciate the current state of the art in impact analysis, consider a more extended treatment of our SciSource case study from Chapter 1. Recall that SciSource proposed to open a new production plant in the instruments sector in the city of Chicago. Assuming that the city government is interested in an evaluation outlining the local economic impact of the plant, what is the best that can be expected given the current state of practice in this field?

A prerequisite for any impact analysis is an accurate account of the employment impact of the plant. The 100 direct jobs that the plant creates need to be adjusted to account for demand displacement, deadweight employment that would have been created in the absence of the plant, and local jobs taken by outsiders (suburban commuters). Only after this downward adjustment, can direct jobs be expanded by a suitable multiplier, to account for the indirect and induced jobs generated by the plant.

In our example, the 100 direct jobs reduce to 62 (Table 3.3). The magnitude of this adjustment is estimated using parameters generated by the REMI econometric model (Treyz 1993) calibrated for Cook County, Illinois, and a range of data from the 1990 census. Export-base theory posits that new nonbasic employment will compete with exist-

Table 3.3 Hypothetical Case Study: Benefits and Costs of SciSource Scientific Instruments Plant

	Direct	Total
Employment		
Projected jobs	100	—
Minus: displaced local jobs endogenous growth suburban commuters		
New resident jobs	62	97
Overall economic impact		
Earnings (1992$, 000)	7,362	11,453
Costs (1992$, 000)	2,500	2,500
Benefit measures		
Cost/Job (1992$, 000)	40	26
Cost/Earnings	0.34	0.22

ing local employment serving local demand. These displaced local jobs are estimated using REMI-generated export shares for the instruments industry. Local endogenous employment growth (i.e., deadweight employment) also has to be subtracted. This endogenous growth is calculated using a modified shift-share approach in which the local share of regional employment growth that would have occurred in the absence of the plant is considered as employment that cannot be credited to the new program. Finally, suburban commuters who take some of the new jobs also have to be discounted. Their shares are based on actual census-derived data on commuting patterns.[4] To complete the jobs account, we expand the 62 direct new resident jobs to 97 using the relevant industry-based REMI employment multiplier.

The next stage is to convert direct and total employment into earnings using REMI-generated data. The annual earnings estimate is based on the average earnings in the instruments sectors and those secondary and tertiary rounds of activity stimulated by the direct employment. Total earnings gains are calculated as a present value over an expected window of 10 years. We arbitrarily assume that project costs are $2.5 million. Two summary "benefit" measures can then be calculated: cost per job and a cost/earnings ratio. Both are measures of project efficiency. The former measures program output and the latter program yield. As noted earlier, these "benefits" are really measuring the project's gross impacts rather than its social worth or value.

In most instances, this type of account would represent the maximum extent of impact analysis. At best, some effort would be expended in trying to create an accurate employment picture, which means consideration of demand displacement, deadweight employment, and indirect and induced jobs. In many instances, an attempt will further be made to translate program-attributable jobs into an earnings estimate. It should be noted, however, that very rarely are these earnings ever discounted to account for the different opportunities foregone by workers who take project-generated jobs rather than alternatives (i.e., opportunity costs). Distributional issues are also not considered. While great pains are taken to accurately account for all new jobs and income, very rarely is the question posed as to how much better off different lower-income groups really are given all this new employment and income.

A cursory, first-cut attempt at observing distribution effects within an impact analysis framework can be easily accomplished using census-derived proportions. In this way, all direct and indirect employment is distributed across five income classes in accordance with real-world proportions derived from the census. Table 3.4 goes beyond standard impact analysis practice and presents direct and total employment distributed across five income classes according to census-derived proportions for the instruments sector in the Chicago area. On the employment side, we can see that once total employment is considered (and not just direct employment), the share of employment going to the poorest group (income class 5) rises slightly. However, the share of employment going to the most wealthy (income class 1) also increases slightly so overall the distribution has hardly become more progressive.

Table 3.4 Hypothetical Case Study, SciSource Instruments: Distribution of Employment and Earnings, by Income Groups

		Income group					
		1	2	3	4	5	Sum
Distribution of employment							
Absolute							
	Direct	2	5	21	29	5	62
	Total	5	8	31	40	13	97
Share (%)							
	Direct	3.4	8.1	33.3	47.3	7.9	100
	Total	4.7	8.6	31.7	41.7	13.2	100
Distribution of earnings (1992$, 000)							
Absolute							
	Direct	699	1,129	2,891	2,466	177	7,362
	Total	1,519	1,842	4,266	3,367	460	11,453
Share (%)							
	Direct	9.5	15.3	39.3	33.5	2.4	100
	Total	13.3	16.1	37.3	29.4	4.0	100

The distribution of earning shows a similar, and even more accentuated, pattern. Earnings are distributed across the five income classes using census-derived proportions for the instruments sector in the Chicago area. While there is a slight distributional shift in favor of the lowest earners when total earnings are considered (from 2.4 to 4.0 percent), the share of earnings going to the highest earners rises more (from 9.5 to 13.3 percent).

While the impact analysis above represents state of the art, its limitations are all too obvious. First, it has only treated the question of the counterfactual situation in a very partial manner. We have simply (and mechanically) distributed estimated employment and earnings across different income classes without asking whether some of this income would have been attained even in the absence of the instrument plant. Presumably, many of the higher-income workers could have attained a similar level of earnings in alternative employment. Consequently, they have a high opportunity cost which should be discounted from the earnings calculation. As illustrated here, standard impact analysis routinely credits all workers with all new earnings, irrespective of their alternative employment possibilities. This is a major source of overestimation and probably accounts for the distributional patterns of employment and earnings as described above. As a rule, impact analyses do not discount the opportunity costs of different income classes from any calculation of new earnings or income. Second, these impact analysis results do not allow us to say anything substantial about changes in welfare and distribution. The results in Table 3.4 give us no idea as to the welfare gains to Chicago workers as a result of the new instruments plant, i.e., how much improvement over their current situation can be credited to the new plant. Are income or employment gains to the poorest greater than to all other income classes? Is there a process of leveling-up going on whereby the poorer groups do proportionately better from the new project than the wealthier groups? These are issues that economic development evaluation would like to be able to answer. Current practice, however, falls short of fulfilling these aspirations.

CONCLUSIONS

If impact analysis as currently practiced does not provide socially useful insights into the workings of the local economy, this has ramifications for both economic development evaluation and practice. While evaluation is meant to inform practice, an inadequate representation of the local economy can leave impact analysis irrelevant or even destructive. An approach that counts everything but values nothing is likely to generate blind spots in both analysis and operation. We deal with each of these issues in turn.

Some Implications for Economic Development Evaluation

A "consensus of dissatisfaction" can be said to characterize the current state of economic development evaluation. Some of this is grounded in issues of technique and method (Bartik and Bingham 1997), while other critiques focus on questions of scope and breadth of evaluation (Reese and Fasenfest 1997). Underlying both these approaches is the absence of an adequate model of economic development. Without this, even the most perfunctory of local economic development goals, such as "generating employment," becomes unclear. Invariably, impact analysis fails to make explicit any underlying model, although by default most impact studies assume the operation of a simple economic base mechanism of growth.

Our own earlier work on evaluating economic development projects has attempted to fuse impact analysis with cost–benefit analysis in order to give the former some welfare moorings. The resultant "mid-level methodology" (Persky, Wiewel, and Felsenstein 1997) attempts to span the divide between the practical experience and insight that informs much impact analysis and the serious consideration of opportunity costs, surpluses, and alternative states of the world that characterizes the cost–benefit approach. Devoid of an analytical framework, impact analysis becomes an exercise in stocktaking. As suggested in Chapter 2, the key link between impact analysis and cost–benefit analysis is forged by the theory of involuntary unemployment and underemployment.[5] If we assume that all resources used in a project would otherwise have been completely unemployed, then the "counting everything" approach of impact analysis makes sense. As we discuss in some detail in the next chapter, this assumption is far too strong. Hence, meaningful impact analysis must be informed by a more extensive understanding of underemployment.

Some Implications for Economic Development Practice

The absence of any coherent model of the labor market leaves its footprint on practice. Even if “creating jobs” is chosen as the strategy for local development, the practitioner is still left ill-equipped to grapple with the contingencies of putting that vision into practice: What kind of jobs, high wage or low wage? Jobs for whom, locals or commuters? Jobs that reduce local unemployment or increase local purchasing power? In the real world, the best that state-of-the-art impact analysis can offer the economic development officer falls short of a guide to practice. Rather, the practitioner is presented with an aggregate picture of employment without any guide as to whether this concentration of jobs within a given space is to the benefit or detriment of the local population.

Notes

1. See Greenstone and Moretti (2003) for a recent study that estimates the counter factual using a revealed preference control group method. This study also attempts to estimate the local “welfare” impacts of new industrial plants but assumes that all welfare increases are capitalized in local property values.
2. The dependent variable is the natural logarithm of cost per job, hence the relatively small coefficient for YEAR (–0.12) can be directly interpreted in percentage terms. Each year cost per job in real 1996 dollars is expected to fall by 12 percent. The LOANS variable has a value of only 0 or 1. Moreover, the coefficient for LOANS (–1.26) is much larger in absolute value. While still interpretable as a percentage shift, the calculation of that shift is a bit more complicated:

   $$\text{percent downward shift} = 1 - e^{-1.26} = 1 - 0.28 = 72 \text{ percent},$$

   i.e., evaluations of loan programs suggest that they are 72 percent cheaper per job created.
3. These estimates start from the coefficients in Table 3.2 and use the same approach as that applied to the coefficient for LOANS in the last note.
4. In-migrants to Chicago are not excluded from this count. The question of standing in an impact analysis or cost–benefit study is essentially political in nature. Here our practice follows that suggested by City of Chicago development practitioners. We appeal to the same political authority in our denial of standing to suburban commuters.

5. Also see Burgan and Mules (2001) for a discussion of the relationship between impact analysis and cost–benefit in the evaluation of tourism events.

4

Delving beneath the Surface

Job Chains in the Evaluation of Local Economic Development

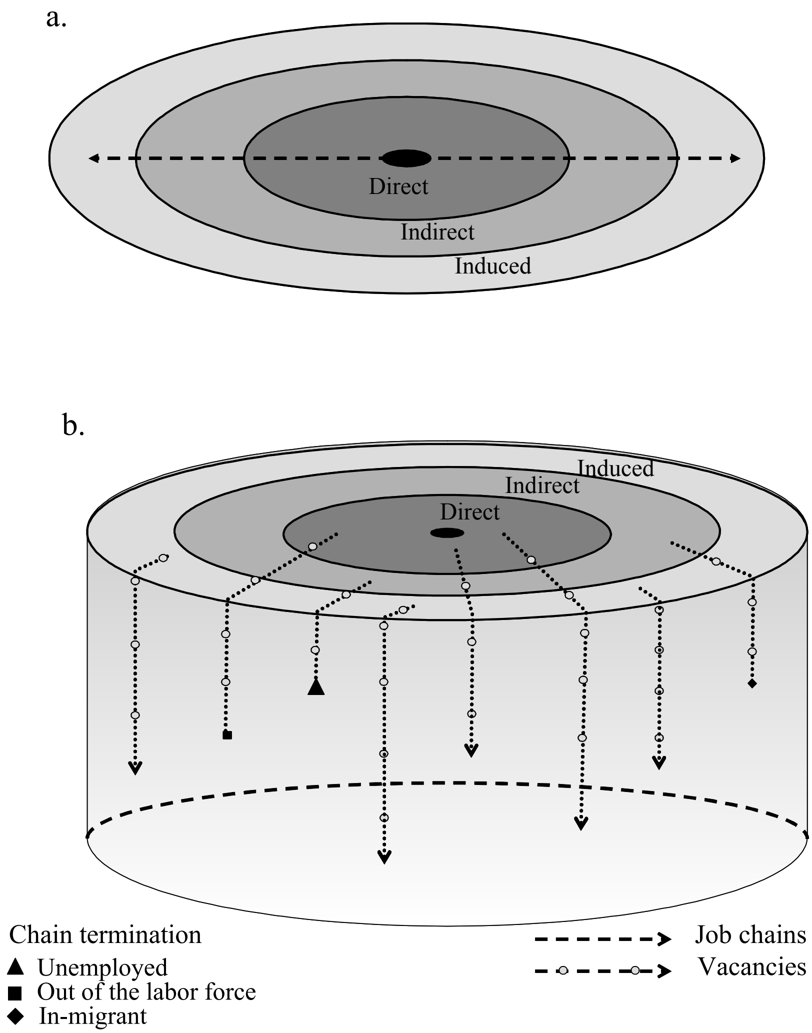
The previous chapter showed how the standard approach to dealing with trickle down has used surface-level measurement of economic development impacts and traced the way they horizontally ripple through the local economy. As demonstrated previously, this approach can be extended to include distributional outcomes in order to answer the question "how many jobs will be created in each earnings class?" However, it still falls a long way short in answering questions of economic welfare arising from new employment—for example, who gains and who loses from new employment, and how much better off are they? To do this, we need some measure of opportunity cost that allows us to assess the alternative opportunities forfeited when a worker moves into a new position.

To grapple with these issues, this chapter introduces the notion of job chains in the context of persistent involuntary unemployment. A surface-level perspective on economic development impacts is not sufficient. In order to answer questions of welfare and equity, we need to understand what is happening below the surface when new employment is generated. To do this we must adopt a vertical perspective on the local labor market, trying to trace out all the subterranean movement set in motion once a new job is created. The job chain is an analytic device that lets us estimate the amount of movement triggered by a new job and record the traffic in and out of the newly created vacancies.

A new job will set in motion a chain-like sequence of moves in the local labor market. For example, A moves to new job *j* and vacates job *i* for B who moves in, thereby vacating job *k* for C and so on. In this instance, we are not simply observing new job *j* and estimating (horizontally) how many surface-level jobs (indirect and induced) are stimulated by this new position. Rather, we are taking job *j* as a starting point and attempting to measure the vertical or subsurface implications of this job. The job chain will continue until it is broken, which will occur when a worker moves into a new job without offering any replacement position—for example, an in-migrant to the local area, an unemployed worker, or someone entering from out of the labor force (Figure 4.1). It should be noted that the focus of this approach is on the position (vacancy) or the job and not the worker.[1]

In addition to measuring the number of subsurface links in a chain, the job-chains approach affords two further insights. First, it enables us to observe how individuals progress up a chain to higher levels of welfare and to measure the welfare that ensues. Existing approaches to measuring surface-level impacts of economic development programs seldom include measures of welfare improvement. At each completed step up the chain, workers move closer to their fully employed status. Workers can make employment and/or wage gains either in jobs newly generated by a subsidized program or as a result of vacancies opened by job chains. Welfare increments pertaining to the program are not just those directly generated by the new job. Rather, they are represented by all the increases in welfare in all the chains opened up by the new job. Second, the job-chains perspective allows us to measure the trickle-down effects of employment creation. While the "vacuum effect" of vacating a job in order to move into a new position has long been noted (Holt and David 1966), standard evaluations of economic development programs generally do not look beyond those who get the new jobs. In this way they ignore the genuine trickle-down effect, preferring to concentrate instead on "trickle-across" or "trickle-within." Trickle down implies positive spillover effects percolating beyond the confines of the original stimulus. Job chains are the vehicle by which this percolation takes place. The job-chains approach suggests an appropriate method for analyzing local labor market change. In the context of program-generated demand, job chains offer a convenient way of handling both the welfare and trickle-down impacts that are so often overlooked in economic development evaluations. To lay the groundwork for our approach, we provide a discussion of alternative methodologies for identifying chains in the next section. This discussion leads to a review of the adoption of the chains metaphor in a variety of research contexts. On this basis, we present the case for a chains perspective in analyzing the effect of economic development programs

Figure 4.1 Horizontal Surface Multiplier (a) and Vertical Job-Chains Multiplier (b)


a.
Direct
Indirect
Induced
b.
Induced
Indirect
Direct
Chain termination
▲ Unemployed
■ Out of the labor force
◆ In-migrant
Job chains
Vacancies

in local labor markets. Finally, we stress the unique properties of the chains perspective, affording insights that cannot be gained from any of the standard approaches currently being used.

DEFINING JOB CHAINS

The notion of the job chain implies the transmission of impulses through the labor market with the creation of a new job. A new job triggers a set of chain reactions as described above. These vertical effects supplement the standard employment multiplier, which maps the horizontal impacts of new direct activity in the form of indirect and induced jobs. With job-chains multipliers, each new job, whether direct, indirect, or induced, sets off its own vertical chain. Table 4.1 outlines further differences between conventional (employment) multipliers as reported in impact analyses and the trickle-down multipliers presented here. Aside from the direction, magnitude, and intensity of impact, a major point of divergence lies in the source of the stimulus. For conventional multipliers, the exogenous shock (the new plant or development project) is the main source of shock. For trickle-down multipliers the main source of stimulus is endogenous because each movement up a job chain leaves behind a vacancy that causes additional movement.

Table 4.1 A Comparison of Multipliers

	Conventional multipliers	Trickle-down multipliers
Direction of impact	Surface ripples – horizontal	Vertical chains
Magnitude of impact	Increases with size of geographic area	Increases/decreases with size of geographic area
Intensity of impact	Decreases with physical distance from project	Decreases with skill/income level
Sources of multiplier expansion	Indirect and induced impacts	Indirect and induced plus chains they set in motion
Unit of measurement	Worker	Jobs/positions
Source of stimulus	Exogenous	Endogenous
Functional form of expansion	Linear-additive	Linear-additive

The idea that the impact of economic growth permeates the local economy beyond the confines of the population, area, or sector in which it originates is hardly new. "Ripple-through" effects of local economic development have been built into many regional growth models. They form the base of growth poles and growth center theory (Perroux 1950), appear in the "soft" institutionalist and evolutionary models of regional growth (Amin 1999), and pervade the new economic geography's focus on agglomeration, increasing returns, and spillover effects (Krugman 1991). These ripple-through effects are, however, all horizontal or surface level. Nowhere has this been more evident than in the studies of the demand-side linkages that have formed the mainstay of regional analysis. Their spreading through the local economy in the form of new expenditures has been the focus of much attention through the estimation of Keynesian-type multiplier effects and input–output linkages. The ripple-through effect of the standard employment multiplier relates to the indirect and induced expansion of an initial (demand-side) employment stimulus.

Adopting a chain metaphor conveys the idea that the movement of individuals ultimately leads to higher levels of welfare. In moving, individuals leave behind job vacancies that successively percolate down the chain. The vacancy rather than the individual is the focus.

The chain metaphor has been applied in a variety of contexts, such as movement in the housing market and second-hand car market. Through vacating a job, car, or house, the individual triggers a "vacancy chain." The maintenance of these chains is contingent on replacement: by occupying a vacancy, an individual simultaneously creates another vacancy. In the absence of replacement, the chain is terminated. Thus, for example, a new entrant to the housing market, a first-time car buyer or an immigrant taking a new job causes the vacancy chain to end as each generates no vacancy as a replacement. The job chains that are the focus of this chapter are simply a subset of vacancy chains.

Probabilistic Approaches

In order to identify chains and measure their length, both probabilistic and nonprobabilistic (mapping) approaches have been adopted. The former refers to the use of probabilities for inferring the length of chains. Rather than engage in the tedious charting of chains, convenient mathematical shorthand allows us to estimate chain length based on the probability that a vacancy at a given level will be filled from a given origin state. In this approach, the properties of chains are simulated synthetically rather than identified empirically. Alternatively, the nonprobabilistic approach is based on the judicious mapping of real-world chains and the tracing of actual movement through the vacancies until the chain ceases to exist. It calls for in-depth interviewing in order to gain detailed information on the units (e.g., houses, cars, or jobs) that are the focus of this method. These kinds of empirical data are difficult to find and expensive to create.

While there are a number of variants on the probabilistic model, they all simulate the way in which new vacancies are diffused through a system. The key here is that the move of a vacancy (originating in a new home or job) from one class to another (as a household or worker moves in the opposite direction) can be assigned a probability of transition. If these probabilities are stable, the response of the system to any initial set of new vacancies can be simulated. A key property of these models is that vacancy moves are determined solely by current state. This makes the model particularly appropriate for simulating moves between units or vacancies such as cars, houses, or jobs. These are devoid of accumulated feelings or choices that could affect their present state. Furthermore, all models incorporate an absorbing state, which means all chains terminate at some point (a housing vacancy may go to a newly formed household, leaving no further vacancy, or a job vacancy may go to a new entrant to the labor force, leaving no opening).[2]

Simple mathematical manipulation (power expansion or matrix inversion) yields a second matrix (the multiplier matrix). The sum of the column entries in this matrix will give us the average length of a chain originating in a certain substratum of the population under consideration (housing classes, income groups, etc.). In this way, the multiplier effects (chain lengths) of vacancies can be estimated and thus indicate the potential benefits arising from the initial stimulus of a new job or a new house appearing in the market. These benefits are couched in terms of the "chains of opportunity" (White 1970a) opened up to those both inside and outside the local market system.

The probabilistic model has been used as the workhorse of chain-based analyses. It is especially popular in disciplines such as sociology. Chain length and individual mobility within chains have been examined empirically using variants of the model in housing-market analyses (Emmi and Magnusson 1994, 1995; Hua 1989; Marullo 1985; Sands 1977; White 1971), studies of occupational mobility (Emmi 1986, 1987; Rosenfeld 1992; Stewman 1975a; White 1970b), residential segregation (Huff and Waldorf 1988), and ecological mobility (Chase, Weissburg, and DeWitt 1988). While particular applications of the chain metaphor will be examined at greater length below, it should be noted that all these analyses do not progress beyond using chain length as a measure of benefit. They tell us very little about the change in welfare of those moving from vacancy to vacancy within a chain, the relative efficiency in creating new (housing or employment) vacancies of chains initiated at different levels, or the distributional effects of chains (i.e., are they benefiting those most in need). While these limitations have been noted (Chase 1991) and, in at least one case, the mechanistic nature of chains has been augmented through a linkage to a behavioral model (Hua 1989), there have been no attempts at explicitly incorporating welfare concerns within the chain model. In this respect, existing formulations stop short of extending an analysis of chains to one of trickle down.

Researchers have long noted the relation between chain models and the Leontief (input–output) model (White 1970b). Historically, the main use for the Leontief model has been in the analysis of the intersectoral ripples generated when final demand changes in a given sector.[3] It uses a double-entry system of accounting in which all sales are registered as rows in an origin–destination (transaction) matrix and all purchases as columns. As in the probabilistic chain models, actual production chains are not mapped; rather, they are estimated mathematical regularities that simulate the impact of final demand change in one sector on all others that are estimated. The mechanics of the Leontief approach involve constructing the origin–destination (transaction) matrix and, on this basis, deriving a matrix of direct purchase coefficients. This matrix represents the average fixed input production vectors or constant "production recipes" for each sector in an economy. Inverting this matrix using the standard Leontief inverse yields the total requirements table in which each element represents the change in gross output in sector *i* in response to change in final demand in sector *j*. This provides a multiplier estimate for each sector in response to an external demand shock in any other sector. These multipliers are simply expressions of production chain length. Thus, the Leontief model is implicitly a demand-driven, chain model. While these chains are not explicitly calculated, they are inherent in the input–output matrix.

The probabilistic chain model can be rewritten as a Leontief system. As developed later in this chapter, this formulation makes it particularly easy to introduce welfare and distributional concepts into the model. Given our focus on program-driven economic development, the augmented Leontief framework articulated below is a natural tool for examining job chains and their trickle-down effects.

Nonprobabilistic Approaches

Nonprobabilistic chain analysis is grounded in intensive field work and data collection with a view to charting and mapping real-world chains. No attempt is made at simulating or inferring chain dynamics using probabilities. In essence, this form of analysis empirically surveys chains and traces vacancies until they disappear; for example, through a dwelling being destroyed or a position being abolished within an organization.

This line of investigation is associated with the work on “filtering” in housing markets that occupied urban geographers and sociologists in the 1960s and1970s. As housing units are well-defined entities that can be identified and contacted, much of this work has taken the form of case studies that trace vacancies through the direct surveying of households and make inferences about average chain lengths (Adams 1973; Dzus and Romsa 1977; Kristof 1965; Lansing, Clifton, and Morgan 1969; Watson 1974). This literature addresses the issues of chain length (multipliers) and trickle down within the constraints of the method employed. For example, much attention is focused on the implications of filtering as a policy prescription for providing housing for the poor, and within this discussion, chain length is often taken as an indicator of filtering. Needless to say, this approach does not address the welfare and distributional issues associated with housing-market filtering. While some attempts have been made to look at who benefits in these cases (Marullo 1985), little attention is focused on how much better off they are compared with any plausible alternative.

APPLICATIONS OF THE JOB-CHAINS METAPHOR

At the heart of the chain model is the observation that a move by an individual will always simultaneously affect all other parts of the system. While Harrison White's seminal book is often credited with introducing the notion of chain reactions in diverse social systems (White 1970a), the roots of the idea can be traced to early descriptive studies in the housing-market literature (Firestone 1951; Kristof 1965). These spawned the housing-market "filtering" literature that collected case study evidence from a variety of settings and tried to draw urban planning and policy conclusions as to efficient allocation of housing for the disadvantaged.

The vacancy model has been used in other diverse social science settings as an instrument for analyzing how supply and demand conditions are matched and how a constant process of realignment between the two takes effect. Aside from matching dwellings and house buyers, the vacancy model has been used for matching a pool of college football coaches with a pool of teams (Smith and Abbot 1983), a pool of clergy with a pool of parishes (White 1970a), a pool of musicians and a pool of orchestras (Abbot and Hrycak 1990), and even a pool of hermit crabs with a pool of shells (Chase, Weissburg, and DeWitt 1988).

In all this literature much effort is expended in measuring and predicting chain lengths. The linear mathematics of Markov processes and Leontief multipliers provide ready-made tools for these analyses. As noted earlier, most of these studies are rather devoid of any behavioral model to supplement the mechanics of chain formation. In the absence of a model of individual preferences for housing, the statistical regularities of chain lengths and housing moves remain rather sterile. We now review the three areas of application most pertinent to our model of job chains: labor market studies, organizational studies, and economic development studies.

Labor Market Studies

Ostensibly, studies of labor market dynamics provide some of the work closest in spirit to the model of job chains presented below. Starting with the much-cited work of Holt and David (1966), labor economists have used vacancies, job searching, and matching functions in order to understand the vacancy–unemployment relationship in imperfect markets. This early work also stressed the demand-side dynamics of the labor market rather than emphasizing supply-side characteristics. In this work, vacancies and unemployment are the stock variables, regulated by the flow variables such as new hires, and recalls into the labor market. The market eventually reaches an equilibrium state.

Building on this approach, the job flows literature further develops the vacancy–unemployment model, showing how job quits are procyclical and how vacancy chains are created in tight labor markets. The existence of vacancy chains is also central to understanding the procyclical behavior of quits (Akerlof, Rose, and Yellen 1988). Vacancy chains are shorter when unemployment is high because the probability of terminating the chain is high with so many available job seekers who offer no job replacement. As opportunities expand, quits will increase and therefore quit behavior is procyclical.

Job-flow studies of labor market dynamics stress that, in imperfect labor markets, flows are often an important source of adjustment (Blanchard and Diamond 1992; Burgess 1994; Schettkat 1996a). Flows reflect high levels of mobility that are not captured in measures of net change. This labor turnover, or churning, suggests that there are subsurface movements that are not captured by indices of net employment change. An obvious source of this discrepancy is the existence of job chains. For the case of Germany, it has been estimated that 50 percent of employment mobility in periods of tight labor markets is due to this movement along job chains (the churning effect) and that this figure drops to less than 10 percent in periods of slack labor markets (Schettkat 1996b). A variant application of job chains has been presented by Gorter and Schettkat (1999), who demonstrated that, rather than employed job seekers crowding out unemployed job seekers, the opposite is the case. Employed workers who find new jobs open up vacancy chains for the unemployed. The unemployed, however, crowd out the employed in the labor market. Job chains become shorter when the unemployed take vacancies. They leave behind no replacement position and consequently opportunities for employed job seekers are diminished.

For our purposes, the upshot of the above is that job chains are often acknowledged as important mechanisms in understanding labor market dynamics. However, much of this interest does not progress beyond measuring chain length. The obvious next step would be to examine the welfare and distributional implications of chain effects, but this issue is left unaddressed in the current state of the literature.

Organizational Studies

Sociologists and organizational scientists have used the vacancy chain model to study intraorganizational mobility (see Stewman 1975a, 1986). The focus of these studies is on occupational advancement and the type of organizations that promote or hinder this. Thus, Stewman (1986) used Markov chains in order show that the probability of advancement within organizations is higher at intermediate levels than at lower levels. Harrison (1988) showed on the basis of U.S. data how the vacancy chain model can predict movement between different occupations nationally. Both of these studies illustrate how the linear mobility model developed by White (1970a) can be extended to organizational mobility applications.

One of the main uses of vacancy models in this literature has been to show remarkable similarities in the social organization of different mobility systems. Using vacancy chains to trace career paths, Stewman (1975b, 1986) showed how similar career patterns develop in very different organizations. While much of this work is concerned with developing the mathematical and graphic frameworks for calculating the probability of advancement within the chain, the results show these mobility probabilities are relatively stable and do not decrease as much as expected as the individual moves up the career ladder. In fact, mid-level career positions often have greater mobility possibilities than lower levels, suggesting segmentation in intraorganizational labor markets.

Mobility considerations aside, this field of study, like the study of labor markets, has not conceptually or empirically expanded the chain model beyond the standard chain length and multiplier calculations.

Local Economic Development Studies

This is the area closest to our focus and ironically the field in which applications of the job-chains model are least developed. While a review of the stock tools of impact analysis and project evaluation has shown the limitations of existing tools in the area of local economic development (see Chapter 3), the current state of the art in applying the job-chains notion to economic development issues remains somewhat pedestrian. The sporadic studies that have appeared are mainly concerned with surveying and charting of chains. Two early papers looking at vacancy chains in the context of local economic development efforts relate to "job shifting" resulting from a program of employment creation in Alberta, Canada (Webster 1979), and a similar process resulting from expansion of coal mines in the Hunter Valley, New South Wales, Australia (Garner et al. 1981). In both cases, extensive empirical charting leads no further than estimates of chain length.

More recently, the "mapping and tracking" variant of the chain model has been revived to evaluate the impacts of urban development corporations in three cities in the United Kingdom (Robson, Bradford, and Deas 1999) and to investigate filtering in the office and industrial property markets of northeast England (Greenhalgh et al. 2003). Again, nonprobabilistic (mapping) methods are employed in order to estimate chain length for commercial property vacancies and the role of the development corporations in encouraging economic regeneration in cities. These studies found particularly short local chains and use this finding to buttress the case for local targeting.

The common feature of the above studies is that, while they all make some attempt at measuring chain length, they all stop short of estimating welfare impacts and distributional (trickle-down) effects. To avoid a purely mechanistic perspective of employment and local labor markets, we need a model of job chains that explicitly includes the welfare gains arising from mobility. The remainder of this chapter presents a simple, linear model of local labor market dynamics under conditions of less than full employment. The welfare effects of job chains and their measurement is at the center of this approach.

A GENERAL MODEL OF JOB CHAINS

To move from intuitions to serious empirical work, we have to construct a formal model of job chains. We now consider the simplest possible job-chains model, one in which all jobs can be ranked along a single dimension. Consider a local economy in which each job grouping can be represented by a rung along a single well-defined job ladder. A job vacancy is resolved in one of two ways:

1) An employee occupying a job on the rung immediately below the vacancy moves up.
2) An individual not currently employed along the ladder obtains the job in question. Such individuals might be drawn from the locally unemployed, those not currently in the labor force, or in-migrants to the community.

The probabilities of these two outcomes ($p_{1,} p_2$) sum to 1.0 and are fixed for the system.

In this setting, a newly created job opens a vacancy at the corresponding rung of the job ladder. Whatever its position in the ladder, it will be filled either by someone in the immediately lower rung or by someone not currently employed in the local economy. The rigidity of the given probabilities necessitates a well-defined hiring multiplier, *m*, the expected number of local job vacancies created and filled as the result of the appearance of a new job on any rung on the job ladder.

To see this, consider the probability that a new job will give rise to at least one more vacancy that is subsequently filled (p_1). Clearly the probability that this second vacancy will itself give rise to a third must also be p_1, and so forth down the line. The expected number of filled vacancies generated by the new job will be:

$$(4.1) \qquad m = 1 + p_1 + (p_1)^2 + (p_1)^3 + \ldots = 1 / (1 - p_1)$$

To use this multiplier to estimate welfare effects, we must assign an expected welfare gain to each worker who fills a vacancy. A worker moving up the ladder forgoes his or her present wage $\hat{w}$ in order to obtain a higher wage w at the next rung up. From the individual's perspective, the lower wage is the opportunity cost of the higher wage. His or her welfare gain is just the difference between the two wages. For simplicity, assume the ratio d (= $\hat{w}/w < 1$) remains independent of the rung in question and incorporates any nonmonetary differences in working conditions. In this context, filling a single vacancy from the rung below increases welfare by $(1 - d)w$, where w is the wage of the vacancy being filled.

What of the welfare gains achieved by those who move into a vacancy from outside the labor force, from unemployment, or through migration? These are complex transitions; their welfare values have been long debated. For the present exercise, we keep matters simple by assuming that such a transition renders a welfare gain equal to $(1 - c)w$, where c is the opportunity cost of individuals moving from nonlocal employment, expressed as a share of that job's wage.

Now the calculation is straightforward:

$$V = p_1 (1 - d)w[1 + dp_1 + (dp_1)^2 + (dp_1)^3 + \ldots]$$

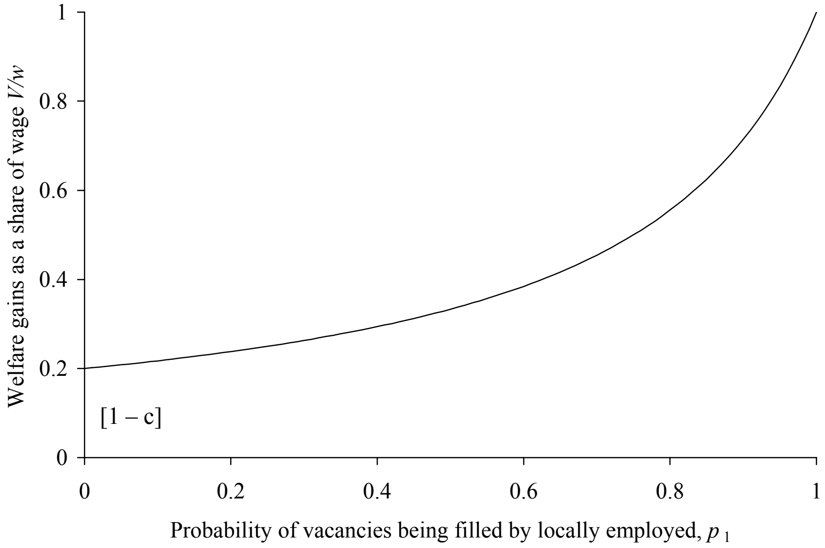
$$+ (1 - p_1)(1 - c)\, w[1 + dp_1 + (dp_1)^2 + (dp_1)^3 + \ldots]$$

$$V/w = [p_1 (1 - d)/(1 - dp_1)] + [(1 - p_1)(1 - c)/(1 - dp_1)] \tag{4.2}$$

where V represents the total expected welfare gain set off by the creation of a job paying a wage of w. This result has several interesting and interrelated implications. Under our assumptions, it is not hard to show that the ratio V/w increases with p_1 but decreases with both d and c. The intuition here is straightforward. The larger the p_1 is, the longer the chain and hence the greater the welfare gain. Larger opportunity costs, however, reduce the overall welfare gain. More specifically, as shown in Figure 4.2, V/w is bounded below by $1 - c$ (here set at $[1 - c] = 0.2$), which gives the value for V/w if all new jobs are filled by the unemployed, those out of the labor force, or in-migrants. At the other extreme, if the chain never ends and p_1 goes to 1.0, the welfare gain as a share of the initial wage approaches 1.0 as those ever lower on the chain move up a rung.

In a similar vein, we note that the first of the two terms in Equation (4.2) can be interpreted as the expected welfare gains by the already employed (i.e., interjob movers). The second term then represents the

Figure 4.2 Welfare Sensitivity



expected welfare gain from those obtaining jobs from "outside," i.e., those who come onto the chain without opening a vacancy in the local area. The former will be larger (smaller) than the latter if $[p_1 / (1 - p_1)] > (<) [(1 - c) / (1 - d)]$.

These simple observations relate directly to the "all or nothing" dilemma in evaluating wage and employment gains from local economic development programs (Felsenstein and Persky 1999). On one hand, impact analyses meticulously count all new wages arising from job creation as a local gain. In contrast, welfare economists claim that converting job counts into incomes represents "a great deal of effort that could have been better spent asking different questions" (Courant 1994, p. 863). Many workers in subsidized jobs could have invariably found alternative employment. Their welfare gain is not represented by their wage but by a much smaller amount—the difference between the new wage and the workers' reservation wage. This is usually taken as reflecting the opportunity cost of the new job and empirical estimates of this cost fluctuate greatly (Heywood and White 1990; Hodge 1982; Jones 1989).

Empirical estimates of V/w are presented in Chapter 5. These are contingent on establishing values for the parameters p, c, and d. At this juncture, however, we make a few educated guesses to at least narrow the likely range. If we set p_2 at between 0.3 and 0.4, divided more or less equally between in-migrants and local residents not employed in the recent past, this leaves us with an estimate of 0.6 to 0.7 for p_1.

These parameters imply that on average a job chain will have a length of about three filled vacancies so $m = 3$. On each link we assume that an upwardly mobile employed worker has an existing wage equal to 80 to 90 percent (d) of his/her new wage. Most arbitrarily, we set c at a lower level, say 50 to 60 percent. Under these assumptions, our basic Equation (4.2) suggests that the welfare gain associated with an average new job will be between 40 percent and 60 percent of the new job's wage.

These figures reflect a considerable discount on wage gains calculated from simple impact models. Yet they also suggest that gains from economic development projects can be substantial. The simple model used here also provides a framework for handling differences across metropolitan areas in their unemployment rates and in-migration rates. However, the model cannot address the very real possibility that different new jobs generate different benefit ratios. Since our central question is the effectiveness of trickle down in the labor market, this deficiency must be corrected.

THE MECHANICS OF JOB CHAINS: A LEONTIEF APPROACH

To operationalize the above and account for job chains of different lengths, welfare impacts, and trickle-down effects, we present a Leontief-type model of chains. The program-driven approach adopted here stresses the demand-side impulses for economic development, and trickle down is itself a demand-oriented concept. As a demand-driven construct, the Leontief model is particularly suitable for examining job chains. Our approach, however, differs from the standard input–output approach used for estimating change in production chains in two respects. First, while the conventional Leontief input–output model implies the existence of production chains, these are never explicitly calculated. Rather, the standard input–output approach is to infer intersectoral transactions from the origin–destination matrix and not to delve beneath the surface in search of production chains. Second, our chains model introduces a probabilistic element to estimating chain length that does not exist in Leontief models of production chains.

Chain Length

Our Leontief approach starts with the recognition that recruitment may look very different across the rungs of the job ladder. Some job vacancies will be filled only with workers already holding very narrowly defined skills/jobs, while others may draw on a wider range of candidates. If we can categorize all jobs into meaningful groupings on the basis of skill requirements, remuneration, and conditions of work, then we can think of a new job vacancy as setting off a "multiplier" effect as successive workers move from one job to another.

The inter-rung probabilities can be represented as a square (origin–destination) matrix (Q) with elements, q_{ij}, which show the chance that a job vacancy of a *j*-type position is taken by a worker currently in an *i*-type position. A hypothetical example is given in Table 4.2 for a local labor market. To keep the discussion manageable, we use only three wage groups: high, medium, and low.[4]

Table 4.2 Hypothetical Local Q Matrix (%)

	New wage group		
Old job	1	2	3
Wage group 1	$q_{11} = 40$		
Wage group 2	$q_{21} = 20$	$q_{22} = 30$	
Wage group 3	$q_{31} = 10$	$q_{32} = 10$	$q_{33} = 20$
Column sum	70	40	20

NOTE: Group 1 represents highly skilled workers, 2 medium-skilled, and 3 unskilled. Columns do not total 100% because some jobs are taken by unemployed workers or by in-migration.

Here, q_{11}, the share of high-skilled vacancies in the market taken by workers already holding local high-skilled jobs, is set at 40 percent. The value of q_{21}, the share of high-skilled jobs going to medium-skilled workers, is 20 percent. Finally, q_{31} tells us that 10 percent of these high-skilled jobs go to unskilled workers. Notice that the sum of these elements over the three *i*-rows for the first *j* column is less than one. Indeed, the sum down each column is less than one. The differences, of course, will be made up by local workers who do not currently hold a job or from in-migration to the area. These terminating events play a role similar to primary inputs and imports in an input–output matrix. They act as leakages that dissipate the flow of demand in the local area.

We have strong theoretical reasons for modeling Q as a triangular matrix as in Table 4.2 (i.e., entering zeros above the diagonal). In general, workers will not voluntarily move from a better job to a worse one. Of course, many such moves do take place, but presumably they are involuntary. In the context of a chain begun by an economic development project, such involuntary moves effectively guarantee that job vacancies always move "down" the job ranking. For example, consider the consequences of a project-created semiskilled ($j = 2$) job being taken by a worker who was fired from a high-skilled ($j = 1$) job. The type 1 vacancy would occur whether or not the economic development project takes place. It is not part of the chain generated by the project. However, this high-skilled worker would presumably have been able to take a job at the semiskilled level even in the absence of the development project. The counterfactual is not that the high-skilled vacancy would not have been created, but that a semiskilled vacancy would have been taken by this worker. In this sense vacancies can only move "down" and never "up" the job ranking.

The local Q matrix allows us to approximate the net consequences of job creation at each job level. The logic here is mathematically identical to that of more traditional input–output analysis, except we deal here not in the horizontal spread through the demand for goods and services but rather in the vertical job chains opened by every new job, whether direct or indirect.

For example, suppose the local Department of Economic Development manages to lure 100 new high-skilled ($j = 1$) jobs to the region. If hiring into these new jobs follows the pattern of the hypothetical Q matrix in Table 4.2, then we expect 40 of these jobs will to go to local high-skilled workers, 20 to local mid-skilled workers, and 10 to local unskilled workers, with the remaining 30 new jobs being filled by workers who currently are not employed in the local market. As suggested previously, the local job changers who gave up existing positions for their new jobs leave vacancies behind them. Over and above the initial 100 new jobs, these job changers create 70 more vacancies for a cumulative total of 170.

Of course, a similar logic applies in the next "round," as local employers seek to fill the 70 vacancies opened by job changers. Since the columns of the Q matrix aren't identical, we have to account for each type of vacancy separately. The 40 high-skilled vacancies will be filled by 16 workers (0.4 × 40) who leave vacancies at the highest level, 8 workers (0.2 × 40) who leave vacancies at the middle level, 4 workers (0.1 × 40) who leave vacancies at the lowest level, and 12 workers who at the start do not hold jobs in local businesses. The 20 vacancies created in the first round by mid-level workers taking high-level jobs now are expected to be filled by workers of whom 6 (0.3 × 20) are drawn from existing local jobs at the middle level, 2 (0.1 × 20) are drawn from existing local jobs at the lowest level, and 12 are not local job holders. Finally, the 10 vacancies created in the first round by low-skilled workers taking high-skill jobs are now taken by 2 (0.2 × 10) workers who already hold local jobs at this level and 8 who are not local job holders. Adding all these up we realize that, while 70 vacancies have been filled in the second round, 38 more have been opened up by local job changers. Now these 38 vacancies need to be filled in a third round of hiring. The 100 new net jobs have given rise to 208 vacancies in two rounds. And a fourth smaller round is still to follow, and so on and on.

As in a typical input–output application the rounds get smaller and smaller, moving toward zero.[5] Since each column sums to less than one, the process does converge. As is well known to input–output specialists, the mathematics of this situation implies that we can solve for the total job hires by performing a Leontief-type inversion of the origin–destination matrix: $(I - Q)^{-1}$. This shortcut yields a multiplier-type matrix of m_{ij}'s, which shows the gross number of local i-type vacancies generated by a j-type vacancy. Summing down the columns of this matrix gives us the total number of links or vacancies per chain triggered by jobs of different types. Thus $M_j = \Sigma_i m_{ij}$ gives the total number of expected vacancies associated with a newly created *j*-type job including that initial vacancy.[6] It seems natural to call M_j the length of a type *j* chain. A rough approach to estimating chain length has been presented above for the simple model in the previous section. Here, as before, the key to measuring the length of chains is estimating the probabilities of a chain being truncated by an in-migrant, unemployed worker, or new entrant. Since these can differ depending on the initial level of the "new job," expected chain length will also vary across levels. For the hypothetical, local Q matrix in Table 4.2, the corresponding multiplier matrix obtained from $(I - Q)^{-1}$ is given in Table 4.3.

The matrix suggests that our calculation of 208 vacancies in three rounds will ultimately be expanded to 241 (241 = 2.41 × 100) vacancies. Had we initially attracted 100 mid-level jobs, the overall multiplier would have meant 161 (161 = 1.61 × 100) total vacancies. One hundred low-level jobs here give rise to only 125 (1.25 × 100) vacancies. At least for this hypothetical Q matrix, high-skilled jobs generate the longest chains.

Welfare Impacts

Having sketched the theory of chain lengths, we turn to an analysis of differences in the expected increments in local welfare arising from the creation of different new jobs. Again we emphasize the importance of opportunity costs in evaluating welfare gains. In particular for each type of vacancy, *i*, the welfare gain is equal to $\Sigma_k\, q_{ki}(w_i - w_k)$, where $(w_i - w_k)$ represents the difference in wages between the *i* job and the *k* job. Notice we assume here that those changing jobs within the same occu-

Table 4.3 Hypothetical Local Vacancy Multipliers

	New wage group		
Old job	1	2	3
Wage group 1	1.67		
Wage group 2	0.48	1.43	
Wage group 3	0.27	0.18	1.25
Column sum	2.41	1.61	1.25

NOTE: Group 1 represents highly skilled workers, 2 medium-skilled, and 3 unskilled. Columns may not sum to total due to rounding.

pational group, i, will experience no gain (or perhaps, only a negligible one), so that $w_i - w_k = 0$ for $i = k$. We assume that the opportunity cost for in-migrants, unemployed workers, or entrants who might take a vacancy is just equal to a fraction (c_i) of the wage w_i they obtain in level i. This fraction may well vary across levels since involuntary unemployment is likely to be greater among less-skilled workers. As before, we take wages at each level to be a constant fraction, d, of the wages at the next highest level. Putting these elements together then suggests that an overall expected gain of adding a j-type job (V_j) is given by:

$$V_j = \Sigma_i m_{ij} \,[(\Sigma_k q_{ki}\,(w_i - w_k) + (1 - \Sigma_k q_{ki})(w_i - c_i w_i)]. \tag{4.4}$$

$$= w_j \,\Sigma_i m_{ij}\, d^{\,i-j} \,[(\Sigma_k q_{ki}\,(1 - d^{\,k-i}) + (1 - \Sigma_k q_{ki})(1 - c_i)].$$

or

$$V_j \,/\, w_j = \Sigma_i m_{ij}\, d^{\,i-j} \,[(\Sigma_k q_{ki}\,(1 - d^{\,k-i}) + (1 - \Sigma_k q_{ki})(1 - c_i)].$$

If we have values for d and c_i for the local labor market, we can use our hypothetical Q matrix (Table 4.2) and its corresponding multiplier matrix (Table 4.3) to calculate these welfare measures for each type of new net job j. If we somewhat arbitrarily set d equal to 0.70 and c to 0.50, we obtain the following results for the local welfare gain: $V_1 / w_1 = 0.60$, $V_2 / w_2 = 0.52$, and $V_3 / w_3 = 0.50$. Thus, new jobs added in the highest skill class ($j = 1$) not only have the longest chains but also the greatest welfare gain per dollar of new wages. Put somewhat differently, the usual practice of adding up new wages will overestimate welfare gains for the highest-class jobs by 40 percent, while it will overestimate for mid-level jobs by 48 percent and by 50 percent for the lowest-level jobs.

Distributional Implications

Finally, we can use the chains matrix to make calculations concerning the distribution of gains across various groups of workers. In particular we might ask, for any given chain, how much welfare gain goes to the lowest group of workers—those who are willing to take bottom-rung jobs if and when such jobs become available. Concentrating on welfare changes in this lowest group is very much in the spirit of the theories of distributive justice of John Rawles. Hence, we will loosely refer to our measure, R, as a Rawlesian welfare measure. More specifically, given the assumptions used in Equation (4.4), this measure can be calculated for each j. The result is given in Equation (4.5).

$$R_j = w_n m_{nj} (1 - q_{nn})(1 - c_n) \tag{4.5}$$

The only term on the right-hand side of this equation to vary with j is m_{nj}. Hence, this measure of the distributional consequences generated by a new type j-type job depends only on the number of vacancies of the lowest level that "end" the job chain.

In our hypothetical local example we just need to check m_{3j} from Table 4.3. Clearly, generating jobs directly in the lowest job class (j = 3) produces the largest multiplier ($m_{33} = 1.25$) and hence the largest Rawlesian measure ($R_3 / w_3 = 0.5$). New jobs created at the middle level ($j = 2$) generate some trickle down and a Rawlesian measure (R_2 / w_3) of 0.07. New jobs at the highest level do somewhat better, with a Rawlesian measure (R_1 / w_3) of 0.11.

JOB CHAINS AND TRICKLE DOWN: THREE PROPOSITIONS

A model built along the above lines can address a broad range of questions about economic development impacts. Most interesting for our purposes, this generalized job-chains approach can be used to explore the logic of trickle down in economic development. In general, a trickle-down theory holds that the poor are best served by policies that directly improve the welfare of the more prosperous. Much economic development activity undertaken by state and local governments explicitly or implicitly invokes a trickle-down perspective. In this view, subsidizing high-skilled, well-paying jobs generates substantial positive spillovers for the less well trained, even though the latter are unable to directly qualify for the subsidized jobs. Of course, these spillovers might take a number of forms. We make no general claim here to explore all of those. However, in the context of job-chains analysis, we interpret the advocates of trickle down as asserting three related propositions.

1) *A job multiplier effect:* This proposition states that the expected length of a job chain goes up as the skill level of the added job increases. It addresses the question of "requisite" chain length in the context of job generation for low-wage earners. On one hand, chains initiated at higher skill levels are likely to be longer but, on the other hand, they are likely to be truncated by in-migrants. While chain length itself does not directly impact on welfare, it does indicate the possibility of trickle-down benefits percolating to low-skilled vacancies. Higher-skilled jobs are more likely to be filled by those employed at a given skill level or at a level close to it. With relatively low unemployment rates amongst skilled workers, skilled jobs are less likely to draw on the unemployed. Job-chain length is important as it is a major vehicle for effecting change in local welfare. In periods of economic growth, the job-chains approach suggests that an individual's welfare gains are more likely to be the result of progression along a chain than of income increases *in situ*. Longer chains, therefore, mean more opportunities for welfare improvement.

2) *An efficiency effect:* Under this proposition we expect the welfare gain associated with a job chain to go up as a proportion of the initial wage as the skill level of the added job increases. This deals with the question of the relative efficiency of high-wage over low-wage job creation. If it costs the same to produce either 100 $75,000/year jobs or 300 $25,000/year jobs, is the first project more or less efficient in generating economic welfare than the second? If the index of efficiency (V/w) is highest for the higher-skilled jobs, trickle down might be observed as working. If, however, new low-skilled jobs provide more local welfare gains per dollar of wages, the implication is that trickle down is not operating efficiently.

3) *A distributional effect:* This proposition contends that the absolute gains to even the least-skilled workers increase as the skill level of the added job increases. Ostensibly, a distributional effect that favors the lowest-skilled workers cannot be readily reconciled with propositions (1) and (2). Trickle down will have a distributional effect when gains to the poor (the low-wage worker, the unemployed, and those out of the labor force) are greater from a job initiated higher up the wage structure than from a lower-wage new job.

How plausible are these trickle-down propositions? We consider this question from a theoretical point of view in Appendix B, using several simplifying assumptions. Our tentative conclusions there give some support to the chain-length proposition, but they contradict the key distributional proposition. These conclusions, however, are at best suggestive, given their hypothetical nature. It seems obvious that the appropriate way to approach this question is with real data, a task to which we turn in Chapter 5.

CONCLUSIONS

The study of simple vacancy chains runs the risk of a mechanistic perspective on labor market dynamics. In such a story, a pool of workers and a pool of jobs exist, and the issue is simply one of matching. No attention is given to markets, prices do not change, and the vacancy model simply gives an account of the rippling-through effect that occurs subsurface with the creation of new jobs. On the other hand, pure market models of this process where a price structure emerges and the market clears can give a sterile and static perspective on what is essentially the dynamic process in which all of us make our career paths.

The job-chains model presented above has tried to break middle ground. By looking at welfare gains from chains at different skill levels and by incorporating insights from opportunity cost theory, we have attempted to show that prices alone do not control the supply and demand for jobs. We have credited workers with more autonomy. Their decisions to in-migrate, reenter the labor market, or retire affect the labor supply. Similarly, by assuming underemployment and a fairly rigid wage structure, we note that demand impacts on chains and on the welfare that accrues from chains set off by different skill levels. Echoing Bartik's "hysteresis" theory of local job growth (Bartik 1991), we note that both supply and demand shocks affect chain length and welfare impacts. In this view of labor market processes, short-run dynamics such as movement through a job chain have long-term effects. Once a chain is triggered, workers start to move up to a new platform. They accumulate new levels of human capital, skills, and work habits that serve them in any further progressions along the job chain. Even if the external agent of change (the job chain) was removed, they would not return to their initial state. Local employment creation, via the chain process, can therefore lead to long-run changes beyond the initial (short-term) effect of the job creation itself.

A further implication of the above is the interrelatedness inherent in employment creation. Chains limit our ability to use targeting as an economic development strategy. The job-chains model shows us that targeting one group in the population will always affect other subgroups, as they are all interconnected via job chains. At the very least targeting economic development efforts must be undertaken in a more sophisticated context—one that accounts for the ramifications generated through labor chains. We will return to such policy implications after building empirical job-chains models in the next two chapters.

Notes

1. Positions, jobs, or vacancies (unlike individuals or households) have no desires, choices, personal wealth, or any other behavioral characteristics. They are purely conditioned by their present state. This property opens up analytic possibilities for assessing movement through chains based on a probabilistic approach for inferring chain length.
2. For more formal treatment of the model, see Bartholomew (1973) and Kemeny and Snell (1960).
3. A full treatment of input–output and its extensions to urban and regional analysis is given in Miernyk (1965) and Miller and Blair (1985).
4. Three groups is surely an unrealistic number since few if any workers will move from unskilled work to highly skilled work in one job change. In most of our empirical work in Chapter 5 we use five groups. The basic limitation, discussed there, is the size of our data set. With more plentiful data, we would surely have considered a more disaggregated structure.
5. Again, keep in mind that these rounds are not opening net new jobs, only gross vacancies.
6. When Q is taken to be triangular, the chain lengths, M_j, are relatively easy to calculate in a recursive manner. In particular, if we follow our ranking of skill levels from 1 as the highest to n as the lowest, then:

$$M_n = 1 / (1 - q_{nn}),$$

$$M_{n-1} = [1 / (1 - q_{(n-1)(n-1)})]\,[1 + q_{n(n-1)} M_n],$$

$$M_{n-2} = [1 / (1 - q_{(n-2)(n-2)})]\,[(1 + q_{(n-1)(n-2)} M_{(n-1)} + q_{n(n-2)} M_n)],$$

$$(4.3)\ \ldots$$

As these formulas make clear, the actual values for the chain lengths will depend on the specifics of the Q matrix. We elaborate this point in Appendix B.

5

Operationalizing a Job-Chains Approach

THE NEED FOR EMPIRICAL RESEARCH

The modest tremors created by a new plant location or a business expansion in a metropolitan area will not generally register on the crude Richter scale of supply and demand. In a world of persistent underemployment, such changes have little effect on wage structures, land values, or other local prices. As a result the assessment of economic development projects has focused on the type of quantity measures—area production and employment—associated with simple Keynesian concepts, economic base theory, and input–output analysis. These common types of impact assessment trace the influence of a new project in terms of product market linkages. Direct production calls forth a range of intermediate supplies. In their turn, new workers demand consumption goods, inducing further expansion. These are the surface effects that spread new economic activity through the community. But, as demonstrated in the last chapter, a simple accounting of these net product and employment changes fails to give an adequate picture of the magnitude and distribution of the economic benefits generated by the project.

The basic thesis of this book holds that a job-chains approach provides a useful framework for addressing several major shortcomings of impact analysis. Indeed, just acknowledging the existence of job chains forces a look below the surface of traditional impact measures. Almost by definition, job chains imply that the gains of new employment will spread to workers who do not themselves take those new jobs but rather find jobs vacated by others. Quite naturally, this realization leads to a set of intriguing questions concerning the sharing of program benefits and the extent to which chains open opportunities to low-wage workers. Job chains provide a way of thinking about trickle down, but theory and a few stylized facts will not answer the key questions posed by job chains.

For example, in the speculative explorations of the last chapter, we noted that high-skilled vacancies were unlikely to be filled by the unemployed and hence chains originating at this level might be expected to be long. Reflection suggests, however, a potentially countervailing force at work. While high skilled jobs in metropolitan areas are usually not filled from the ranks of unemployed workers, these openings do attract many in-migrants. In comparison to the semi-skilled or unskilled, high-skilled workers are more likely to participate in national, and even international, labor markets. An in-migrant cuts off a local job chain just as surely as a hire from the unemployed. In either case, the hire generates no linked vacancy in the local area and no further hiring.

We are unlikely to gain much insight into the outcome of such a tug-of-war without empirical evidence. Nor will stylized facts or common sense suffice. Such simple observations, while often true in isolation, provide little guidance when combined in more complex settings. To start a more serious assessment requires an empirical base.

Similar factors, but with opposite signs, also cloud our expectations concerning chains originating in low-skilled, low-wage vacancies. In the low-skilled market, labor recruitment is likely to be local, but this means that many new workers will be drawn from the unemployed. The resulting average length for these low-skilled chains might be greater or less than that of high-skilled chains. Determining the relative lengths of these chains requires more than theoretical speculation. It requires the empirical estimation of the multiplier effects discussed in Chapter 4.

In the world of job chains, theory has been a good deal easier to come by than empirical evidence. The extensions of the job-chains approach to encompass measures of economic welfare will amount to little if they are not complemented by serious empirical efforts. For example, if job chains are to inform choices among economic development projects, analysts must be able to point to reasonable estimates of efficiency gains and distributional consequences. Only when we have the ability to quantify gains can we hope to integrate the dynamics of job chains into the standard *ex ante* cost–benefit framework.

Empirical advances are particularly central to questions of trickle down. Precisely because low-skilled workers may benefit from chains originating higher up the job hierarchy, an accurate assessment of the likely distribution of gains hinges on quantitative insights into chain dynamics.

A clear analogy exists between job-chains analysis and input–output analysis. The theory of input–output may be of great interest in and of itself. But, until researchers are able to estimate a reasonable empirical transactions table, theory remains of little practical use. The most interesting questions hinge on the magnitude of effects, not on the theoretical certainty that everything is interconnected to everything else.

AN EMPIRICAL STRATEGY

The most common empirical approach to chain research starts from information about actual chains as they unfold. For example, this approach has dominated the investigation of housing chains. In that case, a new residence is added to the stock of housing. The researcher begins by characterizing the housing unit, most importantly its market price. When a household occupies the new house, they are interviewed to ascertain their previous residential location. The researcher then follows the vacancy chain until a unit is withdrawn from the housing stock, occupied by an in-migrating household, or occupied by a newly formed household. Information on actual housing chains can then be averaged to estimate expected chain length. Alternatively, these chains can be used to estimate the proportion of chains ending in a particular population.

In principle such an approach could also be used to estimate the various coefficients in the origin–destination matrix in the local labor market (Q as defined in Chapter 4). Actual chains could be disaggregated to provide information on the probability of a given opening being filled from various sources.

Such an empirical strategy cannot be built on existing U.S. data sources, which lack information on jobs as distinct from individuals. In the United States, jobs are treated not as entities in themselves, to be filled or vacated or destroyed, but rather as incidental information concerning the individuals who occupy them. While a number of data sources allow researchers to track job histories of sample individuals, virtually none allow tracking of the successive individuals employed in a given position. Of course, some data are collected from firms on job flows—hires, separations, etc.[1] None of these, however, allow the tracing of actual vacancy chains.

Even if generous funding were available, a survey research project would face great difficulty in tracing actual job chains. In housing-market studies, a moving household's residence of origin is well defined and the new occupants of that housing unit can be ascertained in a relatively straightforward manner. Defining a job changer's origin position is more difficult, and determining the new worker now holding that position is often impossible.

Under the circumstances the possibility of using actual chains as the underlying data source for empirical work on U.S. job chains seems slight, but this does not imply that we can make no progress in estimating the coefficients of an origin–destination matrix. Even where direct chain data are lacking, we can adopt a synthetic approach, not unlike that used in input–output analysis. After all, input–output researchers do not trace back through actual market transactions at every stage of production for a given good. They do not actually log the sale of the cloth to the apparel firm, then the sale of the cotton to the textile firm, the sale of petroleum to the farmer and so on. Instead, they estimate an average "input vector" for each industry, assume that vector to remain constant whatever the use of the industry's product, and then infer the necessary character of production chains.

To use such a synthetic approach for job chains we need to define and measure the equivalent of the input vector of an input–output matrix. If we break jobs down into discreet groups based on wages or some other general measure of quality, we simply ask what proportion of vacancies in a job at level 1 are filled by workers employed in level 2 jobs, workers employed in level 3 jobs, etc. To fill in the elements of such a vector, we need information only on a sample of job changers (i.e., their new jobs and their old jobs). Still following the input–output model, we now assume that the probability of a given link in a job chain (e.g., the probability that the vacancy opened at level 3 is filled by a worker employed in level 5) depends only on the level of the vacancy being filled (e.g., level 3), and not on any other characteristics of the chain (e.g., the chain began with a new job at level 1). With this key assumption, we need no further information concerning job chains. In effect, once we are armed with these "input vectors," we can synthesize the distribution of job chains.

This approach to job chains greatly simplifies the empirical requirements of the theory. To construct "input vectors" for a given job level, we only need information on job changers. We do not need observations on entire chains, only a representative sample of unrelated chain links. Such data are available from workers' longitudinal job histories. Without ever creating a sample of real job chains, we can now estimate all the relevant coefficients of the "input vectors" including those that make up the origin–destination matrix (Q).

THE PANEL STUDY OF INCOME DYNAMICS

Given the above discussion, the key empirical problem becomes the identification of a data source with information on a large representative sample of job changes. While hardly trivial, these data requirements are far less restrictive than those imposed by a search for complete job chains. Several major longitudinal studies in the United States collect data on individual work histories. Perhaps the most representative and most widely used of these is the PSID from the Survey Research Center in the Institute for Social Research at the University of Michigan. We chose the PSID because it contains detailed information on a broad sample of households, including many job changers.

The characteristics of the PSID subsamples used in our empirical work are discussed in more detail in Appendix C. However, three observations are worth making at this point. First, detailed job data from the PSID are only available for household heads (including unrelated individuals with their own household) and their spouses. While basic employment status and earnings are reported for other household members, these data are not sufficient to determine job changes. As a result our sample consists only of changes by heads of households and spouses of heads. Other household members are likely to be younger, less educated, and lower paid than heads and spouses. These workers are also more likely to move between jobs, but we lack data on this point. At any given time, however, heads and spouses account for approximately 91 percent of all employed workers in the PSID sample.[2] As a result limiting our data to heads and spouses is not likely to grossly misrepresent labor market dynamics.

Second, the PSID data set does not provide a continuous job history even for heads and spouses. Rather it reports detailed data concerning length of tenure for the primary job position, if any, held at the time of the annual interview. Thus, we know when a head or spouse took his/her present job but not what other jobs they may have been hired into and separated from since the last interview.[3] These data miss those multiple job changes that occur within a year. Hence, estimates of the overall frequency of job changes from PSID data have a second source of underestimation.

While the above two points highlight shortcomings of the PSID data set, our third point emphasizes a major positive feature. The PSID allows us to define both firm changers and position changers, where the first denotes a change of employers and the second a change of jobs within the same business. This means we can consider intrafirm mobility as well as interfirm mobility as workers move along job chains.

For the national PSID sample, about 600 individuals (heads and spouses) a year take new positions, with sufficient documentation to be included in this study. Of these, half are starting with a new employer. To increase the sample size in our basic analysis, we include all job takers in six years for which full data are available, 1987–1993. The resulting data can be interpreted as relating to a representative or average state.[4]

ESTIMATING THE AUGMENTED Q MATRIX

Ideally, all welfare-relevant dimensions of job quality would be considered in defining the columns and rows of the origin–destination Q matrix. A comprehensive scheme would have to include not only wage levels, but also fringe benefits, security, and conditions of work. However, given the difficulties surrounding the definition of job quality, we have used only wage levels in determining the groupings for empirical work. Hence, we consider only changes in wage levels as the gain for workers changing jobs.

In practice, then, we assign every reported job, whether it's just being taken or just being left behind, to one of five real-wage groups.[5] The highest of these (group 1) runs from \$25.50 to \$40 per hour in 1992 prices; group two is then \$16.40 to \$25.50; group three, \$10.50 to \$16.40; group four, \$6.70 to \$10.50; and group five, \$4.25 to \$6.70. Although somewhat arbitrarily chosen, each group's lower bound is approximately two-thirds of its upper bound.

Using these definitions, we can estimate the probability that a group j vacancy is filled by a worker currently employed in a group i job (q_{ij} from Chapter 4). Using the sample period of 1987–1993, we simply calculate the ratio of workers who made the i to j move to the total number of workers who took j-group jobs.[6] As in a Leontief input matrix, every column in the resulting Q matrix adds up to less than one. The residual in each column indicates the probability that jobs of that group are filled outside of a vacancy chain.

The residual probability for a wage group can be disaggregated into the probabilities of filling vacancies from each of our three residual categories: unemployed, out of the labor force, and in-migrants. While differentiating among these categories is not crucial to determining chain lengths or the multiplier effect, such differentiation can become significant in estimating welfare and distribution effects. Again, we have looked to our basic PSID data source to determine what proportion of jobs taken at any given job level draw on each of the residual categories. The PSID includes data on the month an individual took his or her present job as well as monthly data on whether that individual was employed, unemployed, or out of the labor force. In addition, it records both the state of residence of a household in each year and whether the household lives in a metropolitan area. We define in-migrants as those who change their state of residence between two years and/or change from a nonmetropolitan county to a metropolitan one.[7]

Before turning to our results, one further point should be made. In the real world, not all job moves increase an individual's wage level. For wage groups 2–5, a fraction of all vacancies is filled by workers stepping down the wage hierarchy. In our data, this fraction rises from about 4 percent for group 2 to 10.6 percent for group 5. As noted in

Chapter 4, these downward movers create a problem in interpretation. It is difficult to conclude that such job changers are actually worse off for the presence of a vacancy at the level they ultimately find work. Presumably, in the absence of the vacancy they actually take, such downwardly mobile workers would have found a job at about the same low level, or perhaps lower. But, such a downward move is essentially exogenous to a job chain initiated by a new (net) job.

Under the circumstances it seems fitting to reallocate these downward movers among all other movers in some manner. This strategem can be interpreted in either of two ways. One possibility is to think of the downward mover as "sinking" to some other job (or one of the residual categories) and then "moving up" to the vacancy they actually take. Alternatively, the downward mover might be considered as taking the new vacancy at the level he/she actually settles, but in so doing opening another equivalent vacancy at that level that otherwise they would have filled. Thus, in the empirical work that follows, downward movers are allocated proportionally to all other categories. In effect, this adjustment triangularizes the Q matrix, which simply amounts to the mathematical expression of the proposition that new vacancies do not cause downward job movements.

What does the resulting Q matrix look like? Table 5.1 presents our basic estimates, drawing on the entire period from 1987 to 1993. Each column in the table shows the "input vector" for the corresponding job

Table 5.1 Basic Origin–Destination Matrix

	New wage group				
Origin wage groups	1	2	3	4	5
Wage group 1	41.1				
Wage group 2	25.0	52.9			
Wage group 3	4.8	22.1	46.6		
Wage group 4	2.2	1.5	18.5	47.3	
Wage group 5	0.0	0.3	2.4	13.3	34.5
Unemployed	2.9	3.8	9.7	15.8	24.7
Out of labor force	4.0	3.8	7.5	13.5	30.5
In-migrant	20.1	15.6	15.4	10.0	10.2
Column sum	100.0	100.0	100.0	100.0	100.0

NOTE: All values expressed as percentage of hires in the new (column) wage group. Columns may not sum to total due to rounding.

group after adjustments for triangularization. An element in a column gives the proportion of the column vacancies filled from that origin row. Every column must sum to 100 percent.

Starting with job vacancies in the highest wage group, as reported in column 1, the element in the top row tells us that 41 percent of vacancies at this level are taken by individuals who already have a job in the same group. About 25 percent of the vacancies go to workers who were employed in the second wage group and switched up to higher-paid jobs in the first group. As we might well expect, workers holding jobs in groups 3 and 4 take few vacancies in the top group, and workers in group 5 take virtually none. The unemployed and those out of the labor force are also relatively unimportant recruiting fields for these high end jobs. However, a large share of group 1 vacancies, about 20 percent, go to in-migrants.

The data in the matrix suggest several generalizations. First, job changes within a wage group, the diagonal elements of the matrix, are somewhat more common for groups 2, 3, and 4 than for the highest group. Group 5 vacancies, however, are less likely to go to those already employed in the group. Second, upward job movement remains largely limited to workers leaving their current job to fill a vacancy in the immediately higher group. Third, the importance of recruiting from the unemployed and out of the labor force groups falls steadily as wage level rises. Finally, the share of vacancies filled by in-migrants rises steadily with rising wage levels.

CHAIN LENGTHS

These observations are of considerable interest. A first, but incomplete, summary of the matrix can be gleaned from calculating the Leontief-type multipliers as defined in Equation (4.3). Recall that these multipliers provide direct estimates of the chain lengths associated with a new job. Given the substantial dependence of low-wage job recruitment on nonemployed workers (i.e., the unemployed, those out of the labor force, and in-migrants), it is not surprising that the multiplier for the lowest category comes out at only 1.5.[8] Still, this multiplier implies that, on average, a net expansion of 100 jobs at this level gives rise to another 50 opening at the same level. One hundred fifty individuals, not 100, will fill vacancies. The chains generated, in this case, are particularly simple. We expect about two-thirds, say 65, of the new jobs to be immediately filled by the nonemployed and hence to create no chain effects. The other one-third of the new jobs, about 35, go to workers already employed in group 5 jobs, thus opening 35 additional vacancies at this level. Again, about two-thirds of these vacancies draw on the nonemployed and one-third on the employed. The probability of a chain consisting of just two vacancies is then 1/3 × 2/3 = 2/9, or in this case, about 23 of the initial chains will have exactly two vacancies. In the same manner, we can calculate that 2/27 of the chains (or about 7 out the initial 100) will have three vacancies, 2/81 will have four, and so on. Taking the full range of possibilities then, we know that the average chain length will just be our multiplier of 1.5. Ideally this predicted distribution of chain lengths and its mean would be empirically tested against an actual distribution taken from a sample of chains. But, as noted above, generating data on full chains remains highly problematic.

Expected chain length for the lowest wage jobs are short. Calculating Leontief multipliers for each of the other wage groups shows a rise in expected length with skill/wage level. The longest chains, with an average of 3.5 links, are found in the top two wage groups. These results answer one of our key questions. In-migrants are more likely to fill high-wage vacancies, and the unemployed are more likely to fill low-wage vacancies. But, on net, the chains for high-wage jobs are considerably longer than those for low-wage jobs. With about 80 percent of all vacancies filled by employed workers, these high-end jobs generate more second-round vacancies. Since these induced vacancies are mostly at high wage levels, they in turn generate quite a few third-round vacancies.

To explore the nature of these chains further, we can disaggregate the chain multipliers to show for each type of chain the expected number of vacancies generated at each level. As discussed in Chapter 4, this disaggregation is our chain-system equivalent of the $(I - Q)^{-1}$ matrix from standard input–output theory. The results for our basic matrix are presented in Table 5.2. The bottom row of the matrix (all groups) gives the set of chain-length multipliers we have just been discussing. The column above each of these entries shows a disaggrega-

Table 5.2 Disaggregated Multiplier Matrix

	Initial new job				
Wage groups	1	2	3	4	5
1	1.70				
2	0.90	2.12			
3	0.52	0.88	1.87		
4	0.28	0.37	0.66	1.90	
5	0.08	0.12	0.20	0.39	1.53
All	3.48	3.48	2.73	2.28	1.53

NOTE: Columns may not sum to total due to rounding.

tion of the generated vacancies by wage group. For example, reading down column 1, we find that on average a new job in wage group 1 generates 1.7 vacancies in its own wage group, 0.9 vacancies in group 2, 0.52 in group 3, and so on. The column adds to the vacancy multiplier of 3.5.

Perhaps the most interesting observation to be made from this disaggregation concerns the extent to which high-level chains reach down to open vacancies in low-level wage groups. A new job in the highest wage group generates 0.36 vacancies in the two lowest wage groups. As noted above, only 2 percent of group 1 vacancies are actually filled by workers currently holding group 4 or group 5 jobs. For new high-wage jobs, the vacancies generated at these lower wage levels are opened only toward the end of the chain. If in the first round a vacancy is opened up in group 2, then in the next round a vacancy might open in group 3. A group 3 vacancy, unlike a group 1 vacancy, has a real possibility of being filled by a worker in group 4 or group 5. Indeed, from Table 5.1, we can read the latter probability as about 20 percent. While not all chains initiated in group 1 will reach these later rounds, those that do will contribute to building vacancies at the lower end of the job hierarchy.

A new job in group 1 opens 0.36 vacancies in groups 4 and 5 together. Similarly, from the second column of Table 5.2, we find that a new group 2 job is expected to generate almost 0.5 vacancies in groups 4 and 5 together. These levels of impact on low-wage job vacancies create at least the possibility of significant benefit from trickle down. However, we can’t really evaluate such trickle-down benefits until we have used our job chains as a basis for measuring welfare gains.

INDIVIDUAL WELFARE GAINS

Job Changers

Given the definition of our wage groups, it is not difficult to determine the average gains of upwardly mobile job changers. From the PSID we can estimate wage levels for both the original job and the new job. The average gains for each origin–destination pair are given in Table 5.3. Since we are primarily interested in what portion of a new wage represents a welfare improvement, these figures are calculated as a percentage of the wage at the new destination job, not the original job. In general these gains are quite impressive.[9]

As might be expected, workers moving up one step in the job hierarchy gain less than the average difference between those two steps. They are either earning above average in their old job or below average in their new job or both. This one-step gain comes in at about 23 percent of their new wage, whereas the average difference between levels is about 37 percent. For two- or three-step movers the difference between actual change and average difference becomes a good deal narrower, 54 percent as compared to 58 percent. Throughout, we use the percentage changes from our sample.

Clearly upward job changes generate significant improvements in welfare. These are relatively easy for us to estimate. Much more difficult to determine are the welfare gains for job takers who were previously unemployed, out of the labor force, or lived elsewhere. At root, any estimate of the welfare gains of these groups requires an evaluation of the alternative opportunities available to such workers. The gain is

Table 5.3 Average Wage Gains by Job Changers

	Destination wage group			
Origin wage groups	1	2	3	4
1				
2	24.1			
3	54.0	21.2		
4	73.6	55.7	23.3	
5	—	66.8	53.3	24.1

NOTE: All changes as a percentage of the destination wage, not the original wage.

the difference between the wages taken and what was given up. As suggested in Chapter 4, these alternatives, or opportunity costs, are notoriously difficult to estimate.

The Unemployed

We start by considering workers obtaining jobs from unemployment. The key question here hinges on the degree to which such unemployment is voluntary. In a world with imperfect knowledge, unemployed workers and job vacancies may exist side by side. As search theory tells us, both workers and employers may make gains from improving their information. These gains from search represent a real opportunity cost when an unemployed worker takes a job. Put somewhat differently, a voluntarily unemployed worker "knows" that he/she can obtain a reasonable position either in this labor market or somewhere else. For such a worker, the opportunity cost can be reasonably associated with the reservation wage that worker seeks from a new job. That reservation wage is likely to be a substantial fraction of the actual wage the worker finally commands.[10]

Of course, not all unemployment is voluntary. As discussed in Chapter 2, Keynesian concepts of involuntary unemployment have received support from more recent theoretical and empirical work by neo-Keynesians. Considerable disagreement remains, however, over details. Where does voluntary unemployment stop and involuntary unemployment begin? We adopt a simple approach to this problem. We take as the cutoff point between voluntary and involuntary unemployment a rate of 2.5 percent. This rate presumably covers the type of job searching in a labor market characterized by less than perfect information. Such a figure has often been mentioned in connection with frictional unemployment. Moreover, it comes very close to the actual unemployment rates we measure for college graduates in our sample in a tight labor market year, 1989. In good times these workers can obtain solid jobs relatively easily. Hence, if they report themselves to be unemployed at such times, we can expect that they are voluntarily unemployed.

In principle, then, an unemployment rate in excess of 2.5 percent indicates the presence of involuntary unemployment. How can we determine unemployment rates for each of our wage groups? By definition, once a worker has a job in a specific wage group, he or she is employed. Our approach to this dilemma rests on estimating an unemployment rate based not on actual wages received but rather on expected wages. We first estimate a wage equation of the type common in the human capital literature. This equation regresses the logarithm of the hourly wage on sex, age, age squared, and a set of educational dummy variables (see Table 5.4). The regression is for all PSID heads of household and spouses employed in 1992. This equation allows us to then calculate a predicted wage for both the unemployed and employed workers in the PSID data set. Since the dependent variable is again transformed to logarithmic form, the coefficients of those worker characteristics entered as 1 or 0 (i.e., sex and education variables) can be interpreted as percentage shifts in hourly wages. For example, our results suggest that men in the sample earned about 25 percent more than women of the same age and education. Similarly, workers with

Table 5.4 PSID Wage Equation, 1992[a]

Independent variable	Coefficient	*t*	*P*
INTERCEPT	1.19	16.9	0.0001
SEX[b]	–0.24	–21.2	0.0001
AGE[c]	0.05	18.7	0.23
AGESQ92[d]	–0.0006	–16.7	0.01
SHS[e]	0.10	2.7	0.02
HS[f]	0.26	7.7	0.0001
SCOL[g]	0.42	11.8	0.0001
COL[h]	0.63	17.5	0.0001
SGRAD[i]	0.72	19.5	0.0001

NOTE: Adjusted $R^2 = 0.26$.

[a] Dependent variable: LOGWAGE92
Dependent mean: 2.45

[b] SEX = 1 if female, = 0 if male.

[c] AGE in years.

[d] AGESQ92 = age × age.

[e] SHS = 1 if some high school, but no degree, = 0 otherwise.

[f] HS = 1 if high school degree, = 0 otherwise.

[g] SCOL = 1 if some college, but no degree, = 0 otherwise.

[h] COL = 1 if college degree, = 0 otherwise.

[i] SGRAD = 1 if some graduate education or graduate degree, = 0 otherwise.

some high school, but not a diploma, earned wages about 10 percent more than workers of the same sex and age who had not attended high school.[11]

While the wage equation in Table 5.4 is estimated only for workers who are employed and currently earning wages, we can use the same equation to predict a wage for workers who are unemployed.[12] On the basis of these predicted wages, it is straightforward to assign all labor force participants, both employed and unemployed, to one of our wage groups. Then, we can calculate an unemployment rate for each of these groups. Since 1992 was the bottom of the recession, we go on to repeat the calculation of unemployment rates (using the same wage equation) for the boom year of 1989.

For individuals with predicted wages in our two highest wage groups our average estimated unemployment rate comes out at about 2.25 percent.[13] Given that our definition of involuntary unemployment requires a group rate greater than 2.5 percent, a worker moving from unemployment to a job in wage group 1 or group 2, is considered voluntarily unemployed. However, for groups 3, 4, and 5, we estimate unemployment rates of 5 percent, 8.5 percent, and 19.5 percent, respectively, and hence involuntary unemployment of 2.5 percent for group 3 (2.5 percent = 5 percent – 2.5 percent), 6 percent for group 4 (6 percent = 8.5 percent – 2.5 percent), and 17 percent for group 5 (17 percent = 19.5 percent – 2.5 percent).

These somewhat speculative calculations give us a way to divide the unemployed into voluntary and involuntary categories, but what is the opportunity cost to place on each of these? The most extreme assumption would be to claim the involuntarily unemployed face no opportunity cost to taking a job, while the voluntarily unemployed face an opportunity cost equal to just about 100 percent of their ultimate wage. A more reasonable approach recognizes that even the involuntarily unemployed gain some welfare from their time, and the voluntarily unemployed generally set their reservation wage below the wage they actually obtain. Rather than setting the opportunity cost of the involuntary unemployed at 0 percent, we place it at 25 percent. For the voluntary unemployed, we place the opportunity cost at 75 percent. The main point here is not the specific numbers chosen but maintaining a significant difference between them.

The final piece in this rather involved train of logic is to assume that the unemployed hired into a job of a given wage class are drawn randomly from the unemployed population at a predicted wage for that group's level. In effect, this assumption makes the opportunity cost for such a new worker the weighted average of the opportunity costs of the voluntarily and involuntarily unemployed, the weights being the shares of that group's unemployment pool in each unemployment category, or

$$oc_i = ([1 - (0.025\ /\ u_i)] \times oc_{\text{involuntary}} + [0.025\ /\ u_{i]}]) \times oc_{\text{voluntary}},$$

where *oc* refers to opportunity cost, *i* is the wage group, and u_i is the unemployment rate of that wage group.

The resulting opportunity costs given by this approach seem plausible. The highest two groups have values of 75 percent, group 3 is 50 percent, group 4 is 40 percent, and group 5 is 31 percent. These opportunity costs play the same role for those drawn from unemployment that original wages play for job changers. Hence, an individual coming from unemployment to a group 1 or group 2 wage should be credited with a welfare gain of 25 percent of that group 1 wage. Coming into a group 3 job, a worker gains about 50 percent of the new wage, in a group 4 job, 60 percent, and in a group 5 job, 69 percent. Thus, for those originating in unemployment, this last set of figures provides the equivalent to a row in Table 5.3 for those originating in a particular wage group.

Out of the Labor Force

Perhaps the trickiest opportunity costs to determine are those for workers drawn from outside the labor force. The vast majority of adults who are not members of the labor force have voluntarily chosen that status. These include many retired workers, students, and those who productively maintain their households and families. However, some fraction of those out of the labor force lack employment despite their preferences. These include the so-called discouraged workers. At first glance, it might seem we could follow a similar strategy here to the one chosen for the unemployed: divide the labor force pool of each wage group between voluntary and discouraged and then assume that those taking employment are drawn randomly from these two groups. Unfortunately, this last assumption seems quite untenable. All of the unemployed, both the voluntary and involuntary, presumably are seeking work. As we have just noted, however, this is certainly not the case for all those out of the labor force. Job takers from this group are not representative of the group.

Rather than compare those who enter employment from the out of the labor force category to that category as whole, it seems more reasonable to compare them to unemployed workers with the same general skills. In tight labor markets, where most unemployment remains voluntary, those entering the labor force will have similar opportunities to the voluntarily unemployed. On the other hand, in markets where involuntary unemployment is high, new entrants are likely to face fewer opportunities and more immediate pressures. From this perspective, the appropriate opportunity cost for labor force entrants will be quite similar to that for the unemployed. We take this approach in all our empirical work. Hence, using our estimates for the unemployed, we set a high opportunity cost, 75 percent, for the top skill/wage groups and a relatively low opportunity cost, 31 percent, for the lowest wage group.

In-migrants

Recall that our basic geographic units are the metropolitan and nonmetropolitan portions of states. In-migrants, both from elsewhere in the country and from abroad, are generally in a position to scan across geographic areas searching for their best opportunities. In-migrants very likely face roughly similar opportunities in a number of alternative places. This logic applies most strongly to high-skilled workers, but it is likely to extend to low-wage workers as well. For simplicity, we use the same opportunity cost for in-migrant workers as for the unemployed in the same wage group.

The simplifying assumptions used to construct the opportunity cost estimates for the unemployed, those from out of the labor force, and in-migrants involve considerable speculation. Under the circumstances it seems useful to perform a sensitivity analysis, supplementing these “best estimates” with a range of alternatives.

WELFARE GAINS ALONG AVERAGE CHAINS

We are now in a position to put together the various pieces and estimate the welfare gains associated with job chains. The key to this exercise is simply to weigh each of the expected moves in a chain with the welfare gain associated with that move. This involves using a variant of Equation (4.4), allowing for different opportunity costs applied to each of the residual categories. More specifically we calculate Equation (5.1) for each wage group, $j = 1, 5$.

$$(5.1)\ V_j / w_j = \Sigma_i m_{ij} (w_i / w_j)[\Sigma_k q_{ki} g_{ki} + q_{ui} (1 - oc_{ui}) + q_{fi} (1 - oc_{fi}) + q_{si} (1 - oc_{si})],$$

where V_j stands for the expected welfare gain from a chain launched by a new job in the jth group, w_j is the average wage in the jth group, m_{ij} is the disaggregated vacancy multiplier that tells how many openings at the ith level are generated from a new opening at the jth level, q_{ki} is an entry in our basic origin–destination matrix (Q), g_{ki} refers to the percentage wage gain in moving from job type k to job type i (from Table 5.2), and oc stands for opportunity cost, with u, f, and s subscripts representing unemployed, out of the labor force, and in-migrant.

Notice that the calculation in Equation (5.1) represents the welfare gain of initiating a j-chain as a percentage of the average j-wage. This seems a good summary measure since so many impact studies simply add up expected wages. In this context, V_j / w_j can be viewed as a discount or markup factor to be applied to wages from new j-group jobs.

Carrying out the calculations (Table 5.5, row 1), we find that all the V/w figures are substantially less than 100 percent, implying that the multiplier effects of the job chains are more than offset by the opportunity costs associated with employed workers and others filling vacancies. Given the relative magnitudes of the multipliers and the opportunity costs reported above, this result is not surprising.

The real story lies in the range of values of V/w across the five wage groups. For chains starting with a new job in any one of the top two wage groups, the total welfare gain to all affected workers runs about 40 percent of the direct wage of the initial job, but this ratio is

Table 5.5 Efficiency and Distributional Effects

	Wage group of initial new job				
	1	2	3	4	5
V/w[a]	0.43	0.42	0.56	0.62	0.69
Share of job changers	0.52	0.37	0.21	0.10	0.00
Per initial new job					
$ per year to lowest (*R*)	397	550	960	1,888	7,202
$ per year to low[b]	4,654	4,303	6,600	10,582	7,202

[a] V/w is defined as the expected sum of all welfare gains in a job chain per dollar of net new wages. V includes gains to workers taking new jobs and to those filling vacancies in jobs left by job changers in the area. The maximum possible value of V/w is 1, if all workers have zero opportunity costs. Most standard techniques of impact assessment assume V/w is equal to 1.

[b] "Low" refers to a broader distributional measure including gains to both group 4 and group 5 workers.

not constant across all wage groups. Rather, it rises sharply as we move to the lower wage groups facing the burden of higher unemployment rates. The ratio is 56 percent for group 3, a bit over 60 percent for group 4, and almost 70 percent for group 5 (Table 5.5, row 1). Hence, what we labeled the efficiency effect in Chapter 4, favors low-wage job creation over high-wage job creation. If subsidy costs for generating a dollar of wages remain roughly constant across wage groups, it will be more efficient to choose projects in which the wage bill is more heavily concentrated at the lower end of the job hierarchy.

In addition to the basic results for V/w, Table 5.5 includes answers to several of the empirical questions we raised earlier in this chapter. Dropping the terms which involve movement from unemployment, out of the labor force, or outside the region in Equation (5.1) allows us to calculate the share of welfare gains achieved by job changers participating in job chains.[14] These shares, reported in row 2 of Table 5.5, fall steadily from 52 percent in the highest wage group to zero in the lowest. Welfare gains at the high end are much more likely to go to the already employed. Welfare gains at the low end go to those without work.

Row 3 presents the Rawlesian measure of distributional impact (*R*). Here we calculate the share of all gains going to those taking vacancies in group 5. The pattern is quite striking. Creating jobs at the top of the job hierarchy does relatively little for those at the very bottom. The chains may be long at the top, but they are most often cut off before creating many vacancies at the bottom. Even if we take a wider measure of those in need, including all those workers either coming from the two lowest groups or taking jobs in the two lowest groups, we still find that adding jobs in the two lowest groups has the strongest distributional impact. Trickle down just is not very strong.

SENSITIVITY ANALYSIS

The results presented so far underscore the potential usefulness of a job-chains approach. If robust, these estimates could add significantly to our ability to evaluate economic development activities, but are these figures highly sensitive to the assumptions that have peppered our empirical methodology? We can address this question most directly by altering key assumptions and observing the results.

Table 5.6 reports the estimated values of V_j/w_j under four alternative sets of assumptions: 1) set the opportunity costs as defined in the basic assumptions of the study; 2) use a high opportunity cost (75 percent) for all in-migrants; 3) set the opportunity costs for all the unemployed and those out of the labor force at 0.25, leaving the opportunity costs for in-migrants at 0.75; and 4) set the opportunity cost for all non-employed job takers at 0.25. These exercises suggest that the findings under the basic assumptions stand up well to alternative specifications of opportunity costs. Only in the fourth alternative does the pattern

Table 5.6 Sensitivity Analysis of Efficiency Results (V/w)[a]

	Wage group of initial new job				
Alternative opportunity cost assumptions	1	2	3	4	5
Basic assumptions	0.43	0.42	0.56	0.62	0.69
0.75 for all in-migrants	0.41	0.39	0.47	0.54	0.62
0.25 for all unemp. and out of labor force/0.75 for all in-migrants	0.51	0.51	0.57	0.63	0.67
0.25 for all non-job-changers	0.74	0.72	0.74	0.74	0.75

[a] V/w is defined as the expected sum of all welfare gains in a job chain per dollar of net new wages. V includes gains to workers taking both new jobs and those filling vacancies in jobs left by job changers in the area.

change substantially. The key change here is the reduced opportunity cost for in-migrants. With this lower cost, new jobs in the higher wage groups yield considerably more welfare per wage dollar, rising from about 40 cents/dollar in the basic run to over 70 cents/dollar in the alternative. If all in-migrants have low opportunity costs, then new high-wage jobs that draw heavily on high-skilled in-migrants generate real gains. The assumptions necessary to generate this conclusion seem unrealistic. The folk wisdom on migration and local economic development argues that providing employment for in-migrants has low real returns.

Recognizing the considerable uncertainty that surrounds our estimates of opportunity costs, we conclude that the sensitivity evidence supports the robustness of our basic findings. Welfare generated per dollar of wages remains lower for high-skilled jobs, despite their larger multipliers. Distributional concerns also favor lower-skilled jobs over high-wage jobs.

EXPANDING ON IMPACT ANALYSIS

Returning to the impact assessment of the proposed SciSource plant presented in Chapters 1 and 3, we can reestimate the gains attributable to the same hypothetical economic development project. The plant employs 100 workers. The top of Table 5.7 reproduces our previous results on job multipliers as presented in Table 3.4. The bottom (all vacancies) shows the revisions if we use a chain approach to calculate job vacancies. These figures assume that chains in Chicago mirror the average national chains estimated above.

Using job chains, we recognize that many more individuals are influenced by the new plant than we first expected. The jobs in the instrument plant ultimately result in 240 vacancies filled by Chicago workers. This vacancy multiplier includes not only the horizontal creation of new jobs through the traditional input–output multipliers, but also the vertical opening of job chains as each new job, whether direct or indirect, sets off a string of job moves.

In terms of vacancies, we do see a trickle-down effect as the lowest earnings group enjoys the greatest overall ratio of total vacancies to

Table 5.7 Distribution of New Jobs and All Vacancies by Earnings Groups: Instruments Plant

	Income group					
Number/share	1	2	3	4	5	Sum
New jobs						
Direct	2	5	21	29	5	62
Total	5	8	31	40	13	97
Direct (%)	3.4	8.1	33.3	47.3	7.9	100
Total (%)	4.7	8.6	31.7	41.7	13.2	100
All vacancies						
Direct	3	12	44	71	24	154
Total	8	21	67	100	43	240
Direct (%)	2.2	8.0	28.5	45.8	15.4	100
Total (%)	3.5	8.9	28.0	41.7	17.9	100

NOTE: Rows may not sum to total due to rounding.

direct new jobs (43/5). The lowest group, which accounted for only 8 percent of direct new jobs, ultimately offers 18 percent of total vacancies. The next to the lowest job group shows a more muted pace of expansion, from 29 direct jobs to 100 total vacancies, roughly in line with the results for more skilled jobs.

While these vacancy effects are of interest, what we really want to know are the welfare implications of the job chains created by the project. Taking both the horizontal and the vertical multiplier processes into account, we estimate that overall welfare benefits generated by the new instrument plant are about $6.3 million, calculated as a present value over a 10-year window. These benefits are down from the initial estimate of total earnings gain of $11.6 million over the same window. While chains imply that more workers are affected by a project, this abundance of vacancies cannot offset the explicit accounting of opportunity costs.

Using job chains, we can explore distributional issues from two perspectives. In the first, as in our work in Chapter 3, we identify individuals on the basis of what jobs they ultimately hold. Thus, we ask what proportion of welfare gains accrue to workers who *ex post* occupy jobs in the various earnings classes, but the job-chains structure we have built allows us to go a good deal further. In particular, the second approach to distribution disaggregates welfare gains by "origin" groupings rather than "destination" groupings. Here, we undertake each type of analysis for our hypothetical instruments project.

Table 5.8 gives our results using the *ex post* categories. In Chapter 3 we found that 4 percent of total earnings (including horizontal multiplier effects) went to workers holding new jobs in the lowest earnings group. Here, we see that the welfare gain achieved by all workers filling vacancies (as opposed to those taking only newly created jobs) in this earnings class amounts to 7.6 percent of estimated overall welfare gains. The group 4 share rises even more, from about 30 percent to 34 percent. All groups except the lowest show absolute welfare gains less than our simple estimate of earnings gains.

While this approach to the distribution of gains is enlightening, it can't directly address the question of trickle down as usually posed. One of the major advantages of the job-chains model is its ability to partition welfare gains on an *ex ante* basis, i.e., in terms of "origins." As discussed above, there is some ambiguity as to exactly how to classify workers coming from non-employment origins (unemployment, out of the labor force, and in-migrants). In what follows, we categorize these workers with the group they eventually join. Thus, a highly skilled unemployed worker who ends up in a group 1 vacancy is counted as originating in group 1. The alternative, aggregating all the

Table 5.8 Distribution of New Earnings and Welfare Gains across *Ex Post* Earnings Groups

	Income group (*ex post*)					
Number/share	1	2	3	4	5	Sum
Earnings						
Direct ($)	699	1,129	2,891	2,466	177	7,362
Total ($)	1,519	1,842	4,266	3,367	460	11,453
Direct (%)	9.5	15.3	39.3	33.5	2.4	100
Total (%)	13.3	16.1	37.3	29.4	4.0	100
Welfare gains						
Direct ($)	287	430	1,532	1,566	184	3,999
Total ($)	718	688	2,279	2,160	478	6,322
Direct (%)	7.2	10.8	38.3	39.2	4.6	100
Total (%)	11.4	10.9	36.0	34.2	7.6	100

NOTE: Rows may not sum to total due to rounding.

unemployed into a single group, seems potentially misleading precisely because we have hypothesized such different opportunity costs for the skilled and unskilled unemployed. We show the distribution along these *ex ante* lines for our hypothetical instruments plant in Table 5.9.

Of course, the calculations based on *ex ante* categories must yield the same totals of welfare gains as those for the *ex post*. However, we see a rise in the welfare gains attributed to the lowest group. Here the share rises from about 7.5 percent to almost 23 percent of all gains. The next lowest group goes up to 40 percent, with the three highest groups all losing share. Thus, the bottom two groups receive more than 60 percent of all the welfare gains of the project, even though they accounted originally for only 36 percent of the direct earnings. In this sense, we might reasonably conclude that the project does spark at least a modest trickle-down process. However, we should recall that in calculating welfare gains we have greatly discounted the earnings of better-paid workers. Perhaps the best summary measure of trickle down is to calculate the total welfare gains of the lowest groups per initial direct subsidized job. On this basis, for every direct subsidized job, the instruments plant generates a 10-year present value of $39,670 in welfare gains to city workers originating in group 4 or group 5.

To summarize, for the instruments manufacturing plant considered here, expanding the basic evaluation model to include vacancy chain effects suggests:

1) more people than first estimated are positively affected by the economic development project,

Table 5.9 Welfare Gains by *Ex Ante* Earnings Groups

	Earnings group					
	1	2	3	4	5	Sum
Number						
Direct ($)	77	217	1,102	1,744	858	3,999
Total ($)	193	430	1,733	2,521	1,446	6,322
Share						
Direct (%)	1.9	5.4	27.6	43.6	21.5	100.0
Total (%)	3.1	6.8	27.4	39.9	22.9	100.0

NOTE: Rows may not sum to total due to rounding.

2) overall benefits are substantially lower than "new earnings,"
3) trickle down increases the proportion of benefits going to those starting in the two lowest earnings groups, and
4) trickle-down benefits are modest in absolute terms, amounting to an annual gain of a few thousand dollars per initial subsidized job.

To provide a context for these results, consider a similar exercise conducted for a very different activity, management consulting. Chicago has long been a center of the consulting industry in the United States. Consider the likely benefits of a subsidy to attract another major national consulting firm to the city. How do these benefits compare to those generated by SciSource Instruments? We use the same regional model as above, but now we specify the initial direct expansion of 100 workers in a consulting firm, ModSource.

Even before we consider the question of trickle down, we note that a consulting firm does far less for the city's economy than the instruments plant. Of the 100 subsidized direct jobs, only 29 are credited with providing new jobs for Chicago workers (Table 5.10). The discount is so great because of two factors: a share of the activity in the subsidized firm will just be displaced from other existing Chicago firms, and a large fraction of the employees in the subsidized firm will be drawn from suburban communities outside of the city. Similarly, the

Table 5.10 Distribution of New Jobs and All Vacancies by Earnings Groups: Consulting Firm

Number/share	1	2	3	4	5	Sum
New jobs						
Direct	5	4	10	6	4	29
Total	6	5	13	10	7	41
Direct (%)	18.9	13.8	33.4	20.8	13.0	100
Total (%)	15.6	12.4	31.9	23.9	16.2	100
All vacancies						
Direct	9	13	25	21	11	79
Total	11	16	32	30	17	107
Direct (%)	11.8	17.0	31.0	26.3	13.9	100
Total (%)	10.0	15.3	29.9	28.5	16.3	100

NOTE: Rows may not sum to total due to rounding.

traditional horizontal multiplier on the subsidized firm adds only another 12 indirect and induced jobs. Thus, even the traditional analysis credits the consulting firm with generating additional earnings only a bit more than half those generated by the instruments plant.

Applying the basic chains approach to this second case further highlights the contrast. We estimate that the consulting firm generates only 107 total vacancies (compared with 240 for the instruments plant). The estimated total welfare gains are just \$3.1 million per year (Table 5.11), as compared to the instruments plant's total of \$6.3 million (Table 5.8).

Of these much smaller welfare gains, the consulting firm provides a smaller share to the two lowest groups. Using our *ex ante* measure, 48 percent of the welfare gains go to the two lowest groups, whereas in the instrument plant's case the corresponding share was 63 percent (Table 5.12). Normalizing by the number of initial subsidized jobs, we find the consulting firm generating only a \$14,600 10-year present value to city workers originating in group 4 or group 5 per direct subsidized job, considerably less than the almost \$40,000 generated by the

Table 5.11 Distribution of New Earnings and Welfare Gains across *Ex Post* Earnings Groups: Consulting Firm

Number/share	1	2	3	4	5	Sum
Earnings						
Direct ($)	1,846	817	1,285	523	202	4,673
Total ($)	2,128	1,029	1,715	839	351	6,064
Direct (%)	39.5	17.5	27.5	11.2	4.3	100
Total (%)	35.1	17.0	28.3	13.8	5.8	100
Welfare gains						
Direct ($)	787	344	718	326	139	2,314
Total ($)	907	434	959	523	241	3,064
Direct (%)	34.0	14.9	31.0	14.1	6.0	100
Total (%)	29.6	14.2	31.3	17.1	7.9	100

NOTE: Rows may not sum to total due to rounding.

Table 5.12 Gains by *Ex Ante* Earnings Groups: Consulting Firm

	1	2	3	4	5	Sum
Number						
Direct ($)	212	351	743	638	371	2,314
Total ($)	244	415	945	890	570	3,064
Share						
Direct (%)	9.1	15.2	32.1	27.6	16.0	100
Total (%)	8.0	13.6	30.8	29.1	18.6	100

instruments plant. Clearly it matters what industries a local government subsidizes.

CONCLUSIONS

State and local subsidies for economic development have long been the subject of political squabbling and theoretical debate. While the reemergence of Keynesian and related ideas in macroeconomics suggests a firmer theoretical foundation for such policies, their effectiveness can ultimately be judged only in the context of serious empirical work. Of course the conclusions of such research will not completely replace political jockeying with purely professional management. Still, a clearer understanding of the promise and limitations of such interventions can make a real contribution to the formulation and execution of public policy.

The empirical strategy adopted here is a compromise with the realities of data availability. Building on the concept of the job chain, we use data on job changers from the PSID to construct a Leontief-type matrix. Using this matrix, we can estimate the length and character of job chains generated by new subsidized facilities. These constructed chains can then be used to calculate expected welfare gains across wage groups. In the absence of data based on jobs, as opposed to people, this may be the best that we can manage.

Our results are suggestive. High-wage jobs generate longer chains than low-wage jobs. However, these high-wage jobs generate relatively low levels of welfare per dollar of direct wages. And despite the long chain length, these high-wage jobs do relatively little for those most in need. They only rarely reach down to the two lowest worker groups. These results, while hardly definitive, are robust to a number of alternative specifications of opportunity costs.

Our basic approach to empirical estimation suggests a natural path for expanding impact analysis into a cost–benefit framework. In providing basic estimates of the level and distribution of welfare gains from new jobs across a range of wage levels, our results make possible a much needed recalibration of impact effects in welfare terms.

From exploring two quite different cases, we tentatively conclude that development projects like the Chicago instruments plant create substantial numbers of mid-level jobs and also generate significant although still modest job-chains effects for less-skilled workers. However, creating new jobs only at the top of the wage pyramid stimulates even less trickle down through the chain mechanism. Subsidized high-skilled, "downtown" firms such as the hypothetical management consulting company produce only skimpy welfare gains for central city residents. This key observation suggests important implications for policy, implications to which we return in Chapter 7, but first we present several expansions on the basic model.

Notes

1. Most notable in this respect are the ES 202 data sets collected by state agencies in conjunction with the Bureau of Labor Statistics. For a review of available and projected labor market flow data see Davis, Haltiwanger, and Schuh (1996, pp. 181–186).
2. This figure is high relative to data sources such as the Current Population Survey (CPS). See Appendix C for a discussion of the differences between the PSID and the CPS.
3. See Appendix C for a full discussion of our definition of a job change.
4. When considering in-migration, we actually divide each state into metropolitan and nonmetropolitan areas. We explore regional as well as other variations in our results in Chapter 6. These years were the most recent available at the initiation of this work. Dates for subsequent years have become available since the completion of this project.
5. The 1992 real wage rate for a worker is calculated from the consumer price index and PSID data on wages and salaries. See Appendix C for details on estimating individual wages and salaries.

6. All sums, ratios, etc. are computed using weights assigned by the PSID.
7. Notice this somewhat awkward definition leaves individuals who move between metropolitan areas in the same state or nonmetropolitan areas in the same state as nonmigrants.
8. Notice that, for a triangular origin–destination matrix, this multiplier can be easily estimated from the data in Table 5.1. It is just equal to 1 / (1 – 0.345).
9. Job changers within the same wage group improve their wage by about 2 percent. These seem to be truly horizontal moves. In some ways they are more akin to downward job movers than to upwardly mobile ones. If we treated these movers in the same way as we treated downward movers, the reported multipliers would be less, but no change would occur in their ranking. This alternative approach would leave all the welfare calculations of this section unaffected.
10. Put somewhat differently, a voluntarily unemployed worker has, in effect, restrained the growth of employment, while the involuntarily unemployed worker has not.
11. This simple approximation works well for coefficients not too far from zero. For larger coefficients, we must take (1.0 – the antilogarithm of the coefficients) to measure their percentage effects. Thus the 0.63 coefficient of the "some college" coefficient (SCOL) becomes (1.0 – antilog [0.63]) = 89 percent.
12. A careful statement of this proposition requires that the employed are a random sample of workers with the same sex, age, and educational characteristics. This is undoubtedly not the case, but the biases introduced in the present analysis by such nonrandom selection are likely to be small.
13. In this chapter we use unemployment rates calculated as weighted averages of these good and bad years, with weights in the ratio 3:1, respectively.
14. The new equation is $V_j / w_j = \Sigma_i m_{ij} (w_i / w_j) [\Sigma_k q_{ki} g_{ki}]$.

6
Extensions

The empirical job multipliers and welfare estimates made in the previous chapter are based on what is in effect a composite data set that includes job changes made over six years, across all the regions of the country, and categorized without respect to industry. Simple armchair introspection suggests that the key parameters of the job-chains approach might well vary over any of these three dimensions, as well as over several others. In this chapter, we explore these variations to the extent made possible by our basic reliance on the PSID data.

BOOM AND BUST

Interest in state and local economic development subsidies always peaks in recessions, when the appeal of attracting new jobs to a region seems most obvious. That appeal reflects sympathy with the unemployed and their heightened difficulty in finding placements in a recession. By definition there are more unemployed workers in such times, but to what extent does this increase in the supply of the unemployed affect the vacancy-filling patterns of employers? And if that pattern does change in a recession, does the change imply a significant change in the efficiency and distributional impacts created by new jobs?

Since our data set spans the expansion of the late 1980s (average monthly unemployment 5.5 percent) and the bust of the early 1990s (average monthly unemployment 7.0 percent), we can directly address the implication of recession for the flow matrix in the labor market. It is straightforward to construct two origin–destination matrices like the one in Table 5.1, one for the expansion years 1987–1990 and the other for the recession years 1990–1993. These are presented side by side in Table 6.1.

The overall first impression is one of similarity between the two halves of the table. This impression is born out by statistical comparisons that suggest no significant difference (5 percent level) for any but

Table 6.1 Origin–Destination Matrices: Boom (1987–1990) and Bust (1990–1993)

	Boom destination group (%)					Bust destination group (%)				
Origin group	1	2	3	4	5	1	2	3	4	5
1	40.8					41.4				
2	23.4	57.9				26.8	46.3			
3	5.4	20.7	47.6			4.1	23.8	45.3		
4	1.3	1.9	18.0	48.3		3.1	1.0	19.0	46.2	
5	0.0	0.5	3.2	13.9	36.6	0.0	0.1	1.3	12.6	32.5
Unemployed	4.2	2.3	10.3	13.6	20.5	1.5	5.9	9.0	18.3	28.9
Out of labor force	3.4	3.3	8.4	13.2	35.1	4.6	4.4	6.5	13.9	26.0
In-migrant	21.6	13.4	12.6	11.0	7.8	18.5	18.6	18.9	8.9	12.5
Column sum	100	100	100	100	100	100	100	100	100	100

NOTE: Columns may not sum to total due to rounding.

the lowest job category. Here we can see that the proportion of workers drawn from the unemployed in the bust rises from 20.5 percent up to 28.9 percent. Since recessions hit unskilled workers the hardest, this result is perhaps to be expected. Less obvious is the parallel rise in the in-migrant share (from 7.8 to 12.5 percent) for these unskilled vacancies.[1]

How important are these observed differences to our basic measures of job multipliers, efficiency, and distribution? Consider first the length of the job chains generated under boom and bust conditions. The general result is that boom chains are somewhat longer, although only for the second wage group does the difference seem large (Table 6.2). The longer chains reflect the greater importance of hiring from the employed in good times. In bad times chains are more likely to be cut short by hiring from the unemployed or one of the other nonemployment categories.

Looking at our simple *V/w* measure, we expect that in years with high involuntary unemployment, *V/w* will rise, while in the best years it should fall. This expectation is based on the reduction in opportunity costs of the nonemployed required by our methodology in bad years. To test this proposition, we calculate *V/w* for each year using group unemployment rates, hence opportunity costs for the nonemployed, based on the actual unemployment rates for that year. Despite our

Table 6.2 Job Multiplier *V/w*, and Trickle Down in Boom (1987–1990) and Bust Years (1990–1993)

	Initiating job group				
Period	1	2	3	4	5
Job multiplier					
Boom	3.53	3.88	2.81	2.36	1.58
Bust	3.41	3.07	2.63	2.21	1.48
V/w					
Boom	0.42	0.45	0.55	0.62	0.68
Bust	0.44	0.40	0.60	0.64	0.70
Trickle down					
Boom ($)	4,048	5,185	6,876	10,533	7,125
Bust ($)	5,342	3,412	6,314	10,796	7,375

expectations, we find only modest increases (2 to 5 percent) in four of the groups and an actual decrease of 5 percent in group 2 (Table 6.2).

While at first surprising, these results probably reflect the fact that the top two groups have low predicted unemployment rates and high opportunity costs in both good and bad times, while the lowest two groups have high unemployment rates and low opportunity costs throughout. The largest increase in *V/w* occurs in wage group 3. This group's unemployment rate moves from 4.5 to 7 percent between the two years. This reduces the opportunity cost of the nonemployed taking jobs in this group from 62 to 47 percent, by far the largest reduction for any group.

Finally, if we look at the welfare gains going to the lowest group, we find that vertical trickle down shows similar patterns in boom and bust. In both phases of the cycle, reaching those at the bottom is easiest if jobs are created in the three lowest wage groups. Our basic distributional finding concerning job chains again applies across the board: despite their length, chains starting at the top are likely to be cut off before they reach those at the bottom. In the absence of evidence to the contrary it seems reasonable to use the same basic matrices for evaluating job-chains effects in boom and bust.

Regional Differences

Most economic development projects are undertaken on the state or local level. Our analysis up to this point has built from a pooled national data set derived from the PSID. One can reasonably ask whether these nationally pooled data provide a workable guide to state and local decision makers or should each area strive to construct a set of localized tables.

Unfortunately, our data set is not large enough to allow for a disaggregation to the state or metropolitan level. However, we can disaggregate to the broad regional level. In particular, we have divided the country into four multistate areas: the East, Midwest, South, and West (Table 6.3). Each region then yields a set of matrices paralleling those previously presented for the country as a whole.

The job multipliers vary modestly across our broad regions. The high-skilled multipliers in the South (wage groups 1 and 2) tend to be somewhat smaller than those for the other three regions (Table 6.4). This pattern reflects the fact that in the South, as compared to the other regions, these job classes had higher in-migration rates and a higher

Table 6.3 Regions Used to Disaggregate National Matrices

East	Midwest	South	West
6 Connecticut	12 Illinois	1 Alabama	2 Arizona
7 Delaware	13 Indiana	3 Arkansas	4 California
8 DC	14 Iowa	9 Florida	5 Colorado
18 Maine	15 Kansas	10 Georgia	11 Idaho
19 Maryland	21 Michigan	16 Kentucky	25 Montana
20 Massachusetts	22 Minnesota	17 Louisiana	27 Nevada
28 New Hampshire	24 Missouri	23 Mississippi	36 Oregon
29 New Jersey	26 Nebraska	30 New Mexico	43 Utah
31 New York	33 North Dakota	32 N. Carolina	46 Washington
37 Pennsylvania	34 Ohio	35 Oklahoma	49 Wyoming
38 Rhode Island	40 South Dakota	39 S. Carolina	50 Alaska
44 Vermont	48 Wisconsin	41 Tennessee	51 Hawaii
		42 Texas	
		45 Virginia	
		47 W. Virginia	

Table 6.4 Job Multipliers, *V/w*, and Trickle Down, by Regions

	Initiating wage group				
Region	1	2	3	4	5
Job multipliers					
East	4.22	4.13	2.73	2.05	1.54
Midwest	2.94	3.86	2.80	2.28	1.38
South	3.10	2.83	2.71	2.37	1.70
West	3.80	3.26	2.74	2.54	1.45
V/w					
East	0.46	0.45	0.55	0.62	0.69
Midwest	0.43	0.45	0.58	0.62	0.69
South	0.39	0.38	0.55	0.62	0.69
West	0.46	0.42	0.56	0.64	0.69
Trickle down ($)					
East	7,319	5,118	6,480	10,585	7,202
Midwest	6,188	5,566	7,974	10,467	7,202
South	2,138	3,618	5,830	10,566	7,202
West	2,360	3,269	6,418	10,816	7,202

proportion of hires from the out of the labor force category. Multipliers for the other job categories demonstrate less variation across the country.

When these data are translated into our basic efficiency measure *V/w*, we find even less variation. The South, with its lower multipliers at the high end, produces a somewhat smaller efficiency effect for the highest skilled jobs (Table 6.4). None of these differences, however, look large enough in and of themselves to influence policy considerations.

Shifting to the distributional measure (welfare gains to the two lowest groups per new job in the given class), we find somewhat more interesting differences. In particular, the two highest wage groups in the East and the Midwest generate considerably more trickle down than do the same groups in the South and West. The Midwest performs much better than the South and West for new jobs generated in the third wage group as well.

In large part these results are due to the somewhat higher job multipliers in the East and Midwest, but they also suggest that those multipliers reach further down the job chains in those regions. Interestingly, if we focus only on those taking the very poorest jobs (group 5), differences among regions are not as large. The pattern in Table 6.4 is due primarily to the upward movement of workers in the East and Midwest in group 4. These findings may well be the result of the historical importance of industrial, unionized labor in the manufacturing belt states. Still, we shouldn't overstate the significance of these interregional differences. If we consider the likely higher cost of subsidizing high-wage jobs, creating jobs in groups 4 and 5 still remains the obvious path to increasing welfare of low-skilled workers.

Of course, these results are based on highly aggregated regions. They suggest that disaggregation might well yield greater differentiation. Does it follow that we should launch a major push to estimate local job-chains matrices for metropolitan regions? In approaching this question, we can gain useful insights from a review of efforts to regionalize traditional input–output analysis. When conducting regional impact studies, fitting a model to local data has generally been considered an imperative first step. Of course, areas do differ substantially in their industrial structures and their degree of self-sufficiency. But, has this focus on model estimation paid off?

Ideally model building should be based on actual shipment data or survey data. However, collecting such data sets has proven quite expensive. The vast majority of impact studies now use indirect techniques to generate multipliers. These techniques can vary considerably in sophistication and reliability. Calibrating regional models has generated a cottage industry of sorts and still commands much of the attention of impact analysts.

One could reasonably argue that the return on estimating extensive regional input–output models has been modest. The likely errors in assessing regional purchase coefficients, export shares, and other parameters are so great that the resulting multipliers are very probably compromised. Once simple adjustments are made for industry differences in direct wage levels and their impacts on local expenditures, remaining differences in multipliers are fairly speculative. In any case, large differences in multipliers are relatively rare. More than one regional economist will confide that an income multiplier estimate between 1.5 and 2.0 will do pretty well for most states or metropolitan areas.

Possibly, those doing regional input–output analysis would better spend their energies by concentrating on the notoriously difficult “but-for” question discussed in Chapter 3, rather than on continuing their fascination with the fine points of multiplier construction. From introspection, we suspect that regional analysts are by nature partial to playing with computer programs. They also tend to be shy in asking hard questions about public deals. Under the circumstances, a rough and ready multiplier accompanied with closer attention to the counterfactual might provide more useful inputs to the public decision-making process.

These cautions with respect to regional input–output studies take on added weight when applied to job-chain analysis. Our estimates are hardly the last word on job chains. Indeed, they should be viewed as only a first effort. Much more work is undoubtedly needed before decision makers can have confidence in the basic estimates of vertical chain multipliers. We hope that effort will be forthcoming. However, we doubt that a repetition of the regional model building enthusiasm, with a job-chains model for each locality, is really necessary. The gains generated from regionalizing impact analysis have been modest; those to be expected from regionalizing job chains are likely to be even less impressive.

Two major differences between impact analysis and job-chains analysis mitigate regionalizing the latter. First, the basic job-chains table is much simpler than an interindustry table. We have argued that the job-chains table should be triangular in nature. Moreover, only the diagonal and the cells immediately below it are likely to generate job movers into newly created jobs. Few jobs are filled by employed workers two cells away. This contrasts sharply with the complex character of most input–output tables. Second, when considering whether to buy locally or import from outside the region, a business will be powerfully influenced by the industry structure of the immediate area and the character of easily accessible regions elsewhere. Except for a few highly skilled specialties, labor market structures tend to be more similar than industrial structures across metropolitan areas. Almost by definition, unskilled and semiskilled workers can be recruited from local markets regardless of industry. Among many well-educated workers, skills tend to be generic. We expect “import rates” to be much less variable for labor than for goods. Moreover, the extent to which a new plant or facility plans to draw its labor force from other locations can usually be ascertained by public agencies, whereas the fine geography of its supply patterns will generally be much more difficult to estimate without detailed industry knowledge. Indeed, negotiating over the proportion of workers to be hired locally often plays a major role in subsidy negotiations.

Given these arguments and the only modest differences found across major multistate regions, we are reluctant to call for an all-out effort to estimate local job chains. Rather, we suspect that energies devoted to improving our national estimates would be better spent at this time.

GOODS AND SERVICES

Economic development professionals have traditionally turned to impact analysis to address questions of industrial targeting. In such efforts, input–output models have often been used to determine employment and earnings multipliers of various industries. To a limited degree such studies have also considered the distribution of direct and indirect impacts. Our purpose here is to address the classic targeting questions from the perspective of chain analysis. In particular, how do chain length, welfare gains, and distribution vary with the industrial sector of newly created jobs?

Targeting studies have generally scanned across a wide range of industries, limited only by the detail of the underlying input–output model. Given our relatively small PSID sample size, we undertake our analysis only for the basic distinction between goods-producing and service activities. We include agriculture, mining, construction, and manufacturing in goods production. Services then are made up of transportation, communications, public utilities, wholesale and retail trade, finance, insurance and real estate, business and repair services, personal services, entertainment, professional services, and public administration. Maintaining our five wage groups, we now generate a 10-by-10 job-mover matrix (Table 6.5). Not surprisingly, the bulk of the cells in this matrix are quite small or zero.

Table 6.5 Origin–Destination Matrix and Job Multipliers for Industry and Services, by Wage Group

	Destination (%)									
Origin	1G	1S	2G	2S	3G	3S	4G	4S	5G	5S
Goods 1	37.6	6.6								
Services 1	14.0	28.6								
Goods 2	18.7	4.4	45.4	5.2						
Services 2	2.1	22.9	6.4	48.1						
Goods 3	5.0	0.0	17.9	2.6	43.9	1.4				
Services 3	0.0	4.7	6.1	18.6	6.2	43.9				
Goods 4	0.0	1.1	2.8	0.0	10.7	1.4	43.2	4.3		
Services 4	0.0	2.2	0.0	0.9	3.5	18.6	10.0	40.6		
Goods 5	0.0	0.0	0.0	0.0	1.6	0.6	6.6	1.2	29.3	1.7
Services 5	0.0	0.0	0.0	0.5	0.5	1.8	4.5	13.0	9.1	32.0
Unemployed	3.9	2.4	4.4	3.6	16.0	7.4	21.4	13.6	35.1	22.5
Out of labor force	1.7	5.3	3.4	3.9	3.2	9.1	7.2	16.0	13.5	34.3
In-migrant	17.1	21.8	13.6	16.5	14.3	15.8	7.2	11.2	13.0	9.6
Column sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total job multiplier	3.76	3.36	3.57	3.45	2.76	2.72	2.46	2.23	1.61	1.51
Goods	2.75	0.62	2.74	0.45	2.23	0.18	1.96	0.18	1.42	0.03
Services	1.01	2.74	0.84	3.00	0.52	2.54	0.50	2.05	0.19	1.48

NOTE: Columns may not sum to total due to rounding.

Three observations on this table seem particularly relevant. First, the two sectors seem to use very different strategies in recruiting nonemployed workers. The industry sector, especially for the three lower wage groupings, is much more likely to recruit from the unemployed. The service sector is much more likely to recruit such workers from outside the labor force. This result very likely reflects the common use of layoffs in manufacturing and the episodic nature of construction work, both included in our industrial sector. Since these differences largely cancel each other in determining chain length, we find the pattern of total job multipliers to be quite similar across the two sectors, each showing the basic pattern of declining from the higher wage groups to the lower ones.

Second, each of our two sectors, industry and services, draws more heavily on itself than on the other to fill vacancies. To a large extent this relative segregation is just the result of firms using internal ladders of promotion, thus guaranteeing that vacancies will be filled from the same sector.[2] Despite this pattern, we find substantial cross-sector job vacancy multipliers (see the bottom two lines of Table 6.5). By a cross-sector multiplier, we simply mean the number of service vacancies generated by a new industrial job or vice versa. For example, a new industrial job in the highest wage group generates 2.75 additional vacancies in the industrial group itself, but it opens up an additional 1.0 vacancies in the services. Similarly, a new job on the service side generates about 0.6 vacancies on the industrial side. Throughout, these cross-sector multipliers are larger for the industry-to-service link. To a great extent this simply reflects the larger size of the service sector as we have defined it. These cross-sector multipliers warn us against too easily assuming complete isolation between sectors.

Turning to welfare gains per dollar of wages (V/w), we find essentially no difference within wage groups. Thus, a goods-producing job or a service job at a given wage level will have the same efficiency in generating welfare. But, as is well known, the wage distributions of goods-producing firms and service firms tend to be quite different, with the former being less unequal than the latter. Much of the efficiency effect we observed in the instrument plants example of Chapters 4 and 5 can be traced to the concentration of the plant's new jobs in middle and moderate wage groups (Table 5.7). A service firm with a wage distribution weighted more heavily toward high-end jobs would thus be less efficient at generating welfare.

A similar set of observations apply to the distributional implications of goods- and service-producing activities. For a given wage group there is relatively little difference between the two sectors in generating welfare for either the lowest group of workers (those taking group 5 jobs) or the broader low group (those taking or originating in group 4 or group 5 jobs). This result is somewhat surprising. Much has been made of internal promotion ladders that allow workers to progress through skill categories in manufacturing. We find no strong evidence that such a process yields substantially greater trickle down in our goods-producing sector. It may simply be that our sector is defined too broadly. Alternatively, it may be that the informal conventional wisdom is mistaken. Given our data, any advantage possessed by the goods sector in promoting trickle down results from its more concentrated wage distribution and not from its internal mobility patterns.

INTERNAL AND EXTERNAL HIRING

One of our major motivations for using the PSID as a basic data source has been our concern to include movement between jobs within a firm on the same basis as movement between firms. All of our data up to this point have included both types of moves. Looking at the relative importance of these two types of moves gives some insight into the character of job chains.

Table 6.6 shows the importance of including "inside movers." Here, each cell from the basic mover matrix has been divided vertically to give separate proportions for those moving within the same firm and those moving between firms. Thus, the first two entries in the first column say that, on average, 37 percent of vacancies in group 1 go to workers already in wage group 1 in the same firm in the same state.

Table 6.6 Job-Chains Matrix Broken Down by Inside and Outside Movers

	Wage group				
Year 1 group	1	2	3	4	5
Inside 1	37.0				
Outside 1	4.0				
Inside 2	19.8	42.2			
Outside 2	5.2	10.7			
Inside 3	1.5	14.9	34.9		
Outside 3	3.3	7.2	11.7		
Inside 4	0.8	0.7	10.4	31.5	
Outside 4	1.4	0.8	8.1	15.8	
Inside 5	0.0	0.0	0.2	6.3	18.4
Outside 5	0.0	0.3	2.2	7.1	16.1
Unemployed	2.9	3.8	9.7	15.8	24.7
Out of labor force	4.0	3.8	7.5	13.5	30.5
In-migrant	20.1	15.6	15.4	10.0	10.2

NOTE: Columns may not sum to total due to rounding.

Only 4 percent of such vacancies go to those holding wage group 1 jobs in another firm in the same state.

The most striking result here is the increase in interfirm mobility as we move down the wage groups. By the time we reach wage group 5, employed job takers are almost evenly divided between those in the same firm (18.4 percent) and those in other firms (16.1 percent), with the remaining vacancies at this level taken by the nonemployed.

It is quite possible that much of the intrafirm job changing at a given level represents noise in our data set. While the PSID takes some pains to emphasize a change in "position" should involve either a "promotion with higher pay" or "a major change in duties with the same pay," many of the respondents in the sample may have interpreted the question about changes in "job title or position" as applying to routine pay increases or modest reassignment of duties. Although it is difficult to judge their magnitude, these reporting errors result in an overstatement of the within-cell churning[3] in our samples. We can get a rough estimate of such an effect by recalculating our job multipliers, excluding all within-firm, within-cell moves. This is certainly an overcorrection and, hence, gives what is likely a lower limit to our job multipliers. The results are presented in Table 6.7, along with our basic job multipliers from the last chapter. The differences here are substantial, although the basic pattern of larger multipliers in more skilled jobs is still maintained.

Whether exaggerated or not, it should be emphasized that these adjustments to our job multipliers have no effect on our welfare calculations. To be conservative, throughout, we have set to zero the expected wage changes for all within-cell movers. Hence, all our welfare gain figures stand.

Having estimated the internal/external flows, it is a relatively simple matter to disaggregate the wage gains. Here, we find the perhaps expected result that those improving their position by changing

Table 6.7 Lower Limits for Job Multipliers

	Initiating wage group				
	1	2	3	4	5
Basic multipliers	3.48	3.48	2.73	2.28	1.53
Adjusted multipliers	2.33	2.23	1.91	1.66	1.26

employers tend to enjoy larger increases than those remaining with the same employer. For the important one-category moves, this difference is highest for the wage group 1 (a 35 percent gain for firm changers vs. a 21 percent gain for position-only changers) and tends to decline in the less-skilled groups.

These differences in wage gains work against the somewhat higher likelihood of promotion from within. The welfare gains to job movers (excluding for the moment all gains to the unemployed, those out of the labor force, or in-migrants) break down fairly evenly between inside and outside movers. At the highest wage levels, the inside movers take a majority (54 percent) of these gains. At level 4,[4] the movers from outside take the majority (60 percent).

If, from a distributional perspective, we look at welfare gains to just those workers originating in the two lowest groups, we find that outside workers take a majority of the gains (Table 6.8). In considering these numbers, keep in mind that the table excludes all those workers drawn from unemployment, out of the labor force, or other states. Also remember that not all inside gains go to workers in the originating firm. Rather, we count any transition as inside if it takes place in a single firm, whether or not that firm is the one which experienced the original increase in employment.

CONCLUSIONS

The basic chain model is a natural starting point for a wide range of extensions. The first efforts discussed above take one or another approach to disaggregating the national Q matrix, allowing consideration of a range of issues: business cycles, regional differences, industrial structure, and internal vs. external labor markets.

Table 6.8 Gains (in $) to Inside and Outside Workers in Groups 4 and 5

Benefits to workers initially employed in groups 4 and 5	Initial wage group			
	1	2	3	4
Inside low	1,211	899	1,302	419
Outside low	1,904	1,428	1,749	619

Although state and local economic development policies are most often advanced during recessions, we find little reason to modify our basic estimates of welfare gains in boom and bust. Given that most projects have an expected lifetime of a decade or more, there is little reason not to view economic development apart from the business cycle. While short-term construction activity generated by projects may be most prized during the poor construction markets of a recession, our basic matrix shows no major increases in turnover or reductions in welfare in the boom. Conceivably, however, the especially strong expansion of the late 1990s would show a more complicated picture than the run-of-the-mill expansion of the late 1980s.

Similarly, regional differences do not play a significant role in our results. Here our conclusions must remain tentative because of our inability to disaggregate below broad divisions of the country. The robustness of the basic matrix across finer regions clearly deserves further attention. In particular, we expect that severely underdeveloped areas will have less in-migration in response to new job development. However, on the coarser grid we use here, no such phenomenon appears important.

Disaggregation by industry complicates the basic matrix. We find no strong evidence of major differences in mobility chains between manufacturing and service jobs. Greater trickle down in manufacturing relates to the more concentrated distribution of jobs in the middle of the hierarchy, not to intrinsically longer chains.

Finally, contrasting internal and external labor markets suggests the importance of the latter at lower levels in the job hierarchy. While not surprising, this observation reinforces the long-standing common wisdom that many low-wage jobs are relatively disconnected from internal promotion opportunities.

All told, these extensions represent just a start—a highly imperfect start at that. A more complete development of empirical job-chains research awaits richer data sets. Ideally, such efforts will be able to draw on job-based data that allow a full specification of job chains.

Notes

1. The only other major difference between the tables is the fall in the share of group 2 vacancies filled from the group itself. We have no intuitive explanation for this perhaps accidental result.
2. Recall that our job-mover data include those changing positions while working for the same employer.
3. The term churning has been used in flow analysis of labor markets to refer to almost any move between jobs. This seems too broad a definition. We reserve the term for those moves that don’t cross our wage-group categories and hence generate little if any welfare gain.
4. No gains accrue at the fifth level to either group, since all gains there go to the nonemployed.

7

Job Chains—Implications for State and Local Economic Development Policy

Two primary policy messages emerge from our job-chains analysis. The first relates to the inherent interconnectedness of the labor market. Job chains exist. A new job generates a string of vacancies down the chain. Due to this intricate web of connections, interventions in the labor market will often produce results far from the point of initial intervention. The ultimate beneficiaries of a given economic development initiative can only be predicted in the context of a well-articulated model that faithfully maps these interconnections.

A second empirical theme points toward the limits of trickle down. Yes, chains build interconnectedness, but our results suggest that the only job-creation policies with a chance of reaching down to those in most need are interventions which directly create middle- and low-wage jobs. Jobs created at or near the top of the earnings pyramid have very little trickle-down effect. They are likely to be truncated before they have any effect on the lower reaches of the employment ladder. In contrast, newly created middle-level jobs produce some trickle down. Low-wage jobs immediately address the employment problems of the unskilled. Compared to high-level jobs, middle- and low-wage jobs generate more welfare gains per dollar of subsidized wages.

In this chapter we build on these basic insights to consider the following questions:

- Where does a job-chains perspective position us in current policy debates?
- What new insights do our empirical findings afford on these existing debates?

ECONOMIC DEVELOPMENT POLICY THEMES

While the metaphorical cliches of economic development have remained constant over time, beneath the aspirations of “leveling the playing field” and “raising the tide for all boats,” little consensus over praxis exists. A range of debates have long stalked the practice of state and local economic development. Should policy pursue efficiency or equity? Are we worried about people or places? Should governments try to pick industry winners? There are many more such questions.

Efficiency versus Equity

Perhaps no economic development debate raises deeper emotions than that between proponents of improved efficiency and seekers after equity. Ever since Okun (1975) proposed his famous trade-off between efficiency and equity, policy advocates have tended to line up on one side or the other. The arena of state and local economic development has proven no exception to this rule. The efficiency argument emphasizes the opportunities to use policy to repair market imperfections in the allocation of resources. The equity argument has looked to local economic development policy as an attractive way to improve the welfare of the most disadvantaged.

The job-chains perspective provides a clear methodological base for considering efficiency equity trade-offs. We have applied this approach throughout the last several chapters. Our empirical estimates suggest that the traditional distinctions between efficiency and equity may be too sharply drawn for many local development situations. Precisely because skilled workers have the greatest opportunity costs, achieving efficiency gains is easiest when we address the underemployment and unemployment problems of the less skilled. In this context, improving efficiency often means improving equity.[1] Indeed, the job-chains perspective forcefully argues for a more careful accounting of *both* efficiency and distributional consequences of development projects.

People-Based versus Place-Based Policy

The issue of “jobs to the people” (place-based policy) or “people to the jobs” (people-based policy) is a long-debated theme in economic development. Place-based policy generally involves visible programs with high present values grounded in immobile factors of production, such as land and buildings. People-based policy leads to programs aimed at particular population subgroups, such as the unemployed or handicapped, irrespective of where they live.

In practice, much of the argument for people-based policies has emphasized programs to increase workers' human capital through training, education, and greater mobility. The job-chains approach, while not hostile to such efforts, starts from the observation that much of the labor force, even the relatively skilled labor force, remains involuntarily underemployed. Hence, there are real limits to human capital development left to itself.

Place-based strategies promise to address the need for jobs on the ground. Still, they run the risk of too easily identifying real increases in local economic welfare with new economic activity. Here, a job-chains approach suggests the need to carefully delineate the character of expected welfare gains. At the very least, significant discounting for in-migration seems warranted.

Place-based policies rely heavily on trickle-down dynamics to reach those most in need. Our empirical work makes clear that unless particularly well-designed, place-based programs will be ineffective in redistributing economic activities to these subgroups. In general, much place-based effort ends up going to the "wrong" groups (in-migrants, nonlocal entrepreneurs, etc.).

Long Run versus Short Run

The job-chains model shows how cumulative short-run forces can create long-term effects. The short-run dynamics of movement through a job chain sets off a process whereby workers accumulate new levels of human capital with each vacancy move. Local job creation via the chain model therefore leads to long-term effects beyond the initial effect of the job creation itself. Following Bartik's (1991) "hysteresis" argument, we note that short-run demand shocks result in human capital upgrading that does not disappear in the absence of the stimulus.

The accumulation of skills and experience along the chain afford another rationale for place-based policy. Local labor supply does not respond fully and immediately to demand shocks since the migration decision takes time. The resulting time lag between job creation and the full in-migratory response allows the local underemployed, the unemployed, and those out of the labor force opportunities to move up the job ladder or at least get a foot on its bottom rung. The hysteresis effect means they accumulate job skills in the process, making them more competitive when facing in-migrants. This view that harmonizes the policy dilemma of long- versus short-term interventions is essentially built on the existence of a job chain.

Targeting versus Neutral Policy

Targeting is a place-based strategy that focuses public resources on a few carefully chosen industries. As an exercise in "picking winners," targeting is perhaps one of the most contentious of economic development policies (Voytek and Ledebur 1997; Buss 1999). It attempts to efficiently allocate scarce resources by comprehensively assessing the prospects of an industrial development project in a particular locale. By matching local comparative advantage with industry attributes, targeting policies aim to maximize the return to public investment. Critics of targeting assert that economic development practitioners can't really pick winners and, even if they could, local economies gain little economic welfare from the expansion of such industries. The job-chains approach has little to say about the ease or difficulty of actually picking winners; however, it has a great deal to contribute to the delineation and measurement of gains derived from targeted industries if successfully attracted to a community.

Targeting attempts to identify new growth industries for which an area may be well suited. While not often mentioned explicitly, targeting must draw heavily on key human resources which are already close to fully employed in the local area. Thus, the welfare gains generated within targeted industries themselves are likely to be quite limited. The positive welfare effects of a targeting strategy, then, are most likely to come through either the traditional surface-level multiplier of indirect and induced expansion or through the vertical job chains that extend below the surface.

Given the importance of these spread effects in determining the welfare impacts of targeting, it would seem incumbent on those advocating such strategies to explain their implicit regional models in greater detail. Targeting studies already emphasize traditional multiplier analysis. A job-chains approach would seem highly relevant to furthering such explications. All growth is not alike. Our results suggest that the type of new high-skilled jobs often emphasized by targeters generate only modest overall efficiency effects. Moreover, they are characterized more by “trickling within” or in-migration than “trickling down toward the bottom.” The importance of within-cell moves, one-step jumps, and in-migration points to human capital constraints in moving across earnings groups. This is an insight that could not have been gained from an aggregate analysis of growth.

Manufacturing versus Services

Short of actually targeting individual industries, advocates of place-based development have often shown a predilection for manufacturing strategies. These advocates of maintaining or rebuilding a manufacturing base tell a story of displacement and multipliers. Subsidized services are more likely than manufacturing to displace local businesses. At the same time, one new local job in manufacturing usually generates a standard (horizontal), input–output multiplier larger than a new job in the service sector (Lefkowitz 1993). This is true for both counties and metropolitan statistical areas and results from the broader horizontal production schedule that characterizes goods production. Our job-chains estimations suggest similarly that manufacturing generates slightly longer vertical job chains than services, irrespective of wage group.

Generally, the magnitude of the multiplier can be taken as an indication of “leakage.” This holds for both “horizontal” and “vertical” multipliers. Smaller horizontal multipliers indicate demand leakage outside the local economy. Shorter vertical multipliers imply chains being truncated by “outsiders” (unemployed, out of the labor force, and in-migrants). The policy debate in this instance relates to the strategy for reducing leakage. An emphasis on manufacturing implies an export-based strategy to plug the leaks.

Our job-chains estimations suggest some further observations pertinent to this debate. First, jobs generated in manufacturing consistently generate more vacancies in services than vice versa. This implies that following an export-based economic development strategy will also create some secondary effect in utilizing underexploited resources and generating local value added. However, our aggregate comparison of the welfare gains and distributional effects of job creation across the two sectors does not point to any obvious policy preference.[2]

Industrial Recruitment versus Indigenous Development

The debate over this issue invariably turns on the magnitude of local spillovers and externality effects of each kind of strategy (Blair 1995). The job-chains model suggests some extra factors not generally considered in this debate. First, indigenous development is likely to call on the nonemployed residents. In contrast, imported smokestacks are more likely to attract migrants in their wake. Our job-chains empirics suggest greater welfare gains ultimately arising from the former.

Second, industrial recruitment that attracts large corporate facilities generally points to plants with long internal chains. Progression along such chains is largely automatic, internalized within the corporation itself, and tenure driven. Our empirical results have suggested that the net welfare effect of this kind of position-changing employment is less than the effect for employment that is driven by job changing. Indigenous development is more likely to be locally based and driven by shorter, external chains with less in-house progression. Job-chains analysis therefore highlights an angle on the “smokestack-chasing” versus “homegrown jobs” debate that progresses beyond a discussion of spillovers and externalities.

Central Cities versus Suburbs

Conventional wisdom is that suburban employment centers suck economic development from the city center (Persky and Wiewel 2000). In this view, job creation efforts should focus on central cities where need is greatest. A job-chains perspective, with its emphasis on interactions in the labor market, suggests that suburban employment growth can play a role in creating employment opportunities for central city residents. This will occur if suburbanites who previously commuted decide to work closer to home, thereby opening up vacancies in the city center. Suburban employment growth may encourage city employers to search closer to home for their labor pool.

Vacancies in the suburbs can affect central city residents. Empirical evidence indicates that this influence is generally negative, grounded in spatial mismatch and wasteful commuting (Cervero and Wu 1997; Cervero 2001). A job-chains approach tends to suggest alternatively, that a rather different mechanism is at work, one that is not necessarily related to physical flows of commuters and transport accessibility. If the link between suburb and city center is via job chains, the outcome of employment deconcentration for central city residents can even be positive. Rising suburban employment/population ratios may open up vacancies in central cities.

Like all trickle-down phenomena, this effect will be limited by the same forces that cut off all job chains, particularly by in-migration. Where suburban jobs are filled by in-migrants from outside the region, no city job vacancy will be created.

TRICKLE DOWN—DOES IT REALLY WORK?

The basic character of a dynamic market economy virtually guarantees that a range of workers will find themselves involuntarily underemployed and unemployed. The flexibility of the system imposes this price on workers, and the price is high. State and local efforts to generate jobs attempt to repair real inefficiencies in the system. The greatest welfare gains are likely to be made at the lower end of the labor market. To what extent though can such gains be achieved through the more or less standard economic development process? To what extent can we rely on trickle down to achieve basic efficiency and distributive gains?

The job-chains approach provides a natural methodology for considering this key question. Combined with impact analysis in a cost–benefit framework, the job-chains approach yields important empirical insights. Our own empirical estimates suggest that trickle down, while not negligible, remains limited. State and local economic development projects must be carefully designed if they are to both achieve serious efficiency gains and open employment opportunities to less-skilled workers.

As we have noted several times, new high-skilled jobs are likely to be filled by skilled workers with a high proportion of in-migrants. Chains set off by such jobs may be relatively long, but they tend not to reach down to the least skilled. Rather, they are cut off before achieving that depth.

Under the circumstances, economic development projects that emphasize the subsidization of highly skilled jobs are not likely to score well in terms of distributive indexes. Projects like the management consulting firm discussed in Chapter 5 do relatively little for local workers most in need. On the other hand, a project like the instruments plant discussed in the same chapter promises considerably more in trickle-down benefits. Carefully conceived economic development efforts can make a real difference. We should not, however, overstate the case. Even well-planned general projects like the instruments plant generate only limited gains, with much of the subsidized wages failing to materialize as welfare improvements. And, where economic development projects fail to pass a serious “but-for” condition, all gains must be illusory.

THINKING “CHAIN-WISE”—WHY IT HELPS

The politics of economic development praxis are such that new methods of evaluation are not always readily embraced. Aside from the short time horizon that governs much policy making, elected local officials are often reluctant to have their programs come under too much public scrutiny. The reasons for this reticence are legion. First, many local projects simply fail to deliver the goods. Benefits only are often highlighted and invariably overstated. In addition, much local economic development is about self-promotion and image creation. Carefully calibrated evaluations do not fit into this scheme. Finally, the driver behind much economic initiative at the local level is not solely a concern for local employment prospects or economic welfare. Rather, localities are sucked into an “arms race” (Hanson 1993; Jenn and Nourzad 1996) because they cannot politically afford to leave the playing field in the hands of a sole competitor. In this kind of a setting, second-best decision making is rife and governments are locked into a form of “prisoner’s dilemma.” Despite the fact that the welfare-maximizing strategy for all authorities is to disengage from the bidding wars and promote some form of inter-jurisdictional collaboration, once they are caught up in this spiral, it becomes increasingly difficult to opt out unilaterally. This is hardly the environment for thoughtful analysis or evaluation.

We are well aware of the political limitations on best practice in economic development. These constraints notwithstanding, we still feel there is a strong case for thinking “chain-wise” about the local economy. For practitioners, the job-chains approach drives home the fact that much job creation is within-group churning. This forces economic development officials to consider ways of incorporating those groups less likely to benefit from “natural” chain progression.[3] For policymakers, aside from presenting time-honored economic development strategies in a new light, job chains offer an opportunity to consider the implicit weights placed on the welfare gains of different income groups. Given budget constraints, the job-chains model forces local elected officials to make a choice between new jobs that may go to high-wage in-migrants or those aimed at first-time entrants or the unemployed. Finally, the notion of job chains is of theoretical and practical importance to the economic development analyst. In the first instance, it presents a new perspective on what constitutes a job “multiplier.” This is not an arcane academic issue but one of hands-on importance when calculating efficiency measures such as cost-per-job indices or benefit–cost ratios. Second, the job chain bridges impact analysis with a more solid grounding in welfare economics. The recognition that markets do not function perfectly and that underused resources (unemployed or underemployed labor) exist, means that job creation can be considered a “real” benefit of economic development.

In the final analysis, thinking chain-wise is also an issue of political will. Applying the rigor and careful analysis of the job-chains model to a development project will not be determined by the sophistication of the method or the implorations of the practitioner who wants an accurate picture of the local economy with the development project. Rather, job chains stand a chance of becoming economic development currency if it can be convincingly shown that the notion expands our sense of what economic development can accomplish. If locally elected officials can be alerted to the role of demand-side policies, the needs of those stuck on the job ladders, and the (less visible) distributional effects of job-generating projects, then job chains will have come of age.

Notes

1. Making this argument from a job-chains perspective offers a real-world application of the broader “informational paradigm” case for the existence of such attractive opportunities. See Stiglitz (1994) and Putterman, Roemer, and Silvestre (1998).
2. It should be noted, however, that a comparison of two archetypal projects in both manufacturing (instruments plant) and services (a consulting firm) does suggest much larger welfare gains and a more equitable distribution in manufacturing than in services (Chapter 5).
3. While it may be argued that job chains have the potential for heightening the rhetoric of job claims for bad projects, we would counter that the welfare focus of chain creation and the prudent consideration of opportunity costs mitigate any such fear.

Appendix A

Unemployment and Underemployment

All of the evaluation techniques discussed in this volume are based on the assumption of significant involuntary unemployment and underemployment. While most economic development practitioners have little problem accepting the existence of involuntary unemployment, theoretical economists have not found it easy to agree on the existence, character, and relative significance of the barriers to perfectly functioning labor markets. This appendix presents a brief overview of those theoretical debates and thus provides a context for the arguments of Chapter 2.

CREATIVE DESTRUCTION, LABOR MARKET CHURNING, AND UNEMPLOYMENT

Consider an idealized world, with a set of perfectly efficient and well-functioning labor markets embedded in a perfectly competitive economy. Such an economy reaches full employment, with equality between the wage of each type of worker and that type's marginal productivity. The firms in this world simply combine labor and capital of various types and produce output according to their underlying production functions. Since these idealized competitive firms are limited in size by powerful diseconomies of scale, savings drive net investment in the form of new firms. The entry of these firms generates upward pressure in all labor markets. In the face of highly inelastic labor supplies, the new firms win away workers from existing firms by offering somewhat higher wages and using somewhat higher capital–labor ratios. Fairly quickly, all markets adjust with wages and capital–labor ratios rising throughout the system.

In the above scenario, the entry of new firms creates little or no increase in employment since aggregate labor supplies are highly inelastic. Under these circumstances, the wage bills of the new firms hardly represent a good measure of the welfare gains from business expansion. All of the workers in new firms have clear opportunity costs equal to their old wage (or, if coming from outside the labor force, a quite similar figure). If we discount for these opportunity costs, we are left with a much smaller estimate of gain. At the same time, workers remaining in other firms are enjoying higher wages, and they also gain by the difference between the new wage rate and the previous wage rate. Thus, the change in the total wage bill going to all workers and not the wages paid at new firms gives us a good estimate of the welfare gain to workers. Presumably, the above story holds for all workers, skilled and unskilled, in roughly the same proportions.

But, what has happened to the owners of the firms? Together they probably now have higher total income flows than previously. However, we should note that the owners of old firms have actually lost as their rates of return have fallen, while the owners of new firms have gained a place in the sun. These new firm owners have presumably gained, although in the above scenario, we make no effort to measure their opportunity cost of capital.

In the simplest versions of the neoclassical growth model, this process of capital deepening faces real limits. In the absence of technological change or population growth, a diminishing marginal productivity of capital guarantees the emergence of a steady state in which all savings are used simply to replace depreciating capital (Solow 1956). At this point the economy reaches a long-run equilibrium with no particular incentive for further change (Schumpeter 1934).

Whatever the uses of this basic model, it can provide little insight into the possibility of involuntary unemployment. Quite simply, the model assumes away such phenomena. Such a worldview must raise objections, however. At least since Keynes, economists have worried that more realistic descriptions of investment and labor markets suggest that modern economies will wrestle with persistent involuntary unemployment. While Keynes's own theoretical efforts left much unexplained, the last quarter of a century has witnessed a flowering of alternative theoretical structures to rationalize such involuntary unemployment. Two major themes of this renaissance—creative destruction and efficiency wages—seem particularly relevant to the job-chains model we develop.

It is not difficult to imagine that the investment process in the simple neoclassical model might entail some real costs as new firms recruit workers away from older firms. At first glance, there is no reason to expect these costs to fall particularly on labor. Presumably, the move of workers from old to new firms remains voluntary in nature. However, the situation becomes more threatening if the moves involved are forced rather than voluntary. Such a possibility emerges if new firms directly undermine the position of old firms. Rather than shedding a few workers to the new firms, old firms now contract substantially or even go into bankruptcy as they lose market share to new competitors.

Recent efforts to reintroduce Schumpeterian concepts into endogenous growth theory (Aghion and Howitt 1998) have generated an interesting class of models that pick up on this theme of aggressive competition. In these models unemployment is driven by creative destruction. While sophisticated in their analysis, the basic ideas behind these models are not difficult to grasp. Much investment is competitively targeted to undercut existing producers. For example, in terms of our simple parable above, new firms in a given period are likely to introduce superior technologies, which displace existing firms. Creative destruction stimulates "churning" in labor markets. This term is used to describe a situation of turnover that leaves total employment unchanged (Schettkat 1996a). The "flows" approach to labor market analysis (Blanchard and Diamond 1992) emphasizes the difference between job flows and worker flows. As long as aggregate job figures do not change, classic employment stock indicators such as net growth will fail to capture subsurface employment turbulence, such as workers moving positions within or between firms. Churning may, however, account for two-thirds of all hires (Burgess, Lane, and Stevens 1996). Rather than simple market clearing, we see large numbers of displaced workers hunting for new jobs even as new firms are sprouting up. Since the matching process is not instantaneous, we find a background level of unemployment in virtually all labor markets.

Aghion and Howitt suggest an equilibrium in which unemployment rises until new firms can be staffed relatively easily.[1] In effect, such models reduce labor costs to new firms not by lowering the wage rate, but by increasing the unemployment rate and thus making recruitment easier. Unemployment reduces the costs of entry.

The competitive nature of investment would not have to be restricted to simple technological improvements. Long ago Marshall argued that firms were best viewed as trees in a forest (Marshall 1961, pp. 315–316). In Marshall's forest, each firm had a life cycle based largely on the waxing and waning of its managerial energies. Such a scenario can easily generate churning in the labor market. New firms with better managements undermine existing producers and lay claim to larger market shares. As some firms in the forest grow and others fall, labor must adjust by shifting toward the more successful competitors.

EFFICIENCY WAGES AND UNDEREMPLOYMENT

The expanding theoretical discussion of labor market churning suggests a rationale for the striking empirical results discussed in Chapter 2. The refurbished Schumpetarian story of creative destruction generates a steady background of firm births and deaths, expansions and contractions that can be identified as a major source of both job switching and involuntary unemployment.[2] But, not all workers are equally likely to experience unemployment. Skilled workers have more options and more fallbacks. In particular, they can often accept underemployment rather than involuntary unemployment. A complementary theoretical stream, the so-called efficiency wage model, offers considerable insight into this phenomenon.

Workers and their employer share a common interest in the success of their firm, but workers and their employer have many conflicting interests as well. Modern labor economics has accepted the fact that workers and managers have long known: a fundamental agency problem haunts the employer–employee relationship. The employer would like to see more effort on the worker's part for any given wage. The worker generally wishes to deliver less effort. The employer and worker have a conflict of interest. This rather Marxian insight is now generally accepted by orthodox economics. The more conservative reading of the conflict sees its resolution in the careful design of incentive systems (Lazear 1999), but for New Keynesians,[3] the agency problem has become the cornerstone of a reconstruction of Keynesian economics (Krueger and Summers 1988; Shapiro and Stiglitz 1984).

If workers' level of effort could be fully observed and known by the employer, a simple contract would suffice to guarantee an agreed-upon level of effort, but employers can rarely obtain such knowledge cheaply. Rather, they can only imperfectly know the extent of shirking by their labor force. The New-Keynesian version of the agency problem, so-called efficiency wage theory, premises that employers offer wages higher than a market-clearing level in an effort to prevent shirking. In and of themselves these higher wages would not erase the agency problem, but these efforts to win agency loyalty do succeed in a roundabout and unanticipated manner. At the increased wage level, employers hire fewer workers than at the market-clearing level, thus opening up excess labor supply and involuntary unemployment. No single employer can anticipate the result, but collectively they have generated a real threat or, in Shapiro and Stiglitz's phrase, "a worker discipline device." In the presence of unemployment, losing a job takes on a sting it would lack in a fully employed economy.

The basic efficiency wage theme has been worked up in a number of variations emphasizing shirking, labor turnover, and/or morale (Yellen 1984). In all these varieties the New-Keynesian approach has been criticized for paying too little attention to the possibilities of more sophisticated incentive schemes (Lazear 1999). New Keynesians have plausibly defended their position, however, by arguing that these incentive schemes open serious problems of moral hazard if employers terminate older workers before those workers have reaped the benefits of their earlier investments.

Perhaps, more puzzling in the efficiency wage story is the fact that it seems to work best for skilled workers whose jobs are more difficult to monitor and whose turnover will be more expensive to the firm. On the other hand, unemployment is heavily concentrated at the bottom of the labor force where monitoring is generally easier. Indeed, several versions of the efficiency wage story (Bulow and Summers 1986) emphasize not the barrier between employment and unemployment, but rather a barrier between a primary and a secondary labor market reminiscent of Doeringer and Piore's dual labor market (1971). Here, the threat is one of losing a good-paying primary job and being forced into the highly competitive secondary sector. More generally, high-skilled workers are usually faced not with the threat of unemployment but with the threat of underemployment.

Ultimately we want a coherent explanation of both involuntary unemployment at the bottom of the labor market and pervasive underemployment up through the ranks. As suggested by the discussion in Chapter 2, such a story does emerge if we bring together our two major theoretical themes, creative destruction and efficiency wages. But, before outlining the character of such a synthesis, we need to comment on the nature of job hierarchies in firms.

Firms cannot operate by simply setting loose their hired labor force without a plan. Labor economics now recognizes the significance of jobs as distinct from the workers who fill them. Job definitions incorporate the firms' production plans. When formalized, they make clear the tasks and decision responsibilities of the job as well as the control over capital equipment. Job descriptions are written in the context of a hierarchy of decision making and define the nature of the coordination required for each job (Lazear 1999).

As suggested in Chapter 2, we can define underemployment as follows: a worker who is fully capable of carrying out a higher-level job but only able to find employment at a lower-level job is underemployed. "Higher" and "lower" here would ideally be defined in terms of the entire package of remuneration, but for the empirical work in this book they simply refer to the wage rate.

The above definition of underemployment raises any number of questions concerning the processes whereby workers acquire (and lose) specific skills. A large share of the research on human capital concerns itself with the investment decisions made by workers and their firms in this regard. For our purposes here, it is enough to suggest that, for many (perhaps even most) workplaces, much skill acquisition takes place on the job in a largely passive and semiautomatic fashion. Job hierarchies almost guarantee such a result. Hence, we can expect a large number of the experienced workers in a given job to possess the skills required for the next job up the ladder.

A significant by-product of the job hierarchy under conditions of insufficient aggregate demand is that it generates a system of efficiency wages. Workers in higher jobs recognize that many workers at the next level down could more or less carry out their jobs. The wage differential between the two jobs serves the functions of an efficiency wage. It is a prize for the ambitious and a disciplining device against potential slackers.

Workers further up the hierarchy are in a much better position to protect themselves from unemployment than unskilled workers. All workers are subject to risks engendered by creative destruction and other competitive processes, but more-skilled workers have a major adjustment technique not open to the less skilled. When displaced from their current jobs, high-skilled workers can accept employment at a lower level in the hierarchy, either in their old firm or some other already established firm with a vacancy unrelated to demand conditions (normal turnover, retirement, etc.). Since these workers can relatively easily engage in job search when employed, accepting a modest setback makes considerable sense.[4] As new firms or rapidly expanding firms assemble their new labor forces and ramp up production, a time-consuming process, these underemployed skilled workers remain in a good position to seek a better match.

The above sketch is meant to describe what is essentially an equilibrium process. Of course, it is a rather busy equilibrium, one characterized by involuntary unemployment and more or less steady rates of change in technology, products, and firms. In a hierarchically organized workplace, the wage structure plays a major role in defining jobs. As suggested by Doeringer and Piore (1971), firms avoid raising and lowering wages in line with labor market conditions. They argued that common personnel practices warned managers against responding to changes in market conditions with wage changes, instead urging adjustments in recruitment efforts. In our terms, excess supplies and demands are likely to be met by underemployment and career advancement through the job ladder. As a result wage structures are likely to be rigid, except in the long run.

Accumulating empirical evidence on rigid wages has contributed strongly to the New-Keynesian efficiency wage models. Krueger and Summers (1988) restated the argument in efficiency wage terms, emphasizing the influence of persistent industry differentials on turnover rates. More recently, Campbell and Kamlani (1997) interviewed 184 firms and found substantial support for a number of rigid wage hypotheses, including the reduction of turnover and the maintenance of morale. Similarly Truman Bewley's (1999) discussion of rigid wages emphasizes the role of morale. Neither Bewley nor Campbell and Kamlani found much support for the classic efficiency wage argument concerning fear of dismissal when shirking.[5] Of course, the personnel managers interviewed may answer more truthfully about the carrots they offer than the threats they wield.

The combination of creative destruction and efficiency wages leads to labor markets in which involuntary unemployment concentrates among the least-skilled workers with the fewest alternatives, while underemployment stalks more-skilled workers. Accepting such conclusions, some theoreticians have still denied that these various mechanisms suggest a role for national employment policy. In principle, unemployment and underemployment can be involuntary; yet, in a world of imperfect information, they might still provide necessary discipline for an efficient labor allocation. However, it is not difficult and is more plausible to emphasize versions of these models with "too much" unemployment/underemployment for efficiency. Our sympathies lie with this latter view. If they are right, national policies to limit the waste caused by unemployment and underemployment are a priority in all but the tightest portions of the business cycle. Policies directed at these problems would necessarily work primarily through stimulating aggregate demand and not through altering the character of supply.

One can interpret the growth of the public sector in modern market economies as a largely unplanned but significant attempt to implement this basic strategy. Indeed, the major economic debates between right and left in the United States are not over business cycle policy, but rather the size of government. The Keynesian endorsement of the balanced budget multiplier takes on extra weight in a federal system of progressive taxation on high-saving wealthy households. On the other side, conservatives see a large government not as assuring aggregate demand, but rather as undermining the incentives to save and invest.

INTERREGIONAL MIGRATION AND METROPOLITAN DEVELOPMENT

The still dominant view of regional labor markets (the Roback 1982 model) leaves little room for unemployment or underemployment. This highly neoclassical model projects full employment and real wage equalization across regions once environmental amenities are taken into account. If such a model literally held across metropolitan areas, there would be little reason to anticipate welfare improvements from regional economic development, apart from general gains in productivity.

This regional equilibrium story suffers from an entirely new set of problems not present in our earlier discussions. In addition to all the frictions associated with adjusting to the contraction and expansion of firms, we now must add the multiple adjustment problems generated by differential regional growth rates as some metropolitan areas blossom and some suffer difficulties.[6] At least a portion of the equilibrium frictional unemployment in the system as a whole comes about as the result of these interregional ups and downs.

While metropolitan growth may pull workers from afar, this mobility hardly establishes the classical functioning of local labor markets. Indeed, just the opposite is the case. The availability of outside unemployed and underemployed labor means most adjustments among metropolitan labor markets are handled without relative wage changes. Wage structures among metropolitan areas, like those among jobs within any given area, can remain rigid without upsetting labor flows (Eberts and Stone 1992).

Most regional input–output models implicitly assume that labor supply will be sufficient to meet regional demands. A number of studies have demonstrated that net job growth in a region is accompanied by substantial population growth through migration.

The above observations suggest that a concerted effort to stimulate economic development at the metropolitan or state level would not be constrained by rapidly rising wage levels. Rather, employment expansion would allow workers at many skill levels to move up to better jobs. For an ambitious effort to quantify the costs and benefits of a broad hypothetical program of this type, see Bartik (1991).

Yet, few if any metropolitan areas or states have the political coherence and sense of purpose to seriously undertake such an effort. Even if such a consensus could be achieved, the record of stimulating metropolitan and state growth has been less than stellar. Most of the highly touted initiatives around the country have produced very little in the way of measured results. Still, if the considerable underemployment rates observed in metropolitan areas have their roots in essentially the same macrophenomenon discussed above, there should be room for well-designed regional programs. With flexibility guaranteed by interregional migration, attempting more serious job creation efforts makes considerable sense. State and local governments would do well to consider the design of such efforts on a broadly expanded scale.

Notes

1. We should note that this literature also suggests counterforces generated by growth. See Aghion and Howitt (1998) for a survey.
2. Notice we are not particularly concerned with variations in this level over the business cycle but rather with its role in establishing a natural rate of unemployment. Again, see Aghion and Howitt (1998) for a review of models that also generate cyclical activity.
3 “New Keynesian” is an adjective broadly applied to a group of economists who, since the late 1970s, have tried to support the original intuitions of Keynes on a sturdier foundation, using the modern tools of information economics.
4. This rule might be weakened to the extent that future offers at the higher old level are reduced if potential employers know that a worker has accepted a lower level job in the recent past.
5. As Howitt (2002) emphasizes, the morale story of rigid wages cannot be easily squared with traditional versions of rationality and rational-expectations equilibrium. Rather, it requires a more complex psychology and behaviorism.
6. We should note that the Roback argument explicitly rules out such differential growth except as a well-defined equilibrium process. This seems a highly implausible argument. However, studies attempting to corroborate the existence of a regional “wage curve” and regional effficiency wages have been unable to produce definitive results (e.g., Mullen and Williams 2001).

Appendix B

Formal Treatment of Trickle Down

In this appendix we explore the trickle-down propositions for a particularly simple set of assumptions.

1) d is a constant. This is not a very serious constraint.
2) $c_i = d$ for every i. This assumption can be interpreted as suggesting that a worker taking a job at level i, but not coming from another local job, had an opportunity cost equal to the wage of jobs at the next lowest level, $i + 1$. This conjecture might be plausible for skilled workers, but it is far less plausible for the unskilled. In the current context, the effect of this assumption is to favor the trickle-down propositions. We discuss this problem in Chapter 5, where we argue that c_i declines at lower skill levels where involuntary unemployment is greater.
3) Q is a triangular matrix, with positive entries only for the diagonal and those cells immediately below the diagonal, i.e., $q_{ij} > 0$ only if $i = j$ or $i = j + 1$. This assumption is not as stringent as it sounds. After all, we do not expect many workers to jump two wage classes in their upward climb.
4) $q_{ij} \geq q_{(i+1),(j+1)}$. This condition is somewhat more speculative. In effect, it implies that high-skilled jobs recruit more heavily both from the same job class and the one immediately below it than do less-skilled jobs. The relatively low unemployment rates among skilled workers point in this direction. We should note that skilled jobs may be more often filled by in-migrants to the local area, a fact which works against this assumption. Again, we discuss the empirics of this question in Chapter 5.

THE MULTIPLIER EFFECT

For Q, an $n \times n$ matrix, M is the corresponding matrix of Leontief multipliers, i.e., $M = (I - Q)^{-1}$. Define chain lengths as M_j, where $M_j = \Sigma_i m_{ij}$.

Multiplier Effect Proposition: given conditions 1–4, then $M_n < M_{n-1} < M_{n-2} < \ldots$

Proof:

$$M_n = m_{nn} = [1 / (1 - q_{nn})],$$
$$M_{n-1} = m_{(n-1)(n-1)} + m_{n(n-1)} = [1 / (1 - q_{(n-1)(n-1)})]\ [1 + q_{n(n-1)} M_n],$$
$$M_{n-2} = m_{(n-2)(n-2)} + m_{(n-1)(n-2)} + m_{n(n-2)}$$
$$= [1 / (1 - q_{(n-2)(n-2)})]\ [1 + q_{(n-1)(n-2)} M_{n-1} + q_{n(n-2)} M_n],$$
$$= [1 / (1 - q_{(n-2)(n-2)})]\ [1 + q_{(n-1)(n-2)} M_{n-1}], \text{ since } q_{n(n-2)} = 0.$$

Or in general:

$$M_j = [1 / (1 - q_{jj})]\,[1 + (q_{(j+1)j} M_{j+1})]$$

Clearly $M_n \leq M_{n-1}$ since $[1 / (1 - q_{(n-1)(n-1)})] \geq [1 / (1 - q_{nn})]$, by condition 1.

But then $M_{n-1} \leq M_{n-2}$, because each positive term in the expression for M_{n-2} is at least as great as the corresponding term for M_{n-1}. Applying induction completes the proof.

THE EFFICIENCY EFFECT

Efficiency Effect Proposition: Given conditions 1–4, the relative index of efficiency gain, V_j / w_j, will be highest for the most skilled jobs, $j = 1$, and falls as j increases.

Proof: Start from Equation (4.4):

$$V_j = w_j \Sigma_{i=j} m_{ij} d^{i-j} [\Sigma_k q_{ki} (1 - d^{k-i}) + (1 - \Sigma_k q_{ki})(1 - c)].$$

Given the assumptions about zeroes in the Q matrix and the value of c_i, it follows that:

$$V_j / w_j = \Sigma_{i=j} m_{ij} d^{i-j} [q_{(i+1)i} (1 - d) + (1 - q_{ii} - q_{(i+1)i})(1 - d)]$$

$$= \Sigma_{i=j} m_{ij} d^{i-j} [(1 - q_{ii})(1 - d)]$$

It is also relatively easy to show that the same assumptions imply: $m_{jj}(1 - q_{jj}) = 1$ for all j and that for $i > j$, $m_{ij} = m_{jj} \Pi q_{k(k-1)} m_{kk}$, where the product is taken from $k = j + 1$ to i. Hence:

$$V_j / w_j = (1 - d)$$

$$+ m_{jj} q_{(j+1)j} (1 - d)d$$

$$+ m_{jj} q_{(j+1)j} m_{(j+1)(j+1)} q_{(j+2)(j+1)} (1 - d)dd$$

$$+ \ldots$$

From this expression, one can see that V_{j+1} / w_{j+1} has one less term in its summation and, given the hypotheses, each of the remaining terms is smaller.

THE DISTRIBUTIONAL EFFECT

Conditions 1–4, which guarantee longer chain length for high-skilled jobs and support the efficiency claims of trickle down, undermine the distributional claims. Using the measure suggested in Equation (4.5), we know that the Rawlesian ranking of new jobs will depend only on the corresponding m_{nj}. It is a relatively easy matter to show that, if the conditions 1–4 hold, then $m_{nn} > m_{nj}$ for all j. The multiplier for the lowest-level job, m_{nn}, is just equal to $1/(1 - q_{nn})$. Hence, the creation of one new n-type job ultimately draws one new worker from the pool of the lowest-skilled unemployed whose opportunity cost is less than w_n. This is the maximum possible since the chain set off by any single new job will draw exactly one worker from outside the system. If $m_{nj} > m_{nn}$, then a total of more than one worker would be drawn into the system.

Appendix C

Data

The research presented in this book uses information on employment changes and associated changes in wages and other work-related variables for labor force participants (both employed and unemployed). To do this work we needed to build what we call a "job event" database. There are three major national data sets that collect information about individual job changes over time: the Current Population Survey (CPS), the National Longitudinal Surveys (NLS), and the PSID. We chose the PSID for several reasons.

The first reason for choosing the PSID had to do with the need to identify intrafirm changes in employment position. To collect the same information from the CPS (at the time we began this project) would have required obtaining and working with undisclosed individual data and thus would have posed a range of additional problems that arise when working with confidential, raw data. We might suggest that the study be repeated with the CPS now that working with those data has become somewhat easier. The NLS does have information on intrafirm changes, but its sample is focused primarily on youth and we were interested in a wider spectrum of the population. In addition, when we began this project the Inter-University Consortium for Political and Social Research (ICPSR is the institution responsible for administering and archiving the PSID) had plans to make available a 1987–1992 work history supplement file which would have made tracking inter- and intrafirm job changes fairly easy. Unfortunately, that file was never released.

THE PANEL STUDY OF INCOME DYNAMICS

A complete description of the methodology of the PSID is beyond the scope of this appendix; however, several aspects of sampling and data collection are especially relevant for the work presented here and will be examined in some detail.

The PSID is a longitudinal panel survey of a sample of U.S. individuals, and the families in which they reside. The Institute for Social Research at the University of Michigan has administered this survey annually from 1968 through 1997, with biannual collection starting in 1999. The PSID includes a large number of topics relating to the demographic composition of families and their members' employment, financial, and housing status.

It is important to note that, unlike other widely used secondary data sets such as the CPS and the decennial Census of Population and Housing, the PSID is a survey of families and does not collect data about households. The PSID defines a family as a group of people permanently living together who share income and expenses. Usually these people are related through blood, marriage, or adoption, but unrelated persons may be part of a family unit if they share income and expenses. Conversely, for the PSID, a household is defined as the house or apartment where the family resides. Not everyone living in the household is automatically part of the family, and the PSID is about family members only.

At the inception of the PSID in 1968, 4,800 families were part of the "core" sample. A Latino subsample consisting of 2,000 families was added in 1990 (but dropped in 1995). From 1968 to 1996, the PSID interviewed individuals from families in the core sample (and the Latino sample, as applicable) every year, adding new family units (FU) as core family individuals created new family units through divorce, remarriage, leaving home, or other reasons. (Substantial changes to the core sample were made in 1997, but our job change database only uses data collected through 1992.) Information is collected on individuals in new FUs as new FUs are created, yet should these new families later dissolve, the individuals no longer associated with the core sample individual are not followed.

Within the file structure for each year, each FU is assigned a designated Head and the other individual family members are assigned a status within the family based on their relationship to the Head. If there is a female/male pair living as either legal husband and wife or as long-term (over one year) cohabitors, the male will be given the status of "Head." The female is designated "Wife." These designations can change, however. For example, in the case of divorce or death of the male Head, the Wife may become the designated Head for subsequent interview waves. If she remarries, she again becomes the Wife.

One aspect of data collection which is crucial for our study here is that the PSID considers certain information on individuals part of the "family story," and thus it does not matter what specific individual is in any family role from year to year. This situation is relevant for our study inasmuch as the PSID is concerned with the ebbs and flows of family income and expenses over time, regardless of the particular individual who is bringing in the income. Thus, detailed employment information such as wage, duties, unemployment spells is collected on only heads and wives of FUs. While we know that other family members often work and may face different labor market conditions than do heads and wives (such as children entering the labor force), we do not have specific employment information about them (although the PSID does ask the rudimentary labor-force status of other certain family members).

In addition, the pool of workers for which we have extended data is further reduced by the fact that, as mentioned above, the PSID was designed to study family dynamics and so does not collect information on any persons living in the household who are not part of the FU. We therefore do not have employment information for individuals who may reside in the household with the FU but are not part of the family, such as unrelated individuals, relatives of a non-core sample PSID partner who do not share income and expenses, and so on.

We gauged the extent to which the PSID sample is a reasonable reflection of the universe of employed persons as measured by the CPS (Table C.1). We found that heads and spouses account for 91 percent of all employed workers in the PSID, while they account for 79 percent in the CPS. We realize that this is a sizable difference. Two factors seem to account for this difference. First, through its definition of a family unit, the PSID counts many fewer individuals in the "other" category; information on their labor force status is just not collected. Second, the employment rates for children (as a percentage of their presence in the study population) are considerably lower in the PSID than they are in the CPS. The PSID offers a "student" category while the CPS does not. Perhaps PSID parents may have used the "student" category for their children despite the latter's holding a part-time job. Third, the PSID allows a head to designate a nonlegal partner as "spouse," and so some of the individuals who are named "other" in the CPS might be found in the "spouse" category in the PSID.

An additional second complication this situation poses is that, since the individual who is designated Head of the FU can change from one year to the next, employment information about the Head collected in any one year may not be from the same person it was collected from last year. To track true year-to-year employment changes with the PSID requires one to pay special attention to individual identifiers on the file such as family codes and relation-to-head codes. In this case, women were more likely to be lost because, as they added a partner, they became a Wife. It is more difficult, though not impossible, to track someone who is a Head this year and a Wife next year than someone whose family status remains constant.

GENERAL INTRODUCTION TO OUR DATA

Our job-change database consists of 12 files, 6 for heads and 6 for wives, for new jobs or new positions (same employer, new position) obtained from

Table C.1 Employed Persons, by Relation to Head of Household or Family, CPS, and the PSID

Relation to householder or family head	CPS (May 1992)		PSID (1987–1992)	
	N (000s)	Total (%)	*N* (000s)	Total (%)
Householder	61,865	53	94	63
Spouse	30,148	26	42	28
Child	14,364	12	12	8
Other	9,671	8	1	1
Total	116,047	100	150	100

1987 to 1992. (Since job information on the PSID is asked about for the previous year, we were required to use PSID Waves XX through XXVI; that is, data collected from 1987 through 1993.) In short, to be included in the database an individual needed to be a new job holder in any of the years we examined. That is, the individual must have taken a new job with a new employer or changed positions with their current employer in the year in question. We refer to this as a job event.

Several additional pieces of information were also crucial to our research and those individuals for whom these data were missing were excluded from the file. These included the individual's employment status upon taking the job (employed or unemployed), wages for new job, and demographic information such as race, sex, age, and education. We thus used particular PSID interview files to identify all those who reported a job event in the year in question and for whom these other crucial pieces of information were not missing. Of course, individuals who did not meet our criteria for inclusion in any one year's file were not excluded from consideration for other years. In addition, those with weights of zero (representing noncore sample members) were not included.

Determination of New Job Events

The PSID asks about the start month and year of the individual's (either Head or Wife) current job and the start month and year of any position changes within the current job. In order to restrict our sample to new job events in any one year, we limited the sample to jobs and positions taken the year before the interview year. So, for example, within the 1992 interview year (Wave XXV) data, we were looking for 1991 job events. In this explanation, the interview year is referred to as the "current" year, the year previous to the interview year the "previous" year.

Our first consideration was to retain PSID respondents and their wives if they had a job event in the previous year. Variables for year and month for the start of current job are fairly straightforward (B24 for Head and D24 for Wife, respectively, in Wave XXV; equivalent variables in other years). However, skip patterns after that allow for three separate places where individuals could indicate they'd started a new position in their current job since the job's start date. Separate questions about new position were asked of those who began their new job in the current year; of those who began their current job in the previous year; and of those who had begun their current job sometime before the previous year (e.g., for the Wave XXV data, it would be "before 1991"). We inspected all three sets of questions about position changes to locate all those who had started a new position in the previous year and included them in our job event file.

There were a few places where we had to make judgments about the event date. First, if the respondent did not know the event year for either him/herself or Wife, a valid PSID response was "this year, or last, don't know which." For those individuals for whom "year" was coded as "this year, or last, don't know which," we assigned the previous year (1991). We did this for both kinds of events, new jobs and position changes. The rationale for this decision was that if an event happened so far in the past that an individual could not remember what year it took place, it was more likely that it happened in the previous year. For month, we assigned a "month value" of zero to all those who could not recall the month of the event, which enabled us to retain the record with "year" information.

Our relative ease in defining job events by considering and comparing position dates is primarily due to changes made in the PSID survey instrument in 1988. For interviews conducted in years prior to 1988, a work history was built around position changes rather than based on employer relationships, as it now has been since 1988. It used to be more difficult to identify promotions or intrafirm position changes because the work history section was structured around questions regarding tenure on the job, not job dates. Research such as that of Kristin McCue (1996) using job data from pre-1988 files brought attention to the inadequacy of the extant survey questions and was partly responsible for the reworking of the employment section. Since the reworking, studies such as Kenneth McLaughlin (2001) and ours here have taken advantage of question changes to do a better job of identifying and investigating intra- and interfirm mobility. This is not to suggest that problems with overlapping job dates, inconsistent employment status reporting from year to year, and other various complications made our task effortless.

A special effort was needed to ensure we counted job events only once. We excluded duplicate job events through several methods. First, if job event dates in two successive interviews were the same, the individual job event was excluded from the second year's file. That is, the job event was included only for the first year for which it was reported. This resulted in the exclusion of from 5 percent to 6 percent of cases in any one year.

Second, in order to avoid possible double-counting of job events among files we excluded, *from any one year's file*, records of individuals who had had two job events in the approximately 16-month period prior to being interviewed. This 16-month period encompasses the entire year prior to the interview ("previous year") as well as three to four months of the interview year that elapsed before the interview (current year PSID interviews take place in the spring). Unfortunately, limitations of the PSID made it extremely difficult to build a truly longitudinal file, and thus we cannot say for certain how many of two job events were captured either in the prior or following year's file. This aside, we still preferred to be conservative. This procedure resulted in the exclusion of about 27 percent of cases in any one year.

How We Determined Pre–New Job Employment Status

The second piece of crucial information was the employment status of the individual during the two months just before and the month of the job event, in order to determine "from where" in the labor market the individual was moving. We took that information from the current file. The PSID asks the respondent, in the current year, what s/he was doing each month of the previous year. The response categories are "employed," "unemployed," "out of the labor force," "both unemployed AND out of the labor force," and "don't know." The answer "both unemployed AND out of the labor force" doesn't fit with conventional labor market measurements; respondents with that response were recoded as out of the labor force. We also reassigned those people who said they didn't know which (either unemployed or out of the labor force) to the "unemployed" category.

One aspect of employment status deserves special mention. Status as an in-migrant took precedent over employment status. That is, if an individual was an in-migrant, we did not consider their previous labor force status when constructing the matrix. For example, we might know that someone was unemployed in Iowa, then came to Illinois and moved into a job at level 2. This person is counted as an in-migrant, not unemployed for his/her origin.

Excluded Cases

Our files include records for individuals with weights greater than zero and unique job events for the year in question. About 31 percent of job events were excluded for any one year for either of the following two reasons:

1) Records were excluded when the employment status prior to the job event could not be determined or was unreliable. For example, the information in the current year indicates that the employment status at the time of the job event was "employed," yet the same month reported on the previous year's file indicates that the individual was unemployed during that month. This resulted in the exclusion of about 4 percent of cases in any one year.

2) Missing wage information also caused some records to be excluded. In addition, records with below minimum wage were excluded ("minimum wage" is defined as below $4.25/hr. in real 1992 dollars). We also excluded individuals with reported wages of greater than $40 in real 1992 dollars. This resulted in the exclusion of about 27 percent to 29 percent of cases in any one year.

Included and excluded records are compared in Table C.2. An excluded person is defined as a person who appeared to have a job event in the year in question but was not included in our sample because of unclear prior employment status or out-of-range wages. Persons who did not appear to have a job event date in the year in question or who had a zero weight do not appear in this table.

Table C.2 Included and Excluded Job Changes from the PSID

Year	1987	1988	1989	1990	1991	1992
Included						
Age	33.31	33.34	33.77	34.85	34.76	34.35
Education	13.38	13.79	13.56	13.74	14.11	13.55
Age year 2	34.33	34.41	34.81	35.79	35.83	35.43
Education year 2	13.38	13.8	13.56	13.85	14.13	13.55
Men	138	115	111	123	121	103
Women	54	47	63	46	46	29
Weight	21.06	27.44	22.11	24.52	20.89	20.67
N	192	162	174	169	167	132
Excluded						
Age	31.5	32.61	33.01	33.64	34.01	32.88
Education	13.73	13.61	13.79	13.77	14.03	13.77
Age year 2	32.7	33.59	33.98	34.69	33.87	33.77
Education year 2	13.74	13.64	13.79	13.82	14.09	13.83
Weight	23.43	27.65	24.55	25.37	23.41	24.11
N	73	69	76	80	78	68

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