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Analysis of labor supply by skill and spatial location in NIAD: a functional economic area of Iowa

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ANALYSIS OF LABOR SUPPLY BY SKILL AND SPATIAL LOCATION IN NIAD - A FUNCTIONAL ECONOMIC AREA OF IOWA

by

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INTRODUCTION

Virtually every community and area desires growth and development. Most local interests perceive economic growth and development as the increase in employment, population, income, and total value of area production. All of these measures of growth are interrelated. For example, people are held in the area or attracted to it by employment opportunities. More jobs mean more income to the workers who spend more in the local community. More effective consumer demand means more local service income and more jobs. Increases in jobs in the area requires additional people, provides more income and so the cycle repeats. The location of a new factory to create jobs is the classical route to area growth and development and hence achieving the objective of the area leaders.

However, in addition to growth, the objectives of a community or area probably include changing the distribution of income, increasing security, and improving the number and quality of services. However, growth measured by increase in the number of workers or jobs will be the focus of this study.

Expanded or improved opportunities for labor employment are major means to area economic growth. The creation of new jobs or raising the productivity of labor in existing jobs will allow fuller and more effective use of existing labor resources and thus increase an area's total product and per capita income. Denison estimated that labor received 77% of the national income in 1958 (10). From this, he deduced that if the quantity of labor employed were raised 1%, national income would increase .77%. The increases from a one percent change in labor employed

are much larger than could be realized from increases in land or capital. Thus, changing the opportunities for labor is of high priority in area development. However, increases in employment when capital is fully employed can only be realized by injection of additional capital investment.

Besides investment, demand is necessary for successful job creation. An investment, such as new or enlarged productive facilities (a factory), which creates new jobs and increases area output will not be profitable, successful, and permanent unless there is sufficient demand for the increased output. The extent to which a small area need be concerned with adequacy of aggregate demand depends on the type of product under consideration. If the expanded output represents a small portion of total regional or national production of a relatively homogeneous good the demand for the product produced by this area will probably be highly elastic. That is, so little percentage will be added to the total supply of the good that the price will not decrease appreciably. If the output is a speciality product, i.e. represents several percent of the total national output or regional consumption of the product, the price depressing effect of investment, job creation, and area output expansion must be considered. It will be assumed for this study that product prices are constant, i.e. product demand does not restrict job creation activities of the area. This is generally realistic for basic export products and the usual investment and job creation activities in small areas.

Assuming that demand is elastic or unrestricting, increasing the total capital stock is a prerequisite for improved employment opportunities. The form of the improvement may be more jobs or higher labor productivity and higher wages. Suppose that an area had been neglected

as an investment opportunity. It would have less than its equilibrium capital stock and the local return to capital would be above the price of capital. The price of labor would be equal to or below the surrounding area wages. The price of capital is determined outside that local area but the return to capital and the level of employment are determined within the area by the level of investment. If the capital stock were increased through investment, employment will increase without raising wages for a time as long as the labor supply is unrestricting. Mobile workers may also migrate to this area as soon as wages reach that of the surrounding areas. Thus, the total supply of workers available to the area or community can be greater than the resident population.

Theoretically, employment could be increased by lowering the local wage rate. Lower wages would reduce costs and make it profitable for local industries to invest, create jobs, and employ more people if the price for the product were constant. This seldom happens because workers usually leave the area quickly if wages are cut below surrounding areas.

Improvement of local technology or efficiency can raise the productivity of labor and reduce the labor costs per unit. With a constant product price, employment or wages could increase as a result of increased local efficiency. Most general or national advances in technology are of a labor saving, cost reducing nature. Output will expand because costs are reduced. To maintain employment levels as technology advances, new wants must be satisfied by new and more products.

Investment in expanding existing production processes and establishing new productive processes are virtually the only hope of increasing

total area employment. Advances in technology and increasing capital per worker will raise the productivity of labor. But unless output expands rapidly as technology and capital per worker advance, total employment will fall. In order for a job creating investment to be feasible and profitable, a sufficient supply of qualified labor must be available. The number, skill, and required wages of potential employees play a large role in the investment decision. For many areas, information on the supply of labor is limited. Potential investors and leaders within the area need assistance in gathering and analyzing the relevant data on labor supply.

One of the functions of land-grant universities is to provide information and assistance to local people so that the people may more rationally appraise their situation and seek solutions to problems with some insights to the consequences of alternative courses of action. The role of the university is not to make policy recommendations but to state the situation and the alternatives. This function of the land-grant university is provided by its extension services. The Cooperative Extension Service of Iowa State University has had a long history of working with rural people. Iowa State University Extension has broadened its perspective to provide extension services for community problems to meet the needs of urbanization and industrialization of the Iowa economy.

The impetus for this study came from the Business and Industry Committee of the North Iowa Area Development (NIAD) committee through the Iowa State University Extension. They requested information concerning the labor supply within the NIAD area and the effects of increased economic activity on the NIAD labor market. Such information is available

only through research and the interpretation of the research to local interests.

The Setting of the Study

The area of interest will be a functional economic area, the North Iowa Area Development region, abbreviated NIAD, which is in north-central Iowa with Mason City as the focal point. The NIAD area includes all of seven counties (Winnebago, Worth, Mitchell, Hancock, Cerro Gordo, Floyd, and Franklin), the northeast portion of Wright County and the northwest portion of Butler County. This is approximately 4,600 square miles of level rich black farm land and includes about 150,000 persons. This is a predominately rural area with only 34.5% of the population living in towns of 2,500 population or larger. The population of NIAD has remained essentially constant over the past 20 years with a total increase of .6% between 1940 and 1960. All of the counties had reached their population peak prior to 1960 except Cerro Gordo County where Mason City is located. Total employment declined 2.8% between 1950 and 1960. Figure 1 shows the counties and some of the towns in NIAD.

The NIAD organization is a voluntary association of representatives from the multi-county area organized for social and economic development purposes (14). This organization draws on Iowa State University Extension as a consulting and coordination resource. The NIAD committee has no legal or governmental jurisdiction within the area. Its objectives are 1) study and analyze the area's social and economic problems, 2) make recommendations and suggestions to the appropriate agencies, and 3) education of the people within the area concerning problems and

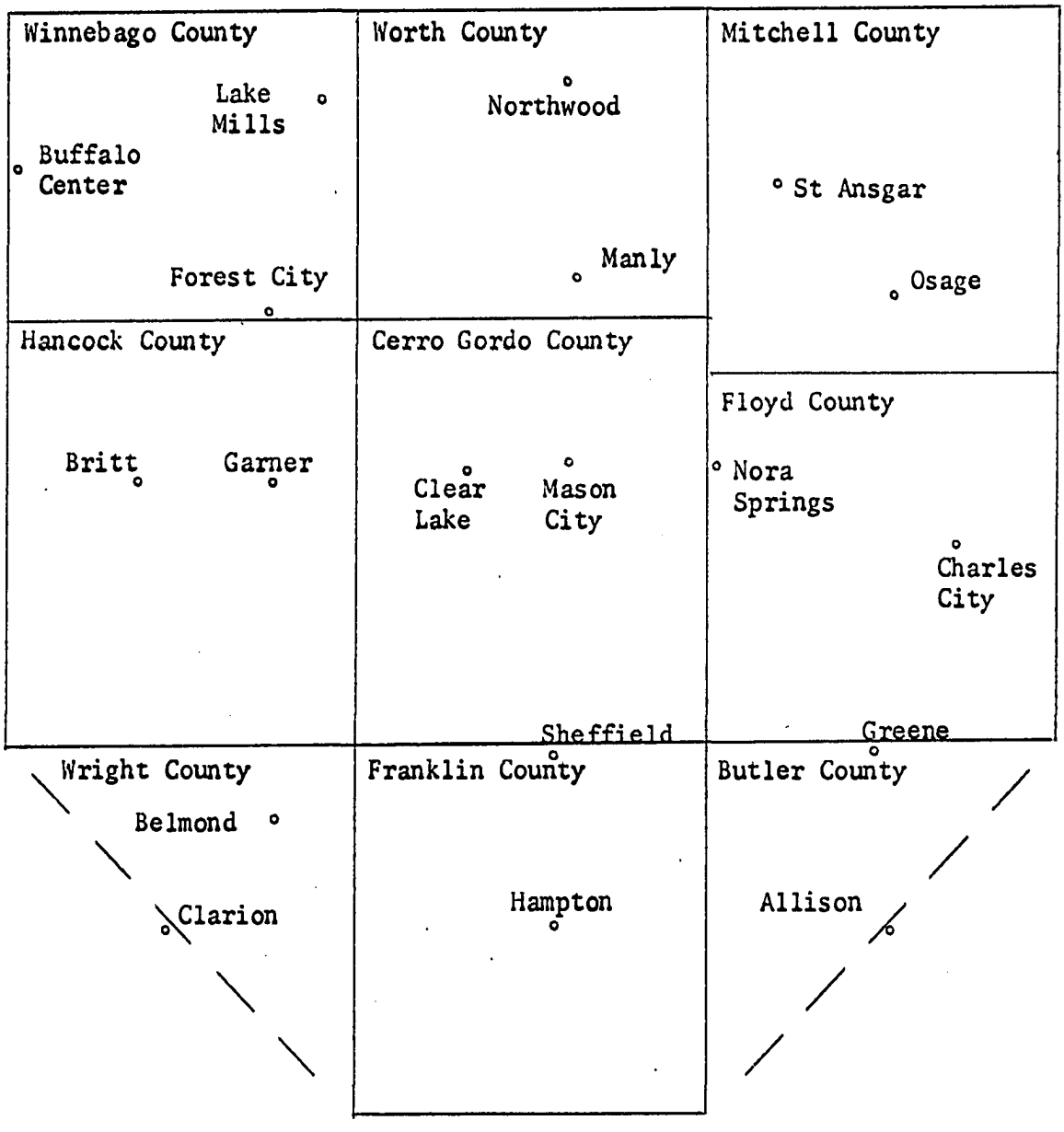

Figure 1. North Iowa area development region

alternative courses of action. Thus, only through knowledge and information can the NIAD committee have influences on area decisions and investments.

The Problem

The problem for this study is the estimation of the labor supply in NIAD with particular emphasis on skills, spatial location, and wage rates. This problem can be approached from two view points. First, potential investors need to know if they will be able to hire the number and kind of workers their investment would require at a wage which would make their investment profitable. From the other point of view, area leaders concerned with the economic growth and development of their area want to increase employment. They need to know the labor resources available within the area in order to attract investment. Thus, there are two sets of clients, each with separate but related labor supply estimation problems: 1) investors who need labor and 2) area leaders who need jobs for workers.

The first set of clients may be considering expansion of existing production processes or considering locating a new plant in the area. If either investment would expand employment, these investors need to know the number and skills of potentially available workers and the wages required to obtain 10, 50, or 100 workers. Many other important variables concerning an investment, besides labor supply, are not considered in this study, but must be considered by the investor. Among the investor's other considerations are the availability of transportation, communications, utilities, raw materials, and markets. It is necessary to remove

the investor's uncertainties concerning the labor supply variable to insure his confidence in making a profit and hence induce his investment.

The second set of clients - area leaders who want jobs for people - are concerned with the economic welfare of the area. One of their objectives is to obtain more local spending power which may be obtained by either more or better paying jobs. Some leaders want to benefit people; that is, ultimately achieve full employment and high productivity for all workers in the area. Because of the lack of adequate jobs within the area, many rural areas have experienced net out migration. Thus, it is desirable in the minds of many local leaders to lessen the outflow of people by providing local employment. For area planning of adequate employment opportunities in total, local leaders need to balance employment opportunities in future years with total availability of workers in future years. Area leaders have a more total interest in labor utilization than do specific investors.

The investors and local interests may have conflicting interests in the use of the labor supply. The investor must assure a profit to his stockholders. His concerns are with competitive pricing and low production costs. To increase wages beyond his ability to pay is to put him out of business. Thus, employers probably find it less risky and costly to operate in a less than full employment environment. With a "comfortable" amount of unemployment they can be assured of a ready supply of workers at constant wages. As area employment approaches its maximum with all available workers employed, an investor will feel less secure.

Local leaders' objectives are less clear than those of investors. There are internal conflicts among local leaders. Some are businessmen

and employers who must maintain their profit with hired workers from the local labor market. For merchants, increased wages raise selling costs and lower profit margins since prices cannot be raised without loss of trade to other towns. This cost increasing effect of job creation can offset in the mind of local employers the value of increased demand for his product from more people and more income from a new factory. Other community leaders--labor leaders, community leaders who are salaried, politicians and public employees--welcome competition for workers and the wage increasing effect of full employment. Thus, there is some detectable ambivalence among community leaders on industrialization. It is hoped this study will also shed some light on local leaders' uncertainties.

With a lack of adequate, accurate, up to date information concerning the degree and uniformity of employment in the area, investors will be hesitant to make investments. Missed opportunities or unprofitable investments can result from misinformation or uncertainty. These are serious economic errors from either the investor or local leaders' viewpoints. Local interests, if lacking information on labor supply, are uncertain about how much job creation (investment) they need and which kind would be most desirable. Inaccurate knowledge leads to unwarranted optimism or pessimism.

The problem is to fill the gap between the existing knowledge on the part of investors and local interests concerning the labor market of the area and the actual labor market situation. Labor market knowledge is quickly obsolete with respect to the extent of unemployment and underemployment. The spatial and skill mobility of workers is seldom esti-

mated but is very important in determining the availability of workers. The feasibility of expanding existing production processes, the potential for establishing new production processes and the potential effects on the whole labor market are central in planning area industrial development. Both sets of clients--local leaders and investors--need the same sort of information even though their goals are different.

The investors know their production process; that is, markets, materials, machines and labor demands. They want to know if additional labor supply is available and at what cost if they create jobs by investment. They must check the hypothesis that the labor supply is at least as large as their labor demand. The local leaders focus on the area population and labor supply and try to secure the desirable level of investment for their area. They must check the hypothesis that investment planned is at least as large as investment required to bring about full employment both for the present and future.

The major emphasis of this study will be on the production work force of the NIAD area. Firms planning job creation by investment in the area would likely bring management and advanced technical personnel from their own organization. The production work force would be recruited locally.

Of all persons employed in manufacturing in Iowa in 1960, craftsmen, service workers, operatives, and laborers comprised 72.5% of the total (See Table 1). These skills are the most numerous in the labor force in both Iowa and NIAD. Furthermore these workers are of most interest in analyzing a local labor market. A local market including discernible

Table 1. Employment by skills in Iowa and NIAD (54)

	Iowa				7 NIAD counties	
	Employed 1960	% of employed	Employed in manuf.	% of manuf. employed	7 county employed 1964	% of employed 1964
Males employed	710,684		149,356		34,796	
Professional	54,435	7.7	10,378	6.9	2,420	7.0
Manager	68,814	9.7	10,085	6.8	3,111	18.9
Farmers	153,470	21.6			9,805	28.2
Clerical	36,113	5.1	9,349	6.3	1,234	3.5
Sales	46,691	6.6	8,996	6.0	2,426	7.0
Craftsmen-mechanics	110,424	15.5	33,334	22.3	5,367	15.4
Operative	115,183	16.2	60,276	40.4	6,401	18.4
Service	31,874	4.5	2,894	1.9	3,508	10.1
Laborers	75,233	10.6	11,871	7.9		
Not reported	18,447	2.6	2,173	1.5	524	1.5
Females employed	308,318		40,304		15,497	
Professional	44,900	14.6	1,354	3.4	2,111	13.6
Manager	10,203	3.3	530	1.3	513	3.3
Farmers	4,690	1.5			302	1.9
Clerical	87,143	28.3	13,948	34.6	3,784	24.4
Sales	27,051	8.8	958	2.4	1,546	10.0
Craftsmen-mechanics	3,222	1.0	1,507	3.7	113	.7
Operative	30,636	9.9	20,170	50.0	2,970	19.2
Service	76,727	24.9	584	1.5	3,667	23.7
Laborers	12,141	3.9	772	1.9		
Not reported	11,605	3.8	481	1.2	489	3.2

demand and supply relationships exists for these skill classes. The two sets of clients for this study, the investors and the local leaders, are concerned with the match between local jobs and local supply of these skill groups. More advanced management and technical personnel need a market of greater space because they are more mobile and exist as a small portion of local workers. They become numerous enough to be a definable population only in a state or multi-state area. Thus, the emphasis of this study is on the skill subset of the labor force composed of farmers, craftsmen, operators, and laborers which will be called the manual occupations.

With this statement of the problems and concerns of investors and local interests, three broad objectives for the study can be stated:

1. Describe the labor market--demands and supply of the area.

2. Analyze the labor supply of the area in total and for selected subsets.

3. Simulate the labor market of the area and adjustments to changes in employment demands.

LABOR MARKET CONCEPTS

A conceptual base is necessary to make a logical investigation into labor markets. There are a number of terms and concepts that frequently have alternative meanings depending on who uses them and in what context.

Labor Markets

Markets are mechanisms for the exchange of goods and services wherein buyers are competing for the supply and the suppliers are competing to fill the demand. In a labor market, much of the supply of workers is already committed to work for employers. The existing supply of labor at a point in time is composed of those workers who are entering the labor market for the first time, not presently employed, or who desire to change jobs. Similarly, the demand for labor competing in the market is composed only of unfilled jobs.

To the buyer or employer, labor is an input which is transformed in the production process into a good or service. Labor to the employer is a perishable, dated, flow resource. The employer's primary concern is the labor's productivity. The welfare of the workers is important to him only as it affects productivity. To the seller or worker, his labor is a human, individualistic resource requiring recognition and relationships. His concern with productivity is limited to maintaining or improving his welfare--income, health, and security. There are other values in work and productivity but materialistic motives are important.

Conceptually, the entire world is a labor market but in practice it is divided into smaller separate markets because of mobility restrictions.

These restrictions include space, skill, time, and industry barriers but they can be overcome by wage incentives, investments, technology, courage, and time.

Willingness to move residence, the technology of travel and the willingness to spend time traveling to and from work sets limits on the spatial dimension of the labor market. No direct method is available to measure willingness to move or willingness to spend time traveling to and from work. These are influenced by the psychological makeup of the individual. Given a persons' residence, the distance he is willing to commute to a job is a function of his technology of travel and the amount of time he is willing to spend commuting. If walking were his only mode of transportation, as is the case in many underdeveloped countries, the potential commuting distance is considerably less than if bus or automobile transportation were available. Fox feels that one hour commuting time is about the limit for most people (15). Assuming that a person is willing to spend one hour in one way commuting time via automobile, the spatial limit for him would be about 50 miles if the route to work were mostly open highway. However, if the route to work were congested traffic, 10 or 20 miles may be the limit. Thus, given that the worker does not move, only those job opportunities within 10, 20, or 50 miles would be within the spatial dimension of his labor market. With the rapid advancements in the technology of travel, one can only conjecture as to the spatial dimension of labor markets in the future.

The spatial dimension of the employers' labor market includes all of the area from which he can draw workers. He has no control over the time spent commuting except as he locates his plant near transportation facil-

ities or provides such facilities. It can safely be assumed that workers will spend 10 to 15 minutes in one way commuting while fewer persons would be willing to spend 30 minutes and still fewer would be willing to spend one hour in transit. Thus, the employer's drawing power diminishes with distance, as measured by commuting time, from the place of employment. It is conducive for the employer to locate investments so that there would be an adequate number of workers or potential workers within easy commuting distance.

For the worker, increased wages may be necessary to induce him to commute a longer distance to work. However, the employer is not concerned with the location of the residence of his employees nor how far they commute to work. Since the employer cannot give added compensation only to those who commute to work, the general wage level and other benefits must be sufficient to attract commuters as well as local workers.

Given the transportation system, the shape of a spatial labor market area may be quite irregular. Super highways, bus routes, commuter trains, and perhaps even air routes can cause bulges in the area. The lack of such facilities can lead to very small spatial areas.

The supply of workers available in a particular location could be increased without any workers changing their residence if all workers would commute toward the particular location. That is, instead of what is perhaps a random pattern of commuting, all persons could, by changing the location of employment, commute toward a central point thus increasing the labor supply at that point while decreasing the supply available at the perimeter. However, if all workers are presently commuting toward a central point, this would not be a feasible method of increasing labor

supply.

Since not all people can fill all jobs, another dimension of labor markets is skills or occupations. There is a market for common labor and another market with its own supply and demand conditions for secretaries, and still another market for doctors. These markets are separated because they involve "non-competing" groups (21). An over supply of laborers would have little price depressing effect on the wage of secretaries because laborers cannot fill secretarial positions. However, since the reverse is true, the lack of secretarial jobs may mean that well trained women would fill jobs that require only unskilled workers. Thus, in times of unemployment, the unemployed are those with the least skills and many workers are employed below their skill level or are "underemployed." The lack of sharp dividing lines between occupations and the range of training and experiences of some workers makes the differentiation of a market by skills only partial.

The extent of separation between skill markets depends upon occupational immobility which can change with time. Given sufficient investment, ability and desire, people can over time make large changes in their occupation. A high school graduate is essentially at the unskilled level and therefore in the common labor market. He can become a doctor in nine years by an investment of $20,000 to $25,000. Less drastic, but very important, occupational shifts take place when workers move from laborers to semi-skilled to skilled occupations. These movements are accomplished by increased experience and on-the-job training. Of course, not all persons can make a complete transition from laborers to skilled occupations. Each person has limitations to his abilities and desires

which may not permit him to climb very high on the occupational ladder.

The time dimension incorporates the dynamic aspects of labor markets. Conditions within a labor market change over time because of varying labor demands reflecting the economic conditions of the area and nation; workers acquiring more skills and experience; and migration into and out of the area. Thus, the time dimension plays a role in the specification of the state of the labor market. Any statement concerning the labor market must specify the point in time or time interval covered. Labor market projections are subject to the changing environment in which it operates. The changing environment is brought about by major alterations in the situation, usually over a period of months or years.

There are also seasonal variations in employment and labor supply which necessitate including a time interval in labor market analysis. Seasonal fluctuations are of short duration and are repetitive between time intervals. Any analysis must include a time interval long enough to include the seasonal factors or recognize that they exist and make adjustments for them.

Some occupational transitions or skill mobility are easier to make within an industry than between industries. Thus, there is an industry dimension or separation in labor markets. Intra-industry inter-skill job changes can sometimes be accomplished easier than inter-industry intra-skill changes. Working with persons of different skills within an industry exposes workers to productive processes, techniques, and problems which ease the transition to other skills within that industry.

Most companies have schools and training programs to assist such mobility. However, such industry training is just as applicable to other

firms within the industry as to the firm who provided the training. Therefore, some companies are reluctant to train their employees for fear of providing assistance to competitors.

For this study, the basic labor market will be spatial in nature covering approximately 50 miles in diameter around Mason City, Iowa. Within this spatial area, skill and spatial sub-area dimensions will be identified.

Why Emphasize Local Labor Markets

The spatial area in which people live who work in the same employment center defines a local labor market composed of people competing and supporting each other. The workers are competing for jobs without moving their residence. On the other hand, they are supporting one another by providing goods and services for consumption by the people within this area. The focus of this labor supply analysis is a functional economic area and the purpose is to guide investment and labor policy for the NIAD area.

Every local labor market is to some degree unique. The economic environment is specific; i.e. the mixture of labor skills the market demands and the mixture of labor supplies the people of the area offer depends upon the skills and attitudes of people, the industrial complex of the area and the trends in employment and population. Because of these unique local features, the average national labor supply and labor demand relationships are not directly transferable to any particular local labor market. National supply and demand conditions have an impact on each

local area in the long run. The supply impacts of national labor market conditions are transferred to the local labor market through movement of workers into or out of areas. Long run labor demands are reallocated between areas by plant relocation and plant closings and expansion decisions. The level of national economic activity affects the demands for the export products of the area. The nation is made up of many local areas, each interacts with the other to some degree. However, the competition among workers and employers is most active within a local labor market.

In the short run, labor supply is nearly a fixed quantity within an area. The greatest short run shifts in local employment conditions are on the demand side. Multi-plant firms can more readily reallocate production quotas between areas and change hiring practices than construct new productive facilities. As new jobs are created, some people change jobs to fill the newly created ones and other people move into the vacated positions.

The abundance or shortage of workers in the local market is, in the short run, of more concern to the area leaders and employers than the nationwide or neighboring area unemployment. This is due to some reluctance of workers to move; i.e. immobility of workers between areas and their lack of knowledge of labor market conditions in other areas. As the knowledge of labor shortages spreads, workers are recruited from other areas, migration begins and the inequities of unemployment are lessened. However, this is a time consuming process and in the short run immediate labor shortages or unemployment will have most effect locally on wages, business profits and expansion.

A labor market defined around an employment center like Mason City is determined not as a specific number of people but rather in terms of travel time and space dimensions. Commuting time and the technology of travel set the feasible daily travel distance and hence the spatial limits, but not the population limits. Thus a local labor market is an area which may have many or few people at the moment and may expand or contract in labor force and change in area with changes in transportation technology. An intensive study of the Pittsburgh region covered an area of approximately 4,500 square miles but included 2,500,000 persons (37). The NIAD area covers approximately 4,600 square miles and includes 150,000 persons. Both are relevant local labor markets. The investment in industry and the size and skills of the labor forces are vastly different. However, both regions are based on the spatial-time dimension of about 50 miles or one hour commuting time. In the long run, the density of settlement and the number of people depends on the number of jobs available in the employment center. The spatial coverage of the local labor market varies very little from area to area in any given decade and only slowly over longer periods of time.

Functional Economic Areas

The area defined by the local labor market is one of the several criteria used by Fox in developing the more inclusive concept of a Functional Economic Area (FEA) (15, 16, 17). An FEA is a spatial region which relates more within itself than it does to other areas and has the capabilities of providing for most of the employment and consumption needs of its residents. A region to be a FEA therefore must be large enough

in population and purchasing power to take advantage of most of the economies of scale and to be able to provide a nearly complete line of consumer and public goods and services. It must be small enough to secure general economic and social orientation to one center. FEA's are focused upon a central city which is the retail, wholesale, and employment center of the area. Around the central city, there will be a number of smaller towns that serve as convenience shopping centers and also provide some employment opportunities. To have sufficient size to provide these amenities, Fox feels that the area "...must contain a central city of at least 25,000 people; the amenities would be more likely to exist in a central city of 50,000 to 100,000 or even more.... The central cities of adjacent areas are rarely less than 50 miles or more than 100 miles apart, 70 miles would be a fair average" (15, p. 83).

"Home-to-work commuting patterns would be the most important single factor in delineating an FEA.... Each FEA would be a relatively self-contained labor market in the short run" (17, pp. 4 and 5). Fox uses approximately one-hour's driving time or 50 miles as the limit for commuting and shopping trips to the central city. Iowa's roads are laid out in a grid pattern with practically all roads running east and west or north and south. Thus an area of 50 road miles from a central city becomes diamond shaped with every point on the perimeter 50 road miles from the central city. Drawing such diamond shaped FEA's for Iowa covers most of the state with a minimum of overlapping (17).

Using this framework and doing some squaring off of corners in order to utilize county data, the FEA area centered on Mason City matches North Iowa Area Development (NIAD).

Labor Supply

The classical labor supply for workers was a function of the wage rate. As wages increased, more workers were drawn from unemployment by overcoming the desire for leisure, commuting distance, and moving expenses. If local demand expanded for skilled workers, wages would rise relatively for skilled workers and these incentives would induce some unskilled workers to take additional training. Similarly in a local area, the usual upward sloping labor supply curve is expected for each skill group and for labor in total.

If there is unemployment, the labor supply curve may be horizontal or completely elastic at the going wage for some increase in demand. The wage level usually does not decline with unemployment. Wages are "sticky" downward. However, as the unemployment rate is lowered, the labor supply curve will turn up as employers compete with each other for existing workers. Workers commuting from longer distances, or workers moving into the area from neighboring areas will probably place an upper bound on local wage rates and create a second elastic section of the labor supply curve. The resulting local market labor supply curve is shown in Figure 2 with an elastic segment as unemployment is reduced (A-B), a rising segment (B-C) as employers raise wages to attract employees, and another elastic portion as in-migrants enter the area's labor market (C-D).

Some labor supply discussions often measure the quantity of labor in terms of hours worked per week by a single worker. In principle within this framework, it is possible to develop a backward bending labor supply curve (10, 27, 28). As workers reach higher levels of income, the

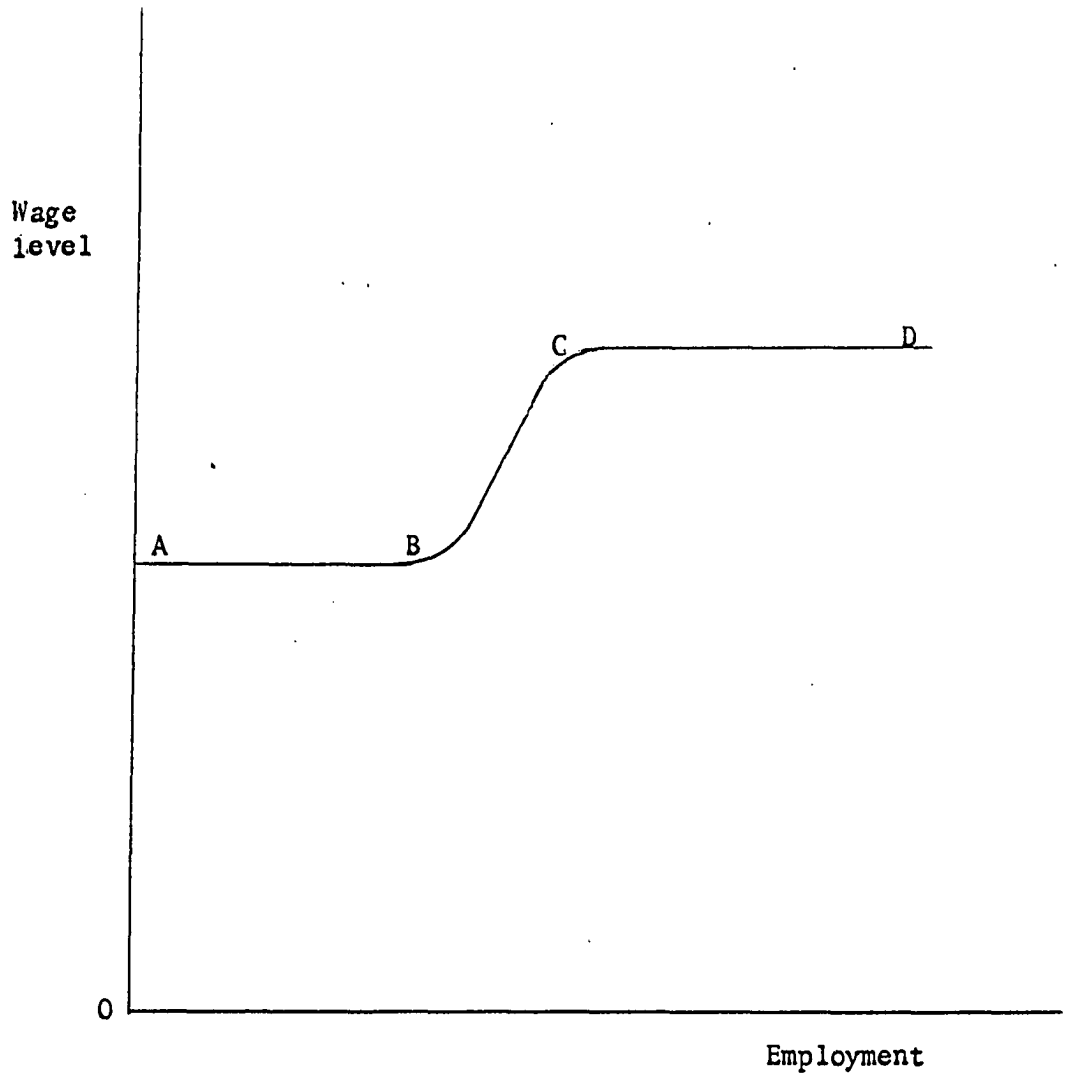

Figure 2. Hypothesized area labor supply curve

marginal utility of leisure rises, the marginal utility of income decreases and the worker is willing to offer less hours per week in order to gain leisure time. However, labor as used in this study refers to persons and not hours worked. A person is considered either in or out of the work force and is not free to choose the number of hours offered for employment. Labor supply will be expressed in terms of number of workers and wages, not in terms of hours per week and wages. A worker will not take himself out of the labor market if his wages increase. Thus, backward sloping labor supply functions are not expected for local labor markets and will not be considered.

Reynolds argued that the labor supply curve to a firm is horizontal and that a firm can hire more workers at its usual terms of employment (39). The critical assumption of this argument is that there exists "...a pool of unemployed which is continuously replenished by layoffs from declining companies, migration from rural areas, and population increases" (39, p. 227). This pool can not be endless as one considers job creation. Thus a normal upward sloping supply curve is hypothesized.

To illustrate Reynolds' argument, Figure 3 shows some relationships between wage level and the number of persons employed by a firm. Wage OA is the lower limit that the firm can pay and still attract employees. This may be set by minimum wage laws or other conditions. BC is the labor supply to this firm under conditions of full employment. BD shows the number of workers actually available for employment. The horizontal

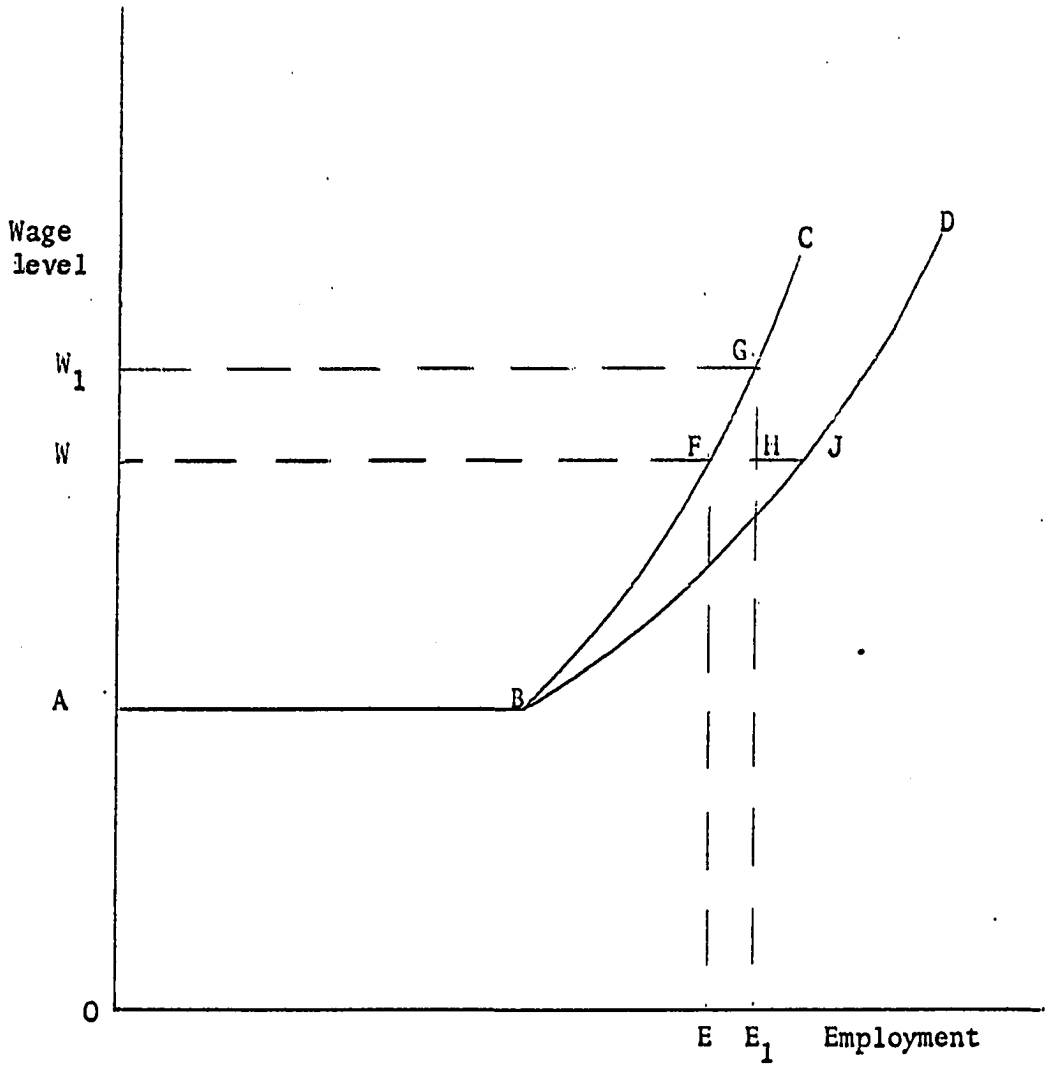

Figure 3. Supply conditions of labor to the firm (39, p. 228)

distance between BC and BD depends on the level of unemployment, hiring requirements of the firm, and this firm's share of the total area employment. Assume that the firm is operating at point F, paying OW wages and employing OE workers. The point F is selected for convenience but there is no reason that it must lie on BC. Now this firm wishes to expand to employ OE_1 workers. Under conditions of full employment, the wage would have to go to OW_1 but since there is unemployment, the firm hires more persons at wage OW and moves from F to H instead of to G. Reynolds says the firm could go to J before it would have to increase its wages, and even farther by relaxing its hiring policies. Thus the relevant labor supply curve to the firm is FJ rather than FC. Increasing the wage rate may be necessary in order for the firm to hire its maximum potential number of workers. Reynolds doubts that this is a restriction as this level of employment would be beyond the firm's requirements. That is, the firm would not likely go to point J. In conclusion, Reynolds states that the relevant supply curve to the firm "... is horizontal, not because of mobility of the employed labor force, but because of the existence of unemployment... I suggest, therefore, that the concept of a rising labor supply curve to the firm be abandoned as technically defective, conveying a false impression of reality, and serving no useful purpose in wage analysis" (39, p. 229). This may be true for a single small firm in a large labor market, but it would not be true for all firms in a local labor market. The horizontal segment will become shorter as area unemployment declines, as several firms are considered, and the skill level to which labor supply concept is applied

becomes more demanding and more narrowly defined. Thus, Reynolds' general statement that rising labor supply curves for a firm should be discarded will not be accepted for an area.

Wilcock and Sobel found firms in a study of Kankakee, Illinois with adequate labor supply at their existing wage level and other firms that had restricted supply (62). Those firms that did not have a labor supply problem were in such a position because of a combination of relatively high wages, satisfactory working conditions, and the firm's reputation. The wage rate appeared to be the key factor. Because of this favorable position, these firms attracted many applicants and the firms had little difficulty finding persons qualified for the job openings.

Wilcock and Sobel found other firms that were having difficulty finding adequate replacements or meeting labor requirements for expansion. The main cause again was the relatively low wage level and the special requirements or skills necessary for the jobs available. Some of these firms were finding it necessary to raise wages to meet their labor requirements and to reduce the number of workers leaving for other jobs. Some of the wage adjustments were selective in that only those jobs that were difficult to fill were undergoing wage adjustment.

Wilcock and Sobel stressed the importance of secondary workers who enter the job market under conditions of tight labor supply and higher wages as explaining the elastic portion of the supply curve. Therefore, it seems safe to infer that the rather elastic portion of the supply curve may be of limited range.

In summary, a firm with relatively high wages, satisfactory working conditions, and a good reputation as an employer probably would face a

very elastic labor supply curve over some range. Firms with less advantageous conditions would find little or no range of elastic labor supply.

The problem is determining for a particular local labor market which industries, skills and locations face a rising wage cost if employment expands and which would be able to expand employment without raising wages. Thus, the important variables to be measured include the quantity of labor that could be obtained at the going wage and the interrelationships between location, skills, industries, and time. These parameters and characteristics define the local labor supply function.

Labor Mobility

There is considerable literature concerned with labor mobility rather than labor supply. The two concepts are very closely related. Bogue described labor mobility as "...any change in the location, occupation, industry, or other work status or work condition of the individual worker. Thus, change with respect to some significant characteristic of the spatial, economic, or social aspects of life is the essence of the mobility concept" (5, p. 3). Gladys Palmer has defined labor mobility as follows: "If labor mobility is broadly defined to include entrance to and withdrawal from the labor market, changes from unemployment to employment and the reverse, and shifts of occupation, industry and place of residence of work, it encompasses all the adjustments which workers make on account of their own needs or aspirations -- for a job, a 'better' job, more income, more social prestige, more leisure, or a more acceptable 'way of life' -- and on account of changes forced upon them by changes in the economy" (35, p. 1).

Parnes classifies labor mobility "...(1) as the capacity or ability of workers to move from one job to another, or into and out of employment, or into and out of the labor force; (2) as their willingness or propensity to make such moves, given the opportunity; or (3) as their actual movement" (36, p. 13).

The first of Parnes' classifications -- the capacity of workers to move ... concerns the flexibility that a worker has and his capacity to meet the requirements of alternative jobs. By knowing the maximum potential transferability of the work force, estimates can be made of how area job requirements could be met. However, the willingness as well as the capacity of workers to perform alternative jobs or to take training needs to be included. If the willingness of workers is not included as a constraint, sources otherwise judged adequate to meet area demand for labor resulting from job creation may be unacceptable to the workers, and hence infeasible.

The second classification of labor mobility as the willingness or propensity to move given the opportunity will be the concern of this study. Reynolds suggests that mobility should be used "...to describe willingness or propensity to move. Opportunity must be added to willingness before any actual movement will occur" (39, p. 240). In this study, the interviewees were asked to assume that an opportunity existed and to indicate their willingness to accept with the wage they would require to move thus indicating their propensity to move.

Actual movement, the third of Parnes' classifications, has been the topic of a number of research projects.

CONCEPTUAL FRAMEWORK

Several sources of labor supply were mentioned in the discussion of labor markets. These sources need to be combined into an overall labor market model.

One of the first sources of labor to be utilized when new jobs are created are the unemployed workers of the area. Being unemployed they are not contributing to the economic production of the area. Since they have no opportunity cost, their employment results in a gain in total area output.

Unemployment is regressive in that a larger percentage of the less skilled are unemployed and would have a lower income even with 50 weeks of work. Smaller pereentages of people at middle and upper wage rates are unemployed. In an unemployment situation, employers will be selective and hire only the most qualified workers. A change in the unemployment rate in NIAD will probably have little effect on those persons with incomes over $5,000. Persons with $2.50 per hour income potential are unemployed only occasionally because of structural or frictional unemployment.

Likewise, when jobs are created and employment rises, the lower skilled, lower income persons probably receive the most percentage benefit as a group. They find employment because of the increased demand for all labor and either fill new jobs or replace workers who move upward to better jobs. Thus, investments designed to alleviate unemployment need not provide jobs for only those skills in surplus supply. Jobs created for skilled workers will likely reduce unemployment for unskilled workers also.

Unemployment can not be entirely eliminated. A tight labor market with 2% or less unemployment could slow growth because of the restrictions of the labor supply and the competition for workers could cause wage increases. On the other side, excessive unemployment indicates that the economy has unused labor resources available. The proper balance between these alternatives is a policy decision for local leaders.

A second labor supply source are workers entering the labor market for the first time. Generally these workers are just out of school, young, and inexperienced. If they can not find employment within the area, these young people, being very mobile, will readily leave the area in search of employment opportunities.

Other new entrants to the labor market include homemakers, some of whom may have had previous work experience, and retired people who are usually more interested in part time employment. The increase in output resulting from the employment of new entrants is all net gain for the area since these workers were not previously contributing to the area's output.

A third source of workers to fill newly created jobs are persons presently employed in jobs about to be abolished. Changing technology or declining demand will reduce the employment needs of some industries, for example agriculture. These potentially unemployed workers will likely not be replaced if additional jobs are created. They often will seek other employment on their own rather than wait to be forced out. If a farm laborer quits to work in town, very often he is replaced by capital in the form of machinery and labor saving equipment. Similarly, sales persons in small stores in declining population areas of NIAD

would probably not be replaced. Job creation may hasten the abolition of jobs which are of low marginal value. Nevertheless, this worker may have an opportunity cost albeit of short duration.

A fourth source of labor supply is the underemployed worker who could retain his job in the future but is not receiving as large an income as he could in some other employment, i.e., he is not producing his maximum potential output. The underemployed worker's job is relatively secure at his wage and degree of employment. Often he is poorly paid or works less than full time. However, he has an opportunity cost. The total output of the area will be increased by creating a job for this worker but the net gain to the area will be approximately his wages at the new job less his wages at the underemployed job.

There are two forms of underemployment. First, there are those workers whose job does not occupy them full time. Migrant farm workers in sugar beets or vegetables in NIAD who are fully employed only seasonally are a good example. Another example would be sales people in a store who are needed only to handle the volume of sales at peak hours. Some sales would be lost if these workers accepted other employment and were not replaced.

The second form of underemployment includes those workers whose jobs occupy them full time but they could be more productive in another job. A person employed as a janitor may qualify as a machine operator where his productivity would be higher. If this person were to move into a machine operator position his janitorial job would most likely be filled, perhaps by someone with lower potential productivity. However, the job

may be less well done and the cost may be higher. Again the gain is offset partially by the opportunity cost.

As jobs are created and underemployment is reduced, employers may reorganize their employment offerings and raise the productivity and wages. The employers, however, would have had no reason to reduce the underemployment by raising productivity if employment had not been created and the opportunity costs for his workers in new jobs increased.

The resistance of employers to employment creation which competes with underemployment then depends on the labor supply situation. If labor supply is elastic to him, he will not be concerned with a level of job creation which reduces underemployment. However as labor becomes scarce and the supply curve turns up, an employer offering "underemployment" will find the level of "job creation" excessive and detrimental.

Finally workers can be obtained for a particular firm but not for the area by removing workers from one firm by wage increases which are not justified by productivity differences. This is merely income transfer from industry to workers and does not increase total area output. In a closed economy this would cause inflation, in a local labor market it would probably induce importation of workers from a neighboring area.

Seven potential labor supply sources have been identified: unemployment, new entrants to the labor market, potential unemployment, underemployment, second job seekers, job changes, and migrants from other areas. These sources must be combined into a model of the local labor market which embodies the sources, their individual characteristics, and the interactions between the sources.

Models

Two models of the NIAD labor market will be discussed. The first describes the supply of labor as perceived by the employers. It incorporates the various supply sources into an area labor supply curve. The second model considers total area output as a function of job creation.

Area labor supply model

Each of the labor supply sources has its own supply curve with its own shape, elasticity, and coordinates. It would be expected that each source would have a different curve. The area wide supply would then be the horizontal summation of the supply curves for each source.

Operationally, the supply from each source will be assumed completely elastic over a segment and then completely inelastic. That is, at one wage rate, an employer can hire all the available workers from that source and then can hire no more from that source at any wage. The horizontal summation of such curves is then a stair step area labor supply curve.

To illustrate, Figure 4 shows four hypothetical supply curves from four sources with source n-h being immigrants from outside the area. The migration labor force is assumed to be completely elastic at a wage above the local sources. The higher wages would be required to overcome relocation expenses and disruptions.

Since sources a-b-k and a-c-m begin at the same point, a, on the wage axis, it is not possible to determine which source would be utilized first by the employers. Most likely, both sources would be used simultaneously.

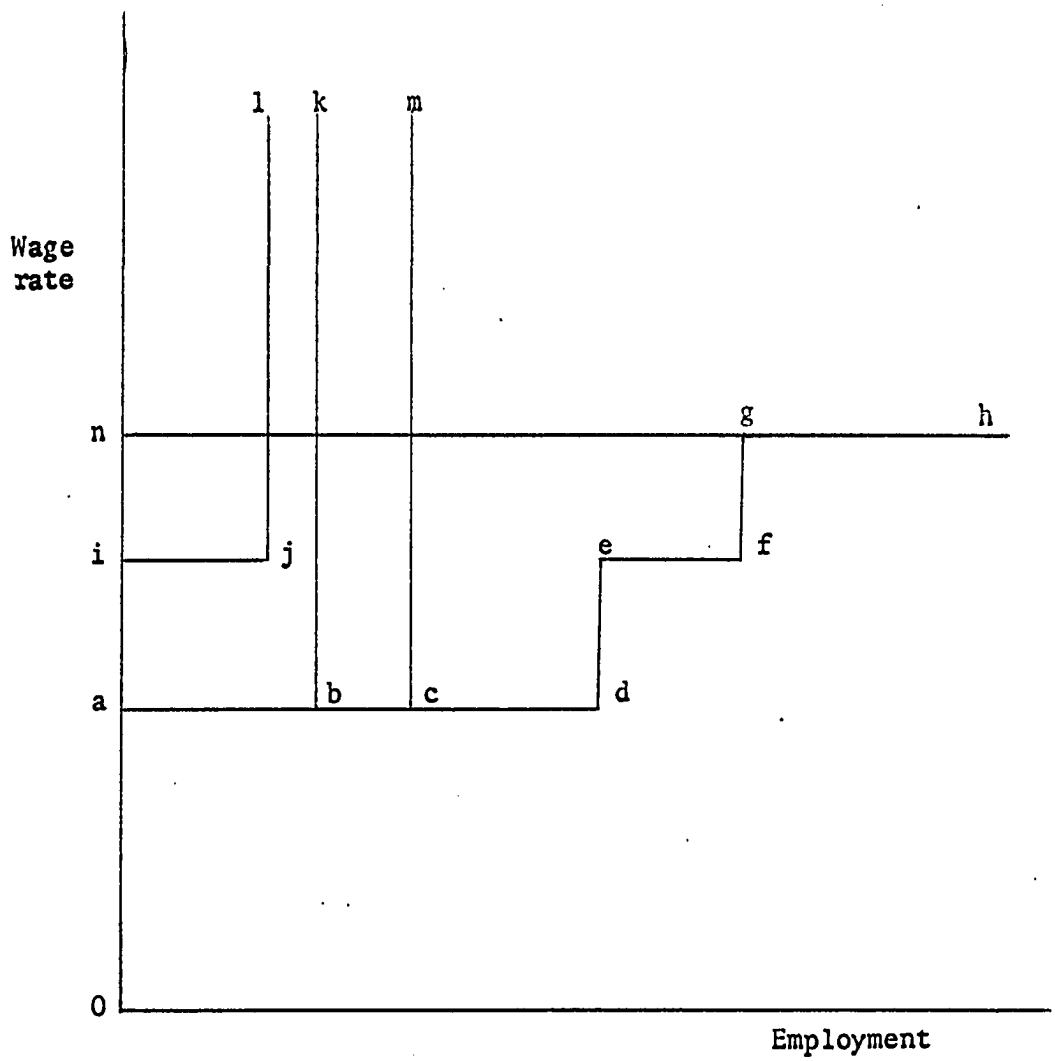

Figure 4. Area labor supply model

The total area labor supply curve in Figure 4 is a-b-c-d-e-f-g-h. This is the curve upon which the area employers operate. The horizontal distance a-d is the sum of a-b and a-c while i-j equals e-f.

Under the assumption of right angle supply curves, only two parameters are required; the wage level and the number of workers available. The problem is to estimate these parameters for each supply source which can be used to estimate the area supply curve. This is one of the major objectives of this study.

Area output and job creation model

The effects on an area's total output of creating and filling alternative levels of new jobs and corresponding by reducing unemployment and underemployment is shown schematically in Figure 5. The labor market in a local area for a given skill such as laborers is portrayed. Assume that initially there was 8% unemployment in the area with total output O_1 and the unemployed could qualify for the jobs available. As new jobs for laborers are created, unemployed workers take jobs and total output rises sharply. When unemployment is below about 4%, output probably rises less rapidly above O_2. The slope of the total output curve between O_1 and O_2 is equal to the productivity of each worker added to the employed labor force. At some point before unemployment is reduced to zero, workers previously employed in low productive jobs begin to fill the new jobs. Thus, the total output curve rises less rapidly because only the net gain in productivity of underemployed workers adds to total area output. Full employment has thus been reached at O_3 and total output cannot be increased further by job creation. Changing technology to increase

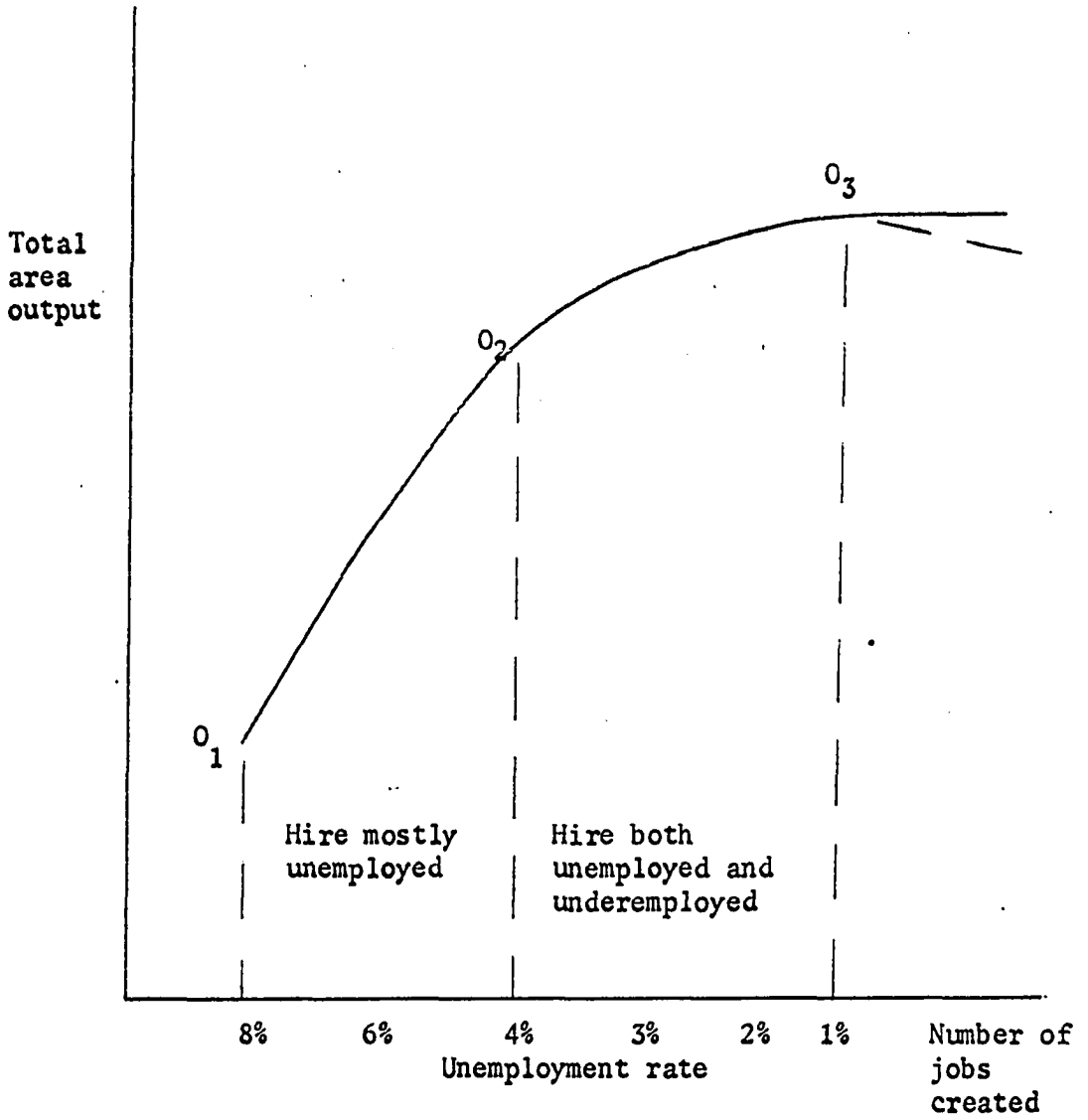

Figure 5. Area output and job creation model

productivity, or importing workers from outside the area, or training workers and moving them to another skill group can, of course, increase total area output.

It is possible that the total output could decline if an overemployment situation developed and several employers were short of workers for efficient operation. This would be an extreme case, however. Generally employer protests would halt job creation at a level substantially below the maximum total area output level.

The problem for investors and local interests is to determine the area's position on the total output curve and the shape of the curve. They need to know the extent of unemployment and underemployment. Then given the number and kinds of jobs that would be created by a particular investment, they could determine the effects on other employers, workers and total area output and income.

METHOD OF PROCEDURE

The data for this study was taken from a survey conducted in the summer of 1964 in the NIAD region supplemented with census data. Since this study was concerned with workers and potential workers, the population of interest was persons who were out of school. The comparable census classification is that of persons 14 and over, minus students and inmates of institutions. In the sample areas, all persons 14 and over and not in school or institutionalized were asked to complete the interview schedule.

Much of the research on labor mobility has been conducted in an ex-post sense. This research attempts to find out what people believe they would be willing to do. This survey was ex-ante. The heart of the survey was the question "what is the minimum weekly wage that you would accept to work in (town)?" This question was asked of each person for four different towns.

Parnes was very critical of posing hypothetical questions such as this because he doubted the validity of the responses (36, p. 17). However, Reynolds used this type of question in one of his studies where he asked how large an increase over current wages would be required for the interviewees to change jobs (39, p. 78).

The accuracy or truthfulness of the responses to the questions in this study can not be judged. Hopefully, even if the reply of a given individual for a given town is not exact, the average differences between towns and skill groups will yield reasonable accurate estimates of average population differentials.

A copy of the questionnaire is included as Appendix A. In addition to the information on the questionnaire, the distance that each respondent lived from the alternative towns was recorded in terms of road distance.

Comparisons of Sample and Census Data

The sample for the survey consisted of area segments drawn by the Statistical Laboratory of Iowa State University. The sample consisted of all persons who lived within the selected area segments. A sampling rate of .0082 was used for the entire area so that the sample was selfweighting. From the sampling frame, it was expected that 381 households would be included and that two adults would live in each household. Contact was made with 375 households from which 739 interviews were obtained, an average of 1.97 persons per household. If two persons would have been contacted in each of 381 households drawn for the sample, 762 persons would have been in the sample. Thus, the 739 persons actually contacted was 3% too low. This is within the acceptable range of sampling error.

With a sampling rate of .0082, each person in the sample would represent 122 persons in the population, the inverse of .0082. Thus, the total eligible population would be estimated from the sample by multiplying the factor of 122 by the number of sample observations, i.e. (122) (739) or 90,158 adults in NIAD.

To check the sample estimate of the adult population of NIAD with census data, the number of eligible persons (14 years of age or over, not students or inmates) for 1964 had to be estimated. This was obtained by extrapolating a linear trend of the NIAD population of 1950 and 1960.

The estimated census population for the area in 1964 was thus 96,888, 6.9% above the sample estimate of 90,158. The observed sampling rate then was .0076 which means that each person in the sample actually represented 131 persons in the population. If 762 persons had been interviewed as was expected when the sample was drawn, the total sample estimated population still would have been 4.1% short of the census extrapolation. Thus the 7% total error can be partitioned into two parts. Four percent can be attributed to less interviews in the sample segments than expected and 3% due to too few segments drawn. This level of sampling error is not unreasonable and it can easily be compensated for by using a weighting factor of 131 for each person in the sample to make area estimates rather than 122. All estimates will still be unbiased.

The census reports the number of workers by skill classification by county. It is not possible to accurately divide the skill groups for Butler and Wright counties into NIAD and non-NIAD segments. Thus, the accuracy of the sample in estimating the NIAD labor force by skill group must be checked by considering only the seven full counties of NIAD. (See Table 2).

After correcting the weighting factor to 131 on the basis of population, the sample still estimates total male employment 4.4% below the extrapolated census estimate for 1964. The sample over-estimated managers by 22% while clerical, sales, and craftsmen-mechanics were underestimated by 15, 24, and 29%. Total female employment was underestimated 23% by the sample and especially large negative errors of 66 and 53% were made in estimating sales and laborers. The female managers and professionals were over estimated.

Table 2. Employment by skills of the seven full counties of NIAD

	Males				Females			
	Census estimate 1964	Sample observation	Total estimate from sample	Percent error	Census estimate 1964	Sample observation	Total estimate from sample	Percent error
Total employed	34,796	254	33,274	-4.4	15,497	91	11,921	-23.1
Professional	2,420	19	2,489	2.9	2,111	20	2,620	24.1
Farmers	9,805	76	9,956	1.5	302	-	-	-
Managers	3,111	29	3,799	22.1	513	7	917	78.8
Clerical	1,234	8	1,048	-15.1	3,784	24	3,144	-16.9
Sales	2,426	14	1,834	-24.4	1,546	4	524	-66.1
Craftsmen-mechanic	5,367	29	3,799	-29.2	113	-	-	-
Operatives	6,401	53	6,943	8.5	2,970	23	3,013	1.4
Laborers	3,508	26	3,406	-2.9	3,667	13	1,703	-53.6
Not reported	524				489			

As was mentioned earlier, the manual labor force (laborers, operatives, craftsmen, and farmers) will be the primary emphasis of this study. The sample estimated 24,104 men in manual occupations which was 4% below the 25,081 estimated for 1964 from the census data. The sample underestimated female laborers and operatives by 13% and underestimated female sales and clerical workers by 46%. Thus, the sample estimates of the female labor force are less accurate than for the male labor force because of the undersampling. Rather dependable inferences can probably be made for the most important segment of the NIAD labor force...men in manual occupations...since the 4% sampling error is not unreasonable.

The estimation errors appear large in percentage terms but a reclassification of 10 men in manual occupations would bring all of those skills within 4% of the census estimate. The reclassification of 15 men and 17 women in the sample would result in all skill estimates being within 4% of the estimation error for each sex. The probability of one or two more or fewer observations in a skill classification is little different than the probability of the sample actually drawn.

Part of the discrepancies between census and sample estimates may be due to alternative classifications of skills made from the census and the questionnaire. The dividing lines between unskilled, semiskilled, and skilled occupations is difficult to determine especially from the uncomplete description of work activities reported by some respondents on the questionnaires.

Also, the census has a classification for "service workers" which included among others, protective workers, waiters, cooks, bartenders,

janitors, and practical nurses. These were divided between laborers and operatives in this study with service included as an industry. The division of workers into skill classifications as used in this study is shown in Appendix B.

Limitations of Sample and Inferences

This study was designed to provide estimates of area totals and proportions. Thus, a sampling rate of a little less than 1% of the population was thought to be adequate. Population proportions based on a random sample of 385 observations will estimate within about 5% of the true proportion with 95% confidence regardless of the size of the population from which the sample was drawn. Labor supply estimates for the area as a whole made from this sample can probably lead to approximations accurate enough to judge labor feasibility of investments adding specific numbers of specific skill jobs in specific locations in NIAD.

This study probably can not provide data accurate enough for an individual small investor desiring a completely local labor force, nor can it determine precisely what wages would be necessary to hire a specific small number of workers. With a sampling rate of one out of 131 persons in the population, it is possible to make estimates only within a confidence range of several hundred workers. It is impossible, for example, to estimate whether 50 or 75 employees would be available for a specific skill within the NIAD area.

Proportions of population and number of people are frequently estimated in this study. It is clear from Table 3 that estimates of proportion based on small sample numbers will have wide confidence intervals.

Table 3. Confidence intervals for selected sample sizes and proportions

Sample size	Proportion	95% confidence interval	90% confidence interval
10	.1	.00 to .46	.00 to .39
	.2	.12 to .57	.14 to .51
	.5	.18 to .82	.22 to .78
50	.1	.03 to .22	.14 to .20
	.2	.10 to .34	.11 to .31
	.5	.35 to .65	.38 to .62
100	.1	.05 to .18	.06 to .16
	.2	.12 to .29	.14 to .27
	.5	.40 to .60	.42 to .58
250	.1	.07 to .15	.07 to .14
	.2	.15 to .26	.16 to .24
	.5	.43 to .57	.45 to .55

Although the sample is 739 for the area as a whole, it often will be necessary to deal with small subsets who live in one area and have a particular skill. If, for example, 10 of 50 persons in a subset, 20%, said they would work in a particular town, the 95% confidence interval for the 20% estimate is from 10% to 34%. Thus we infer, with 95% confidence, that between 655 and 2227 persons are willing to work in that town. In another subset of 100 persons, 20% of whom gave a particular response, the 95% confidence interval for the estimated 20% would be 12% to 29% and thus from 1572 to 3799 persons would be estimated to be willing to change employment. This gives an indication of the limits of small samples.

Therefore the usefulness of this sample is limited to area estimates because of the small numbers in some of the cells and classifications. Estimates that will be made will include the confidence intervals for that

estimate. By combining areas, towns, and occupations into relatively homogeneous groups, the sample number can be raised to allow more precise estimates. The results are then averages over broad classes of potential workers. To make precise estimates for a given investment, a supplemental survey should be run for that particular area and that particular investment. This study will give the first round approximations and more precise estimates must come from other work.

The sample estimate of a mean for a subset of some characteristic is also frequently used in this study. Wage required to induce workers to move from one area to another is a sample mean. Any characteristic such as this is estimated without bias by this sample but with a wide confidence interval if the number of observations is small and the variation among the observations is large.

SUPPLY OF WORKERS

It is thought that the supply of workers for the local labor market within the NIAD area is composed of the following components:

1. Current unemployment
2. Persons not in the labor force
3. Future unemployment
4. Underemployment

Of the four components, underemployment is the most difficult to measure. Job descriptions, worker requirements, and the personal attributes of the workers would need to be assessed in order to accurately measure the extent of underemployment within any given area. For the purpose of this study, an alternative method of estimating underemployment was employed. In order to have some method of estimation, the indications of willingness to accept second jobs and the willingness to change jobs by the respondents were analyzed. Such estimations do not measure underemployment, but they do yield information concerning the potentially available workers for labor force expansion. The availability of workers, regardless of their source, is of primary concern to the employers within a local labor market.

Therefore, the labor supply sources to be examined with regard to the number of workers available for employment from each of the labor supply components will include current unemployment, persons not in the labor force, future unemployment, the willingness to change jobs and the willingness to accept a second job.

Current Unemployment

According to the 1960 Census, 3% of the NIAD labor force was unemployed. A breakdown of the data according to sex indicated a 3.1% unemployment rate among the males and a 2.9% rate among the females for a total of 1,997 unemployed workers. (See Table 4).

However, further analysis revealed that the unemployment rate varied among skills with the highest percentage of unemployment among the males with the lower skills. This would indicate that a 3.1% increase in demand for men in each labor skill could not be met from the currently unemployed males since there would be shortages of qualified men to fill the demands from the classifications of professionals, farmers, managers and salesmen. An excess supply of males qualified for only the lower skills would be evident. Interskill mobility in the upward direction is more likely with extensive retraining programs but still limited.

Three and six tenths percent of the men with manual skills were unemployed in 1960. If one considers only laborers, service workers and operators, it is found that 5.8% were unemployed. Since farmers do not declare themselves unemployed, it would seem that a 5.8% increase in demand or 1,246 jobs for non-farm male manual labor could be met from the unemployed. However, one must consider that even within manual skills a certain amount of immobility may be met which would mean shortages of certain skills would result before demand for all manual skills could be increased by 5.8% (See Table 4). It would seem, therefore, the demand for unskilled groups could expand by at least 5.8% before exhausting the

Table 4. Labor force and unemployment by skills[a]

	Male			Female		
	Labor force	Unemployed	Percent unemployed	Labor force	Unemployed	Percent unemployed
Professional	2659	8	.3	2440	8	.3
Farmer	14186	31	.2			
Manager	4277	33	.8	992	12	1.2
Clerical	1593	63	4.0	4261	78	1.8
Sales	2920	28	1.0	1771	25	1.4
Craftsmen	7038	349	5.0			
Operative	8034	360	4.5	3457	192	5.6
Laborer	6243	537	8.6	4113	140	3.4
Unexperienced	5	5	100.0	30	30	100.0
Not reported	715	76	9.8	558	22	3.9
Total	47730	1490	3.1	17622	507	2.9
Manual occupations	35502	1277	3.6			
Non-farm manual occupations	21316	1246	5.8			
Clerical-sales				6032	103	1.7
Laborer-operative				7570	332	4.4

[a]Source: 1960 census; includes all of Butler and Wright counties (57).

unemployed.

Similar unemployment patterns for women within the NIAD area appear. The rate of unemployment for the females is highest for those women whose previous skill was operative or laborer. Data in Table 4 indicates that 65% of the unemployed females were formerly operators or laborers.

Unemployment is a relatively smaller component of labor supply for women than for men. Many homemakers do not consider themselves unemployed, but could become members of a local labor force by accepting jobs in addition to their homemaking activities. Wilcock and Sobel refer to this component of supply as "secondary" labor force or "people not in the labor force" which will be analyzed further in the next section (62).

Another important factor which must be considered with regard to unemployed persons is spatial location. Within the NIAD area it was found that Cerro Gordo county had the highest unemployment rate. The rate for males was 4.0% which accounted for 528 unemployed men. Since Cerro Gordo and Floyd counties are the two most highly industrialized counties in the NIAD area, it was noted that there were 567 unemployed men with manual skills. Since Mason City, the population and industrial center of NIAD, is located in Cerro Gordo county, it was not surprising that the highest unemployment rate was found since the large employers of an area can influence unemployment more than several smaller employers in less industrial areas. However, such an assumption does not hold true when considering Floyd county. The second largest industrial area, Charles City, is located within Floyd county which has an unemployment rate of 2.8% which is slightly below the NIAD average. This would indicate that the large employers within the Charles City area have been assimilating

the male unemployed into their labor force.

A female unemployment rate of 2.9% in Cerro Gordo county was the same as the entire NIAD area. However, since Cerro Gordo is the most populous county 33% of the unemployed females of the NIAD area are found there. This included 94 unemployed manual occupation women and 46 unemployed in clerical-sales occupations.

Conversion of the unemployment percentages to numbers of persons yield a total of 1490 men and 507 women unemployed within the NIAD area in 1960. If it were possible to gainfully employ these persons at an average weekly wage of $50.00 for men and $40.00 for women, they would earn over $4,800,000 annually providing a definite economic gain to the NIAD area. However, it is highly unlikely that unemployment could be reduced to zero. If unemployment were reduced to 2%, these presently unemployed persons would earn $1,600,000 per year in additional wages.

All unemployment is not due to lack of job opportunities within any given area. Lack of skills, aptitudes, and many other personal factors can prevent people from gainful employment. The value of some "hard core" unemployed to any employer may be very small indeed.

The analysis of the current unemployment component of the NIAD labor force was based on data from the 1960 census. No more recent data concerning the NIAD area was available excepting those results ascertained from the survey conducted in connection with this study. From the data for this study, it was found that 212 men were employed in manual occupations while only four replied that they were not employed but were looking for a job. This would yield a 1.9% unemployment rate. The 95% confidence interval for the 1.9% estimate is from .8% to 4.0%. Therefore,

although the unemployment rate in 1964 was probably smaller than in 1960, the difference can not be confidently estimated by the sample.

The only 1964 unemployment data available for comparison would be data including all of Iowa. Unemployment in Iowa averaged 2.4% in the summer of 1964 (22). This was a decrease from the 3.0% rate of 1960 which indicates a tightening of the labor supply in Iowa and most likely in the NIAD area. This would lend some support to the lower estimate obtained from the sample data of this study.

People Not in the Labor Force

One source of labor force expansion is students recently out of school who are seeking employment. Most high school graduates become available for employment within a short period of time in the spring of the year. These workers often lack needed skills which can be acquired only through experience and training. Vocational, technical and trade school graduates will have skills within their chosen fields. College graduates tend to enter the professional, technical and managerials areas in accordance with their college training. Some students become available for employment throughout the year due to mid-year graduations and other personal factors. However, a certain portion of those available in midyear may be those leaving high school before graduation and may possess only limited skills.

Since the unemployed are considered to be a part of the labor force even though they are not currently employed, most of the out of school men not in the labor force are retired workers or handicapped. Thus, the only method of expanding the male labor force in the NIAD area without

importing workers from other areas would be hiring the handicapped and bringing men out of retirement. Most retired men are interested only in some form of part time employment.

Therefore, the largest potential source of persons not in the labor force available for increasing the NIAD labor force are women who are not currently employed, but do not consider themselves unemployed. Results of the survey indicated 16 women who were interested in employment. This was 6% of the 286 not employed women in the sample. The confidence interval would be from 3% to 10%. If these women were employed, the female labor force would increase 28% and the total NIAD labor force would increase 5%. Since the sample underestimated the number of employed females in NIAD in comparison to the census giving a small base from which to figure percentage change, this estimate may be too high. However, it is clear that there is a large reserve of women who could come into the labor market as a secondary labor force if jobs were available.

Future Unemployment

The third source of labor supply is the potentially unemployed workers. These presently employed workers will be available for alternative employment some time in the future because technology and declining demand will force them out of their current jobs. Data on potential unemployment is not directly available. However, some insights can be gained by analyzing the trends in employment for NIAD industries and the projections to 1975 (See Table 5). These projections are based on the past trends in NIAD, the national trends in industrial mix, and other information. Between 1950 and 1960, total employment in NIAD declined 1,585 jobs and is

Table 5. NIAD employment data and projected trends[a]

Type of employment	1950	1960	Change 1950-1960	Estimated change 1960-1975	Estimated 1975
Agriculture	20,314	15,926	-4,388	-5,403	10,523
Construction	3,362	3,168	-194	-402	2,766
Manufacturing	7,346	8,110	764	2,737	10,847
Transportation, Communication & Public Utilities	3,614	3,243	-371	-75	3,168
Wholesale and retail	10,968	11,294	-326	15	11,309
Finance, insurance & real estate	1,208	1,561	353	219	1,780
Business and repair services	1,497	1,140	-357	-115	1,025
Professional and related	4,282	6,262	1,980	120	6,382
Public administration	1,408	1,470	61	182	1,652
Entertainment & recreation	416	339	-77	109	448
Personal services	2,006	2,724	318	589	3,313
Total	56,822	55,237	-1,585	-2,024	53,213

[a]Source: The economic base of NIAD (14).

expected to decline another 2,024 jobs by 1975 (14). The largest losses in employment are in agriculture due to the declining number of farms and farmers. Agricultural employment declined 4,388 jobs between 1950 and 1960 and was projected to decline another 5,403 jobs by 1975. Employment declines also occurred in construction; transportation, communication, and public utilities; and business and repair services.

On the other side, between 1950 and 1960, employment rose 46% in professional and related services with smaller relative and absolute gains in manufacturing; wholesale and retail; finance, insurance, and real estate; and personal services. Further gains are expected in each of these industries between 1960 and 1975 with manufacturing as the largest growth center in both absolute and relative terms with a gain of 2,737 jobs or 34%.

The total number of workers available from declining industries would be 5,995 between 1960 and 1975, 400 per year or .7% of the labor force. The projections are that of these 400 workers per year, an average of 182 will be employed in manufacturing and 82 in other industries with a net loss of 135 jobs per year.

County data, although not presented here, shows that the estimated 1960 to 1975 changes in employment are negative for all counties except Cerro Gordo and Floyd (14, pp. 25-29). Thus, the growth in manufacturing will be concentrated in the largest cities.

In terms of comparative statics, the labor demand curve will move to the left for some industries and to the right for others. The horizontal sum will move to the left for demand. The supply available would move to

the right as workers enter the labor force, to the left as some leave the labor force creating unemployment and outmigration.

The preceeding analysis is on an industry, not skill, basis. Since the emphasis of this study is on the manual occupations, it would be desirable to have parallel data for skills. This data is not available, but 97% of the projected decline in employment is in agriculture and construction. Farmers and most construction workers are in the manual occupations. Thus, it will be assumed that the decline in these two industries will be available as men in manual occupations fill jobs in other industries. Therefore, 5,805 men are projected to be available between 1960 and 1975 because of declining demand and technology. This is an average annual flow of 387 men in manual occupations or 1.5% of the manual labor force.

One possible goal for NIAD would be to maintain total employment at the 1960 level by increasing manufacturing employment. To meet this goal, 317 new manufacturing jobs would have to be created each year, 74% above the projected rate of 182 per year. The 2.0% annual growth rate which has been projected would have to be increased to 3.1% per year. This is not an impossible goal since Cedar Rapids, one of the fastest growing manufacturing centers in Iowa, has been increasing manufacturing employment 4.75% per year (22).

Second Jobs

Of the 212 men in the sample employed in manual occupations, five or 2.3% indicated a desire to accept a second full time job. The 95% confidence interval for the 2.3% estimate is from 1.2% to 4.4%. Three of these

five second full time job seekers were farmers who wanted full time non-farm jobs with the other two employed in non-farm manual occupations. Those seeking second jobs are a stock of potential workers at a point in time. There is no method to estimate future additions to this stock.

The potential for part time and seasonal employees is much larger; 13% of the men in manual occupations, 23% of the farmers, and 4.5% of the men in non-farm manual occupations. The 95% confidence interval for the 13% overall estimate of potential part time and seasonal labor is from 8% to 19%.

The 23% of the farmers interested in off-farm part time or seasonal employment is an indication of the underemployment of farmers in the NIAD area.

Investments which could utilize the potential part time and seasonal labor force would be desirable in NIAD. The increase in output resulting from the employment of these workers in part time and seasonal jobs would all be net gain since their current opportunity cost for their time is negligible. Investments to utilize the off farm labor force should have seasonal employment patterns which would not coincide with the seasonality of farming, i.e. peak labor demand in the winter months.

Job Changes

Two methods of measuring the willingness to change jobs are available from the sample questionnaires. First, each respondent was asked "what is the minimum weekly wages that you would accept to work in (town)?" with four different towns listed. A companion statement which could be checked

was "would not work in (town)?" Thus, one method would be to analyze those persons who gave their required wage to work in at least one of the four towns listed. This would give an estimate of those with at least some interest in changing jobs.

A second alternative would be to consider the responses in a later part of the questionnaire concerning the respondent's current situation. The alternatives included:

A. Currently unemployed and:

1. retired
2. seeking work
3. not looking for work

B. Currently farming and:

1. not looking for off-farm employment
2. looking for full time off-farm employment
3. looking for part time or seasonal off-farm employment

C. Currently employed full time and:

1. not interested in changing jobs
2. looking for a different job
3. looking for a second job full time
4. looking for a second job part time

Those who checked C.2. would be most interested in changing jobs.

It would be expected that many of the respondents would give their required wage to work in one or more of the alternative towns with fewer responding later in the questionnaire that they were currently employed but looking for a different job. The latter classification would be a better estimate of those seriously interested in changing jobs. Both methods of estimating willingness to change jobs will be used with the emphasis on the latter.

Of the men currently employed in manual occupations, 67% gave at least one wage to work in the alternative towns. The 95% confidence interval would be from 61% to 73% of the employed males. Age is the most important variable in whether or not the respondent gave at least one required wage. Eighty percent of those under 45 years of age gave at least one required wage as did 76% of those under 55. Only 52% of those over 45 years of age gave at least one wage as did 30% of those over 55. These are highly significant differences.

Thirty one respondents said that they were currently employed full time but looking for a different job. This is 15% of the males in manual occupations with the 95% confidence interval from 10% to 19%. These men could most likely be induced to change jobs but their old jobs need to be filled.

Turning to the women, 17 of the 57 employed as laborers, operatives, clerical or sales workers indicated a strong interest in alternative employment. This was 30% of those employed, the 95% confidence interval of which is from 18% to 44%. This was higher than the interest shown by the men, perhaps because women are not the primary earners for the family and are more concerned with income than job security and seniority.

NIAD Area Labor Supply Curve

The previous estimates of the various labor supply sources can be combined into part of the labor supply curve for the area for men in manual occupations. These estimates provide information on the quantity axis but not the wage axis.

Two sources of men are a stock of potential workers: unemployment and second jobs. Using the sample estimates, 1.9% of the men in manual occupations, 486 would be available from unemployment with 2.4% or 615 available from second job seekers. Thus, 4.3% of the manual labor force or 1,101 men would be available as a stock of workers with the 95% confidence from 2% to 7%. In terms of numbers, the confidence interval would be from 513 to 1,792.

In addition, an estimated 1.5% of the men in manual occupations, 387, would be available each year from future unemployment. Combined with the stock available, 5.8% of the manual labor force or 1,487 men would be available within one year. However, if they were all employed, the future supply would be 387 per year from future unemployment since the stock of unemployed and second job seekers would be exhausted.

If it were assumed that unemployment could not be reduced below the estimated 1.9% because of frictional or structural unemployment, the available stock would be 615 men from second jobs with an additional 387 per year from potential unemployment for a total of 1,002.

Available to accept jobs but needing to be replaced were 14.6% of the male manual labor force which could add 3,738 more workers. However, this does not mean that 3,738 new jobs could or should be created in NIAD. These men indicated a willingness to change jobs but they would need to be replaced from other sources. That is, these workers are willing to be reallocated within the NIAD labor force.

The comparative magnitudes of these labor supply sources are shown in Figure 6. This diagram is in a different form than the labor supply curves previously discussed since no information is available for the wage

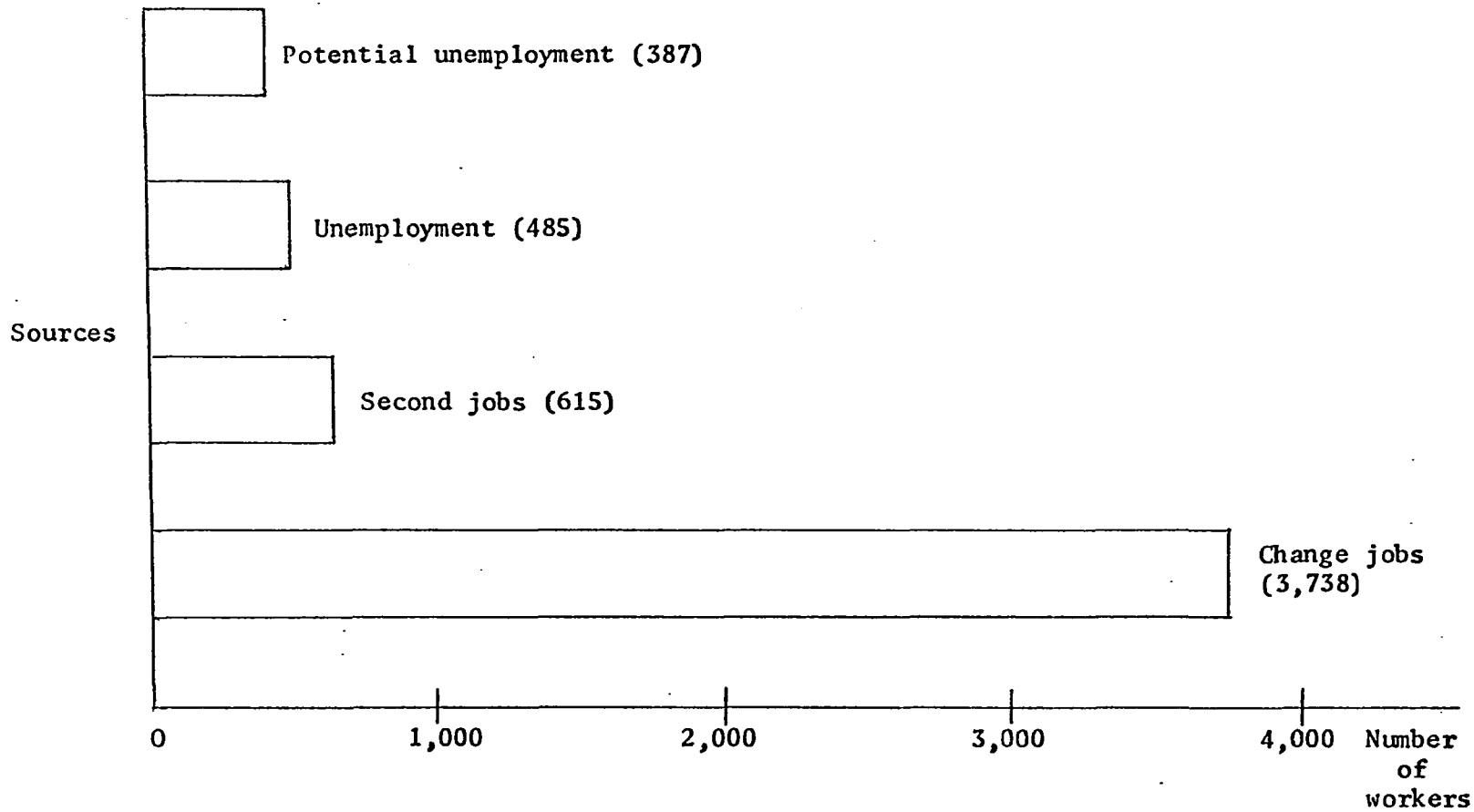

Figure 6. Magnitude of labor supply sources

axis. It is clear that with only four men in the sample who were unemployed and five seeking second jobs, no estimate of required wages can be made for these supply sources because of the small number of sample observations. Those men who are potentially unemployed were not identified in the sample so no estimate of their required wages are available. Only those men in manual occupations who indicated a willingness to change jobs constitute a large enough sample to make wage estimates. Because of the lack of wage estimates, it will not be possible to go any further in constructing a labor supply curve for the sources of labor supply.

The above labor supply data is for men in manual occupations. No comparable analysis will be made for women because of the undersampling of employed women and the small number of observations which leads to even wider confidence intervals.

Distance, Commuting, and Town Size

The criteria for labor supply estimates in the job changes section was whether or not the respondent gave his required wage for at least one of the four alternative towns listed on the questionnaire. This section will focus on whether a required wage was given for each town, the distance to that town, whether the respondent would move or commute, and the size of the town. For each respondent, these factors vary with each alternative town whereas the respondent's skill, age, etc. are the same for all towns.

Considering each respondent four times, once for each alternative town, required wages were given for 42% of the alternatives. The percent-

age that gave their required wage declined with distance with a definite drop at 25 miles. Fifty one percent of those living within 25 miles of the town gave their required wage as did 35% of those over 25 miles. This difference is significant at the 1% level. Many potential workers are willing to accept jobs who live up to 50 miles away but the level of interest declines at 25 miles.

Mason City was the only alternative included on all the questionnaires. Thus, it can be used as a basis of comparison for all respondents. Forty nine percent of the men in manual occupations gave their required wages to work in Mason City with 58% of those within 25 miles and 42% over 25 miles indicating some interest in employment in Mason City. The difference between over and under 25 miles is significant at the 5% level but not the 1% level of significance.

The respondents were more willing to consider work in towns under 4,000 population as 51% gave a required wage for such towns versus 41% for towns over 4,000 population. The difference is significant at the 5% level. However, the alternatives presented were such that only six of the under 4,000 population towns were more than 25 miles from where the respondents lived. When only towns within 25 miles were considered, the percent willing to consider employment as measured by whether or not a required wage was given were 51% and 52% for towns over and under 4,000 population. Thus, the apparent difference was due to distance and not population.

Willingness to commute is not the same as willingness to accept employment. Commuting is concerned with whether or not the respondent would move to a town if he accepted employment there. For those people who

already live in the town, the question is irrelevant and thus they will be excluded from this analysis.

Considering the men in manual occupations and including each as many times as he gave a wage for the alternative towns, 31% indicated on the questionnaire that they would commute to work if they accepted employment in the town in question. Willingness to commute declined from 53% of those living one to five miles away to 21% of those over 50 miles away. There was a definite break at 20 miles with 43% of those under 20 miles and 23% of those over 20 miles planning to commute if they accepted employment in the town. This was a highly significant difference.

Dividing the towns by population, 40% of the men in manual occupations would commute to the town if it were under 4,000 population while 28% would commute if it were to a town over 4,000 population. As before, most of the smaller towns were within 20 miles of the respondent's residence. Of those living less than 20 miles from the town, 40% would commute if the town were under 4,000 and 44% if it were over 4,000 population. Again, the apparent difference in willingness to commute due to population can be explained by the distance factor.

There is a contrast between the rather high commuting rate indicated on the questionnaires and the current commuting patterns. Of the non-farm male manual labor force in NIAD, 71% live and work in the same town, 24% commute less than 15 miles, and only 5% commute more than 15 miles to work. The actual commuting pattern is much lower than the indicated willingness to commute.

The responses of the women followed the same pattern as the men. The distance variable had significant kinks at 15, 20, and 25 miles but there

was no basis to choose between the alternatives. Thus, the kink in the distance variable for women is some place between 15 and 25 miles but not well defined. As with the men in manual occupations, there was no difference between towns over and under 4,000 population when restricted to towns within 25 miles of the place of residence.

Willingness of women to move is dependent on the husband and family willingness to move. There were no significant trends nor breaks in the willingness of women to commute with respect to distance to the town, population of the town, skills, age, or education. Fifty six percent of the women indicated that they would commute to work if they accepted employment. This again is a very high proportion willing to commute considering the current commuting pattern since 23% currently commute one to 10 miles and only 5% commute more than 10 miles to work.

In summary, some people indicated that they would consider employment and commuting to that employment up to 50 miles from their current residence. However, there was a significant decline in interest in employment at 25 miles or less and a decline in willingness of men to commute more than 20 miles. This indicates that the relevant labor market may be less than the full size of the functional economic areas which have a fifty mile radius. This concept will be developed further in a later chapter. Also, there were no differences in willingness to consider employment or to commute to towns of varying size.

WAGE PATTERNS

Two types of wage data are available from the questionnaire; current wages and wages required to accept employment. Both current and required wages are useful tools in delimiting some dimensions of the NIAD labor market. Correlating the wages with the variables available from the questionnaires indicates subsets within the labor market which have significantly different wage levels. These subsets are some of the dimensions of the NIAD labor market in that they are concerned with different classes of workers.

The characteristics of the higher and lower wage workers can be used by local leaders as a guide to promote the creation of higher wage jobs. This analysis will also aid prospective investors in determining how their proposed job creation would fit into the current wage structure of NIAD and give them some indications of what wages would be necessary to attract workers from their current jobs.

Current Wages

Current weekly wages were reported by 95 of the men in the sample employed in manual occupations or 45% of the 212 possible respondents. Much of the non-response may have been due to the phrasing of the question in terms of weekly income. Since farmers do not think of their income in weekly terms, none of them responded to this question. Among men in non-farm manual occupations, 84% gave their current weekly wage which is a reasonable response rate.

The average current wage reported by the 95 respondents was $99.20 per week or about $5,160 per year while the median income reported was $100.00 per week. The standard error of the average weekly wage was $3.38 making the 95% confidence interval for the average wage from $92.51 to $105.89. However, the standard error of the observations was $32.99 per week. This variation can be reduced by dividing the current wage market into several subsets.

Directly comparable income data is not available but an estimate can be obtained from the 1960 census which reports median incomes. The approximation median income of the comparable skill classes was $84.00 per week in 1960. This is an approximation since it is a combination of several median incomes for skills and counties.

Since incomes have been rising, the 1960 census estimate is probably too low for 1964. Per capita income in NIAD rose 20.8% between 1950 and 1960 or about 2% per year (14). The 1964 income can be estimated by raising the 1960 estimate by 8% to $91.70 per week. Therefore, the median weekly wage reported on the questionnaire of $100.00 is 9% above the median of $91.70 estimated from the census.

The average weekly wages by age groups, skills, location of work, completion of high school, and major industry groups are shown in Table 6. An examination of the averages suggests some division of the labor market on the basis of current wages. Significant differences will be determined by the usual t test for the comparison of two means, $t = \frac{\bar{x}_1 - \bar{x}_2}{S_{\bar{x}_1 - \bar{x}_2}}$.

Table 6. Average weekly current wages

	Number	Average wage
Age		
Under 25	19	$ 82.26
25 - 34	18	87.94
35 - 44	19	112.37
45 - 54	23	110.78
55 - 64	13	97.69
65 and over	3	108.33
Under 35	37	85.03
Over 35	58	108.24
Education		
Non-high school	38	96.82
High school	57	100.79
Skill		
Laborer	20	78.10
Mechanics	6	80.00
Operative	52	104.44
Craftsmen	17	114.77
Labor-mechanic	26	78.54
Operative-craftsmen	69	106.99
Location work		
Mason City - Charles City	55	113.56
Elsewhere	40	79.45
Industry		
Manufacturing	48	107.98
Transportation, communication and public utilities	7	102.14
Construction	11	101.55
Government	8	94.75
Wholesale-retail	12	83.75
Service	5	81.00
Agriculture	4	60.25

Age alone is not a rational variable in current wages. It does however reflect the increased experience of the worker. Experience is not directly measurable from the data available and thus age is used as a proxie to estimate the wage increases resulting from added experience.

Those men over 35 years of age reported their current weekly as $23.21 higher than did those under 35. This difference is highly significant since the computed t value of 3.54 is well above the 2.64 value for the 1% level with 93 degrees of freedom. Thus, the NIAD labor market can be divided on the basis of age into two groups; those over 35 years of age and those under 35.

Those men who had completed high school earned an average of $3.97 per week more than the non-high school graduates. The computed t value of .57 for this difference is not significant which indicates that completion of high school does not significantly affect current wages. This result must be viewed with caution since completion of high school is correlated with age. Eighty one percent of the men under 35 years of age had completed high school while only 47% of those over 35 had completed high school. Men over 35 who had completed high school earned an average of $117.26 per week compared to $100.39 for those over 35 but had not completed high school. This was a significant difference but the difference between the $81.00 per week earned by non-high school graduates under 35 and the $85.97 earned by high school graduates under 35 is not significant. Therefore, for the whole sample and for men under 35, completion of high school did not significantly affect current wages but there was a significant difference for men over 35 years of age.

The four non-farm skill classes can also be divided into two groups on the basis of current wages; laborer-mechanic and operative-craftsmen. The weekly wage difference between the two groups of $28.45 is significant at the 1% level with the t value computed to be 4.04. It would be expected that craftsmen would have the highest current wages because of their higher skill but the difference of $10.33 is not significant, t = 1.12, because of the wide variation within each skill. Thus, operatives and craftsmen will be combined on the basis of current wages. The apparent low wage for mechanics is not too reliable because of the few number of responses. Given the data available, they will be combined with the laborer skill.

Those men in manual occupations who were employed in Mason City and Charles City earned $34.11 more per week than did those employed elsewhere in the area. This is the largest and most significant difference of any variable to be examined with t = 5.77. There were no significant differences between the current wages of workers in towns other than Mason City and Charles City. This suggests a rather uniform current wage surface throughout the area except for peaks in Mason City and Charles City. Possible reasons for the higher wages in Mason City and Charles City include the heavier emphasis on industry and the unionization in the two largest cities of NIAD.

The industry dimension of the NIAD labor market is reflected in the average current wages by industry classifications arrayed in Table 6. Combining manufacturing; construction; transportation, communication, and public utilities; and government into one industry group gives an average

weekly wage of $105.04. The remaining industry group contains agriculture, wholesale-retail, and service industries which have a combined average wage of $78.62 per week. The difference of $26.42 is significant at the 1% level with a t value of 3.57.

An alternative is to include government in the lower wage group. However, the difference in weekly wages under this grouping is $23.22 with a t value of 3.32. Both the average difference and the t values favor the former grouping with government in the higher wage classification.

The average current wages consider each variable independent of all the other variables. The effects of interactions between the variables can be considered by using multiple regression. A number of regressions were computed utilizing different sets of variables. The following regression was selected as having the best statistical fit as measured by r and standard error with all variables significant.

$$\begin{array}{lllll} CW = 58.88 + 14.94\,A + 21.16\,S + 26.09\,P & & & & r = .628 \\ \quad\quad (6.21) \quad (5.72) \quad\quad (6.12) \quad\quad (5.75) & & & & Se = 26.09 \end{array}$$

The variables are defined as follows: A, 1 if over 35 years of age and 0 if under 35; S, 1 if operative-craftsmen and 0 if laborer-mechanic; and P, 1 if work in Mason City or Charles City and 0 if work elsewhere. The industry dimension does not enter this regression since the skill variable is highly correlated (r = .470) with the industry classification. Thus, the skill variable includes much of the variability previously attributed to industry.

The coefficient for each variable is the change in current wages resulting from moving to the higher wage bracket of the variable. The num-

bers in parentheses below the coefficients are the standard errors of the coefficients, a measure of the variability of each coefficient. The overall standard error, "s.e.", measures the variability remaining after the effects of the variables has been removed while "r" measured the reduction in variability of current wages because of the regression.

The rather high overall standard error of $26.09 per week will not allow accurate prediction of current wages for any given worker since the 95% confidence interval would be at least plus or minus the standard error of $26.09 times the t value of 1.98 or plus and minus $51.66 from the estimated wage. This is much too wide a range to be useful for predictive purposes.

The large standard error indicated that there are other factors influencing the current wages which are not included in the regression equation. There are many intangibles in current wages such as the worker's attitude, aptitude, aggressiveness, and other personal factors. These intangibles are present in the population of workers and can not be quantitatively measured under the best of circumstances. Thus, an increase in sample size would not lower the variability to any great extent.

The results of this regression are essentially the same as those results derived from the averages but it will be noted in Table 7 that there are some reductions in the differences estimated by the regression and the simple averages. For every variable, when the effect of other variables are taken into account in the regression coefficient, the difference between the two classifications of a variable are less than the average difference considering each variable independently. The inter-

action between the variables lessens the effect of the variable. Therefore, the divisions between the dimensions are not as pronounced as indicated by the simple averages and the industry dimension is not significant when the effects of age, skill, and location of work are considered.

Table 7. Average differences and regression coefficients of variables

	Regression coefficient	Average difference
Age	$14.94	$23.21
Skill	$22.16	$28.45
Work in Mason City or Charles City	$26.09	$34.11

In summary, current wages can be useful in identifying some of the dimensions of the NIAD labor market. Significant differences were found for age, skill, and location of work. However, these variables explained only 39% of the variability in current wages.

Even so, the identified dimensions of the labor market will be useful to local interests in identifying those types of jobs which are currently generating the most income. The emphasis in job creation can then be placed on the high wage jobs. The investors can use the same information in estimating their wage costs for certain types of workers.

Required Wages

Required wages are the minimum weekly wages which the respondents indicated they would require to work in the alternative towns listed on the

questionnaire. Each respondent was presented with four alternative towns and was given the opportunity to give required wages for other towns of their choosing. Thus, each respondent could have given his required wage for none to four or more towns. Each required wage will be considered as a separate observation for the following analysis. The required wages to be analyzed are those given by the men in manual occupations.

Since not all of the men in manual occupations gave their current weekly wages, current wages can not be used as a variable for all persons and wages given. Those who gave both their current and required wages gave a total of 197 required wages, all of which will be used in this analysis.

Two hypotheses concerning the relationship between current and required wages will be tested. They are : 1. required wages are higher than current wages by an absolute amount for all wage levels, and 2. required wages are proportional to current wages. Required wages were regressed on current wages to obtain the coefficients needed to test the hypotheses. The resulting regression was:

$$\begin{array}{lll} RW = \$51.33 + .698\ CW & & r^2 = .450 \\ \quad\ (5.40) \quad\ (.055) & & s.e. = \$21.64 \end{array}$$

where RW is the required wage, CW the current wage, and the numbers in parentheses below the coefficients are the standard errors of the coefficients.

If required wages were proportional to current wages, the intercept term of the above regression would be zero and the coefficient for current wages would be the proportionality factor. To test whether the intercept term is significantly different from zero, the appropriate test

is:

$$t = \frac{\vec{\alpha}}{S_{\vec{\alpha}}} = \frac{51.33}{5.40} = 9.51.$$

The t value for 196 degrees of freedom at the 1% level is 2.60. Since the computed t value is larger than 2.60, the hypothesis that required wages are proportional to current wages is rejected because the intercept is significantly different from zero.

If required wages were larger than current wages by an absolute amount for all wage levels, the coefficient of the current wage term should equal 1.00 in which case the difference between current wages and required wages would be the intercept term. The appropriate t test is:

$$t = \frac{\beta_0 - \vec{\beta}}{S_{\vec{\beta}}} = \frac{1.00 - .698}{.055} = 5.49.$$

This hypothesis is also rejected since the coefficient for current wages is significantly different from 1.00.

Thus, the difference between current wages and required wages is larger for men with lower current wages both relatively and absolutely. Those men with lower current wages apparently have higher expectations, perhaps unrealistically high, than those with higher current wages.

To illustrate the differences, a man with current weekly wages of $60.00 would have an estimated required wage of $93.21 per week, $33.21 or 55% above his current wage. If his current wage were $120.00, the estimated required wage would be $135.09, $15.09 or 13% above his current wage.

The above regression is not very useful for prediction due to the high overall standard error of $21.46. The 95% confidence interval for

an estimated required wage would be at least plus and minus $42.41.

The men in manual occupations gave a total of 425 required wages to work in towns in or near NIAD. Since not all of the men who gave their required wages also gave their current wages, it is no longer useful as an explanatory variable.

The average required wage given by the men in manual occupations was $117.12 per week. This is 18% above the current weekly wage of $99.20. The standard error of the required wages was $38.05 but with the large number of observations, 425, the standard error of the mean is only $0.09 making the 95% confidence interval $116.94 to $117.30.

The average weekly required wages of the men in manual occupations by age groups is shown in Table 8. The averages increase up to the 35 to 44 years of age group and then declines. Since there were few men over 55 years of age who gave required wages and they average about the same as the 25 to 34 year old group, they will be comgined into one group with an average required wage of $110.83. Thus, four age groups remain with the differences between each group highly significant. The resulting age grouping is four levels of required wages with the lowest being for men under 25 years of age, a higher step for those 25 to 34 or over 55, the highest for men 35 to 44 and a little lower step for men 45 to 54. The age variable is again a reflection of the added experience.

The laborers gave the lowest required wages of the five skill groups but there were no significant differences between the other four skill classifications (See Table 8). Craftsmen had the highest required wages but they were not significantly higher than mechanics or operatives. Thus, the men in manual occupations can be divided into two groups on the

Table 8. Average required wages

	1960 population	Number	Average required wages
Town			
Greene	1,427	10	$121.50
Northwood	1,768	10	96.00
Garner	1,990	11	100.91
Belmond	2,506	11	93.18
Forest City	2,930	22	95.45
Clarion	3,232	10	95.50
Osage	3,753	10	108.00
Others under 4000 population		22	108.64
Hampton	4,501	13	114.62
Iowa Falls	5,565	10	114.00
Algona	5,702	26	105.96
Clear Lake	6,158	22	128.73
Waverly	6,357	15	139.00
Charles City	9,864	62	125.03
Albert Lea	17,108	33	119.45
Austin	27,908	23	129.57
Mason City	30,692	115	121.45
All under 4000 population		106	101.60
All over 4000 population		319	122.28
Age			
Under 25		93	97.43
25 - 34		92	111.74
35 - 44		105	138.86
45 - 54		112	119.57
55 - 64		20	107.25
65 & over		3	106.67

Table 8. (Continued)

	1960 population	Number	Average required wages
Skill			
Laborer		50	96.72
Farmers		187	116.08
Operative		130	121.12
Mechanics		17	124.71
Craftsmen		41	130.98
Education			
High school		267	119.61
Non-high school		158	112.92
Distance			
Zero		46	125.91
1 - 5		23	113.26
6 - 10		55	106.04
11 - 15		47	103.09
16 - 20		38	114.40
21 - 25		36	119.31
26 - 30		57	120.83
31 - 40		61	126.07
41 - 50		38	121.71
51 and over		24	119.17
1 - 15 miles, towns under 4,000		74	99.05
1 - 15 miles, towns over 4,000		51	116.71
1 - 20 miles, towns under 4,000		84	100.71
1 - 20 miles, towns over 4,000		79	116.06

basis of skills: laborers and others. The difference between these two groups is highly significant. It will be recalled that mechanics were combined with laborers on the basis of current wages, but using required wages mechanics are better combined with operatives, craftsmen, and farmers. This is not a critical difference since the mechanics are a small skill group.

Those men who had completed high school gave higher required wages than did those who had not completed high school but the difference was not significant. This was also the case when current wages were previously discussed.

The average required wages given vary with the distance from the residence of the respondent to the town in question (See Table 8). Those men who were zero distance from the town (lived in the towns for which the required wage was given) gave significantly higher required wages than did those living near the town. Thirty of the 46 responses in this classification were from men living in and giving required wages for Mason City and Charles City. Their required wages for zero distance was $130.73. This is a direct reflection of the higher current wages in Mason City and Charles City. If these men are excluded from the zero distance group, the average required wage falls to $116.87 per week which is not significantly different from the wages required by those living close to the town.

Higher wages were required as the distance to the town increased with a jump at 15 or 20 miles. It is not clear whether the 16 to 20 miles group should be combined with those under 15 miles or over 20 miles. Both combinations are significantly below the average wages required by

respondents over the distance break but the difference in significance is so small that there is no basis to choose between the alternatives. Thus, the break in the distance variable is some place between 15 and 20 miles but not well defined.

Since the average required wages for those zero distance is about the same level as those over 15 or 20 miles, they could be combined leaving two distance classifications: one to 15 or 20 miles and zero or over 15 or 20 miles. The difference between these two classifications is highly significant for either dividing line. This alternative is preferred over using Mason City and Charles City as a separate classification as the higher wages were given by those living in Mason City and Charles City rather than all required wages for Mason City and Charles City. Also, Mason City and Charles City are in the larger population group which had significantly higher required wages.

The higher required wages required by those in the town are a reflection of current wages. The rationale for increasing wages with more distance is to overcome commuting or moving costs. Those within 15 or 20 miles indicated they would commute to work if employed in that town so the higher wages for farther distances would be the incentive needed for the men to commute or move.

Average required wages tended to increase with the population of the town with the correlation just significant at the 5% level (See Table 8). However, there was a definite break at 4,000 population which is significant at the 1% level with an average required wage of $122.28 for towns over 4,000 versus $101.60 for towns under 4,000 population.

It will be recalled that when distance is taken into account, there were no significant differences in willingness to accept employment nor to commute to towns over and under 4,000 population. However, there were significant differences between the wages required to work in towns over and under 4,000 population even when the distance factor is taken into account (See Table 8). Using the 1 to 15 or 20 miles distance factors removes the higher wages required by those living in and giving wages for Mason City and Charles City. Thus, they do not contribute to the difference.

No other explanation is available from the data to explain the difference due to population. Perhaps the reason is the expectation of higher wages in the larger towns or a willingness to work in the larger towns but only for higher wages.

Multiple regression considers all variables together rather than independently as do averages. Dummy variables allow the inclusion of the dimensions of the labor market as set out in the analysis of averages. The divisions of variables as was done by averages provides the best statistical fit for the regression. The 1 to 15 miles distance variable provided a little better fit than did the 1 to 20 miles variable but the difference is small. The resulting estimated equation is:

$$\underset{}{RW=69.49} + \underset{(6.88)}{7.90\ HS} + \underset{(3.86)}{13.29\ A_1} + \underset{(4.79)}{41.61\ A_2} + \underset{(4.90)}{24.13\ A_3} + \underset{(9.20)}{17.90\ S} + \underset{(5.36)}{12.60\ P} - \underset{(4.49)}{9.90\ D} \quad (4.20)$$

$$r^2 = .244 \qquad \text{s.e.} = 33.36$$

The variables are defined as follows: HS, 1 if completed high school and zero if not; A_1, 1 if 25 to 34 or over 55 years of age and zero if not; A_2, 1 if 35 to 44 and zero if not; A_3, 1 if 45 to 54 and zero if not; S,

1 if farmer, operative, craftsman, or mechanic and zero if laborer; P, 1 if wage is for town over 4,000 population and zero if for town under 4,000; and D, 1 if 1 to 15 miles to the town and zero if no distance or over 15 miles.

All the variables in the above regression are significant at the 1% level except completion of high school which is significant at the 5% level. This is the first instance where completion of high school has become a significant variable. Thus, when other factors are accounted for, completion of high school is a significant variable in required wages even though it is not significant when considered independently of the other variables.

The basic required wage would be $69.49 per week given to work in a town under 4,000 population by a non-high school graduate under 25 with laborer skills who lived in the town or more than 15 miles away. From this base, additions are made according to completion of high school, age, skill, size of town, and distance. The maximum required wage would be $149.50 for a town over 4,000 population by a non-laborer 35 to 44 who had completed high school and lived in the town or more than 15 miles away.

The usefulness of the estimated equation is again limited because of the large standard error which would make the 95% confidence interval of a predicted required wage at least plus and minus $65.39, much too wide for use in predictive purposes. However, the regression does confirm the delimitation of the dimensions of the NIAD labor market. As a rough approximation, based on the standard errors of the coefficients, a differ-

ence between two means of about $10.00 per week is significant at the 5% level.

Summary

The analysis of current and required wages delimited some of the dimensions of the NIAD labor market. Age is not a rational dimension of the labor market by itself but it is an estimate of experience which could not be measured in any other manner from the available data. Two age groups were evident in the current wage analysis, those men under and over 35 years of age. However, the additional observations available in the required wage analysis permitted defining four age groups as dimensions of the labor market: under 25, 25 to 34 and over 55, 35 to 44, and 45 to 54 years of age. Required wages increased up to the 35 to 44 age group and then declined.

There were small differences with respect to completion of high school but in one case, the regression with required wages, those who had completed high school require significantly higher wages.

Laborers had the lowest current wages and gave the lowest required wages but the differences between the other skill groups were not significant. Mechanics fit into the higher wage group on the basis of required wages but were closer to the laborers in the current wage analysis. This is not a critical difference as mechanics are a relatively small skill group. Craftsmen had the highest current and required wages but they were not significantly above the other skills.

Men working in Mason City and Charles City had higher current wages than did the rest of the men in manual occupations and higher wages were

required to work in towns over 4,000 population. The higher required wages to work in the larger towns were most likely based on the expectation of higher wages in the larger towns which would be realistic based on the higher current wages in Mason City and Charles City. Also, this indicated a willingness of this predominately rural sample to work in larger towns but only for higher wages.

Required wages vary with distance but there was a significant increase in wages for persons over 15 or 20 miles. Those within 15 or 20 miles would most likely commute to work while many of those over 15 or 20 miles from a potential job indicated they would move to the town. Thus, the higher wages were required to overcome the costs of moving and disruption or the longer commuting distance.

Current wages were a strong factor influencing required wages. Required wages were not a absolute dollar amount higher than current wages for all levels of income and required wages were less than proportional to current wages. The lack of current wage data from many of the respondents limited its use for the required wage analysis.

It is not possible to make reliable wage estimates for the price axis of the NIAD labor supply curve. The persons comprising the quantity axis of the labor supply curve were a part of the total group analyzed in the preceeding section of current and required wages. All men in manual occupations and all required wages which they gave were included in the required wage analysis, not just those who were considered as being actively in the labor market. The reason those individuals who comprised the quantity axis of the labor supply curve were not analyzed separately is

that there were so few of them that any wage estimates would have had large standard errors and non-significant differences between the labor supply sources. The standard errors of the estimates based on all wages were too large for predictive purposes and the problem would have increased with the smaller numbers involved in the quantity axis of the labor supply curve.

POTENTIAL MIGRATION FROM NIAD

An alternative to providing employment within NIAD is for some of the people to move out of the area to seek employment. Between 1950 and 1960, the nine full counties of NIAD had a net loss of 22,265 persons through migration (64). This was slightly more than offset by the natural increase in population to give a .6% gain in total population. All counties experienced net out migration between 1950 and 1960 although some showed gains in total population (64).

To examine the potential for emigration, each person in the survey was asked if they would be willing to accept employment away from the NIAD area. The questions were directed toward Des Moines, Minneapolis-St. Paul, and Out of Iowa-Minnesota. Mason City is almost equal distant from Des Moines and the Minneapolis-St. Paul area.

Thirty-seven percent of the men in manual occupations indicated they would consider leaving NIAD since they gave their required wage for one or more of the out of area alternatives. The 95% confidence interval for the 37% estimate is from 30% to 43%.

There was a difference between age groups in willingness to leave the area with 59% of the men under 44 years of age willing to consider such a move compared to only 16% of those 45 and over. There were no significant differences between the skill classes with respect to willingness to leave the area.

The average weekly wage required by the men to leave NIAD was $142.00, 21% above the $117.00 per week required to work within NIAD. The pattern of required wages with respect to age to leave the area was

essentially the same as required wages to work in NIAD but 21% to 29% higher. Those men under 25 years of age required an average of $120.00 to leave the area, $136.00 for those 25 to 34, and $180.00 per week for men 35 to 44. The average required wages declined for persons over 45 but the number of observations was too small for meaningful analysis.

Those with laborer skills required lower wages, $105.00 per week, to move out of the area than did the other skill groups, $147.00. Completion of high school did not have a significant effect on the required wage to leave NIAD.

Twenty percent of the women with laborer, operative, clerical or sales skills indicated willingness to leave the NIAD area. Age is again a very important factor with 46% of those under 25 years of age and 36% of those under 35 willing to leave the area versus only 15% and 11% over the respective age breaks. There were no significant differences between the skill groups with respect to willingness of women to leave the area.

The mobility of married women is closely tied to the mobility of their spouse. Fifteen women in the sample were self supporting but living with others and 12 of them were willing to leave NIAD. Of those under 25 years of age in this group, 11 of 11 were willing to consider leaving NIAD.

In summary, the younger people were very willing to consider leaving NIAD for alternative employment with the women who were self supporting especially willing to move. However, wages 20% to 30% above those required to work in NIAD would be necessary to induce people to leave the area. If employment opportunities were available within NIAD, these

young people would most likely remain in the area. The NIAD employers have a comparative advantage since they can retain these workers at a lower wage than other employers would have to pay to attract them.

LABOR MARKETS IN FUNCTIONAL ECONOMIC AREAS

Evidence has been presented that 15 to 25 miles distance is a more relevant spatial area for labor markets than the 50 miles hypothesized in the development of the concept of the functional economic areas. Willingness to consider employment as evidenced by whether or not a required wage was given for a town showed a definite break at 25 miles for men with a less well defined break between 15 and 25 miles for women. The kink in willingness to commute was at 20 miles for the men as indicated on the questionnaire and only 5% of the men currently employed presently commute more than 15 miles. The men in manual occupations also gave lower wages if they were within 15 to 25 miles of the town, the exception being those men living in Mason City and Charles City.

All of these combine to provide a strong basis for labor market subareas within a functional economic area. This does not invlaidate the concept of the functional economic area as the assumption of 50 miles does not rest solely on the labor market area. Smaller labor market areas can be included within the concept of the functional economic area.

Consider a functional economic area with the boundary 60 road miles from the central city giving the diamond shaped area. The diamond shape is due to the north-south and east-west grid road system and the distance to the boundary is measured in road miles. Sixty miles was chosen for convenience and the 20 miles distance will be used for the labor market areas. Since the population of the town did not affect the distance factors, all of the labor market areas will be the same size. Around the

central city there would be a diamond shaped labor market with the 20 miles boundary. The rest of the area can be divided into similar areas resulting in nine labor markets within the functional economic area as shown in Figure 7. Each of these labor markets should have its own "central city" as far as the labor market is concerned. These small labor markets are not completely independent of one another any more than functional economic areas are independent of one another.

To adapt this conceptual framework to a particular functional economic area, consideration needs to be given to the location of the towns and their importance as an employment center. In the case of NIAD, only seven labor market areas appear as shown in Figure 8. They are centered on Mason City, Charles City, Hampton, Belmond, Forest City, Northwood, and Osage. The Northwood area in the northern part of NIAD is most likely the southern end of the Albert Lea, Minnesota labor market area. Present commuting patterns and the location of highways were used in the formation of these areas. Ninety six percent of the men in manual occupations live and work within the same labor market area as drawn in Figure 8 as did 93% of the women. Thus, these areas are quite self sufficient with respect to current employment patterns. These labor market areas will be the basis for the simulation of the NIAD labor market.

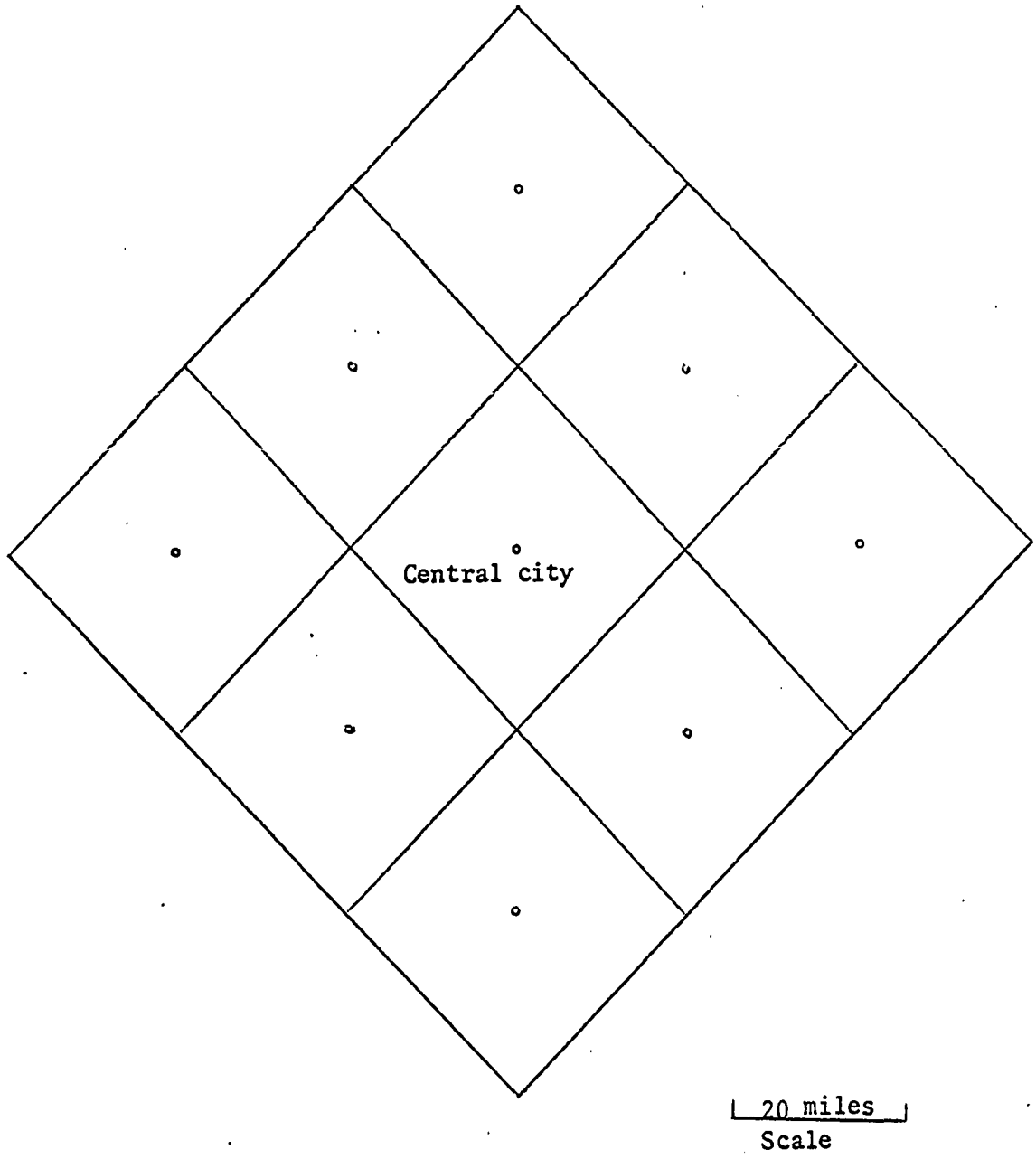

Figure 7. Theoretical labor market areas in a functional economic area

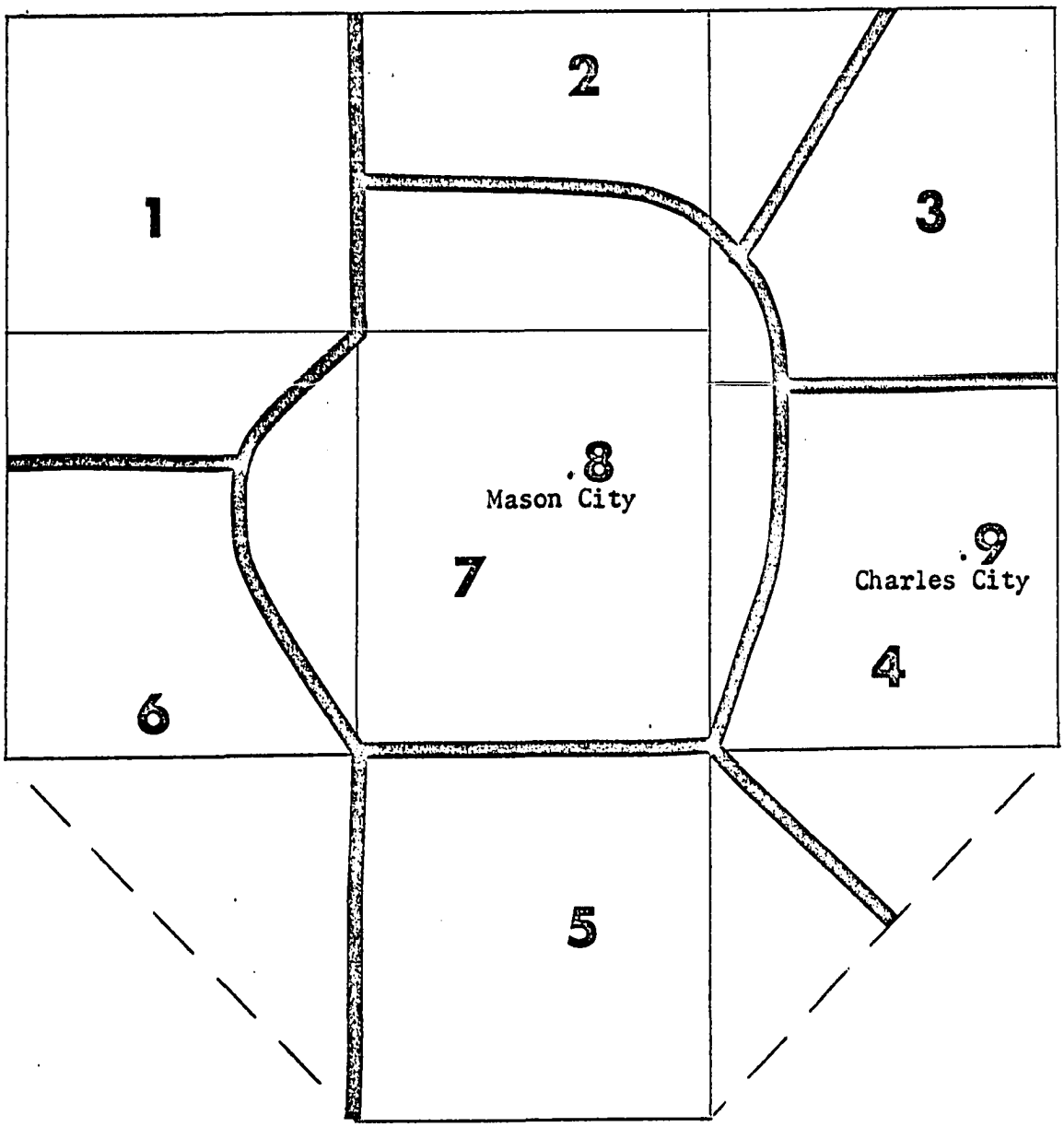

Figure 8. Labor market areas in NIAD

SIMULATION OF THE NIAD LABOR MARKET

The NIAD labor market has allocated workers to their jobs or into unemployment. However, other allocations are possible and perhaps more desirable. Alternative allocations of workers to jobs can be analyzed by developing a model of the NIAD labor market which would allow the simulation of the market under alternative conditions. Such a model could also be used to simulate alternative job creation policies and their effect on the NIAD labor market.

Simulation as a tool of economic analysis has become quite popular in recent years (31, 45, 46). Given a model which describes the phenomenon of interest, simulation is the numerical manipulation of that model to simulate the reaction to alternative events. Simulation is the social scientist's experiment. A variable of the model, such as labor demand, is altered and the new results are observed.

It is often more feasible to build a model to simulate some event than to experiment with the real world. Real world simulation is often impossible and, when possible, usually only one alteration can be performed. To simulate the reaction of the NIAD labor market to job creation within the area, thousands of dollars would have to be invested in physical facilities and hiring employees. The reaction of the labor market could then be observed. This same job creation can be simulated and the effects can be estimated with a labor market model. An alternative simulation could be performed with the model, but if the jobs were actually created, the labor market could not be returned to its original state for use with alternative simulations.

Two types of errors, model errors and estimation errors, can cause deviations between a model and the real world. Model errors arise because the specification of the model does not correspond to reality. The postulated behavior of the model, as stated in the assumptions, may not correspond to the patterns of actual behavior. Model errors also occur if relevant variables are excluded by assumption, oversight, or lack of understanding of the real world.

Estimation errors are due to incomplete data, incorrect data, inaccurate observation, sampling error, or improper estimation techniques. Model errors and estimation errors theoretically could offset each other but they often compound one another to give a total error which is larger than the sum of their separate errors.

The complexity of the real world can often be made more manageable by the use of an economic model. However, abstractions from reality can result in misinterpretations. The difficulty is not that a model is an abstraction, but it may be an abstraction which does not properly reflect the real world. A model which gives "reasonable" approximations of the real world can be useful for certain purposes. The objective is not to have a perfect model explaining all of the intricacies of the real world, but to have a useful, workable model.

Some simulation problems require specially built models and imaginative computational techniques. The NIAD labor market can be adapted to correspond to the transportation model. Transportation models are a subset of linear programs and have characteristics which permit efficient solutions (9, 20, 51). The usefulness of the transportation model in this problem is a function of the model's characteristics and assumptions.

Nothing is actually going to be transported in the usual sense of the word.

As a brief overview, transportation models require four things: 1) a product, 2) supply points, 3) demand points, and 4) transportation costs between the supply and demand points. The transportation model then chooses the least cost allocation of supply to demand. In terms of the NIAD labor market, the product is laborers, the supply points are the locations where workers live, the demand points are the locations where the jobs are available, and the transportation costs are the wages required by workers to accept jobs in various locations. The model then minimizes the total wage bill for the area. With this brief statement of the labor market model, the transportation model and its implications for the NIAD labor market model will be developed more explicitly.

The Transportation Model

Each of the seven assumptions of the transportation model will be discussed and more precise interpretations of the assumption in terms of the NIAD labor market will be stated (20, 51).

Assumption 1. The product is homogeneous. In terms of the NIAD labor market, the product is workers. The homogeneity assumption implies that the employers are indifferent between workers of a given skill level. This is not a valid assumption when an employer, according to the model, has to fire some of his employees and replace them with employees who would work for lower wages. His current employees have the training and experience to fill their current jobs. This background is not available in all work-

ers of that skill. Some of the difficulties arising from his assumption are met by dividing the workers into skill groups. However, for purposes of this study, only four skill groups will be used. If skills could be sub-divided into more classifications, this problem could be surmounted. Data collection difficulties and small numbers preclude this approach for the study of the NIAD labor market.

Assumption 2. The quantities supplied and demanded are known and fixed with the total supply equal to the total demand. The supplies of the labor market model are the number of workers available in various locations who have given skills. The demands are the jobs existing in these locations which require certain skills. This data is available from the census of population. The equality of supply and demand is met artificially by introducing unemployment as a "job" which must be filled (11). The unemployed are treated as excess capacity on the supply side. This assumption presents no large data or conceptual problems.

Assumption 3. Transportation costs are independent of volume. In the context of a labor market, the wages required for workers to accept employment serve as the transportation costs. Since the wages are assumed to be independent of volume, if an employer can hire one person at a given wage, he can hire all of the workers available of that skill in that sub-area at the same wage. This implies that the labor supply curve is infinitely elastic over the range of workers available and then is completely inelastic. Workers are available to an employer at different wages from different areas. Thus, the combination of the alternative supply sources presents a stairstep supply curve to the employer as shown in Figure 9.

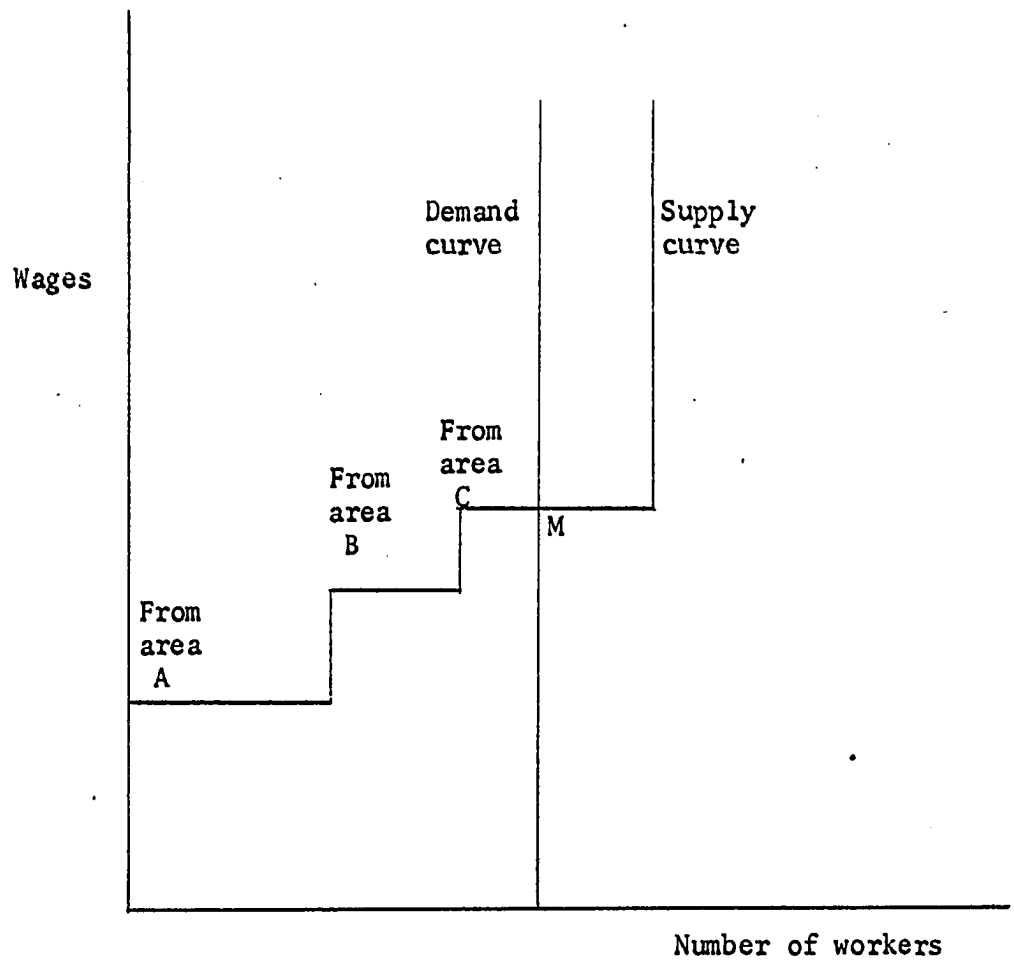

Figure 9. Supply and demand curves in the transportation model

The employer's demand is completely inelastic in that he has to fill all of his demand for workers. The point of intersection of the supply curve and demand curve is shown as point M in Figure 9. All of the workers available from Areas A and B would be utilized as well as some from Area C. This assumption is probably not met within a supply sub-area, particularly over a large number of workers since not everyone will work for the same wage. It is met according to Reynold's concept of labor supply to a firm being elastic (39). Also, workers are not completely rigid in their wages required for employment and employers may not have to meet all of their demand as stated above. However, the transportation model requires point estimates for wages and does not allow confidence intervals of the estimate. The model does not allow sloping supply or demand curves. This is the largest model error encountered in using the transportation model to simulate the NIAD labor market.

Assumption 4. There is an objective function to be minimized. One formulation to satisfy this requirement is to minimize the total wage bill of the area. The employers are then forced to hire the workers who meet their skill requirements and will work for the lowest wage. This assumption is probably true if the workers are equally qualified. However, because of the broad skill classes, the qualifications of the workers may not be equal and the employer may choose to hire the better qualified worker within the skill class at a higher wage. Also, there is not a great deal of bargaining over wages since many are controlled by union contracts. Alternative formulations of the problem will be discussed later.

Assumption 5. Shipments must be made a non-negative quantities. This mathematical requirement is an assist because only positive quantities are of interest. Employers can not produce workers.

Assumption 6. Each supply point is represented by a base point where all the supply is concentrated. This assumption concerns the definition of regions and the homogeneity of supply. The only problem is that a person living near the boundry of one area may be more willing to work in the neighboring area than to work at the other side of the area in which he lives. To completely eliminate this problem would mean including each person as a supply point which is unfeasible because of computation limits. The same is true of demands in that they are assumed to be concentrated at one point within the area.

Assumption 7. The system operates under perfect competition. That is, all the workers who are active in the labor market have complete knowledge of all the alternatives available to him and the employers have complete knowledge of the workers available. The labor market of an area does not operate under perfect knowledge as few of the workers are aware of the market conditions. Only those workers who are looking for employment and are active in the market are aware of the demands and wages of the market. Union and senority programs also restrict the free movement and bargaining in the market.

The two largest model errors in the transportation model with reference to the NIAD labor market are that the skill classifications are too broad and the labor supply of a skill group within a sub-area is completely elastic. The first model error, broad skill groups, could be elimin-

ated within the context of the transportation model if adequate data were available to further divide skills and locations. A model which incorporates sloping supply and demand curves would be much more complex than the transportation model. Such a model would need to allocate workers to jobs according to some criteria, but the transportation model is designed to allocate supplies to demands according to the specified criteria. Thus, an alternative model would be computed in essentially the same manner as the transportation model. The gains in accuracy would not offset the added costs of a special model. Therefore, the transportation model will be used as an abstraction of the NIAD labor market.

The NIAD labor market as formulated into the transportation model views the allocation of labor from the demand or employer side of the market. That is, the employer's labor cost is minimized. Little consideration is given to the seller or employee side of the market since they are allocated to their lowest paying job.

An alternative formulation of the labor market into a transportation model would be to use as the objective function the maximization of the total wage bill. Thus, each worker would be moved to his highest paying alternative job. This formulation would not be to the best interest of the employers, but would maximize income for the employees. The optimum allocation would most likely move all workers to other locations to raise their income. This would cause a complete disruption of the NIAD labor market. The properties of the transportation model do not allow such a maximization. Entering wages as a negative quantity would be a possibility but this was not feasible in the computer program. Another possi-

bility would be to use the inverse of each wage as the transportation cost. However, this could destroy the relationships between the wages. Therefore, the maximization of the income of workers is not feasible because of computational difficulties and the likelihood of completely upsetting the labor market.

Another formulation of the problem could be to define transportation cost as the increase over current wages required to accept alternative employment. That is, the current wage of each worker would be subtracted from each of his required wages to work in other skills and/or other locations. This formulation assumes that all persons prefer their present job but would move to alternative jobs or alternative locations at a cost. The objective function is then to minimize the additional wages required for movement to other jobs and/or other areas. Computationally, this is a feasible formulation of the problem. However, there are some difficulties in the interpretation of the results. The employers are directed to hire those workers who meet his qualifications and will work for the lowest increase over their current wages.

Although this is in a sense the employer's marginal labor cost, the fixed cost (current wages) varies with workers of different skills who live in different locations. The employer is concerned with the total wages, not just the increase over current wages. The solution to this formulation of the problem minimizes the worker's increase over his current wages. However, he also is concerned with his total wage and not just the increase over current wages.

In an earlier section of this study, it was determined that those per-

sons with lower current wages required larger increases to accept alternative employment than did the workers with higher current wages. Thus, the formulation of the model would encourage those with higher current wages to move to still higher wage jobs while retaining the low wage workers in their current jobs. The effect is to encourage wider income disparaties. Also, no data was available from the survey concerning the current income of farmers. Therefore, this formulation of the model would maximize the wages of those workers with higher current wages, retain the lower paid persons in their current jobs, and force employers to hire on the basis of wage increases rather than total wages.

Considering the alternative formulations, the use of wages as transportation costs with the objective function minimizing the total wage bill is the best alternative and will be used as the model of the NIAD labor market.

The theory of transportation models is available with methods of solution in a number of places and will not be discussed here (6, 8, 9, 11, 18, 20, 51, 60). The solution of the problem proceeds in two phases - a feasible solution and the search for an optimum solution. A feasible solution allocates all the workers to jobs with all supplies exhausted and all demands met. Then alternative solutions are systematically examined to see if any have a lower total cost. The stepping stone method, which was used in the computor program for this application, proceeds by lowering the allocation of high wage employees and raising the allocation of workers in low wage jobs to give a lower total wage bill. Such a reallocation, if feasible under the supply and demand restrictions, is included as the next solution. This process is repeated until the total

wage bill reaches its minimum (the optimum solution) given the supplies, demands and wages.

Shadow costs play an important role in the solution of transportation problems and the interpretation of the results. A shadow cost in the optimal solution is the amount that a wage would have to be changed in order for that allocation to come into the final solution. If a shadow cost in the final solution were, for example, minus $10.00, the wage for that allocation would have to be lowered by $10.00 or more in order to be utilized in the optimum solution. If the shadow cost were zero, that allocation either is utilized in a final solution or could be utilized in the final solution with no changes in the total cost. However, if a shadow cost were positive, the solution would not be optimal since the wage could be raised and this allocation of workers still would come into the final solution. Therefore, the final solution to the transportation model requires that all shadow cost be non-positive. If there are zero shadow costs for allocations that are not used in the final solution, the solution is not unique since with no change in total cost, that potential allocation could enter the optimal solution.

To illustrate with the NIAD labor market problem suppose that laborers living in Charles City would be willing to work in Mason City for $129.00 per week but the optimal solution to the problem did not utilize this alternative. If the shadow costs for this allocation were -$9.00, lowering the required wage for laborers in Charles City to work in Mason City to $120.00 per week or less would mean that this allocation would enter the final solution. Thus, comparisons of shadow cost in the final

solution indicate which alternative allocations of workers "almost" were in the optimal allocation. Small shadow costs imply that small changes in the wages could alter the final solution. Since the wages are subject to estimation errors, different solutions with different conclusions could result if the estimation errors were larger than the shadow cost. It will be recalled that, based on the standard errors of regression coefficients for required wages, differences between the average required wages of different groups of $10.00 or more were usually significant. Thus, when the shadow costs in an optimal solution are under $10.00 per week, the reliability of the solution and conclusion is lowered. The shadow costs can be used as an indication of the sensitivity of the solution to estimation errors.

Data for the Model

To adapt the transportation model to the labor market problem of NIAD, the supply and demand points will be the labor market sub-areas as drawn in Figure 8 except that Mason City-Clear Lake will be considered as a separate area, Area 8, and Charles City will be considered as a separate area, Area 9. Thus, there are a total of nine areas within the NIAD labor market each supplying and demanding workers. Areas 1 through 7 are predominately rural areas with the largest town in each under 5,000 population. The area designations with counties and some of the towns included in each area are as follows:

Area 1. All of Winnebago county and part of Hancock county.
Forest City and Lake Mills.

Area 2. Northern portion of Worth county and part of Mitchell county.
Northwood

Area 3. The remainder of Mitchell county.
Osage.

Area 4. Most of Floyd county and half of the NIAD portion of Butler county.
Greene, but not Charles City.

Area 5. All of Franklin county and part of Butler county.
Hampton.

Area 6. The NIAD portion of Wright county and the southern portion of Hancock county.
Belmond

Area 7. Cerro Gordo county, the southern part of Worth county, the eastern part of Hancock county and the western part of Floyd county.
Garner, Manly and Nora Springs but not Mason City and Clear Lake.

Area 8. Mason City and Clear Lake.

Area 9. Charles City.

The men in manual occupations will be used as the labor force and will be divided into four skill groups: laborers, operatives, craftsmen, and farmers. Thus, the labor force within each of the nine areas will be divided into these four skill groups. The exceptions are that Mason City-Clear Lake and Charles City do not have any farmers. This is a total of 34 supply points and 34 demand points.

It was assumed that workers who live within a certain area would be willing to work in that area or any contiguous area. That is, those living in Area 1 would be willing to work in Areas 1,2,6, and 7 plus Mason City-Clear Lake, Area 8, but not in any other areas.

Some workers have the potential to move to other skill groups. Two assumptions concerning skill mobility will be employed. The first assumption will be called full skill mobility with mobility between skills as indicated by X in Table 9. The feasible movements of Table 9 are based on the responses to the alternative skill questions in the questionnaire.

Table 9. Mobility under full skill mobility assumption

From	To			
	Laborers	Operatives	Craftsmen	Farmers
Laborers	X	X		
Operatives	X	X	X	
Craftsmen		X	X	
Farmers	X	X		X

None of those men with laborer skills gave craftsman as an alternative skill. Only one craftsman indicated that he would be willing to accept employment as a laborer and none of the farmers indicated craftsmen as a non-farm skill. Sixty six percent of the farmers indicated laborer and operative as their first choice non-farm skill.

A more restricted skill mobility assumption is that laborers, operatives, craftsmen and farmers can only be employed in their own skill classification except that farmers can be employed in non-farm jobs as laborers or operatives. This will be referred to as the restricted skill mobility assumption. These two assumptions dealing with skill mobility are the extremes, but finer breakdowns are impossible when only four skill

classifications are used.

The required wages for the various feasible allocations were obtained from two sources. The diagonal costs, same skill to same skill within the same area, were obtained by regressing current weekly wages on a set of variables for skills plus variables for those employed in Mason City and Charles City. It will be recalled that the current wages of men who work in Mason City and Charles City were higher than for the rest of NIAD. As only one farmer gave his current income, they are excluded from this estimation. Using CW to denote current wages, O for operatives, C for craftsmen, MC for work in Mason City, and CC for work in Charles City,

$$CW = \underset{}{63.15} + \underset{(5.87)}{19.29}\ O + \underset{(6.36)}{34.47}\ C + \underset{(8.42)}{29.28}\ MC + \underset{(6.06)}{35.78}\ CC \qquad r^2 = .395$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad (7.54) \qquad s.e. = 26.22$$

All variables in this equation are significant at the 1% level. Laborers are included in the intercept term and the coefficients are additions to the current wages of laborers for different skills and location of work. The estimated current wages for each of the areas and skills are shown as the diagonal elements in Table 10. The current wages for farmers were arbitrarily set at $90 per week.

The non-diagonal wages were estimated by using all the wages required by men in manual occupations. The notation is as follows: O, operatives; C, craftsmen; F, farmers; MC, required wage for Mason City; CC, required wage for Charles City; LMC, live in Mason City; LCC, live in Charles City; and D, live less than 15 miles from the town.

$$RW = \underset{}{98.85} + \underset{(5.12)}{13.67}\ O + \underset{(5.52)}{24.69}\ C + \underset{(7.30)}{19.04}\ F + \underset{(5.34)}{6.03}\ MC + \underset{(4.14)}{7.24}\ CC +$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad (5.37)$$

$$\underset{(5.48)}{22.49}\ LMC + \underset{(9.10)}{23.74}\ LCC - \underset{(3.67)}{11.91}\ D \qquad r^2 = .116$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad s.e. = 36.11$$

Table 10. Cost matrix for transportation model with full skill mobility

Demand points	Supply points[a] Location 1				Location 2				Location 3				Location 4				
	L	O	C	F	L	O	C	F	L	O	C	F	L	O	C	F	
Location 1																	
Laborers	63	87			99	99											
Operatives	101	82	101		113	113	113										
Craftsmen		112	98			124	124										
Farmers	106	106		90	118	118											
Location 2																	
Laborers	99	99			63	87			99	99							
Operatives	113	113	113		101	82	101		113	113	113						
Craftsmen		124	124			112	98			124	124						
Farmers	118	118			106	106		90	118	118							
Location 3																	
Laborers					99	99			63	87			99	99			
Operatives					113	113	113		101	82	101		113	113	113		
Craftsmen						124	124			112	98			124	124		
Farmers					118	118			106	106		90	118	118			
Location 4																	
Laborers									99	99			63	87			
Operatives									113	113	113		101	82	101		1
Craftsmen										124	124			112	98		
Farmers									118	118			106	106		90	1
Location 5																	
Laborers													99	99			
Operatives													113	113	113		1
Craftsmen														124	124		
Farmers													118	118			1
Location 6																	
Laborers	99	99															
Operatives	113	113	113														1
Craftsmen		124	124														
Farmers	118	118															1
Location 7																	
Laborers	99	99			99	99			99	99			99	99			
Operatives	113	113	113		113	113	113		113	113	113		113	113	113		1
Craftsmen		124	124			124	124			124	124			124	124		
Farmers	118	118			118	118			118	118			118	118			1
Location 8																	
Laborers	121	121			121	121			121	121			121	121			1
Operatives	135	135	135		135	135	135		135	135	135		135	135	135		1
Craftsmen		146	146			146	146			146	146			146	146		
Location 9																	
Laborers									123	123			111	111			1
Operatives									136	136	136		124	124	124		1
Craftsmen										147	147			135	135		

[a] L stands for Laborers; O stands for Operatives; C stands for Craftsmen; F stands for Far

Location 5				Location 6				Location 7				Location 8			Location 9		
F	L	O	C	F	L	O	C	F	L	O	C	F	L	O	C	L	O	C
					99	99			99	99			105	105				
					113	113	113		113	113	113		119	119	119			
						124	124			124	124			130	130			
					118	118			118	118			124	124				
									99	99			105	105				
									113	113	113		119	119	119			
										124	124			130	130			
									118	118			124	124				
									99	99			105	105		106	106	
									113	113	113		119	119	119	120	120	120
										124	124			130	130		131	131
									118	118			124	124		125	125	
	99	99							99	99			105	105		94	94	
	113	113	113						113	113	113		119	119	119	108	108	108
		124	124							124	124			130	130		119	119
90	118	118							118	118			124	124		113	113	
	63	87			99	99			99	99			105	105		106	106	
	101	82	101		113	113	113		113	113	113		119	119	119	120	120	120
		112	98			124	124			124	124			130	130		131	131
	106	106		90	118	118			118	118			124	124		125	125	
	99	99			63	87			99	99			105	105				
	113	113	113		101	82	101		113	113	113		119	119	119			
		124	124			112	98			124	124			130	130			
	118	118			106	106		90	118	118			124	124				
	99	99			99	99			63	87			93	93		106	106	
	113	113	113		113	113	113		101	82	101		107	107	107	120	120	120
		124	124			124	124			112	98			118	118		131	131
	118	118			118	118			106	106		90	112	112		125	125	
	121	121			121	121			109	109			92	115		129	129	
	135	135	135		135	135	135		123	123	123		129	112	129	142	142	142
		146	146			146	146			134	134			140	127		153	153
	123	123							123	123			129	129		99	118	
	136	136	136						136	136	136		142	142	142	132	118	132
		147	147							147	147			153	153		143	133

or Farmers.

All the variables in this regression were significant at the 5% level except work in Mason City and work in Charles City. The fit of this equation is not as good as one previously fit to the required wages of men because age was a major factor in the previous regression and is not included here. Age was not included because the demands for workers were obtained from census data which did not classify workers by age, skill, and county. No suitable method was available for dividing the demands into age groups.

Each of the variables in this equation is defined as 0 or 1 depending on the wage to be estimated. The estimated wage becomes the summation of the appropriate coefficients.

The under 15 miles distance variable, D, is defined as 1 in estimating the wage for men to live and work within the same area and defined as 0 to estimate wages for contiguous areas. Thus, required wages were $11.91 lower for the area in which the worker lived than for contiguous areas.

The live in Mason City or Charles City variables are included to compensate for the higher wages required by the men living in Mason City or Charles City to work in Mason City or Charles City. Variables for wages required to work in Mason City and Charles City were included even though they were not significant since both towns were included as separate labor market areas in the model.

Data in Table 10 show the cost matrix for the full mobility assumption of the transportation model. When the restricted skill mobility assumption is employed, some of the costs are eliminated. Allocations are

assumed to be infeasible where no cost was given to the model.

The demands for the transportation model were obtained from the census classification of persons employed by skill by county. These were divided into labor market sub-areas as shown in Table 11. The supplies were the total of the number employed in each area and skill, the number unemployed in each area, 2% of farmers for those willing to accept second jobs and 1% of other skills for second jobs. The man willing to accept a second job is treated as another man seeking employment although he is one man counted twice. The difference between the supply and demand in each area is the excess supply, not just unemployment since those workers seeking second jobs are also included.

The unemployed, the second job seekers, and the persons who would like to change jobs are active in the labor market. Those employed but not interested in changing jobs are already firmly committed to their present job and are, therefore, not active in the market. However, the labor market as reflected in the transportation model assumes that everyone is active in the market. It is hoped that most of the presently employed persons will remain in their current jobs with the movements between jobs and locations concentrated among those workers who are active in the market.

Table 11. Number of workers supplied and demanded by skill and area of residence[a]

Area of residence	Laborers		Operatives		Craftsmen		Farmers		Total	
	Demand[b]	Total supply[c]	Demand[b]	Total supply[c]	Demand[b]	Total supply[c]	Demand[b]	Total supply[c]	Demand[b]	Total supply[c]
1	210	250	671	712	798	850	1810	1850	3489	3662
2	218	247	350	370	304	322	1009	1034	1881	1973
3	211	228	401	412	298	303	771	788	1681	1731
4	275	322	652	697	432	459	1454	1487	2813	2965
5	596	680	573	615	560	590	2080	2122	3809	4007
6	312	334	499	522	415	434	1308	1334	2534	2624
7	712	791	883	936	725	802	2387	2451	4707	4980
8 (Mason City-Clear Lake)	921	1087	2465	2548	1801	1909			5187	5544
9 (Charles City)	114	144	653	676	531	567			1298	1387
Total	3569	4083	7147	7488	5864	6236	10819	11066	27399	28873

[a]Source: U.S. Census of Population (57).
[b]Number of males employed.
[c]Number of males employed, unemployed, or seeking second jobs.

SIMULATION RESULTS

Nine runs of the simulation model will be discussed, the results of which are summarized in Table 12. In the following discussions, any allocation that is not to the same skill in the same area as the person lives will be referred to as a "change." Thus, a change can refer to changing skill class, changing location, or changing both.

NIAD Labor Market as Perceived by the Model

Run 1--benchmark with full skill mobility

The first run of the NIAD labor market was to establish a benchmark situation in the labor market against which simulations can be compared. The labor supplies for the benchmark run of the model included those workers currently employed or unemployed as determined from the census and those workers seeking second jobs as determined from the survey. The demands were the currently filled jobs determined from census data (See Table 11).

The least cost allocation of workers to jobs was estimated under the assumption of full skill mobility with the cost matrix as shown in Table 10. With full skill mobility, laborers could be placed in jobs for laborers or operatives; operatives could be placed in jobs for laborers, operatives, or craftsmen; craftsmen could be placed in jobs for operatives or craftsmen; and farmers were allowed to accept non-farm jobs as laborers or operatives in addition to farming.

The solution of the model placed all of the unemployed and second job seeking laborers and operatives from the rural areas in Mason City and

Table 12. Summary of simulation results

Run number	1	2	3	4	
Purpose	Benchmarks		Eliminate excess supply		Com
Supply conditions	As in Table 11	As in Table 11	As in Table 11	As in Table 11	As Tab
Demand conditions	As in Table 11	As in Table 11	Non-farm increased 8.9%	Non-farm increased 6.3%	Mas and Cha inc 22.
Mobility assumption	Full	Restricted	Full	Restricted	Ful
Move to Mason City	175	0	28	8	5
Move to Charles City	189	35	11	0	
Move between rural areas	0	0	56	28	
Area 7 to Mason City	273	130	76	70	2
Area 4 to Charles City	152	152	43	67	1
Skill changes in Mason City	0	0	124	0	
Skill changes in Charles City	264	0	31	0	
Skill changes in rural areas	0	0	241	25	
Total number of changes	1053	317	610	198	10
Number of shadow costs under $10.00	34	21	54	26	
Average wage of employed	$93.03	$93.29	$93.66	$93.50	$9
Excess supply - total	1474	1474	0	432	
Laborers, rural areas	0	271	0	128	
Operatives, rural areas	0	137	0	0	
Craftsmen, rural areas	89	89	0	0	
Farmers	150	214	0	120	
Laborers, urban areas	166	243	0	161	
Operatives, urban areas	317	237	0	19	
Craftsmen, urban areas	752	283	0	4	
Changes by skill					
Laborer to operative	348	0	197	0	3
Operative to craftsman	469	0	145	0	1
Farmer to laborer	0	0	0	0	
Farmer to operative	97	33	248	127	2
Laborer to laborer	0	47	8	30	
Operative to operative	0	98	0	10	
Craftsman to craftsman	139	139	12	31	2
Craftsman to operative	0	0	0	0	

4	5	6	7	8	9
excess	Concentrated job creation		Reduce agricultural employment		
As in Table 11	As in Table 11	As in Table 11	As in Table 11	As in Table 11	As in Table 11
Non-farm increased 6.3%	Mason City and Charles City increased 22.7%	Mason City and Charles City increased 16.1%	Farmers decreased 5.0%, non-farm increased 3.3%	Farmers decreased 5.0% non-farm increased 3.3%	Farmers decreased 5.0% non-farm increased 12.1%
Restricted	Full	Restricted	Full	Restricted	Full
8	548	300	102	0	155
0	55	25	103	12	0
28	0	0	0	5	38
70	273	194	316	260	183
67	152	152	181	181	94
0	0	0	0	0	111
0	3	0	266	0	45
25	0	0	7	2	541
198	1031	671	975	460	1167
26	37	9	36	20	45
$93.50	$94.34	$94.17	$93.25	$93.43	$94.09
432	0	434	1474	1474	0
128	0	271	0	198	0
0	0	0	0	58	0
0	0	0	39	34	0
120	0	86	499	497	0
161	0	77	136	200	0
19	0	0	308	341	0
4	0	0	492	146	0
0	304	0	262	0	55
0	176	0	346	0	329
0	26	0	0	0	20
127	221	161	289	291	759
30	17	47	0	38	4
10	59	235	0	48	0
31	210	228	78	83	0
0	18	0	0	0	0

Charles City as operatives and craftsmen. All available craftsmen and farmers who lived within 15 miles of Mason City and Charles City also became employed in the urban areas. These lower cost workers replaced the higher cost operatives and craftsmen who lived in Mason City and Charles City, forcing them into unemployment.

The movement of workers into Mason City and Charles City would mean that 364 men would have to move or commute more than 15 miles to work while 689 more would change skill group within their own area. This would be a total of 1,053 changes in jobs and/or location, 3.6% of the labor force. While this is not a large percentage of the labor force, it would be a disruption of the labor market patterns.

The reason for these changes was the high current wages of operatives and craftsmen in Mason City and Charles City. Persons living in the rural areas were willing to work in Mason City and Charles City at lower wages than those living in these towns. This result would be expected given the objective function of the model which requires employers to hire the lowest cost workers who are available and qualified. Because of the assumption of full skill mobility, laborers are assumed to be qualified for operative jobs and operatives are assumed to qualify for craftsmen jobs.

Of course, the indicated 3.6% replacement of urban operatives and craftsmen with lower cost less experienced rural workers may not be practical. The replacements might not have the experience and might not be as productive as the replaced workers. Many of the replacements would be moving up a skill class and might not meet the higher skill require-

ments for the better paid position without some training. However, some selective replacement of high cost urban workers by lower cost rural workers is possible and feasible. If the model has exceeded the feasible replacement rate, the reduction in labor cost estimated would be offset by a still larger reduction in productivity.

A useful tool in determining the feasibility of worker replacement is the learning curve. A learning curve shows the time necessary to complete a task as a function of the frequency at which the task is performed and the complexity of the task. The slope of the curve will be relatively flat for a simple task which is performed repeatedly. The experienced worker would have only a small advantage in efficiency and productivity over a new worker. The new worker will perform the task frequently and soon be almost as efficient as the experienced worker. Thus, a small difference in wages would justify the replacement of the higher cost experienced worker with a lower cost inexperienced worker. The more complex the task, the steeper the learning curve and the larger advantage the experienced worker would have in comparison to the inexperienced worker. Thus the difference in wages must be larger to compensate for the difference in efficiency and productivity.

The feasibility of replacing high cost experienced workers with lower cost inexperienced workers, thus, depends on a) the complexity of the task, b) the frequency with which it must be performed, and c) the wage difference between the workers. These factors must be weighed by each employer in each situation.

The NIAD labor market does not operate under perfect competition. The response of workers and employers to price differences is not instantaneous, but is restricted because of immobility, union seniority rules, and employer preference for experience. All labor even within the same skill is not homogenous. Some increased homogeneity could be obtained by increasing the number of skill groups. But, within skill groups variation would still exist due to experience in a particular job. The lack of perfect knowledge of all alternatives on the part of workers of course means the market is not perfect and the response of workers and employers is less than instantaneous to price differences.

The average weekly wage of those employed in this first simulation run of the NIAD labor market was $93.03 per week. If everyone had been employed in his own area in his own skill, the average weekly wage would have been $93.37. Thus, the labor cost minimizing simulation of the NIAD labor market reduced the average weekly wage by $0.34 or 0.4%. This appears to be a small difference in weekly wages but when spread over the 27,399 employees for a year, it amounts to almost half a million dollars. Such a reduction in total labor costs would improve the competitive position of the NIAD employers slightly. However, savings on specific job changes are as much as $55 per week. The model observes such wage differences and, by definition, selects the least cost allocation of workers to jobs.

The differences are small in average wages and total wages between the simulation with mobility and a simple placing of workers in jobs in their own area. This is because in the simulation most of the workers

remain in their own skill and in the same area as they reside. The relatively small number of changes when averaged over the total number of men employed makes little change in total labor cost or average wage.

The required wages used in the transportation model are subject to estimation errors. Such errors could cause a different allocation of workers to jobs. If a potential allocation of workers to jobs was not included in the final solution of the run, lowering the required wage should make that allocation more economical and it would have become part of the final solution. The shadow cost is the amount that the required wage would have to be lowered in order for that route of the transportation model to be utilized.

Therefore, an examination of the shadow costs will show which alternative labor market movements could occur because of errors in estimating required wages. Shadow costs of less than $10 per week will be used as the criteria for determining possible alternative patterns. Ten dollars per week was selected because, based on the standard errors of the regression coefficients, such a difference between average required wages of two groups usually was significant at the 95% level.

In the benchmark run of the model with full skill mobility, most of the low shadow costs were for rural area laborers to replace rural area operatives. In the final solution, no rural area workers moved to different skills in rural areas but such movements could occur if wages required by rural laborers were lowered by not more than $10 per week. Other shadow costs under $10 per week were for more rural area workers to replace Mason City and Charles City workers. Thus, the presence of

low shadow costs does not alter the conclusion that rural area workers could replace urban workers lowering the total labor costs in NIAD.

In addition to estimation errors causing instability of the solution, workers may be willing to change their wage expectations and requirements in order to replace another worker. Urban workers might be willing to reduce their current wages in an attempt to retain their job which is threatened by a rural worker. The presence of unions will likely prevent such reductions or perhaps make them unnecessary because of provisions prohibiting his involuntary replacement. On the other side, the rural worker may lower his required wages depending on his particular situation. If farm prices were low or if a convenient opportunity to leave farming were presented, the farmer may be willing to accept non-farm employment on a full time or second job basis more readily and at a lower wage.

In summary, this first run of the model allocated the available supply of workers to available jobs and unemployment. Most of the workers were allocated to jobs in their current skill group in the area where they live. More people were unemployed since those from rural areas seeking second jobs were employed. Those who became unemployed were high wage skilled workers in urban areas. Laborers and operatives from rural areas received jobs because they required lower wages than the current wages of the operatives and craftsmen in Mason City and Charles City. Thus, the workers from rural areas forced the urban workers of higher skills into unemployment. The total labor bill was reduced making NIAD employers slightly more competitive. In general the benchmark

simulation is quite similar to the current labor utilization pattern.

According to the model including the full skill mobility assumption, Mason City and Charles City employers may be foregoing opportunities to reduce labor cost, if they do not hire lower cost rural workers who will work for lower wages and lay off some higher cost experienced workers. However, they may not be free to do so because of labor contracts and/or may not want to do so because of the difference in productivity. The cheaper workers per week may produce enough less that labor costs per unit of output will rise. Skill and experience not detected in the model may justify the wage differences.

The model represents an estimate of the NIAD labor market if unleased from inter-skill mobility constraints. Training and retraining might be necessary to obtain the skill mobility assumed by the model. However, the commuting or residential movement of workers into Mason City and Charles City from rural areas probably is not an obstacle if the job qualifications could be met.

Run 2--benchmark with restricted skill mobility

Since there is uncertainty as to the degree of mobility among skills, a more restrictive skill mobility assumption was made. Under this assumption, all workers must remain in their skill group excepting farmers who could accept non-farm employment as laborers or operatives. This restricted skill mobility assumption is used in Run 2 of the model, the results of which are summarized in Table 12.

In Run 2 all of the excess workers living within 15 miles of Charles City replaced an equivalent number of comparably skilled workers in

Charles City forcing them to become unemployed. Farmers near Charles City seeking second jobs replaced Charles City operatives. Similarly, the excess unemployed operatives and craftsmen living near Mason City replaced their counterparts in Mason City. In addition, 35 craftsmen from over 15 miles away replaced craftsmen in Charles City. This is a total of 317 changes in jobs, less than one-third of the number of changes required under the full skill mobility assumption with the same supply and demand conditions. Of course, the labor bill was reduced less and the chance of unqualified workers was less also.

When the skill mobility was restricted, there was less replacement of expensive Mason City and Charles City workers forcing fewer of them into unemployment. Thus, the excess supply of workers in Run 2, unemployed and second job seekers who did not find employment, was now not concentrated in the urban areas but spread throughout the area. Forty-eight percent of the excess supply was in the rural areas versus only 16% in Run 1 of the model.

Even with the restricted skill mobility, Run 2 illustrated the same pressure of lower wage workers replacing the higher wage workers, rural workers replacing urban workers, and less experienced replacing more experienced workers. These forces are real and most likely combine to hold down wage increases for the experienced urban workers in NIAD.

There is a probable pattern of outmigration from NIAD. This process may be likened to a "domino" effect with the experienced urban workers moving to another area vacating a NIAD central city position which is filled by a lower skilled urban worker who in turn is replaced by someone

from the rural areas whose non-farm job in a rural area is taken by a farmer. The extent to which this system operates cannot be determined from the information available. However, the general pattern is simulated by the model although not all of the intermediate steps are evident. There was no evidence to reject the replacement pattern.

The nature of the "push" effect of cheap rural workers against urban experienced workers has been simulated and explained. There may also be a "pull" effect against all skill levels of opportunities outside NIAD. Other areas may offer more wages and induce all types of workers to move to other parts of the state or midwest. Thus, experienced workers may leave NIAD as well as unemployed workers and underemployed farmers. The migration pull effect on experienced NIAD workers would be increased by lower wages within the region relative to wages of similar workers outside the region. The availability of plentiful rural workers in NIAD may hold down wages for experienced workers.

All the low shadow costs of the final solution of Run 2 were for the replacement of Mason City and Charles City operatives and craftsmen by workers from rural areas. Thus, with small changes in the relative cost or willingness to commute from different outlying rural areas, the workers from one rural area would replace those commuting from another rural area. To some extent, lower required wages by rural workers would increase the number of rural workers replacing urban workers. Such changes would reduce the excess supply of workers in rural areas with a corresponding increase in excess supply of Charles City and Mason City.

Naturally the restricted skill mobility assumption allows fewer movements within the NIAD labor market. Probably less skill mobility portrays more accurately the restrictions imposed by employers if there is some unemployment. With full employment, a more liberal skill mobility would be permitted by employers and the first assumption may be more accurate when employers relax their requirement as they must to fill their openings. The high current wages in Mason City and Charles City relative to wages required by rural workers allowed rural workers to replace urban workers. The pressure could be accentuated with a) small decreases in wages required by rural workers or b) small increases in urban wages.

Under restricted mobility the excess supply was spread throughout the areas rather than concentrated in the urban areas as under the full skill mobility assumption. The transportation model with variable assumptions on skill mobility is a reasonable approximation of the NIAD labor market.

Elimination of Excess Supply

The elimination of excess labor supply is one of the usual objectives of local interests. This implies that all those men who are unemployed or seeking second jobs become employed. Full employment could be achieved by creating jobs throughout NIAD or by concentrating job creation in the two largest cities, Mason City and Charles City. Both alternatives will be simulated.

Run 3--proportional job creation with full skill mobility

Run 3 simulated the elimination of excess labor supply by creating jobs proportional to current employment in all nine areas of NIAD. Since there is little likelihood of increasing agricultural employment, all hypothesized new jobs were non-farm. Labor demand for non-farm jobs was increased 8.9% in all non-farm skills in all areas for a total of 1,474 new jobs. This was sufficient to provide jobs for the unemployed and second job seekers.

Such a proportional increase or scaled up labor demand is not likely. That is, it is not a prediction of the pattern of where jobs will actually be created. Newly created jobs tend not to be proportional to existing labor demands. They are most likely to occur in the 3 or 4 larger towns of NIAD. This assumption implies at least nine job creating investments would be made in NIAD (at least one for each area). The jobs created in each area would be of the same proportion skilled and unskilled as present employment. The "balanced" job creation pattern is merely a convenient assumption and easy to work out mathematically.

However, even with such an unusual and convenient growth in labor demand and assuming full skill mobility (everyone could move up or down one skill class), 95 men would have to move or commute 15 miles or more and another 515 would have to change skill classes within their own area to become employed. This is fewer changes than were required in the first run of the model where the labor cost was minimized with no increase in jobs. In Run 1, the benchmark, there were 364 movements of over 15 miles to Mason City and Charles City, but under the assumption of proportional

increases in jobs in every skill and location (Run 3), only 39 men would have to move to Mason City and Charles City with another 39 moving between rural areas and 17 moving out of Charles City. Actually the ideal job creating patterns would be one with more unskilled workers required than the present employment pattern.

To become employed as labor demand grew proportionately, 241 men would have to change skill classes within the rural areas. In the first run to minimize labor costs, no skill changes needed to take place within rural areas. Of course with proportional labor demand increase, there was no replacement of Mason City and Charles City experienced workers and no one was forced into unemployment with full skill mobility. Thus, achieving job creation of 8.9% in every location and spreading the excess supply to skills without restrictions on skill mobility would cause little disruption of current job patterns. However some commuting and some skill mobility was required. Thus, it is desirable from the workers and local leaders standpoint to create jobs in every area and in every skill since there is little disruption. However, this is probably not economically feasible since to create the needed jobs in this manner would require a number of smaller developments spread throughout NIAD. Job creation in larger developments in the larger cities of NIAD is more economically feasible. This condition will be discussed and simulated in Runs 5 and 6.

The number of shadow costs under $10 per week increased to 54 with no excess supply from the 34 in first run of the model when there was excess supply. The increase occurred in the rural areas, particularly for laborers moving to operative jobs, operatives moving into craftsmen jobs,

and farmers potentially moving to non-farm jobs as laborers and operatives. Thus, with small declines in required wages, a number of shifts could take place within the rural areas as well as in Mason City and Charles City. This indicates that the commuting patterns may not be stable and with small changes in the wage structure, an apparently inefficient pattern could appear. Thus, it is possible to understand that in reality second job seekers might force full time employees into unemployment and there could be cross-area commuting.

The excess supply of workers could be eliminated by proportional increases in all non-farm labor demands. This simulation required fewer changes than did the first run of the model which included excess supply. The demands in Run 3 of the model were increased proportionally to current employment. However, even this pattern of job creation, as unrealistically convenient as it is, requires some changes. The excess supplies are not distributed proportionally to employment. Thus, some reallocation of workers to jobs was necessary to match the available supply to the location of proportionately increased jobs.

Run 4--proportional job creation with restricted skill mobility

If skill mobility is restricted by forcing all workers to remain within their skill group, it is not possible to obtain full employment with a pattern of job creation proportionate to existing employment. Before reaching a 8.9% proportional increase in labor demand, a shortage of craftsmen develops if no operatives are permitted to become craftsmen. Since no workers are permitted to enter the craftsmen skill group under

restricted skill mobility, job creation is limited to the current craftsmen supply within NIAD. Thus, either craftsmen would have to be imported or laborers exported to meet a proportional demand increase. The excess supply of craftsmen, including those willing to accept second jobs, was 6.3% of the employed craftsmen. Thus, a proportional increase of 8.9% in labor demand can not be simulated without creating an excess demand for craftsmen. Beyond a 6.3% increase, craftsmen would have to be trained from the operative group or imported from other areas.

Thus, with restricted skill mobility and a closed labor market, the maximum proportional increase possible in all employment is 6.3%. Thus, 1.6% of the labor force would remain in excess supply if proportional job creation were stopped at the point of the first bottleneck. This would require 1,042 new jobs and leave 432 workers as excess supply. Such an increase could reduce unemployment to zero and leave only some seekers of second jobs in excess supply. However, it might not reduce unemployment to zero. If enough second jobs were taken, some unemployed would stay unemployed. Since both sources of supply are in competition, there is no way to ascertain which component of supply becomes employed and which remains in excess. Thus, without skill mobility or retraining in the NIAD area, job creation should ideally be concentrated relatively more in the lower skill categories which are current areas of NIAD unemployment. If no training is given and jobs increase proportionately, those left in excess supply will be laborers, operatives, or farmers.

Retaining the restricted skill mobility assumption, all demands for workers except farmers were increased 6.3% in Run 4 of the simulation

model leaving an excess supply of 1.6%. Only 36 men were allocated to jobs in areas other than where they lived. Twenty-eight of these moves were craftsmen forced to leave Area 7, the central area around Mason City, to fill the increased demand for craftsmen in other rural areas. Another 162 men also had to make changes: 25 farmers to operatives in rural areas and 137 laborers, operatives and farmers adjacent to Mason City and Charles City who worked in the urban areas. This is a total of 198 changes in skill and/or location, the fewest number of changes of any simulations.

There was still an excess supply of 432 workers who were not utilized. These were laborers in both rural and urban areas and farmers. Since the excess supply was composed of laborers and farmers, the simulation seems to suggest that restricted skill mobility and less than perfect competition among workers within skill classes is realistic. It is reasonable given the current high unemployment incidence among laborers and farmers unsatisfied desire for second jobs. Other than some reallocations of craftsmen to even out the supply and demand by locations, there were few movements between areas. Many of the excess farmers moved into operative jobs within their own area.

Thus, a proportional increase of only 6.3% in non-farm labor demands would be feasible under the restricted skill mobility assumption. This is perhaps the most feasible and desirable job creation pattern for the area leader of all of the simulations in this study. This one required the fewest number of changes and would not require wage increases or importation of workers. From a practical standpoint, this simulation retained a

small pool of unemployed (1.6%) which is probably more realistic than eliminating all excess supply.

Neither Run 3 or 4--the simulation runs raising all non-farm labor demands--is as stable as Run 1 or 2. That is the pattern of commuting and job matching is less stable or certain if jobs increase. Fewer changes of location or skill were required to minimize total labor cost in the market if more jobs are created. This was because the excess labor supplies were spread throughout NIAD into newly created jobs rather than concentrated as excess supply of expensive experienced workers in the urban areas.

The average weekly wages of the employed persons were a little above Runs 1 and 2. The reason for this is that high wage urban workers were employed and not replaced by lower cost workers. As would be expected as full employment is approached, the average wage tends to increase. If job creation could be concentrated in the lower skills and in rural areas, the average wages might decrease because of the higher proportion of low skill low wage workers. However, such a pattern is probably very difficult to create in practice.

Even the restricted mobility assumption provides flexibility. Laborer and operative demands can both be met by the excess supply of farmers. If farmers were not able to enter the operative group, to eliminate unemployment among operatives would require only a 4.8% increase in total demand. But since all of the excess farmers were permitted by the model to become operatives, a realistic assumption, the operative job creation

could be as much as 8.2% without creating an operative shortage. Thus, if it were not for the availability of farmers seeking second jobs as operatives, proportionate job creation would be limited not to 6.3%, but 4.8%.

If farmers are allowed to fill operative jobs and jobs are created proportionately, laborers will be in excess supply but much less so than if farmers are considered also as only available for unskilled labor. Among laborers, a 14.4% increase in total demand is the minimum to eliminate the excess supply. If farmers are added to the labor group, 21.3% is the required labor increase. If all excess farmers were to become laborers 761 laborer jobs would be needed in NIAD.

Therefore, given the restricted skill mobility assumption and a constant demand for farmers, elimination of all the excess supply of workers in NIAD would require a 6.3% increase in total demand for craftsmen, a 4.8% to 8.2% increase in the demand for operatives, and a 14.4% to 21.3% increase in the demand for laborers. The assumption of double qualification of farmers as laborers or operatives create the range for laborers and operatives.

The availability of craftsmen could be the critical skill in NIAD. A shortage of importable craftsmen or craftsmen training programs was probably restricting the industrialization of NIAD in 1965. The abundant supply of operatives and especially laborers is the dilemma of NIAD and many areas. The advance of technology has increased the demand for more skilled workers and lowered the demand for unskilled labor.

Run 5--concentrated job creation with full skill mobility

The concentration of job creation in Mason City and Charles City is distinctly more feasible than spreading job creation throughout the area. Larger developments are possible and the larger communities could more easily assimulate the demand for water, sewage, power, banking, housing, etc. that new employment would create.

To simulate the concentration of job creation in urban areas, Run 5 of the model eliminated excess supply by adding jobs in Mason City and Charles City while holding all other labor demands constant. No jobs were eliminated outside of these central cities, only the new job creation was concentrated in the central cities. Again, job creation was assumed proportional to current central city employment patterns. Because of the smaller base of current employment, labor demands were increased 22.7% in these two cities to create 1,474 jobs and thus eliminate all the excess supply of labor in NIAD.

Under the full skill mobility assumption, 548 men would have to move or commute more than 15 miles to Mason City and 55 would have to move or commute to Charles City. Another 428 men living within 15 miles of Mason City and Charles City would have to take employment in these cities. This is a total of 1,031 changes, essentially the same as in Run 1, the benchmark but this time the rural workers were coming in to take new jobs. Urban workers this time are not forced into unemployment. However, the number of men having to work in an area different from where they lived if jobs were created in the central cities was 603. Thus to create jobs enough for the workers in the central cities would cause considerable

commuting or change of residence.

Thus, under the full skill mobility assumption, all unemployment could be eliminated and all seeking second jobs could be employed by adding sufficient jobs in Mason City and Charles City. However, a large number of changes and moves toward the urban areas would have to take place in the NIAD labor market. This could cause some growth problems in Mason City and Charles City.

There were 37 shadow costs under $10 in the final solution. However, all 37 were zero shadow costs for workers to move into Mason City and Charles City. Any or all of these alternative allocations could have been utilized without changing the total labor bill for the area. Thus, this solution was unstable in the sense that there was a choice as to which workers would work in outlying areas and which would come to the central city. Job creation could be expanded further in Mason City and Charles City with little addition to marginal labor cost. However, further job creation in the central city would eliminate workers from current jobs in rural areas.

The creation of jobs only in Mason City and Charles City required a total of 1,031 changes to eliminate excess supply versus 610 changes to eliminate excess supply by creating jobs throughout NIAD. Both of these simulations assumed full skill mobility. Therefore, the cost of proportionate job creation must be compared with the cost of job and location changes. If proportionate job creation is no more expensive than job creation in the central cities, it should be spread throughout the areas rather than concentrated in one or two locations.

The average weekly wage of those employed was $0.68 higher when job creation was concentrated rather than dispersed. This is 0.7% higher, but for all employees for one year, the total wage bill is about $1,000,000 higher for the same amount of job creation when concentrated rather than dispersed.

However, there are several reasons why concentrated job creation is more likely and feasible which are not included in the simulations. These include new industry's desire to be close to large concentrated supplies of labor, better transportation facilities, better public parks, schools and other services and the better social opportunities of managerial and professional employees in larger communities. Thus, it is more feasible to concentrate job in Mason City and Charles City. The disadvantages are many commuters or much moving to the urban centers. The growth pains of the central cities may limit concentrated job creation before full employment is reached. The alternative effects and cost of concentrated versus proportionate job creation must be weighed by the investors and the local leaders.

Run 6--concentrated job creation with restricted skill mobility

When skill mobility is restricted while concentrating job creation with proportional increases in labor demands, both Mason City and Charles City had an excess demand for craftsmen and operatives. Craftsmen are the limiting skill with a 16.1% proportional increase as the maximum versus 22.7% under the full skill mobility assumption. In Run 6 of the model, all skill demands in Mason City and Charles City were increased 16.1% which left 1.6% of the labor force as excess supply, the same as in

Run 4 when job creation was dispersed.

The solution to the simulated increases in labor demand in Mason City and Charles City allocated 300 men from more than 15 miles away to Mason City and 25 men from over 15 miles distance to Charles City. As much as possible, the increased demands were met from Mason City, Charles City and the surrounding areas as they supplied 69% of the increased demand. Other workers were drawn from areas farther away to fill the remainder of the jobs. The excess supply which was necessary was composed of laborers and farmers. All operatives were employed but there still were farmers available to fill operative positions.

This was the most stable of the simulation runs with only nine shadow costs under $10. All of these low shadow costs were for more workers to move into Mason City and Charles City indicating that some additional workers, except craftsmen, would be available at little added cost. However, beyond this, workers would commute to the urban areas only at higher wage levels.

The average wages of those employed was $0.67 per week higher in this simulation than when job creation was dispersed under restricted skill mobility. This would increase the total wage bill of the area by almost $1,000,000 per year over the dispersed job creation simulation.

Thus, increasing all Mason City and Charles City labor demands by up to 16.1% is feasible under the restricted skill mobility assumption with the increased demand being met first from local and nearby supply and then expanding to the outlying areas. More changes were required than when job creation was spread throughout the area and the average weekly

wages were higher. Thus, the same desirability and obstacles of locating job creation near where the workers live is applicable to both the full and restricted skill mobility assumption. Again, the feasibility and profitability of dispersed versus concentrated job creation investment must be considered irrespective of the skill mobility assumption.

Reduction in Agricultural Employment

The historical decline in agricultural employment has been considerable. Such employment declines can be simulated with the model by reducing the labor demands for farmers with a corresponding increase in the excess supply of workers. In Runs 7 and 8, the demand for farmers is decreased 5.0% (an arbitrary number) while all non-farm labor demands were raised 3.3% resulting in no change in the total excess supply. In other words, just enough non-farm jobs were created to offset the decline in farm jobs. Run 7 assumed full skill mobility while Run 8 assumed restricted skill mobility. In Run 9, all excess supply including 5% of the farmers was eliminated as in Run 3. In this run, a larger increase in non-farm jobs was necessary, 12.1%, to provide jobs not only for the existing excess supply but also for the added excess supply of farmers.

Run 7--reduced farm employment with full skill mobility

Run 7 of the simulation model was under the assumption of full skill mobility with 5.0% fewer farm jobs and 3.3% more non-farm jobs leaving the same excess supply as before the demand changes. To meet this new set of demands, the model directed 102 men to move or commute more than 15 miles to Mason City, 103 to move or commute to Charles City and 763 to

change skills within their own area. The total number of job changes, 975, is a little less than for the benchmark, Run 1, but the number of persons having to move or commute more than 15 miles declined from 359 to 205. The pattern of movements between jobs is very similar to Run 1, the benchmark.

All of the increased demand in rural areas is taken up by the non-farm excess supply existing in rural areas. The farmers become unemployed except for those who lived within 15 miles of Mason City or Charles City who were employed as operatives in those towns. Since more of the excess supply come from farmers, fewer Mason City and Charles City operatives and craftsmen were forced into unemployment than in the benchmark, Run 1.

The conclusion of this simulation is that unless there are employment opportunities in nearby towns for which farmers are better qualified than the excess supply existing within the area, the farmers who leave the farm are likely to become unemployed. Since there will undoubtedly be a decline in agricultural employment, this is further evidence of the advisability of creating more jobs in rural areas. The alternative for the displaced farmers is to leave the NIAD area in search of employment.

Run 8--reduced agricultural employment with restricted skill mobility

In Run 8, the restricted skill mobility assumption was applied to the same simulated set of demands giving similar results. The excess supply within a given location filled the increased demands for their skill and location, the displaced farmers became part of the excess supply except for those within 15 miles of Mason City or Charles City who took employment in these cities, and fewer Mason City and Charles City operatives

and craftsmen are forced to become unemployed than in Run 2.

The number of changes was reduced by more than half from Run 7 where full skill mobility was permitted. With the restricted skill mobility, the movements are between areas. The number of farmers as excess supply is essentially the same in Runs 7 and 8 (499 and 497) indicating that under either skill mobility assumption, reductions in the demand for farmers forced them into excess supply.

Runs 7 and 8 were about equal with respect to stability of patterns within the labor market. About one-half of the low shadow costs in Run 7 were for workers to move into Mason City and Charles City while in Run 8, where skill mobility was restricted, 18 of the 20 low shadow costs were for movements into Mason City and Charles City. This would indicate that other non-farm rural area workers could easily replace urban workers. Very few of the low shadow costs were for the excess supply of farmers to take non-farm employment. Thus, their required wages would have to be lowered more than $10 per week to make them competitive for the non-farm jobs.

The average wages of those employed in Runs 7 and 8 were $0.22 and $0.14 per week higher than in Runs 1 and 2 respectfully. These are small increases, 0.2%, caused by fewer farmers employed who had low current wages, more non-farm workers employed, and fewer high wage workers in excess supply.

Both Runs 7 and 8 demonstrate the same conclusion that unless sufficient employment opportunities are available locally for which the displaced farmers are more qualified than the existing local excess supply,

a reduction in the number of farmers means that they will likely become unemployed.

Run 9--reduced farm employment and elimination of excess supply with full skill mobility

Simulation Run 9 was similar to Runs 7 and 8 in that the demand for farmers was decreased by 5% in all areas. However, the demand for non-farm workers was raised proportionally by 12.1% which would eliminate all the excess supply in the NIAD area. This simulation was run only under the assumption of full skill mobility since it was apparent from previous runs that such an increase in demand could not be met under the restricted skill mobility assumption.

Simulation Run 9 required 155 workers to move to Mason City and 38 workers to move between rural areas. Practically all of the displaced farmers were employed in operative positions. The increased demands for workers in Mason City and Charles City were met, as much as possible, from the excess supply of workers in and around Mason City. The increase demand in the rural areas was met by workers living in the rural areas with 541 workers required to change their skill. The total number of changes required by this simulation, 1167, was the largest of any of the runnings of the simulation model. However, 759 of these shifts were farmers who had to accept non-farm jobs as operatives because of the decreased demand for farmers. This is 511 more farmer to operative shifts than were required when excess supply was eliminated without reducing farm employment. These shifts account for the additional farmers available

because of reduced farm labor demands. Since the simulation assumed that job creation took place in all areas, most of the displaced farmers were employed in the newly created jobs in the rural areas as operatives. There was a sufficient supply of excess laborers available in rural areas to fill the increased demand for laborers.

Thus, a reduction in farm employment and the elimination of excess supply is feasible with full skill mobility. The large number of changes should not be a major concern since a number of farmers were forced to change skills. If job creation had been concentrated in Mason City and Charles City, there undoubtedly would have been a very large number of moves from rural areas to urban areas causing a major disruption of labor market patterns.

Summary of Simulation Results

The transportation model can be adapted to labor market analysis and provides a reasonable approximation of the existing patterns in the NIAD labor market. The linear nature of the transportation model is a fault that can be partly overcome by subdividing the supplies and demands by locations and skill classes. Further subdivision is prevented by data weaknesses but would be desirable to make the skill classes more homogeneous and lessen the difficulties with the linearity assumption. The broad skill classes preclude estimations for specific investments and caused the skill mobility assumptions to be at the extremes. The whole skill class had to be assumed capable of moving to another skill class or none of the persons in that skill could change skill class. Required wages were subject to estimation errors since they were projective answers

by respondents and the sample size limited the number available. However, pooling the data with regression analysis allowed more accurate estimation of differences in required wage levels which served the needs of the simulation model rather well.

If an excess supply of labor permitted choice among workers, the model directed lower cost rural workers to replace higher cost urban workers thus forcing urban workers into unemployment. While this reduces labor cost, it may not be agreeable to unions or employers. The reduction in productivity caused by replacement may more than offset the reduction in wages. When skill mobility was restricted, the excess supply was spread throughout the NIAD area rather than concentrated in the urban areas. Thus available lower cost rural workers hold down wages in the urban areas of NIAD.

The complete employment of all unemployed and second job seekers is feasible by increasing labor demands 8.9%. If jobs are created proportionally throughout the area in all skills and if full skill mobility is permitted, relatively few workers would have to commute or retrain. However, even under this very convenient pattern of job creation, some would have to commute or retrain. When skill mobility is restricted, proportional job creation can not employ all people. An excess demand for craftsmen is created if labor demands are increased more than 6.3% for all skills in all areas. This leaves 1.6% of the manual labor force as excess supply.

Concentrating job creation in Mason City and Charles City forced more workers to change their skill and/or location of employment toward the urban areas to fill the increased demand. The average weekly wages required were higher with concentrated job creation.

When the current off-farm migration was simulated with a corresponding increase in non-farm labor demands, many of the farmers were forced into unemployment. The jobs created by the simulation to offset the farm jobs eliminated were largely taken by unemployed and second job seekers. Farmers required wages were greater than non-farm unemployed. Thus, unless sufficient non-farm jobs are created for all slack in the labor force, some of the off-farm migration will end up in unemployment.

SUMMARY AND CONCLUSIONS

Industrial development is an important aspect of total community development. The most costly and valuable input of industrial development is the local labor supply. Predominately rural areas, such as NIAD, have an excess supply of labor. Under current job creation rates, there must be a constant out migration of young adults. Fuller local utilization of the available local labor supply requires investment in job creating facilities.

Both local leaders and investors need information concerning the local labor cupply. This study was an investigation of the possibility of using a small survey to provide needed information such as the number of workers available, the skills possessed, the interest in alternative types and location of employment and the wages required. The interdependent effects of job creation on the local labor market were simulated by a computer manipulation of a transportation model.

Labor markets are segregated or compartmentalized by skill, spatial, time, and industry dimensions. The NIAD labor market was divided in this study into skill and spatial dimensions with the regional labor market.

The setting of this study is the North Iowa Area Development (NIAD) region in north central Iowa. Approximately 150,000 people reside in the 4,600 square miles encompassing seven full counties and portions of two other counties. The labor force is 55,000 workers of whom 16,000 work in agriculture and 8,000 in manufacturing. There are a few industrial firms in the small communities and rather significant industrial and retail employment in Mason City and Charles City.

The major portion of this study is concentrated on the men in manual occupations within the NIAD labor market. Manual occupations include laborers, operatives, craftsmen and farmers. They comprise 72% of the NIAD labor force. The match of men and jobs within these skills is of most concern to investors and local leaders.

Construction of an area labor supply function incorporating sources of labor supply within NIAD was attempted. The quantity of labor available from each of several sources was estimated but the lack of sufficient data precluded estimation of wage levels for each source.

The average current wage of questionnaire respondents was significantly correlated with the respondent's age, skill, and industry with higher wages for those working in Mason City and Charles City. When the variables were combined into a multiple regression, the high correlation between skill and industry caused the industry variable to become non-significant. Thus, the age, skill, and industry variables define some of the dimensions of the NIAD labor market.

Each respondent was asked to indicate what wage he would require to accept employment in each of four alternative towns. The difference between a respondent's current wage and his required wages was larger, both relatively and absolutely, for men with lower current wages than for men with higher current wages. Significantly higher wages were required if the respondent was an operative or craftsmen, was over 35 years of age, lived more than 15 to 20 miles from the town in question or the town was over 4,000 population. Additional wages are necessary to overcome additional commuting distance or moving expenses.

The survey responses indicated a reluctance to commute more than 20 miles to work. Of the men willing to accept employment, 43% indicated they would commute one to 20 miles to work. Only 23% of those who would need to commute more than 20 miles said they would accept a job that far away. The present commuting pattern showed 24% of the non-farm labor force commute 15 miles or less and only 5% commute more than 15 miles. Thus, most workers live and work in the same city, town or rural area.

The occurrence of breaks at 15 to 20 miles for willingness to commute and required wage levels provides strong evidence that perhaps 15 to 20 miles is the more relevant size area with respect to labor markets. Conceptually, this would mean nine labor market areas within a functional economic area, each with an employment center. However, when applied to the NIAD area, the location of the towns indicates seven areas. These seven labor market areas plus Mason City and Charles City comprise the nine areas which were used for the simulation of the NIAD labor market.

The transportation model was used in the simulation of the NIAD labor market. The supplies of workers and the demands for workers in four skill classes were grouped within each of the nine labor market areas identified in NIAD. The "transportation costs" were the wages required by workers to accept employment in each of the areas and skills. The objective function minimized the total labor bill for the area. Employers were forced to hire the qualified workers that would work for the lowest wage. Thus, the solutions are an area optimum and are not necessarily an optimum for any single location or particular employer.

The assumptions of the transportation model fit reasonably well the needs of the NIAD labor market problem. A major difficulty lies in the

linearity assumption of the transportation model which forces employers to completely exhaust one supply source before utilizing other sources. Thus, all workers in one area were employed before any were employed from other areas. The lack of available data and computational techniques precluded curvilinear analysis which would have been more realistic.

The simulation analysis of the NIAD labor market indicated that lower cost rural workers should replace urban workers and force the urban workers into unemployment. Such replacement is partially realistic but the extent to which it is possible depends on productivity and wage differences.

When skill mobility is restricted, a proportional increase in jobs would create a shortage of craftsmen in NIAD before the excess supply of workers is eliminated. Thus, craftsmen is the restricting skill in NIAD industrialization and training programs or importation of craftsmen are required unless disproportionally more jobs for laborers can be created.

The workers might prefer job creation spread throughout NIAD since fewer changes in skill and location would be required to meet the added demand. However, investors may prefer to concentrate job creation in the largest cities since there may be economies of location and the larger cities could more easily assimulate the growth. The wage bill is higher for concentrated job creation but probably the cost of creating a given number of jobs in Mason City and Charles City is less than in the rural areas.

Farmers are in constant excess supply. The simulation indicated that some farmers migrating off the farm will be forced into excess supply.

The non-farm excess supply become employed first according to the model because their required wages are lower. When sufficient jobs were created for all the excess supply including the displaced farmers, the farmers are employed as operatives since there is a sufficient excess supply of laborers.

It is concluded that a small sample of less than 1%, if combined as a ratio estimator with census data can provide estimates accurate enough only for area wide estimates of broad skill classes. Estimates of labor supply for smaller areas and for more specific skill groups would require special local studies with a larger proportionate sample size.

It is concluded that an area wide labor market simulation may be justified when considering the feasibility of a large job creation facility. The interdependencies among areas and skills are sufficiently great that significant chain reactions may be overlooked without area wide simulation.

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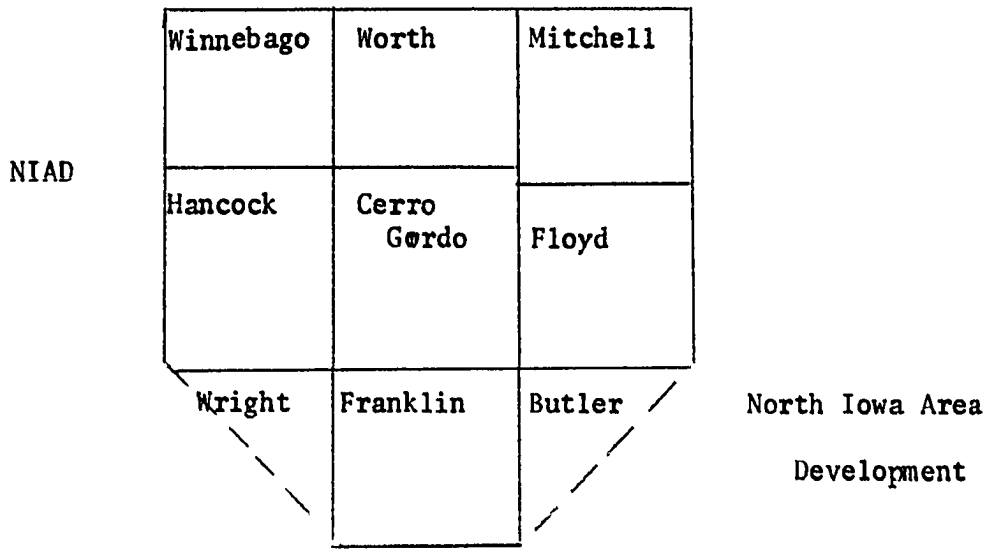
APPENDIX A



Dear Friend:

The North Iowa Area Development (NIAD) committee, is an organization of volunteer leaders whose objective is to study the economic and social problems of North Central Iowa. The Business and Industry sub-committee of NIAD would like to obtain some basic information on the potential labor supply in this area. This information will be useful in attracting new industry to the area as well as to existing industries wishing to expand.

We have requested that Iowa State University in Ames prepare this information and make it available to all interested persons in the NIAD area. Ivan Lappin, Area 4-H Leader from Osage, will be conducting this research project. The research project consists of a questionnaire to be completed by all adults in your family.

The information that you give will be strictly confidential. You need not sign the questionnaires. Please answer all questions completely and accurately. This is imperative to the success of this project.

Thank you for your cooperation.

Sincerely,

/s/ B. E. Throndsen
Business and Industry Committee
North Iowa Area Development
Committee

LABOR QUESTIONNAIRE

(To be completed by each person who is out of school)

Male _____ Female _____

1. Are you:

_____ providing most of the income for the household.

_____ providing supplementary income for the household.

_____ self-supporting but living with others.

_____ living alone.

_____ a housewife not working outside your home.

2. Your age:

Under 25 _____ 45 - 54 _____

25 - 34 _____ 55 - 64 _____

35 - 44 _____ 65 & over _____

3. Education (circle last year completed)

Grammar School 1 2 3 4 5 6 7 8

High School 1 2 3 4

Major areas of study _____

College 1 2 3 4 5 6 7

Major areas of study _____

Trade School 1 2 3 4

Major areas of study _____

1964 Iowa State University of Science and Technology Ames, Iowa

4. Are you currently employed? Yes _____ No _____

Name of employer _____

Location of job _____

Type of work _____

Weekly Wages $_____

5. Please review this list of jobs, and check all of those for which you qualify.

Laborers

_____ Manufacturing
_____ Food Industries
_____ Farm Labor
_____ Construction
_____ Railroad
_____ Wholesale and Retail Trade
_____ Other Laborers (please list)

_____

_____

Service Workers

_____ Barbers
_____ Bartenders
_____ Cooks
_____ Elevator Operators
_____ Hairdressers and Cosmetology
_____ Janitors
_____ Practical Nurses
_____ Firemen
_____ Guards and Watchmen
_____ Law Enforcement Officers
_____ Waiters and Waitresses
_____ Private Household Workers

Operators

_____ Assemblers
_____ Attendants, Auto Service
_____ Brakemen and Switchmen, Railroad
_____ Bus and Taxi Drivers
_____ Laundry and Dry Cleaning Operators
_____ Machine Operators
_____ Meat Cutters
_____ Packers and Wrappers

Operators (continued)

_____ Truck Drivers and Deliverymen
_____ Welders and Flame Cutters
_____ Other Operatives (please list)

_____

_____

Clerical

_____ Bank Tellers
_____ Bookkeepers
_____ Cashiers
_____ File Clerks
_____ IBM Operators
_____ Insurance Adjusters, Examiners and Investigators
_____ Office Machine Operators
_____ Receptionists
_____ Secretaries
_____ Stenographers
_____ Telegraph Operators
_____ Typists
_____ Other Clerical (please list)

_____

_____

Sales Workers

_____ Advertising Agents
_____ Insurance Agents, Brokers, and Underwriters
_____ Real Estate Agents and Brokers
_____ Stock and Bond Salesmen
_____ Retail Sales Person, Store
_____ Retail Sales Person, Other
_____ Wholesale Sales Person
_____ Other Sales Workers (please list)

_____

_____

Managers, Officials and Proprietors

Salaried

_____ Farm Manager
_____ Government Administration
_____ Manufacturing
_____ Wholesale and Retail Trade
_____ Finance, Insurance, and Real Estate
_____ Other Industries

Self-Employed

_____ Farm
_____ Construction
_____ Manufacturing
_____ Wholesale and Retail Trade
_____ Other Industries
_____ Other Managers, etc. (please list)

_____

_____

Craftsmen

_____ Bakers
_____ Brickmasons, Stonemasons and Tile Setters
_____ Cabinetmakers
_____ Carpenters
_____ Cement and Concrete Finishers
_____ Compositors and Typesetters
_____ Cranemen, Derrickmen, and Hoistmen
_____ Electricians
_____ Electrotypers and Stereotypers
_____ Engravers
_____ Excavating Equipment Operators

Foremen

_____ Construction
_____ Manufacturing
_____ Transportation
_____ Communications, Utilities
_____ Inspectors
_____ Linemen and Servicemen, telephone telegraph
_____ Machinists

Mechanics and Repairmen

_____ Air Conditioning, Heating and Refrigeration
_____ Airplane
_____ Automobile
_____ IBM Equipment
_____ Office Machine
_____ Radio and Television
_____ Painters
_____ Plasterers
_____ Plumbers and Pipe Fitters
_____ Roofers and Slaters
_____ Stone Cutters and Stone Carvers

Mechanics and Repairmen (continued)

_____ Structural Metal Workers
_____ Tailors
_____ Tinsmiths, Coppersmiths, and Sheetmetal Workers
_____ Toolmakers and Die Makers and Setters
_____ Other Metal Workers
_____ Other Craftsmen & Foremen (please list)

_____

_____

Professional

_____ Accounts and Auditors
_____ Architects
_____ Artists and Art Teachers
_____ Chemists
_____ Clergymen
_____ Dancers and Dancing Teachers
_____ Dentists
_____ Dietitians and Nutritionists
_____ Draftsmen
_____ Editors and Reporters
_____ Engineers
_____ Farm and Home Management Advisors
_____ Foresters and Conservationists
_____ Funeral Directors and Embalmers
_____ IBM Technicians
_____ Lawyers and Judges
_____ Librarians
_____ Musicians and Music Teachers
_____ Nurses - Registered
_____ Natural Scientists
_____ Pharmacists
_____ Physical Scientists
_____ Physicians and Surgeons
_____ Social Scientists
_____ Teachers and Instructors

Technicians

_____ Medical and Dental
_____ Electrical and Electronic
_____ Other Professional and Technical, (please list)

_____

_____

6. Of the jobs you checked in Question 5, in which would you prefer to work?

1st Choice Job _____

2nd Choice Job _____

3rd Choice Job _____

7. Please check the type of training or experience you have had in:

Your 1st Choice Job

____ High School Courses
____ College Courses
____ Business School
____ Vocational or Technical School
____ On-the-job Training
____ Self-taught through study or experience
____ Correspondence Courses

Others (please list)_____

Your 2nd Choice Job

____ High School Courses
____ College Courses
____ Business School
____ Vocational or Technical School
____ On-the-job Training
____ Self-taught through study or experience
____ Correspondence Courses

Others (please list)_____

Your 3rd Choice Job

____ High School Courses
____ College Courses
____ Business School
____ Vocational or Technical School
____ On-the-job Training
____ Self-taught through study or experience
____ Correspondence Courses

Others (please list)_____

8. Would you be willing to take additional training to get a better job?

Yes _____ No _____

If yes, in which job areas would you prefer to take additional training?

_____ _____

_____ _____

From which of the following would you be willing to take this training?

_____Vocational or Technical School
_____Correspondence Courses
_____High School or College Night Courses
_____Business School

Other (please list) _____

_____

_____Not Sure

9. If you were offered a new full time job in one of the three areas which you listed in Question 6, what would be the minimum weekly wages you would need for working in each of the following cities?

Minimum weekly wage for full time work in Iowa Falls. $_____
Would prefer not to work in Iowa Falls. _____

Minimum weekly wage for full time work in Hampton. $_____
Would prefer not to work in Hampton. _____

Minimum weekly wage for full time work in Mason City. $_____
Would prefer not to work in Mason City. _____

Minimum weekly wage for full time work in Charles City. $_____
Would prefer not to work in Charles City. _____

Minimum weekly wage to move to the Des Moines area. $_____
Would prefer not to work in the Des Moines area. ____

Minimum weekly wage to move to the Twin Cities area. $_____
Would prefer not to work in the Twin Cities area. ___

Other nearby towns in which you would work, and the minimum weekly wage you would need for full time employment in each town.

Town	Minimum Weekly Wage
_____	$_____
_____	$_____

10. If you were to accept a job in a location other than where you now live, would you move to that city if it were:

Iowa Falls?	Yes _____	No _____
Hampton?	Yes _____	No _____
Mason City?	Yes _____	No _____
Charles City?	Yes _____	No _____

11. Would you move to states other than Iowa or Minnesota to work?

Yes _____ No _____

If yes, what minimum weekly wages would you need before you would move?

$ _____

12. What would be the minimum hourly wage you would need for part-time employment in a new job in the following cities?

Minimum hourly wage to work part-time in Iowa Falls. $_____
Would prefer not to work in Iowa Falls. _____

Minimum hourly wage to work part-time in Hampton. $_____
Would prefer not to work in Hampton. _____

Minimum hourly wage to work part-time in Mason City. $_____
Would prefer not to work in Mason City. _____

Minimum hourly wage to work part-time in Charles City. $_____
Would prefer not to work in Charles City. _____

Other cities in which you would work on a part-time job, and the wage you would need before you would work there:

Town	Hourly Wage
_____	$_____
_____	$_____

13. Suppose you were offered your choice between two jobs, Job A was a postal employee and job B was in construction. Which job would you prefer if they both paid the same wages? _____

How much additional wages would you need to accept the other job?_____

THIS PAGE TO BE COMPLETED BY WOMEN ONLY

(Men please turn to next page)

14. Please check the one statement under A or B or C that bests fits your situation.

A. I am not now working outside my home:

_____ and am not interested in outside work.

_____ but would be interested in part-time employment for approximately _____ hours per week.

_____ but would be interested in full-time employment.

B. I am currently working part-time outside my home and:

_____ do not wish new or additional employment.

_____ would be interested in changing to another part-time job.

_____ would be interested in full-time employment.

C. I am currently working full-time outside my home and:

_____ do not wish new or additional employment.

_____ would be interested in changing jobs.

_____ would be interested in additional employment for approximately _____ hours per week.

15. What special conditions would be necessary for you to accept new or additional employment?

_____ None

_____ Particular type job. What type? _____

_____ Special hours or days. When (be specific)? _____

_____ Need someone to help with housework.

_____ Need someone to help care for children or dependent adult.

_____ Other _____

Thank you for your cooperation.

THIS PAGE TO BE COMPLETED BY MEN ONLY

14. Please check the one statement under A or B or C that best fits your situation.

A. I am currently unemployed and:

_____ am retired.

_____ am seeking work.

_____ am not looking for work.

B. I am currently farming and:

_____ am not looking for off-farm employment.

_____ am looking for full-time employment off the farm.

_____ am looking for part-time or seasonal employment off the farm. For what hours, or what season?_____

C. I am currently employed full-time:

_____ and am not interested in changing jobs.

_____ and am looking for a different job.

_____ and am looking for a second full-time job.

_____ and am looking for a second job on a part-time basis.

_____ Other (please specify)_____

15. If you are currently farming and are interested in off-farm employment, please answer the following questions.

Would you continue to farm if you accepted off-farm employment?

Yes _____ No _____

If yes, what changes would you make in your farming operation?

_____ None
_____ Farm fewer acres
_____ Less row crop acres
_____ Less livestock
_____ Use more labor saving equipment
_____ Hire more custom machinery
_____ Use more family labor
_____ Hire more labor
_____ Other (specify)_____

Thank you for your cooperation.

APPENDIX B

NIAD Survey

Skill Code

1. Laborers

0. Under industry
1. Waitress, bartender
2. Janitor, dishwasher, custodian
3. Elevator operator
4. Laundry
5. Paper hanger
6. Seamstress
7. Baby sitting
8. Gas station attendant
9. Bellhop

2. Operator I

0. Unspecified
1. Office machines, IBM
2. Assembler, Airlines work (47 industry)
3. Machine operator
4. Truck driver, deliveryman, draftsman (30 industry)
5. Assistant welder
6. Assistant carpenter
7. Assistant painter
8. Heavy equipment, firemen, boiler room, NW cement
9. Excavating equipment, switch board & turbine operator IPS

3. Operator II

0. Nurses aid - no schooling (76 industry)
   cement & concrete finisher (20 industry)
1. Barber, hairdresser, "scaler" at Deckers (38 industry)
2. Guards, law enforcement, firemen
3. Cook, baker, Tool & die maker unskilled (30 industry)
4. Meat cutter, Machinist unskilled (30 industry)
5. Packer and wrapper, roofing (20 industry)
6. Assistant plumber
7. Assistant electrician
8. Inspector, supervisor
9. Practical nurse - some school (76 industry)
   sheet metal unskilled (32 industry)

4. Clerical

0. Clerk, unspecified
1. Office work, file clerk
2. Typist, secretary, stenographer
3. Bookkeeper, record clerk, Interstate Power (46 industry)
4. Cashier, bank teller
5. Receptionist
6. Telephone operator PBX, radio dispatcher, Dept. of Public Safety (86 industry)
7. Mail carrier, Photographer (74 industry)
8. Library
9. Depot agent, reporter

5. Sales

0. Unspecified
1. Insurance
2. Real estate
3. Retail - in stores
4. Retail - outside stores
5. Wholesale
6. Broker, securities
7. Farm supplier
8. Auctioneer
9. Advertise

6. Mechanics and repairmen

0.
1. Auto
2. Appliances - air conditioner
3. Airplane
4. Radio - TV
5. Mechanic
6. Tarp & canvas, tree trimming
7. Electric motor
8. Telephone
9. Furniture

7. Craftsmen, foremen

0. Watch repair
1. Foremen
2. Welder
3. Electrician
4. Tool and die
5. Machinist
6. Lathe operator
7. Carpenter

Craftsmen, foremen (continued)

8. Brickmason
9. Plumber

8. Manager, proprieter & official

0. Unspecified
1. Farm Operator
2. Farm manager
3. Retail store owner
4. Retail store manager
5. Other - county assessor, ASC county committee, JP, small town mayor, owner of portable grinder, greenhouse (55 industry)
6. Library - General Services Adm.
7. Hog buyer - Wilson's provision, cattle buyer, egg buyer, buyer female - 8754, purchasing male - 8753
8. Manufacturing
9. Office, sales, housemother

9. Professional

0. Soil conservationist, forest service
1. Teacher
2. Accountant
3. Nurse
4. Minister
5. Newsman
6. Technician electronic
7. Technician medical
8. Dietitian
9. Veterinarian

10. Professional Continued

1. Lawyer
2. Engineer
3. Speech pathologist
4. Social work, service worker
5. Doctor
6. Musician & music teacher
7. Flight instructor
8. Ass't interior decorator, layout artist, art work
9. Mortician