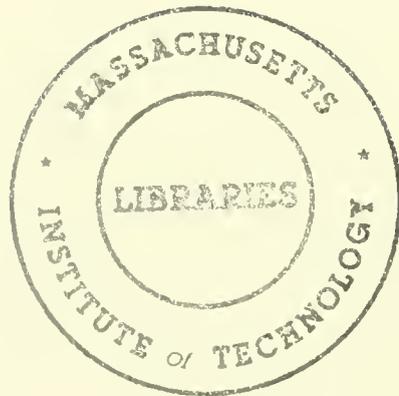


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"Structural/Frictional" versus
"Deficient Demand" Unemployment:
Some New Evidence*

Katharine G. Abraham

Massachusetts Institute of Technology
and National Bureau of Economic Research

WP #1273-82

January 1982

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* The research discussed in this paper has benefitted from discussions with Mary Corcoran, David Gower, Paul Harrington, Lois Plunkert and Eric Van der Wolt and from the comments offered by the participants in a seminar at Harvard University. I owe particular thanks to James Medoff for his many helpful suggestions. This work was supported by the Department of Labor under Contract No. J-9-M-9-0220.

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ABSTRACT

This paper demonstrates that, at least since the mid-1960's, the number of vacant jobs in the U.S. civilian economy has typically been much smaller than the number of persons unemployed or seeking work. Two alternative approaches are taken to estimating the job vacancy rates associated with various unemployment rates: first, available survey-based vacancy rate figures are inflated to correct for various possible sources of downward bias; and second, information on the new hire rate gleaned from the Current Population Survey is combined with data on job vacancy duration to produce independent vacancy rate estimates. These two different paths yield highly consistent conclusions. The ratio of job vacancies to number unemployed most likely averaged below .400 during the second half of the 1960's and the early 1970's and below .250 for the whole decade of the 1970's; the comparable average job vacancy to active job seeker ratios were perhaps 20 percent higher. The fact that there have been many more people unemployed or actively seeking work than vacant jobs suggests that measures designed to create new jobs must be an important part of any policy package designed to lower the unemployment rate.

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Macroeconomic policymakers devote a substantial fraction of their effort to combatting unemployment. One fact that has perhaps not been sufficiently recognized is that the magnitude of our country's job vacancy rate greatly conditions the optimal strategy in this arena. The potential efficacy of microeconomic labor market policies designed to facilitate matching people with already existing jobs versus aggregate policies designed to create new jobs depends critically on the extent to which unemployment is attributable to "frictional" or "structural" problems as opposed to "deficient demand"; this can really only be gauged with information both on those seeking work and on the availability of unfilled jobs.

Except during periods of deep recession such as were experienced in 1971-1972 and 1974-1975, there have always been those who asserted that the number of vacant jobs was large relative to the number of persons seeking work. During the middle 1960's, Arthur Burns apparently believed it to be possible that the number of vacant jobs actually exceeded the number of unemployed persons.¹ A Wall Street Journal editorial which appeared late in that decade lamented that there had been "little official recognition of the fact that a large part of the problem is simply matching jobless men with available jobs."² A similar point of view is implicit in another Wall Street Journal assessment of the then-current unemployment problem written in June of 1973 which concluded that "most of [the 4,300,000 unemployed] were probably out of work either by their own choosing or for reasons that have little to do with total economic growth."³ More recently, at least one spokesman for the Reagan administration has stressed the availability of "jobs out there that people don't want to take."⁴ President Reagan himself commented in March of

1981 that there are many pages of help wanted advertising in the New York Times and suggested that the unemployment problem may reflect programs which encourage people to delay taking jobs rather than a scarcity of employment opportunities.⁵

Whether these beliefs are in fact correctly held has extremely important implications for the selection of an unemployment policy. If the number of available jobs is large relative to the number of unemployed persons, then microeconomic policies, such as measures designed to improve job training programs, to increase worker mobility or to keep workers better advised of new job opportunities, might potentially have a large impact on the unemployment rate. If, on the other hand, the number of available jobs is small relative to the number of unemployed persons, Keynesian aggregate demand stimulation (or some other approach to job creation) would seem to be required in order to lower the unemployment rate substantially.

How many vacant jobs have existed at various points in time during the past two decades? How has the number of vacant jobs compared to the number of unemployed workers? These questions appear to be of great importance for economic policy; they motivate the ensuing discussion.

The potential value of aggregate vacancy data for selecting an unemployment policy is considered more fully in Section 1 below. Section 2 discusses efforts made during the 1960's and 1970's to collect information on the number of unfilled job openings in the United States and Canada. These vacancy data are brought together with the appropriate unemployment data in Section 3. Even after very generous allowances are made for sources of downward bias in the vacancy rates and the unemployment rates have been redefined to exclude persons already attached to an employer (those on temporary layoff and those due to start a job within 30 days), comparison of

the two rates suggests that the number of vacant jobs has typically been much smaller than the number of persons seeking work. Section 4 takes an alternative approach to estimating the relationship between the availability of unfilled job openings and the number of persons seeking work. Information on the average duration of a job vacancy is combined with information on the new hire rate to produce independent estimates of the vacancy rate, which are then compared with the relevant unemployment rates. The conclusions in this section are consistent with those reached in Section 3. The final section offers a summary of the paper's central findings and some conclusions.

I. The Potential Usefulness of Aggregate Job Vacancy Data

Suppose you were offered access to monthly data on the aggregate stock of job vacancies in the U.S. economy. By a job vacancy, I mean a currently available position which an employer would like to fill with someone from outside his firm at the prevailing wage rate. When I say you would be given aggregate stock data, I mean to imply that you would be told nothing about the occupational, industrial or regional mix of the available job openings, but only the total number of vacant jobs. Would such data be worth having? This section argues that even the limited sort of job vacancy information just described, while certainly no panacea, would be of considerable value to economists struggling to understand our unemployment problem.

What Aggregate Job Vacancy Data Can Tell Us

Perhaps the most obvious point to be made is that the potential of programs designed to deal with "frictional" or "structural" unemployment for bringing down the overall unemployment rate will be limited by the

availability of vacant jobs (V) relative to the total number of unemployed persons (U). Employment service job banks, moving subsidies, training subsidies and similar policy tools can only speed up the process whereby unemployed workers are matched with available jobs; they do nothing to create new jobs. Furthermore, speeding up the process of matching workers to jobs is apt to be more difficult when V/U is low than when V/U is high.

Consider the following simplified model, in which there is a fixed labor force, L, and a fixed number of total available jobs, J. Given some level of employment E:

$$(1) \quad L = E + U;$$

and

$$(2) \quad J = E + V,$$

where U represents the number of unemployed persons and V represents the number of job vacancies. If L is greater than J, U will be greater than V. The absolute minimum level of unemployment which could conceivably be attained would be:

$$(3) \quad U_{\min} = L - J.$$

This would be the level of unemployment in a situation where all available jobs were always filled (E equal to J) so that there were never any vacancies (V equal to zero). It can easily be shown that:

$$(4) \quad V = d_v F_v,$$

where d_v represents the average length of time a job remains vacant and F_v represents the flow of new job vacancies. Assuming a positive flow of job openings (F_v greater than zero), V will equal zero only if d_v equals zero. That is, the level of unemployment U_{\min} can be attained only if all new job openings are filled instantaneously.⁶

Given initial equilibrium values of V and U , the maximum potential reduction in U attainable through policies designed to reduce d_v will depend on the ratio of V to U . If V is X percent as large as U , then the initial level of unemployment could at most be reduced by X percent. The actual reduction in U which policies designed to speed up the process of matching workers to jobs can achieve will depend on the amount by which d_v can in fact be reduced from its initial level. Two points seem important here. First, when jobs are scarce relative to the number of people seeking work, employers are apt to receive a larger number of applications for each job opening. In this situation, the probability of an attractive candidate appearing and accepting the employer's job offer should be greater. A higher probability of some applicant being offered and accepting each employment opportunity means that less time will be required on average to fill job openings. Thus, d_v should tend to be smaller when the ratio of V to U is smaller. Second, it may be difficult to reduce d_v beyond some lower bound. This seems particularly likely to be an important factor if procedural requirements are imposed upon the hiring process.⁷ If d_v tends to be smaller when the ratio of V to U is smaller and if reducing d_v tends to become more difficult as d_v approaches zero, then potential reductions in the unemployment rate linked to possible reductions in d_v may be more difficult to realize when the ratio of V to U is small than when the ratio of V to U is large.

On the Use of Aggregate Demand Stimulation

Thus far, I have argued that "frictional" or "structural" policies alone are not apt to be very effective in lowering the overall unemployment rate when the vacancy to unemployment ratio is low. Is aggregate demand

stimulation appropriate in such a situation? While no definitive answer to this question is readily apparent, a few observations seem warranted.

First, aggregate demand stimulation can be expected to reduce the unemployment rate only at the cost of increased inflationary pressure. However, for a given unemployment rate, the level of inflationary pressure contributed by labor market conditions will be smaller when the vacancy rate, and thus the vacancy to unemployment ratio, is smaller. Chapter 3 presents compensation growth equations with an unemployment rate, either the Conference Board help wanted index divided by employment or the manufacturing quit rate, and lagged inflation terms on the right hand side. The normalized help wanted index and the quit rate can be viewed as proxies for the vacancy rate. These variables tend to be significantly related to the rate of growth in wages, whereas the official unemployment rate and the prime age male unemployment rate do not.⁸ These results would seem to imply that, holding the initial unemployment rate constant, the level of inflationary pressure associated with achieving a given unemployment rate target by means of aggregate demand stimulation will be lower when the initial vacancy to unemployment ratio is low. Thus, data showing the vacancy to unemployment ratio to be low should make aggregate demand stimulation more acceptable to policy makers, all else the same.⁹

A second and related point is that there is no reason to think that an equilibrium where the number of vacant jobs equals the number of unemployed persons would be optimal. Suppose for the moment that policy-makers could select freely any point along a given Beveridge curve, where the Beveridge curve traces out feasible unemployment rate and vacancy rate combinations, higher unemployment rates being associated with lower vacancy rates. The optimal position along this Beveridge curve will depend upon the marginal

social costs associated with unemployment and with job vacancies. The social cost of another person becoming unemployed should equal the value of foregone production net of the value of time spent in job search and leisure. For some workers, leisure time while unemployed may have a positive value; others may suffer severe physical and psychological stress as a result of being out of work, so that for them enforced leisure may actually have a negative value. The social cost of an added job vacancy should reflect at least the following: the cost to employees asked to put forth extra effort for which they may not be fully compensated; the cost to goods purchasers of their orders not being filled promptly; the cost to services purchasers who must wait in a longer queue; and the cost of any increase in inflationary pressure resulting from the existence of the vacancy.¹⁰ There is no reason to think that a situation in which unemployment equalled vacancies would be associated with an absence of inflationary pressure, nor that such a "full employment" situation would be optimal even if no inflation costs were associated with its attainment.

Third, while aggregate demand stimulation would surely lead to additional jobs being created, at least in the short run, there is some risk that the unemployed might not be well matched with the newly created jobs. In the worst possible case, skill, locational or other mismatches might be so severe that aggregate demand stimulation would simply lead to "deficient demand" unemployment being replaced by "frictional" or "structural" unemployment. To say the same thing in another way, in the extreme case, the Beveridge curve might be vertical at the current unemployment rate. While "matching" policies alone cannot be effective in a situation where the vacancy to unemployment ratio is low, in this event such "matching" policies might appropriately be used in conjunction with aggregate demand stimulation.

On the Use of Microeconomic Policies Designed to Match People With Jobs

The preceding discussion evoked several considerations which would seem to be relevant for policy makers thinking about moving along a given Beveridge curve by means of aggregate demand stimulation, suggesting that there would be both costs and benefits associated with such a move. Similarly, the adoption of microeconomic policies designed to increase the rate at which workers are matched with jobs, thereby shifting the Beveridge curve inward, should also be evaluated on a cost/benefit basis. As mentioned above, there are numerous possible approaches to speeding up the "matching" of workers to jobs. Establishment of job banks, payment of moving subsidies, and subsidization of training programs are all possibilities. It was argued above that "matching" policies can work only if there are available jobs which are waiting to be filled. However, just because the number of vacant jobs is large relative to the number of unemployed people does not mean that use of any or all of these "matching" policies is warranted. Job availability is a necessary but not a sufficient condition for reliance on "matching" policies as a means of lowering the unemployment rate to be desirable.

Information on the skill requirements of the stock of job vacancies compared to the skills possessed by those currently unemployed would at first blush appear to be of great potential value for generating insight into whether training programs could significantly reduce both the vacancy rate and the unemployment rate. However, even if such information could be collected, it would have to be used with considerable caution. In particular, one would expect the normal functioning of the market to alleviate skill mismatches over some period of time. Workers should seek to prepare themselves to fill available jobs, employers should develop in-house training paths and/or jobs

should be redesigned so that they can be filled by available workers. Graduates from a government-sponsored training program might find no demand for their newly-minted skills. Expensive training programs may thus prove to be of minimal value.

The use of job banks or moving subsidies should also be evaluated on a cost/benefit basis. Having, for example, the state employment service offices maintain listings of available jobs can only be effective in reducing the amount of "frictional" unemployment if employers cooperate and if individuals who use the listings are willing and qualified to fill the available jobs. Additional resources devoted to employment service activities might or might not produce significant positive results. Nor is it clear that bribing people to move long distances to accept jobs available outside their home communities is necessarily desirable.

Clearly, then, one would want to know a great deal besides the vacancy to unemployment ratio before deciding upon an unemployment policy. However, it would still seem that aggregate vacancy rate data would be of great value as a starting point.

II. Past Efforts to Collect Job Vacancy Data

In November 1961, President John F. Kennedy appointed a Committee to Appraise Employment and Unemployment Statistics. The Committee's 1962 report indicated that job vacancy data would be useful for several purposes, including assaying unemployment trends and locating business cycle turning points, and recommended that a research program be undertaken to investigate the feasibility of collecting job vacancy data.¹¹ The Bureau of Employment Security/Bureau of Labor Statistics (BES/BLS) pilot job vacancy projects begun

late in 1964 were an outgrowth of this recommendation. The first batch of pilot surveys was circulated during the period from October 1964 through January 1965; the second round produced data for April 1965; and the third round produced data for April 1966. In each round, 14 or 15 cities accounting for approximately 25 percent of the nation's total employment were included. Almost all of the pilot survey data collection was done by BES. Several variations on the basic BES survey form were experimented with. The program was oriented toward collecting sufficiently detailed data that local Employment Service offices would find it useful for placement purposes. BLS was responsible for vacancy data collection in 2 of 14 SMSA's covered in the April 1966 survey round. Rather than using a vacancy survey instrument similar to those used by BES, BLS created a combined job openings and labor turnover form. In part, the different approach used by BLS can be attributed to their analytic as opposed to operational orientation; it was thought that interesting analyses could be performed with data on both labor stocks (employment and vacancies) and labor flows (accessions and separations). A combined survey instrument also seemed to promise reduced respondent burden and lower total costs.¹²

Based on the early pilot project experience, it was decided that collection of vacancy data on an ongoing basis was feasible and that a national data collection effort should be initiated. One important question was whether a separate vacancy survey should be conducted (following the BES model) or whether questions about vacancies should be asked on the same form as questions about labor turnover (following the BLS model). The BLS approach won out, and the Job Openings and Labor Turnover Survey (JOLTS) program was born. At first, only members of the panel of primarily manufacturing establishments already cooperating in the labor turnover data collection

program were solicited for participation in the JOLTS program. The plan was for the panel to gradually be expanded so that a representative sample of both manufacturing and nonmanufacturing establishments were included.

The JOLTS program produced national data on job vacancies in the manufacturing sector on a monthly basis from April 1969 through December 1973. The effort to expand the original labor turnover panel so that vacancy and turnover statistics could be produced for nonmanufacturing industries on a national basis was never very successful; some nonmanufacturing data were collected, but not enough to produce publishable national figures. The JOLTS program was discontinued in December 1973.¹³ The Commissioner of Labor Statistics, Julius Shiskin, stated that the program was being dropped because "the data cannot be used for direct placement. In addition, the current program does not appear to meet the needs of economic analysts because the data cannot be matched with the components of the employment and unemployment surveys."¹⁴

When BLS discontinued funding for the job openings part of the JOLTS program, the states of Minnesota and Wisconsin chose to continue collecting job openings data on their own. Both of these states developed large enough employer panels that they were able to generate both vacancy and turnover rates for the nonmanufacturing sector, Minnesota beginning in 1972 and Wisconsin beginning in 1976. Current data for the two states are available in the form of unpublished tabulations maintained by agencies of their state governments.¹⁵

During the late 1970's, the U.S. Congress once again became interested in the collection of job vacancy information. An appropriation of \$500,000 was given to BLS in fiscal year 1977 for the purpose of conducting a job vacancy pilot survey, with the objective of assessing whether a national vacancy data

collection program would be feasible. BLS appears to have responded lethargically to the Congressional mandate, so that vacancy pilot projects did not get underway until March of 1979. In the end, job openings information was collected quarterly for six successive quarters in each of four cooperating states (Florida, Massachusetts, Texas and Utah). Several different survey forms were experimented with, the most important differences among the forms being whether the occupational coding of job openings was structured (an exhaustive list of occupational groups provided) or unstructured (employers wrote down their own job titles). In each participating state, the pilot project sample consisted of 1200 randomly selected establishments representing all major private nonagricultural sectors. These experiments were discontinued following the June 1980 survey date.¹⁶ Given current funding realities, together with the low priority BLS apparently gives to vacancy data collection, it seems unlikely that the program will be revived.

The history of vacancy data collection in Canada appears to have been in certain respects not unlike its history in the U.S. Following experimentation with pilot data collection efforts in the middle through late 1960's, a full scale Job Vacancy Survey (JVS) was launched in 1970. In contrast to what was done in the JOLTS program, a random sample of establishments was selected for participation in the JVS. Because of concern that no single respondent in a large establishment would be able to give an accurate report on all current job openings, an establishment profiling procedure was also used. Large establishments were broken into subunits on the basis of where hiring points were located and these subunits became the sampled entity. The survey was conducted in two phases: first, a mail phase; and second, a followup interview phase. The results of the interview phase were used to correct for

systematic over-reporting or under-reporting on mail forms and for nonresponse bias. The JVS produced data for the entire Canadian nonagricultural economy from the start of 1971 through the end of 1978, when the program was discontinued.¹⁷

Data on job openings which cover a variety of time periods and geographic areas are thus available: (1) for selected U.S. cities, we have data for each of three dates during the mid-1960's; (2) data for the U.S. manufacturing sector are available for the period from April 1969 through December 1973; (3) manufacturing (nonagricultural) vacancy rates have been produced in Minnesota since 1969 (1972); (4) manufacturing (nonagricultural) vacancy rates have been produced in Wisconsin since 1970 (1976); (5) the recent BLS pilot program produced 1979 and 1980 data covering four states; and (6) Canadian JVS data were generated quarterly from the start of 1971 through the end of 1978. Table 1 summarizes the availability of job vacancy data (areas, dates and sectors covered) and how that data was collected (sample selection and survey technique).

III. Direct Estimates of the Vacancy to Unemployment Ratio

The six available sources of vacancy data can be used to estimate the vacancy to unemployment ratio associated with different unemployment rate levels. This section first discusses estimates which use the available vacancy rate and unemployment rate data just as reported. One problem with this set of numbers is that there is good reason to believe that the reported vacancy rates are biased downwards. Accordingly, correction factors for inflating the available vacancy rate estimates are developed and these corrected-for-bias vacancy figures are then used to create a revised set of

Table 1: A Brief History of Job Vacancy Data Collection in the United States and Canada

<u>Areas and Dates Covered</u>	<u>Sectoral Coverage</u>	<u>Sample Selection</u>	<u>Survey Technique</u>
(1) Bureau of Employment Security/Bureau of Labor Statistics (BES/BLS) pilot projects produced vacancy data for 15 SMSA's during the last quarter of 1964 or January of 1965, for 15 SMSA's as of April 1965, and for 14 SMSA's as of April 1966.	Farms, private households, the military, and the self-employed were not covered.	In each SMSA, a random sample stratified by industry and establishment size was selected for surveying.	In some SMSA's, contact was initiated by personal visit; in others, the mail was relied upon exclusively. Extensive followup efforts were made.
(2) The U.S. Job Openings and Labor Turnover Survey (JOLTS) program produced monthly vacancy data from April 1969 through December 1973, when the program was discontinued.	Only manufacturing statistics were ever published on a national basis, although some nonmanufacturing data was collected.	Under this program, job openings questions were tacked on to the pre-existing labor turnover survey, which relies upon a panel of cooperating establishments rather than a randomly selected sample. Large firms tend to be over-represented on the panel.	A mail shuttle form was used. Establishments reported their vacancies as of the end of each month. Little followup work was done.
(3) When the national JOLTS program was discontinued, the Minnesota Department of Economic Security continued to collect vacancy data on its own. This program has produced monthly manufacturing data since January 1969 and monthly nonmanufacturing data since January 1972.	Farms, private households, the military, the self-employed, railroads and construction are not covered.	Like the national program of which it was once a part, this program links job openings data collection with labor turnover data collection. The panel of cooperating establishments represented approximately 60 percent of manufacturing universe employment and 25 percent of nonmanufacturing universe employment in 1979.	A mail shuttle form is used. Establishments report their vacancies as of the end of each month. Little followup work is done.

Table 1: A Brief History of Job Vacancy Data Collection in the United States and Canada - Continued

Areas and Dates Covered	Sectoral Coverage	Sample Selection	Survey Technique
<p>(4) When the national JOLTS program was discontinued, the Wisconsin Department of Labor, Industry and Human Relations continued to collect vacancy data on its own. This program has produced monthly manufacturing data since January 1970 and monthly nonmanufacturing data since January 1976.</p>	<p>Farms, private households, the military, and the self-employed are not covered.</p>	<p>Like the national program of which it was once a part, this program links job openings data collection with labor turnover data collection. The panel of cooperating establishments represented approximately 65 percent of manufacturing universe of employment and 25 percent of nonmanufacturing universe of employment as of mid-1980.</p>	<p>A mail shuttle form is used. Establishments report their vacancies as of the end of each month. Little followup work is done.</p>
<p>(5) BLS pilot projects produced data for the states of Florida, Massachusetts, Texas and Utah quarterly from March 1979 through June 1980.</p>	<p>Public administration, farms, private households, the military, and the self-employed were not covered.</p>	<p>Surveys were sent to a stratified random sample of 1200 establishments in each state.</p>	<p>Surveys were sent out by mail. Extensive phone, mail and/or personal visit followup efforts were made.</p>
<p>(6) The Canadian Job Vacancy Survey (JVS) program produced quarterly data from the beginning of 1971 through the end of 1978, when the program was discontinued.</p>	<p>Farms, private households, the military, the self-employed and fishing and trapping were not covered.</p>	<p>Large establishments were profiled for the purpose of locating internal hiring points; if warranted, these larger establishments were then broken into the appropriate number of Job Vacancy Reporting Units (JVRU's). Small establishments constituted a single JVRU. The population of JVRU's was stratified by type of JVRU (large private, small private, educational, federal government or local government), location, industry group and size. Each stratum was then randomly divided into panels which were surveyed in a repeating rotation.</p>	<p>Data were collected twice each month, so that the published quarterly statistics reflected information from six occasions during the quarter. Preliminary estimates for each of the six occasions were derived from mail responses. These estimates were then refined based on the results of extensive interviews with both mail phase respondents and nonrespondents.</p>

vacancy to unemployment ratio estimates. Even the corrected-for-bias numbers imply that the number of unemployed persons has typically been much larger than the number of vacant jobs, roughly two and one half times as large during the middle 1960's and early 1970's and roughly four to five times as large during the past decade. Another problem with the numbers based on the raw data is that the pool of unemployed persons may include some who are not actively seeking work. Even the most generous correction to allow for this possibility leaves intact the conclusion that during the past 15 years, the number of persons seeking employment has on average greatly exceeded the number of available jobs.

Using Available Rates to Estimate the Vacancy to Unemployment Ratio

One problem with all of the available vacancy rate data is that certain sectors are excluded from coverage. Even the most inclusive surveys omit agricultural vacancies, private household vacancies and self-employment opportunities.¹⁸ The least inclusive data collection effort, the national JOLTS program, covered only the manufacturing sector. Does the vacancy rate in the covered sectors exceed or fall short of the vacancy rate in the excluded sectors? For every survey except the JOLTS, the largest excluded group is the self-employed. In some sense, it may not be meaningful to speak of self-employment vacancies at all. Imputing the existence of self-employment vacancies in the ratio to the number of self-employed persons indicated by the vacancy rate in the covered sectors would clearly be a very generous procedure. This line of argument suggests that, at least for all of the surveys except the U.S. JOLTS, the vacancy rate in the covered sectors very likely exceeds the vacancy rate in the excluded sectors. As for the JOLTS, the relevant question would seem to be whether the manufacturing sector

vacancy rate is typically higher or lower than the overall vacancy rate. Each of the other surveys produced both manufacturing sector vacancy data and overall vacancy data. The estimated manufacturing vacancy rate tended to be higher than the overall rate, sometimes substantially so.¹⁹ Thus, the JOLTS manufacturing vacancy rates may in fact overstate the relevant true overall vacancy rates.

In all instances, the available vacancy rate estimates were equal to:

$$(5) \quad VR_c = V_c / (V_c + E_c)$$

where VR_c represented the reported vacancy rate, V_c represents the estimated number of vacancies in the sectors covered by the vacancy survey, and E_c represents employment in the same sectors. The overall unemployment rate equals:

$$(6) \quad UR = U / (U + E)$$

where UR represents the unemployment rate, U represents the estimated total number of unemployed persons in the economy, and E represents total employment in the economy. Remember that in every case for which I have data, E exceeds E_c . Above, it was argued that in all probability:

$$(7) \quad VR_c \geq VR,$$

where VR represents the overall vacancy rate:

$$(8) \quad VR = V / (V + E),$$

with V the total number of vacant jobs that would have been estimated with an economy-wide survey and E total employment in the economy as in (2) above. If (7) holds, then information on VR_c and UR permits creation of an estimate of the ratio of vacant jobs to unemployed persons at least as large as that which would have been arrived at based on a vacancy survey covering all sectors:

$$(9) \quad VR_c / (1 - VR_c) \div UR / (1 - UR) > V/U$$

Calculating vacancy to unemployment ratios in the fashion just described

required obtaining unemployment rate estimates for the geographic areas and time periods covered by the available vacancy rate data. The only SMSA unemployment rates available to be matched with the 1964, 1965 and 1966 BES/BLS pilot project vacancy data were monthly figures produced using the BLS "handbook" or "70 step" method. Overall national unemployment rates were used in conjunction with the national JOLTS data. BLS supplied monthly unemployment rates based on the Current Population Survey (CPS) covering the period from 1970 to the present for the states of Minnesota, Wisconsin, Florida, Massachusetts, Texas and Utah; these rates were matched with the Minnesota and Wisconsin JOLTS vacancy data and with the new BLS pilot project vacancy data. Finally, unemployment rate data based on the monthly Canadian Labor Force Survey, a household survey similar to the CPS, were obtained for the quarters covered by the Canadian JVS.²⁰

Estimates of the Vacancy to Unemployment Ratio Based on Unadjusted Vacancy Rate Data

Table 2 presents estimates of the vacancy to unemployment ratio calculated using unadjusted vacancy rate and unemployment rate data, with figures reported separately for various unemployment rate levels. Two things seem noteworthy about the data which are presented. First, the estimated vacancy to unemployment ratios are surprisingly low. Only in the one cell which reflects observations for unemployment rate levels from 1.6 to 2.0 percent does the estimated vacancy to unemployment ratio exceed 1.000. In almost all of the cells for unemployment rate levels of 5.0 or above, the estimated vacancy to unemployment ratio is below .200. Second, except in the column containing data for the BLS 1979-1980 pilot projects, there appears to be a very strong inverse relationship between the unemployment rate and the

Table 2: Estimates of the Number of Vacant Jobs per Unemployed Person at Various Unemployment Rate Levels Calculated Using Unadjusted Vacancy Rate Data^a

Period spanned by survey	BES/BLS 1964-1966 Pilot Projects ^b		U.S. JOLTS Program ^c		Minnesota JOLTS Program ^d		Wisconsin JOLTS Program ^e		BLS 1979-1980 Pilot Projects ^f		Canadian JVS Programs ^g	
	October 1964-April 1966		April 1969-December 1973		January 1972-December 1979		January 1976-December 1979		March 1979-June 1980		January 1971-December 1978	
1.6-2.0	1.101 (N=3)		NA		NA		NA		NA		NA	
2.1-2.5	.937 (N=5)		NA		NA		NA		NA		NA	
2.6-3.0	.535 (N=9)		.475 (N=1)		.484 (N=2)		NA		NA		NA	
3.1-3.5	.372 (N=8)		.351 (N=5)		.372 (N=12)		NA		NA		NA	
3.6-4.0	.285 (N=3)		.352 (N=2)		.286 (N=17)		.246 (N=4)		.569 (N=4)		NA	
4.1-4.5	.260 (N=5)		.204 (N=8)		.249 (N=11)		.190 (N=12)		.293 (N=1)		NA	
4.6-5.0	.262 (N=4)		.179 (N=9)		.197 (N=17)		.167 (N=12)		.503 (N=4)		NA	
5.1-5.5	.159 (N=1)		.117 (N=15)		.140 (N=16)		.135 (N=8)		.372 (N=5)		.273 (N=2)	
5.6-6.0	.160 (N=2)		.093 (N=8)		.138 (N=8)		.133 (N=4)		.415 (N=3)		.194 (N=5)	
6.1-6.5	.106 (N=2)		.077 (N=7)		.098 (N=5)		.106 (N=5)		.310 (N=4)		.149 (N=2)	
6.6-7.0	NA		.057 (N=2)		.090 (N=5)		.114 (N=1)		.277 (N=3)		.131 (N=5)	
7.1-7.5	NA		NA		.096 (N=2)		.076 (N=1)		NA		.096 (N=7)	
7.6-8.0	NA		NA		.072 (N=1)		.073 (N=1)		NA		.052 (N=1)	
8.1-8.5	NA		NA		NA		NA		NA		.068 (N=7)	
8.6-9.0	NA		NA		NA		NA		NA		NA	
9.1-9.5	NA		NA		NA		NA		NA		.052 (N=2)	
											.038 (N=1)	

Unemployment Rate Range:

Footnotes to Table 2:

- ^aThe numbers reported are the means of the estimated vacancy to unemployment ratios for observations in the cell. These individual observation ratios were estimated as $VR_C / (1 - VR_C) \div UR / (1 - UR)$, where VR represents the vacancy rate in the sectors covered by the vacancy survey and UR represents the overall unemployment rate. None of the raw data used were seasonally adjusted.
- ^bThe data used here cover a total of 16 different metropolitan areas. Data for up to three different reference dates for each city are included; all of the reference dates fall between October 1964 and April 1966. The source for both the metropolitan area vacancy rates and the matched metropolitan area unemployment rates was an unpublished paper written by Paul Harrington, formerly of BLS, entitled "The Labor Department's Experience in the Collection and Analysis of Job Vacancy Statistics: The Experimental Programs of 1964-1966."
- ^cThe U.S. JOLTS manufacturing sector vacancy rate data were published monthly for the period from April 1969 through December 1973 in various issues of Employment and Earnings. Unadjusted monthly unemployment rates for the civilian labor force are published a month at a time in the same source; the numbers actually used were taken from an unpublished BLS tabulation which showed the complete time series.
- ^dThe Minnesota Department of Economic Security made available monthly vacancy rate estimates covering most of the state's nonagricultural wage and salary employment (as discussed in Table 1) for the period from January 1972 through December 1979. Unadjusted monthly CPS-based unemployment rate estimates for the state of Minnesota covering the same period were supplied by BLS.
- ^eThe Wisconsin Department of Labor, Industry and Human Relations made available monthly vacancy rate estimates covering most of the state's nonagricultural wage and salary employment (as discussed in Table 1) for the period from January 1976 through December 1979. Unadjusted monthly CPS-based unemployment rate estimates for the state of Wisconsin covering the same period were supplied by BLS.
- ^fThe vacancy data used here were collected in each of four states once every three months beginning in March 1979 and ending in June 1980. The vacancy rate estimates were taken from unpublished BLS tabulations. Unadjusted CPS-based unemployment rate estimates for the relevant states and months were also supplied by BLS.
- ^gThe complete time series of quarterly Canadian vacancy rate estimates was published in Annual Report on Job Vacancies 1978; the series covers the 32 quarters beginning with 1971:1 and ending with 1978:4. Quarterly unemployment rate estimates were created by averaging the relevant unadjusted monthly unemployment rates; these monthly figures came from Historical Labor Force Statistics 1979.

vacancy to unemployment ratio. This is of course what one would find whenever higher unemployment rates are associated with lower vacancy rates so that the Beveridge curve has the expected negative slope.²¹

Data from each of the six available data sets were next used to estimate Beveridge curve equations expressing VR ($\ln VR$, $1/VR$) as a linear function of UR ($\ln UR$, $1/UR$). For every survey except the BLS 1979-1980 pilot projects, all of the estimated regression coefficients were highly significant; the unemployment rate variable coefficients in the models estimated using the BLS 1979-1980 pilot project data were much smaller than those in any of the other regressions and not significant. For operating purposes, it was assumed that the U.S. Beveridge curve during the period spanned by each survey was located in the same position as the vacancy rate/ unemployment rate observations for that survey.

Given this assumption, what do the estimated equations imply about the mean vacancy to unemployment ratio in the United States during the relevant time periods? To answer this question, the relevant monthly U.S. unemployment rates were introduced into the estimated Beveridge curve equations to get predicted vacancy rates; vacancy to unemployment ratios were calculated using the actual unemployment rates and the predicted vacancy rates; and an average of those ratios was taken. The resulting figures are reported in Table 3. Even during the period from October 1964 to April 1966, when the U.S. unemployment rate averaged only 4.5 percent, the numbers suggest that the average vacancy to unemployment ratio was only about .250. The BLS pilot project results for the March 1979 to June 1980 period are somewhat suspect given that the unemployment rate variable coefficients in the relevant regressions are much smaller than those in any of the other models; any understatement of the true coefficients would make the estimated average

Table 3: Regression Analysis of the Relationship Between Vacancies and Unemployment
Based on Unadjusted Vacancy Rate Data

Period spanned by survey	BES/BLS		Minnesota		Wisconsin		BLS 1979-1980		Canadian JVS	
	1964-1966 Pilot Projects	U.S. JOLTS Program	JOLTS Program	JOLTS Program	January 1976- December 1979	January 1976- December 1979	March 1979- June 1980	Pilot Projects	January 1971- December 1978	Program
Mean U.S. unemployment rate during period spanned by survey	4.5	5.0	6.4	6.6	6.2	6.4				
Implied mean value of vacancy to unemployment ratio given monthly unemployment rates for the U.S. during period spanned by survey:										
VR on UR model	.262	.163	.113	.099	.334				.137	
lnVR on lnUR model	.242	.161	.115	.100	.319				.137	
1/VR on 1/UR model	.231	.174	.115	.101	.301				.154	
Implied unemployment rate at which number of vacancies equals number of unemployed:										
VR on UR model	1.9	1.6	1.5	1.1	2.2				1.8	
lnVR on lnUR model	2.0	2.3	2.0	1.5	2.3				2.9	
1/VR on 1/UR model	2.0	3.0	2.5	2.2	2.5				4.2	

^aAll data sources are as described in the footnotes to Table 2. The results reported are based on regressions of $VR_C(\ln VR_C, 1/VR_C)$ on $UR(\ln UR, 1/UR)$, where VR_C represents the vacancy rate in the sectors covered by the vacancy survey and UR represents the overall unemployment rate.

vacancy to unemployment ratio based on the actual U.S. unemployment rates for this period larger than they would otherwise be. However, even those figures show an average vacancy to unemployment ratio of no more than .300.

Again given the previously stated assumption that the U.S. Beveridge curve during the period spanned by each survey was located in the same position as the vacancy rate/unemployment rate observations for that survey, what do the Beveridge curve equation estimates imply about how low the unemployment rate would have had to fall for number of vacancies to equal number unemployed? Table 3 reports all of the relevant estimated unemployment rates; excluding the BLS 1979-1980 pilot project numbers, their average value is about 2.2 percent. Except for one outlier, all of the estimated equations imply that the unemployment rate would have to be 3.0 percent or less before the number of vacant jobs would equal the number of unemployed people.²²

Adjusting for Downward Bias in the Reported Vacancy Rate Data

All of the preceding discussion assumes that the reported vacancy rates are good estimates of the relevant true vacancy rates. Part of the reason so little attention has been paid to available vacancy rate data is that the published numbers are widely believed to be seriously downward biased. Table 4 contains as exhaustive a listing of the possible sources of downward bias as I have been able to compile. For each of these factors, the likely magnitude of any resulting understatement in the reported vacancy rate is also assessed. My objective is to develop a set of correction factors for inflating the reported vacancy rates to yield upper bound estimates which will equal or exceed the "true" vacancy rate. For a particular vacancy survey, this correction factor will equal:

Table 4: Possible Sources of Downward Bias in the Reported Vacancy Rate Estimates

Source of Downward Bias in Reported Vacancy Rate	Likely Magnitude of Downward Bias	Data Collection Efforts Likely to be Affected
(1) Not all firms keep records; without records the firm's personnel staff may understate the number of vacancies.	Not judged to be important.	None.
(2) Recruiting and hiring may occur at other points in the firm besides the central personnel office, so that the survey respondent may be unable to provide a complete count of current job vacancies.	Not judged to be important.	None.
(3) Mail solicitations may not elicit as careful a response as interview solicitations. Firms may omit some vacancies because they fear employment service referrals, because they don't understand all occupations are supposed to be covered, or because giving an incomplete listing is easier than filing out the form correctly.	No more than 10 percent.	All of the U.S. programs.
(4) Nonresponse bias may be a problem if cooperating firms are not representative of the universe.	From 10 to 20 percent, depending upon the survey.	All of the U.S. programs.
(5) Over-representation of large firms and under-representation of small firms in the reporting sample may cause an underestimate of the vacancy rate.	Under 15 percent.	Only the JOLTS programs.

Table 4: Possible Sources of Downward Bias in the Reported Vacancy Rate Estimates - Continued

Source of Downward Bias in Reported Vacancy Rate	Likely Magnitude of Downward Bias	Data Collection Efforts Likely to be Affected
(6) Firms just being born will not be represented in the sampling frame. A priori, one might expect such firms to have very high vacancy rates.	Under 5 percent.	All of the programs.
(7) Particularly in professional occupations, hiring may occur without any preceding active recruitment.	No more than 10 percent.	All of the programs.
(8) There may be "discouraged vacancies" which employers would like to fill but for which they have given up recruiting.	No more than 10 percent.	All of the programs.
(9) Vacancy rates may be higher in the middle of the month, when the unemployment rate is measured, than at the end of the month, when vacancy data collected.	5 percent for JVS, 10 percent for U.S. surveys.	All of the programs.

$$(10) CF_j = \sum_i^{\pi} (1 + P_i \delta_{ij})$$

where P_i is the maximum proportional understatement which bias i might reasonably be expected to cause, δ_{ij} equals 1 if bias i affects survey j and equals 0 otherwise, j indexes surveys and i indexes sources of bias.

The first possible source of downward bias in the reported vacancy rates is that many firms do not keep written vacancy records, so that some job openings may be omitted when reports are made. Common sense would suggest that the absence of records is unlikely to be a problem for establishments employing fewer than several hundred employees. Data on the record keeping practices of large establishments are sparse. Early studies which investigated firms' record keeping practices have included: a 1964 Chicago feasibility study; the 1965 response analysis survey (RAS) which followed the first round of BES/BLS pilot studies; the 1966 RAS which followed the first experimentation with combined job openings and labor turnover data collection; and the 1966 RAS which followed vacancy pilot projects in two Canadian provinces. I have been unable to locate raw data produced by these investigations which show what percentage of establishments with several hundred employees or more maintained vacancy records. However, informed analysts do not appear to have been concerned that lack of records would preclude accurate vacancy reporting.²³ The report prepared on the RAS which followed the March 1979 BLS vacancy pilots indicated that, at least at small and medium sized firms, vacancies should be reportable even in the absence of records; "a knowledgeable respondent can work from memory, since openings tend to be small in number and since the definition depends only on the status at the close of a single business day." Data collected as part of this RAS on the record keeping practices of units with 250 or more employees indicated

that between 82 and 100 percent of manufacturing establishments and between 66 and 90 percent of nonmanufacturing establishments in this size range kept records of job availability.²⁴

A related issue is that recruiting and hiring may occur at more than one location within an establishment. It would seem that such decentralization is likely to cause problems only if the survey respondent is not promptly informed when recruiting and hiring activities are undertaken and if there are many hiring points. Decentralization should be of particular potential concern with regard to larger units. Data from a feasibility study conducted in Chicago early in 1964 indicated that roughly one in four of the 62 firms interviewed kept complete vacancy records. Of those which did not, 30 said that one person recruited for all vacancies, 17 stated that all recruiting occurred at a central location, and only 2 said that recruiting took place at more than one location. I was unable to locate separate figures for the larger firms in this study.²⁵ Data from the RAS which followed the March 1979 BLS pilot projects indicated that survey respondents were promptly informed regarding recruiting and hiring activities at between 79 and 100 percent of manufacturing establishments with 250 or more employees and at between 45 and 85 percent of nonmanufacturing establishments with 250 or more employees. No data were available from this source concerning how many separate recruiting and hiring locations there were at those large establishments where timely information was not available to the survey respondent as a matter of course.²⁶ As mentioned earlier, when job vacancy data was collected in Canada, all large establishments were profiled and broken up into reporting units based on where hiring occurred within the establishment. I have seen no evidence indicating that this very costly procedure was necessary.²⁷ Based on available data and on conversations with various individuals who were involved

with the recent BLS vacancy data collection efforts, my judgment is that the existence of multiple recruiting and hiring points per se is unlikely to have caused downward bias in reported vacancy rates.

A third possible source of downward bias in reported vacancy rates is that respondents may be careless in their reporting when filling out forms received in the mail; interviews may produce a more complete vacancy count. Available evidence supports the proposition that followup interviews elicit a slightly higher number of reported vacancies than appear on mail forms. RAS work done following the second and third rounds of the BES/BLS pilot projects conducted during the mid-1960's indicated that reliance on mail responses lead to a net understatement of 3 to 4 percent in number of vacancies reported.²⁸ Small scale reinterview studies conducted in Florida and Utah following the first round of the recent BLS pilot efforts indicated that originally reported total vacancy estimates may actually turn out to be higher than those that would have been obtained after careful probing interviews.²⁹ The limited amount of data from the Canadian pilot project undertaken in 1966 implied total vacancy estimates based on interviews that were almost 70 percent larger than total vacancy estimates based on mail responses.³⁰ However, calculations I have done using the very large amount of JVS microdata for the six survey occasions during the months of February, March and April of 1976 indicate that correcting for net differences in interview as compared to mail reports increases the estimated average number of job vacancies by less than 10 percent.³¹ All of the available U.S. vacancy estimates were inflated by 10 percent to take account of likely net underreporting on mail forms.

Perhaps the most important potential source of understatement in reported vacancy rates is nonresponse bias. The presumption has been that nonrespondent firms most likely have a higher vacancy rate than respondent

firms, so that imputations for nonresponding firms based on reports from cooperating units are apt to be too low. A correction for nonresponse bias is explicitly incorporated into the JVS estimates, so that no additional correction need be made to those vacancy data; some nonresponse bias correction would seem to be appropriate in the case of each of the U.S. vacancy data sources. Knowing two things about each of these data sources should permit one to make a reasonable correction for nonresponse bias: (1) the survey response rate, preferably in terms of represented employment as a proportion of total employment; and (2) the proportion by which the nonrespondents' vacancy rate exceeds the respondents' vacancy rate. Given this information, one would want to inflate an otherwise accurate vacancy estimate based on the assumption that nonrespondents have the same vacancy rate as respondents by a factor equal to:

$$(11) \quad 1 + P = R + (1 - R) \frac{VR_{nr}}{VR_r},$$

where P is the proportion by which the corrected estimate should exceed the uncorrected estimate, R is the response rate, VR_{nr} is the nonrespondents' vacancy rate and VR_r is the respondents' vacancy rate.

What are the response rates for the various vacancy surveys which have been relied upon in this paper? The BES/BLS 1964-1966 pilot surveys attained overall response rates averaging above 70 percent of covered employment.³² The employers on the JOLTS panel who provided information on vacancies represented an average of just under 45 percent of total manufacturing sector employment between 1969 and 1972; the Minnesota JOLTS sample covered roughly 50 percent of nonagricultural employment excluding railroads and construction as of 1974; and the Wisconsin JOLTS sample covered just under 40 percent of nonagricultural employment as of mid-1980.³³ If all employers were solicited

for participation in the various JOLTS programs, then the proportion of total employment covered would be equal to the response rate R ; since some employers were never solicited, R must be larger than the proportion of total employment covered. Unfortunately, no information on response rates is available for any of the JOLTS programs. Given any VR_{nr}/VR_r , a smaller R implies a larger correction for nonresponse bias. Treating proportion of total employment covered under each of the JOLTS programs as if it were a response rate should lead to overstating the potential importance of nonresponse bias in those programs, so that the relevant vacancy rates may end up being overinflated. The proportion of sampled establishments responding to the BLS 1979-1980 pilot vacancy surveys averaged over 65 percent; data on the proportion of total employment covered were not available.³⁴

By what proportion does the vacancy rate at nonresponding firms exceed the vacancy rate at responding firms? Results based on a very small number of nonrespondent interviews in the RAS following the BLS 1965 pilot project (where the response rate was about 80 percent of both establishments and employment) indicated that nonrespondents' vacancy rates were about 35 percent larger than respondent's vacancy rates.³⁵ Data for a very small sample of nonrespondents interviewed following the 1966 Canadian vacancy pilot project (where the response rate was about 65 percent of establishments and 90 percent of employment) indicated that the nonrespondent vacancy rate was 119 percent larger than the respondent vacancy rate.³⁶ These numbers are both based on a very limited number of observations and they differ considerably from one another; which is the more reasonable to use for our purposes? One plausible way to choose would be to compare the magnitude of the implied adjustment to the total vacancy estimate based on each of the two figures with the magnitude of the nonresponse adjustment in the Canadian JVS. The response rate in the

JVS averages roughly 60 percent of sampled units and this does not seem to vary tremendously as between smaller and larger establishments. If this proportion were used in equation (11), the 35 percent figure above would imply that correcting for nonresponse bias should increase the estimated vacancy rate based on the JVS by 14 percent and the 119 percent figure would imply that correcting for nonresponse bias should increase the estimated vacancy rate by 48 percent. In fact, calculations with the JVS microdata for the six survey occasions during the months of February, March and April of 1976 show that the nonresponse bias correction actually used increases the estimated vacancy rate by an average of 8 percent.³⁷ The primary reason that the vacancy rate for nonrespondents in the Canadian pilot project was so much higher than that for respondents was that the nonrespondents were disproportionately very small firms and smaller firms tend to have higher vacancy rates; a separate correction is made below for underrepresentation of small firms on the JOLTS panels and both the BES/BLS 1964-1966 and BLS 1979-1980 pilot programs used estimators which incorporated stratification by firm size. Given these considerations, it seems reasonable to make a nonresponse bias correction which assumes a vacancy rate for nonrespondents 35 percent higher than that for respondents. The nonresponse bias correction factors used for the various surveys are thus approximately as follows: BES/BLS 1964-1966 pilot projects, 1.10; U.S. manufacturing JOLTS, 1.19; Minnesota JOLTS, 1.18; Wisconsin JOLTS, 1.21; and the BLS 1979-1980 pilot surveys, 1.12. As discussed, the JVS estimates do not need to be inflated since the reported figures already incorporate a nonresponse bias correction.

Another problem closely related to nonresponse bias is that in the three JOLTS programs, large firms tend to be over-represented. This may cause downward bias in the reported vacancy numbers if smaller establishments tend

to have higher vacancy rates. One way to correct for this problem would be to construct stratified vacancy rate estimators such as the following:

$$(12) \hat{VR} = \sum_i (V_{si}/E_{si}) * (E_{ui}/E_u)$$

where V_{si} represents number of vacancies reported by sampled establishments in size group i , E_{si} represents employment in sampled establishments in size group i , E_{ui} represents universe employment in establishments in size group i , E_u represents total universe employment, and i indexes size groups. This stratified estimator would replace the actual JOLTS estimator:

$$(13) \hat{VR} = \sum_i V_{si} / \sum_i E_{si}$$

One would expect that the downward bias in estimated vacancy rates resulting from over-representation of small firms in the JOLTS panel would be of approximately the same magnitude as any downward bias in estimated new hire rates based on the same panel, given that the same unstratified estimator is used in both cases. Researchers at BLS have explored the effect of stratification on the estimated new hire rate. Stratifying by firm size groups of 0 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 249, 250 to 499, 500 to 999 and 1000 or more employees and recalculating the new hire rate for March 1977 produced a 12 percent upward movement in the estimate.³⁸ All of the JOLTS vacancy rates were multiplied by 1.150 to correct for over-representation of large firms.

A sixth possible source of downward bias in the reported vacancy rates is that firms just being born will not be represented in the vacancy survey sample. A priori, such firms might be expected to have relatively high vacancy rates. However, because new firm employment is very small relative to total employment, omission of new firm vacancies will nonetheless most likely

have only a very small effect on the overall vacancy rate. If it can be assumed that the average duration of new firm vacancies is of approximately the same magnitude as the average duration of all vacancies, then the proportional understatement in any estimated vacancy rate due to not sampling new firms should be approximately equal to the proportional understatement in any similarly estimated new hire rate attributable to the same cause. A researcher at BLS has explored the issue of downward bias in the new hire rates estimated for the U.S. manufacturing sector. She noted that universe employment in the manufacturing sector has grown more rapidly than employment at firms in the labor turnover panel; on a month-to-month basis:

$$(14) \quad E_{u,t+1} / E_{u,t} = 1.001 * (E_{s,t+1} / E_{s,t}),$$

where $E_{u,t+1}$ ($E_{u,t}$) represents universe employment in month $t+1$ (t) and $E_{s,t+1}$ ($E_{s,t}$) represents employment in the labor turnover panel in month $t+1$ (t).

Under the assumptions that all of this discrepancy in employment growth rates can be attributed to new firm employment and that after the initial hiring the turnover rate at new firms equals the turnover rate at old firms, $.001 * E_{u,t}$ should be added to the estimated number of new hires to correct for having missed initial hiring at the new firms. In March 1977, making this correction increased the estimated new hire rate by only 4 percent.³⁹ A similar exercise performed by a staff economist at Statistics Canada for calendar year 1969 suggested that missing new firms would lead to an understatement of approximately 2.5 percent in the estimated number of new hires.⁴⁰ Birth of new firms should be even less important than these figures might indicate during periods of slower economic growth. All of the available vacancy rate estimates were inflated by a factor of 1.050 to account for bias due to not surveying firms just being born.

An often-cited potential problem with reported vacancy rate estimates is that employers may be willing to hire well-qualified individuals who walk in off the street even if the employer is not recruiting to fill a specific job, so that any estimate of vacancies will understate the true number of available employment opportunities. The limited empirical evidence on this point which I have been able to locate suggests that such hiring without prior recruiting is very rare. BLS asked approximately 100 employers in the state of Massachusetts and approximately 100 employers in the state of Utah to keep a record of all of their recruiting and hiring activity during the month of March 1980. Altogether, the Massachusetts employers hired 560 people during the month; only 6 were walk-ins for whom a position was created. The data from the Utah diaries indicate that 17 of 639 persons hired were walk-ins; however, BLS personnel are convinced that this figure overstates the magnitude of such hiring, for the reason that the Utah interviewers apparently did not really probe to discover whether there had been prior recruiting activity.⁴¹ While the available data don't yield a direct estimate of the maximum number of hidden employment opportunities which might be available to attractive walk-in candidates, inflating the reported vacancy rate estimates by 10 percent to reflect the possible existence of such opportunities seems if anything excessively generous, especially since a separate "discouraged vacancy" correction was also made.

A "discouraged vacancy" can be defined as a position which an employer would like to fill but has given up recruiting for; the concept is analogous to that of the "discouraged worker". Evidence on this eighth possible source of downward bias in reported vacancy rates as a measure of potentially available employment opportunities was collected during March, June and September 1979 in the states of Florida and Texas as part of the BLS pilot

project effort. Employers were asked to report both positions for which they were currently recruiting and positions for which they had given up recruiting. The number of "discouraged vacancies" averaged only 3 percent as large as the number of current job openings in Florida and only 6 percent as large in Texas. The largest single month's "discouraged vacancy" to current job opening ratio was only 0.11.⁴² All of the available vacancy rate estimates were inflated by 10 percent to correct for "discouraged vacancies" being missed.

Finally, there is the problem that vacancy rates have typically been measured as of the end of the month, while the unemployment rate is measured as of the middle of the month. Available empirical evidence seems to suggest that the vacancy rate may be higher mid-month. A Statistics Canada research economist noted average differences as large as 8 or 9 percent when he compared vacancy estimates for mid-month and end-of-month reference dates.⁴³ However, during March 1980, the number of vacant jobs recorded by the approximately 100 Massachusetts employers participating in the special study mentioned earlier was larger at the end of the month than the average for the week including the 12th. Data from the Utah vacancy diaries showed a higher average number of vacancies during the week including the 12th; however the Utah employers appear to have been confused regarding what to report as a current job opening and what to report as a future job opening, so that the day-to-day tabulations for Utah are of questionable value.⁴⁴ All of the U.S. vacancy rates were multiplied by a factor of 1.100 to correct for possible bias attributable to counting vacancies as of the end of the month and unemployment as of the middle of the month. Since the JVS vacancy estimates were based on the average of mid-month and end-of-month estimates, a factor of 1.050 was used for that survey.

Combining the effects of all of the possible sources of downward bias in reported vacancy rates just discussed produced approximately the following aggregate correction factors for the various vacancy surveys: BES/BLS 1964-1966 pilot projects, 1.70; U.S. JOLTS program, 2.11; Minnesota JOLTS program, 2.08; Wisconsin JOLTS program, 2.14; BLS 1979-1980 pilot projects, 1.73; and Canadian JVS program, 1.33.

The correction factors just developed were applied to the vacancy rates from each of the six available sources and revised vacancy to unemployment ratio estimates were calculated. These adjusted ratio estimates very likely overstate the availability of jobs relative to the number of unemployed persons. For one thing, fairly generous allowance was made for the impact of each source of downward bias on the reported vacancy rate estimate, and, no consideration was given to possible sources of upward bias in the reported vacancy rate estimates. Some jobs with future starting dates may have been counted and some of the jobs counted as available were most likely offered at a below-market wage. My understanding is that the AFL-CIO has opposed the collection of aggregate vacancy data, apparently from fear that a large number of jobs paying unacceptably low wages would be counted, which might cause policymakers to place too little emphasis on job creation.⁴⁵ In addition, no effort was made to correct for downward bias in the measured unemployment rate. A good argument can be made for believing that the official unemployment rate excludes a large number of persons who do indeed want to work but have given up active search because they have become convinced no work is available. During the period from the beginning of 1969 through the end of 1979, the number of "discouraged workers" (defined as persons who say they would like to work but have not searched within the past four weeks because they are convinced they will be unable to find a job) averaged almost

20 percent as large as the pool of persons officially counted as unemployed.⁴⁶ Furthermore, to have been counted as a vacancy, a job need only have been available on a single day, whereas to be counted as unemployed a person must have been out of work during an entire week. The unemployment rate would be at least somewhat higher if the unemployment concept were more analogous to the vacancy concept in terms of using a one day rather than a one week reference period.

Estimates of the Vacancy to Unemployment Ratio which Incorporate Vacancy Rate Corrections

Table 5 reports estimates of the vacancy to unemployment ratio calculated using the adjusted vacancy rates just discussed, reported separately for various unemployment rate levels. Since substituting the adjusted-for-bias vacancy rates for the originally reported vacancy rates is almost equivalent to multiplying the ratio estimates for each survey by a correction factor, the strong inverse relationship between the vacancy to unemployment ratio and the unemployment rate found for every survey except the BLS 1979-1980 pilot projects is of course preserved. With one exception, the revised estimates suggest that the number of available jobs has equalled or exceeded the number of unemployed persons only when the unemployment rate has fallen below 3 percent. The ratios estimated using the BLS 1979-1980 pilot project data indicate that number of vacancies equalled number unemployed for unemployment rates between 3.6 and 4.0 percent. Except for the BLS 1979-1980 numbers, the estimated vacancy to unemployment ratios were below one third in all the cells for unemployment rate levels of 5.0 or greater. The figures for the BLS 1979-1980 pilots are quite a bit larger than the comparable figures for any of the other surveys. This may at least in part reflect an outward shift in the Beveridge curve during the past few years.

Table 5: Estimates of the Number of Vacant Jobs per Person at Various Unemployment Rate Levels Calculated Using Adjusted Vacancy Rate Data^a

Period spanned by survey	Unemployment Rate Range:	BES/BLS 1964-1966 Pilot Projects		U.S. JOLTS Program		Minnesota JOLTS Program		Wisconsin JOLTS Program		BLS 1979-1980 Pilot Projects		Canadian JVS Program	
		October 1964-April 1966		April 1969-December 1973	January 1972-December 1979	January 1976-December 1979	March 1979-June 1980	January 1971-December 1978					
1.6-2.0		1.897 (N=3)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.1-2.5		1.621 (N=5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.6-3.0		.920 (N=9)	1.018 (N=1)	1.021 (N=2)	1.021 (N=2)	NA	NA	NA	NA	NA	NA	NA	NA
3.1-3.5		.638 (N=8)	.750 (N=5)	.784 (N=12)	.784 (N=12)	.532 (N=4)	.998 (N=4)	.998 (N=4)	.998 (N=4)	.998 (N=4)	.998 (N=4)	.998 (N=4)	.998 (N=4)
3.6-4.0		.489 (N=3)	.752 (N=2)	.601 (N=17)	.601 (N=17)	.411 (N=12)	.511 (N=1)	.511 (N=1)	.511 (N=1)	.511 (N=1)	.511 (N=1)	.511 (N=1)	.511 (N=1)
4.1-4.5		.446 (N=5)	.435 (N=8)	.524 (N=11)	.524 (N=11)	.362 (N=12)	.883 (N=4)	.883 (N=4)	.883 (N=4)	.883 (N=4)	.883 (N=4)	.883 (N=4)	.883 (N=4)
4.6-5.0		.449 (N=4)	.381 (N=9)	.414 (N=17)	.414 (N=17)	.292 (N=8)	.652 (N=5)	.652 (N=5)	.652 (N=5)	.652 (N=5)	.652 (N=5)	.652 (N=5)	.652 (N=5)
5.1-5.5		.272 (N=1)	.248 (N=15)	.294 (N=16)	.294 (N=16)	.288 (N=4)	.729 (N=3)	.729 (N=3)	.729 (N=3)	.729 (N=3)	.729 (N=3)	.729 (N=3)	.729 (N=3)
5.6-6.0		.274 (N=2)	.198 (N=8)	.289 (N=8)	.289 (N=8)	.229 (N=5)	.544 (N=4)	.544 (N=4)	.544 (N=4)	.544 (N=4)	.544 (N=4)	.544 (N=4)	.544 (N=4)
6.1-6.5		.181 (N=2)	.163 (N=7)	.206 (N=5)	.206 (N=5)	.246 (N=1)	.486 (N=3)	.486 (N=3)	.486 (N=3)	.486 (N=3)	.486 (N=3)	.486 (N=3)	.486 (N=3)
6.6-7.0		NA	.120 (N=2)	.188 (N=5)	.188 (N=5)	.163 (N=1)	NA	NA	NA	NA	NA	NA	NA
7.1-7.5		NA	NA	.201 (N=2)	.201 (N=2)	.158 (N=1)	.069 (N=1)	.069 (N=1)	.069 (N=1)	.069 (N=1)	.069 (N=1)	.069 (N=1)	.069 (N=1)
7.6-8.0		NA	NA	.151 (N=1)	.151 (N=1)	NA	.091 (N=7)	.091 (N=7)	.091 (N=7)	.091 (N=7)	.091 (N=7)	.091 (N=7)	.091 (N=7)
8.1-8.5		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8.6-9.0		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9.1-9.5		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aThe numbers reported in this table were created in the same way as those appearing in Table 2, except that the vacancy rate estimates used were inflated to correct for the sources of downward bias discussed in Table 4.

As was done before with the unadjusted data, Beveridge curve regressions with VR ($\ln VR$, $1/VR$) as a linear function of UR ($\ln UR$, $1/UR$) were estimated using the adjusted data from each vacancy survey. Again, all of the estimated unemployment rate variable coefficients were highly significant except for those in the models using the BLS 1979-1980 pilot project data. Table 6 summarizes the implications of the regression models, based on the assumption that the U.S. Beveridge curve during the period spanned by each survey was located in the same position as the adjusted vacancy rate/unemployment rate observations for that survey. During the mid-1960's and early 1970's, when the unemployment rate averaged 4.5 to 5.0 percent, it would appear that the vacancy to unemployment ratio averaged around .400. The Minnesota JOLTS, the Wisconsin JOLTS, and the JVS are all consistent in their implication that during the middle and late 1970's, periods during which the unemployment rate averaged just over 6.5 percent, the vacancy to unemployment ratio averaged under .250. While the BLS 1979-1980 pilot project data suggest a much higher average vacancy to unemployment ratio than any of the other survey data, even that average is under .600.

How low would the unemployment rate have had to fall for the number of vacancies to equal the number of unemployed persons? Excluding the BLS 1979-1980 numbers, the average implied by the estimated Beveridge curve regressions is 2.9 percent. Only the regressions based on the BLS 1979-1980 data consistently imply any higher unemployment rate and even those regressions suggest the unemployment rate would have to fall below 4 percent before the number of available jobs would equal the number of unemployed persons.⁴⁷

Thus, even when very generous allowance is made for possible downward biases which might exist in the originally reported vacancy data, two

Table 6: Regression Analysis of the Relationship Between Vacancies and Unemployment Based on Adjusted Vacancy Rate Data^a

Period spanned by survey	BES/BLS		U.S. JOLTS		Minnesota		Wisconsin		BLS 1979-1980		Canadian JVS	
	1964-1966	Pilot Projects	April 1969- December 1973	April 1969- December 1973	January 1972- December 1979	January 1976- December 1979	March 1979- June 1980	January 1971- December 1978	Pilot Projects	Pilot Projects	January 1971- December 1978	Program
Mean U.S. unemployment rate during period spanned by survey	4.5		5.0		6.4	6.6	6.2		6.4			
Implied mean value of vacancy to unemployment ratio given monthly unemployment rates for the U.S. during period spanned by survey:												
VR on UR model	.449		.348		.236	.214	.585		.184			
lnVR on lnUR model	.415		.344		.241	.216	.558		.183			
1/VR on 1/UR model	.395		.373		.240	.218	.577		.207			
Implied unemployment rate at which number of vacancies equals number of unemployed:												
VR on UR model	2.8		2.8		2.8	2.2	3.8		2.2			
lnVR on lnUR model	2.7		3.1		2.9	2.5	3.7		3.2			
1/VR on 1/UR model	2.5		3.3		3.1	2.8	3.7		4.3			

^aThe numbers reported in this table were created in the same way as those appearing in Table 3, except that the vacancy rate estimates used were inflated to correct for the sources of downward bias discussed in Table 4.

conclusions seem to hold up well. First, over the past 15 years, it would appear that the average vacancy to unemployment ratio has been quite low, approaching .500 during the middle 1960's but below .250 during most of the past decade. Second, it would seem that only when the unemployment rate has fallen below 3.0 percent has the number of vacant jobs consistently equalled or exceeded the number of unemployed persons.

Adjusting for the Inclusion of Persons Not Seeking Jobs in the Unemployment Rate Data

The conclusions reached thus far might be criticized on the grounds that the definition of unemployment is not symmetric with the definition of a job vacancy. In particular, jobs which are to be filled by recall from temporary layoff are not counted as vacancies, whereas the unemployment rate does reflect persons who have been temporarily laid off. More fundamentally, to the extent that some of those counted as unemployed may not be actively seeking work, it could be argued that we ought to be interested in the vacancy to job seeker ratio rather than in the vacancy to unemployment ratio.

The BLS tabulates number of job seekers for the U.S. as a whole, where the number of job seekers is defined as total number unemployed minus number on temporary layoff minus number due to start jobs within 30 days.⁴⁸ These data have been recorded monthly from January 1970 through December 1980. Over this period, the number counted as job seekers averaged 83 percent as large as the number of unemployed persons. While data on job seekers covering the same time periods and geographic areas as the available vacancy data could not be obtained, in the aggregate monthly U.S. data the job seeker rate and the unemployment rate are closely related, which suggests that a reasonable estimate of the job seeker rate can be created given the unemployment rate.

Using the available monthly U.S. data, the following equation was estimated:

$$(5) \quad \text{JSR} = -.020 + 1.570 \text{ UR} - 6.529 \text{ UR}^2$$

$$(\text{.050}) \quad (\text{.158}) \quad (\text{1.193})$$

where JSR represents the job seeker rate (number of job seekers divided by number in labor force) and UR represents the official unemployment rate. The number in parentheses under the coefficient estimates are standard errors. The R^2 for this regression was .937. The regression coefficients obtained were then used to convert the unemployment rates corresponding to available vacancy data into job seeker rates.

These job seeker rates were used together with the adjusted-for-bias vacancy rates already discussed to calculate estimated vacancy to job seeker ratios. The resulting numbers almost surely overstate the availability of work relative to the number of job seekers. For one thing, as was mentioned earlier, the adjustments made to correct for downward bias in the originally reported vacancy rates were very generous. Second, the assumption implicit in the BLS definition of a job seeker that no one who is on temporary layoff is actively looking for work is almost certainly incorrect. Data from the May 1976 job-search survey, conducted as a supplement to the May 1976 CPS, indicate that persons on temporary layoff search almost as intensely as the average unemployed worker. Those data show persons on temporary layoff to have spent an average of 18.3 hours per month searching for a job; among the entire pool of unemployed, the average was 24.9 hours. Persons on temporary layoff used an average of 2.5 search methods, compared to an overall average of 3.4 search methods.⁴⁹ Moreover, it appears that a very high proportion of those on temporary layoff do not return to their original employers.⁵⁰ Thus, the figures on the vacancy to job seeker ratio to be presented in the tables

which follow must be viewed with a rather large degree of scepticism. It seems highly probable that the true vacancy to job seeker ratios for the relevant time periods were much lower than the reported numbers would suggest. The data can thus best be viewed as offering very loose upper bound estimates of the relevant true vacancy to job seeker ratios.

Estimates of the Vacancy to Job Seeker Ratio which Incorporate Vacancy Rate Corrections

Table 7 reports estimates of the vacancy to job seeker ratio reported separately for various unemployment rate levels. The vacancy rates used in constructing these estimates were corrected for the sources of downward bias described in Table 4 and the job seeker rates were created by plugging the relevant unemployment rates into equation (15). Not surprisingly, there is a strong inverse relationship between the vacancy to job seeker ratio and the unemployment rate. Further, most of the estimated vacancy to job seeker ratios are quite low. Excluding the data for the BLS 1979-1980 pilot projects, only those cells for unemployment rates of 3.5 percent or less show vacancy to job seeker ratios of 1.0 or greater.⁵¹ Again excluding the BLS 1979-1980 data, every cell for unemployment rates above 5.0 percent shows an estimated vacancy to job seeker ratio of .350 or less. Even the BLS 1979-1980 data typically produced estimated vacancy to job seeker ratios well below 1.0. It should be reiterated that the vacancy to job seeker ratio estimates reported in Table 7 are very much upper bound statistics.

As was done before with data on VR and UR, Beveridge curve type regressions with VR ($\ln VR$, $1/VR$) as a linear function of JSR ($\ln JSR$, $1/JSR$) were estimated using the adjusted vacancy rate data from each survey and corresponding job seeker rates. All of the job seeker rate variable coefficients were highly significant except for those in the models using the

Table 7: Estimates of the Number of Vacant Jobs per Job Seeker at Various Unemployment Rate Levels Calculated Using Adjusted Vacancy Rate Data^a

Period spanned by survey	BES/BLS				Canadian JVS Program			
	1964-1966 Pilot Projects	U.S. JOLTS Program	Minnesota JOLTS Program	Wisconsin JOLTS Program	BLS 1979-1980 Pilot Projects	1971-1978	1971-1978	1978
1.6-2.0	6.102 (N=3)	NA	NA	NA	NA	NA	NA	NA
2.1-2.5	2.823 (N=5)	NA	NA	NA	NA	NA	NA	NA
2.6-3.0	1.390 (N=9)	1.488 (N=1)	1.513 (N=2)	NA	NA	NA	NA	NA
3.1-3.5	.862 (N=8)	1.006 (N=5)	1.048 (N=12)	NA	NA	NA	NA	NA
3.6-4.0	.616 (N=3)	.959 (N=2)	.764 (N=17)	.671 (N=4)	1.265 (N=4)	NA	NA	NA
4.1-4.5	.546 (N=5)	.534 (N=8)	.643 (N=11)	.504 (N=12)	.625 (N=1)	NA	NA	NA
4.6-5.0	.539 (N=4)	.457 (N=9)	.497 (N=17)	.434 (N=12)	1.063 (N=4)	NA	NA	NA
5.1-5.5	.324 (N=1)	.296 (N=15)	.350 (N=16)	.348 (N=8)	.777 (N=5)	NA	NA	.438 (N=2)
5.6-6.0	.326 (N=2)	.236 (N=8)	.345 (N=8)	.343 (N=4)	.870 (N=3)	NA	NA	.310 (N=5)
6.1-6.5	.218 (N=2)	.196 (N=7)	.247 (N=5)	.275 (N=5)	.654 (N=4)	NA	NA	.237 (N=2)
6.6-7.0	NA	.146 (N=2)	.228 (N=5)	.298 (N=1)	.589 (N=3)	NA	NA	.211 (N=5)
7.1-7.5	NA	NA	.249 (N=2)	.202 (N=1)	NA	NA	NA	.157 (N=7)
7.6-8.0	NA	NA	.190 (N=1)	.198 (N=1)	NA	NA	NA	.085 (N=1)
8.1-8.5	NA	NA	NA	NA	NA	NA	NA	.115 (N=7)
8.6-9.0	NA	NA	NA	NA	NA	NA	NA	NA
9.1-9.5	NA	NA	NA	NA	NA	NA	NA	.093 (N=2)
								.071 (N=1)

^aThe numbers reported in this table were created in basically the same way as those appearing in Table 2, but with two differences. First, the vacancy rate estimates used were inflated to correct for the sources of downward bias discussed in Table 4. Second, while the official unemployment rate formed the basis for the ranges in the left hand column, the estimated job seeker rate (job seekers divided by labor force) was used in calculating the ratios presented in the other columns. The estimated job seeker rates used were predicted based on the unemployment rate; the equation for doing this was estimated using monthly U.S. data for January 1970 through December 1980 and expressed the job seeker rate as a function of the unemployment rate and its square.

BLS 1979-1980 pilot project data. Table 8 summarizes the implications of the regression models, based on the assumption that the relationship between the vacancy rate and the job seeker rate for the U.S. as a whole during the period spanned by each survey was the same as that reflected in the vacancy rate/job seeker rate observations for that survey. Taken at face value, these numbers imply that during the mid-1960's and early 1970's, when the unemployment rate averaged 4.5 to 5.0 percent, the number of vacant jobs was roughly half as large as the number of persons seeking work. The Minnesota JOLTS, the Wisconsin JOLTS and the Canadian JVS all span periods with average unemployment rates around 6.5 percent; the reported calculations based on these surveys all show an average vacancy to job seeker ratio of under .300. For reasons previously discussed, the BLS 1979-1980 pilot project calculations are rather shaky; even those numbers imply that at an unemployment rate near 6.0 percent, there are many more people actively seeking work than there are available jobs. Again, it should be stressed that the estimated vacancy to job seeker ratios reported here almost surely overstate the availability of work relative to the number of people who would truly like a job.

How low would the unemployment rate have had to fall for the number of vacancies to equal the number of job seekers? Excluding the BLS 1979-1980 data, the average implied by the estimated regressions is 3.4 percent. Even the regressions based on the BLS 1979-1980 data imply that the unemployment rate would have to fall below 4.5 percent before the number of available jobs would equal the number of persons seeking work.^{52, 53}

The numbers reported in Tables 7 and 8 reflect very generous allowance both for possible downward bias in the vacancy rate as a measure of the availability of work and for possible upward bias in the unemployment rate as a measure of the number of persons who really would like work. It seems clear

Table 8: Regression Analysis of the Relationship Between Vacancies and Job Seeking Based on Adjusted Vacancy Rate Data^a

Period spanned by survey	BES/BLS		Minnesota		Wisconsin		BLS 1979-1980		Canadian JVS	
	1964-1966 Pilot Projects	U.S. JOLTS Program	January 1972- December 1979	January 1976- December 1979	March 1979- June 1980	January 1971- December 1978	January 1971- December 1978	March 1979- June 1980	January 1971- December 1978	Canadian JVS Program
Mean U.S. unemployment rate during period spanned by survey	4.5	5.0	6.4	6.6	6.2	6.4	6.4	6.2	6.4	6.4
Implied mean value of vacancy to job seeker ratio given monthly unemployment rates for the U.S. during period spanned by survey:										
VR on JSR model	.545	.435	.292	.262	.705					.226
lnVR on lnJSR model	.516	.432	.297	.265	.673					.217
1/VR on 1/JSR model	.516	.540	.297	.267	.636					.162
Implied unemployment rate at which number of vacancies equals number of job seekers:										
VR on JSR model	3.3	3.3	3.3	3.0	4.5					3.1
lnVR on lnJSR model	3.1	3.4	3.3	3.1	4.4					3.8
1/VR on 1/JSR model	2.9	3.4	3.3	3.3	4.3					4.6

^aThe numbers reported in this table were created in basically the same way as those appearing in Table 3, but with some important differences. First, the vacancy rate estimates used were inflated to correct for the sources of downward bias discussed in Table 4. Second, the regressions included the estimated job seeker rate described in the footnote to Table 7, instead of the unemployment rate. The numbers in the bottom panel were created by first computing the implied job seeker rate such that number of vacancies equalled number of job seekers, then translating the job seeker rate back into an unemployment rate. The equation for performing the last of these steps was estimated using monthly U.S. data for January 1970 through December 1980 and expressed the unemployment rate as a function of the job seeker rate and its square.

that these numbers most likely overstate the availability of work for those who want it. Even so, the basic conclusion originally reached on the basis of the unadjusted data seems to hold up well: there are many more people seeking work than there are jobs available. In relatively good times, there may be half as many jobs as people seeking work; on average over the past decade, there would appear to have been fewer than 30 percent as many jobs as people seeking work. Furthermore, the data seem to imply that the unemployment rate would have to be reduced to under 3.5 percent before the number of available jobs would be brought into equality with the number of persons seeking work.

IV. Indirect Estimates of the Vacancy to Unemployment Ratio

The preceding conclusions are based on vacancy rate data collected directly from surveyed establishments. An alternative route for obtaining vacancy to unemployment (or vacancy to job seeker) ratio estimates would be to start with data on new hire rates and on the average duration of a completed vacancy spell. In a steady-state situation:

$$(16) \text{NHR} * d_v = \text{VR},$$

where NHR represents the new hire rate, d_v represents the average length of time a job remains vacant and VR represents the vacancy rate. In this section of the paper, data on job tenure from four January CPS files are used to estimate the new hire rate and available evidence on the average duration of a job vacancy is presented. The resulting new hire and duration information is combined to yield estimates of the vacancy rate for four points in time. The implied vacancy to unemployment (vacancy to job seeker) ratios are similar in magnitude to the relevant ratios obtained earlier. The results of this indirect approach are thus supportive of the conclusion that the vacancy to unemployment and vacancy to job seeker ratios have typically been quite low.

Using Tenure Data to Estimate the New Hire Rate

In January of 1963, 1968, 1973 and 1978, the CPS questionnaire contained a question regarding job tenure. Individuals were first asked whether they had been employed during the survey reference week, the week containing the 12th of the month. Those who said "yes" were asked when they had started the job at which they were employed. If hiring occurred at a uniform rate during the month of January, then the following expression should yield a reasonable approximation to the new hire rate:

$$(17) \frac{31}{k} * \frac{N_1}{N_2},$$

where k is the date of the last day in the week including the 12th of January, N_1 is the number of persons who said they started their jobs on a January date during or prior to the reference week, and N_2 is the total number of persons employed during the reference week. Using data from unpublished BLS tabulations, I calculated the relevant overall new hire rates to be as follows: January 1963, 6.5 percent; January 1968, 6.4 percent; January 1973, 4.7 percent; and January 1978, 6.2 percent.⁵⁴

Are these numbers reasonable? One way to check their reasonableness would be to compare similarly computed new hire rates for manufacturing sector wage and salary workers to the manufacturing sector new hire rates obtained under the labor turnover program. However, some of the same downward biases that likely affected the JOLTS vacancy rates, in particular the four problems of mail versus interview responses differing, nonresponse bias, overrepresentation of large firms and nonrepresentation of firms just being born, would also be expected to affect the labor turnover program new hire rates. Using the correction factors developed earlier to deal with these four problems would suggest that the true new hire rate may be approximately 1.56 times as large as the new hire rate estimated based on the labor turnover

panel reports. CPS-based new hire rates for manufacturing sector wage and salary workers were thus compared to labor turnover program manufacturing sector new hire rates multiplied by a factor of approximately 1.56. The two resulting sets of numbers were as follows: January 1963, 3.7 percent (CPS based) versus 3.0 percent (labor turnover program); January 1968, 4.5 percent versus 4.7 percent; January 1973, 3.6 percent versus 5.5 percent; and January 1978, 4.5 percent versus 3.9 percent.⁵⁵ On the whole the two sets of numbers appear to correspond fairly closely, at least with regard to their average level; the CPS-based set averages 4.1 and the inflated labor turnover program set averages 4.3.

Information on the Average Duration of a Job Vacancy

Two sources of information on the average duration of a job vacancy are available. The first is a Canadian study which relied upon questions asked during the interview phase of the JVS; the second is the vacancy diary project undertaken in the states of Massachusetts and Utah during March 1980.

The Canadian duration data were collected from JVS large employer interview forms (for units with more than 20 employees) for the period from the third quarter of 1971 through the first quarter of 1973. During the interview phase of the JVS, large employers were asked: (1) when did you last hire somebody? and (2) when did you initiate action to fill the job for which this person was hired? Based on the answers to these questions, researchers at Statistics Canada estimated the mean length of time a job vacancy remained open to be approximately 10 working days, which is roughly equivalent to 14 calendar days.⁵⁶ To the extent that large firms are more bureaucratic in their hiring process than smaller firms, this estimate very likely overstates the mean duration for all vacancies. Data on the duration of job openings was

also collected as part of the BLS vacancy diary project carried out during March of 1980 with the cooperation of Massachusetts and Utah employers. The employers were supposed to list the date they had begun recruiting for all jobs that were open at the beginning of the month, and then to record all recruiting and hiring activity which occurred during the month. The official report on the project contains a table showing percentage of jobs open 0 days, 1 to 7 days, 8 to 14 days, 15 to 30 days, 31 to 60 days and 61 or more days, tabulated for all jobs filled or cancelled during the month.⁵⁷ Calculating a mean job vacancy duration under the assumption that the midpoint of each interval represents the length of time it took to fill each job in the interval yields an estimated mean duration of 10.66 calendar days for Massachusetts and 8.07 calendar days for Utah. Calculations done by a state employment service staff member in Utah based on the actual duration of each completed job vacancy spell show an average duration of all filled or cancelled jobs of 6.76 calendar days, slightly under the 8.07 calendar days estimated using the interval data contained in the official report.⁵⁸

Based on the available information, it would appear that the average duration of a job vacancy is probably somewhere between 5 and 15 calendar days. It is important to note that how long it takes to fill job openings may vary considerably over the business cycle. Both of the sources of information on duration discussed above apply to places and time periods where the unemployment rate was between 5 and 6 percent. One would expect shorter durations in situations with a higher unemployment rate and longer durations in situations with a lower unemployment rate.

Estimates of the Vacancy to Unemployment and Vacancy to Job Seeker Ratio

Table 9 reports estimated vacancy to unemployment ratios for January 1963, January 1968, January 1973 and January 1978. Three sets of figures are

Table 9: Estimated Vacancy to Unemployment Ratios Based on Tenure Data from the January CPS Files^a

	January 1963	January 1968	January 1973	January 1978
Unemployment rate	6.9	4.0	5.5	7.0
Implied new hire rate based on proportion of employed persons who started job on a January date during or prior to the CPS reference week.	6.5	6.4	4.7	6.2
Implied vacancy to unemployment ratio assuming a mean vacancy duration of:				
5 calendar days	.151	.250	.131	.133
10 calendar days	.304	.506	.264	.269
15 calendar days	.462	.767	.399	.408
Implied vacancy to job seeker ratio assuming a mean vacancy duration of:				
5 calendar days	.182	.312	.156	.163
10 calendar days	.368	.631	.314	.329
15 calendar days	.559	.956	.475	.499
Best guess about which of these vacancy durations is closest to the true mean vacancy duration.	5 calendar days	15 calendar days	10 calendar days	5 calendar days
Implied vacancy to unemployment ratio assuming mean vacancy duration indicated above.	.151	.767	.264	.133
Implied vacancy to job seeker ratio assuming mean vacancy duration indicated above.	.182	.956	.314	.163

^aData on the unemployment rate were obtained from various issues of Employment and Earnings. The implied new hire rates were based on tabulations showing the distribution of tenure among persons employed as of the time of the relevant January's CPS interview; these were supplied by BLS.

reported, the first assuming a mean vacancy duration of 5 calendar days, the second a mean duration of 10 calendar days, and the third a mean duration of 15 days. The 15 day duration is probably closest to accurate for January 1968, when the unemployment rate was 4.0 percent; this implies a vacancy to unemployment ratio of .767. The 5 day duration figure is probably the most appropriate for January 1963, with an unemployment rate of 6.9 percent, and for January 1978, with an unemployment rate of 7.0 percent; this duration figure yields estimated vacancy to unemployment ratios of .151 and .133 for those two dates. The best duration estimate for January 1973, when the unemployment rate was 5.5 percent, is probably 10 calendar days, which produces an estimated vacancy to unemployment ratio for that date of .264. All four of the above vacancy to unemployment ratio estimates seem to correspond closely to the ratio estimates for the relevant unemployment rate levels that are reported in Table 5.

The unemployment rates for each of the four relevant months were also translated into estimated job seeker rates using equation (15) so that estimated vacancy to job seeker ratios could be calculated. Under the same assumptions as were just stated regarding the mean vacancy duration as of each of the four January dates, these calculations imply that the vacancy to job seeker ratio was near 1.000 in January 1968, when the unemployment rate was 4.0 percent; under a third in January 1973, when the unemployment rate was 5.5 percent; and under .200 in January of 1963 and in January of 1978, with unemployment rates of 6.9 percent and 7.0 percent, respectively. These estimated vacancy to job seeker ratios seem to correspond closely to those for the relevant unemployment rate levels reported in Table 7.

While the calculations just described are admittedly rough-and-ready, it is reassuring that the results obtained from two quite different approaches to

estimating vacancy to unemployment and vacancy to job seeker ratios, one via adjustment of the reported vacancy rates to correct for downward bias and the other via combining information on the new hire rate with information on the duration of job vacancies, should yield such seemingly consistent results.

V. Conclusion

This paper has examined the available data relevant for estimating the job vacancy rates prevailing in our country at various points in time since the mid-1960's. The data imply that at least during the past fifteen years, the ratio of job vacancies to the number of unemployed has been quite low. Reasonable estimates would be that the ratio averaged .400 in the second half of the 1960's and the early 1970's and below .250 in the past decade. While somewhat higher, the number of vacant jobs per person counted as actively seeking work would also appear to have been quite low. Generous upper bound estimates place the average value of this ratio around .500 during the latter half of the 1960's and the first part of the 1970's and under .300 over the course of the past decade.

The availability of jobs relative to the number of persons seeking work constrains the potential effectiveness of unemployment policies designed to deal with "frictional" or "structural" problems. The relatively low value of the vacancy to unemployment ratio, particularly during the last decade, suggests that such policies are apt to be of limited effectiveness if used alone to lower the unemployment rate. While it certainly cannot be concluded that it would be optimal to stimulate the economy sufficiently to bring the number of vacant jobs into equality with the number of persons seeking work, the data do suggest that large reductions in the unemployment rate will only be achieved if new jobs can be created.

FOOTNOTES TO CHAPTER 1

¹The Wall Street Journal, April 6, 1965.

²The Wall Street Journal, July 10, 1969.

³The Wall Street Journal, July 13, 1973.

⁴The New York Times, April 8, 1981.

⁵The New York Times, March 17, 1981.

⁶The simple steady state model used here was first laid out in Myron L. Joseph, "Job Vacancy Measurement," Journal of Human Resources, vol. 1 (Fall 1966), pp. 59-80.

⁷A series of steps to be gone through before hiring may be spelled out in a firm's personnel policy manual or in a collective bargaining agreement. Administrative delay in filling vacancies may also arise from government requirements concerning efforts to hire women and minorities.

⁸These results are presented in James L. Medoff and Katharine J. Abraham, "Unemployment, Unsatisfied Demand for Labor, and Compensation Growth in the United States, 1956-1980", Working Paper . WP1206-81 (Massachusetts Institute of Technology, September 1981).

⁹Note that the argument here is not that a given aggregate demand stimulus will produce a smaller change in the inflation rate when the initial vacancy to unemployment ratio is low, but rather that, all else the same, the level of the inflation rate will be lower when there are fewer vacancies. One might argue that policy makers care primarily about the change in the rate of inflation associated with their actions, in which case the stated conclusion would not hold.

¹⁰This discussion of the social costs of unemployment and of vacancies draws heavily on Robert J. Gordon, "The Welfare Cost of Higher Unemployment," Brookings Papers on Economic Activity, 1:1973, pp. 133-195.

¹¹See President's Committee to Appraise Employment and Unemployment Statistics, Measuring Employment and Unemployment (GPO, 1962), pp. 199-202 and pp. 271-281.

¹²Perhaps the most thorough available report on these early BES/BLS pilot vacancy projects is Paul Harrington, "The Labor Department's Experience in the Collection and Analysis of Job Vacancy Statistics: The Experimental Programs of 1964-1966," unpublished BLS report, undated. (Hereafter Harrington, "The Experimental Programs of 1964-1966.") Job Vacancy Statistics, Hearings before the Subcommittee on Economic Statistics, Joint Economic Committee, 89 Cong. 2 sess. (GPO, 1966) contains copies of the various survey forms that BES experimented with and testimony from a number of individuals concerning the pilot project experience.

- ¹³ A description of the JOLTS program, including a copy of the survey form used, can be found in U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Methods, Bulletin 1711 (GPO, 1971), pp. 35-42. For a summary of the results from the JOLTS data collection efforts written after the job openings part of the program was discontinued, see Paul A. Armknecht, "Job Vacancies in Manufacturing, 1969-73," Monthly Labor Review vol. 97 (August 1974), pp. 27-33.
- ¹⁴ Julius Shiskin, Commissioner of Labor Statistics, Memorandum to Paul Krueger, Office of Management and Budget, December 7, 1973, cited by Harry Frummerman, "Job Vacancy Statistics in the United States," in Counting the Labor Force, Appendix Volume 1: Concepts and Data Needs, National Commission on Employment and Unemployment (GPO, 1979), p. 606.
- ¹⁵ See Paul Harrington, "Collection of Job Vacancy Statistics in Minnesota and Wisconsin," unpublished BLS report, April 1978, for a discussion of the Minnesota and Wisconsin JOLTS programs. Richard Johnson of the Minnesota Department of Economic Security and Kenneth D. Siemers of the Wisconsin Department of Industry, Labor and Human Relations provided much valuable information concerning their states' vacancy data collection efforts.
- ¹⁶ A thorough discussion of the BLS 1979-1980 pilot vacancy projects can be found in U.S. Department of Labor, Bureau of Labor Statistics, Office of Employment Structure and Trends, "Job Openings Pilot Program," unpublished BLS report, June 1981. (Hereafter "Job Openings Pilot Program.")
- ¹⁷ See Paul Harrington and William Milligan, "A Brief Review of the Canadian Job Vacancy Survey," unpublished BLS report, undated, for a discussion of the JVS. Statistics Canada, Labor Division, Job Vacancy Survey Section, Canadian Job Vacancy Survey: Technical Appendix, Catalogue 71-521 Occasional (Ottawa: Information Canada, July 1972), contains copies of the various survey forms used and a detailed description of the survey methodology.
- ¹⁸ Military enlistment opportunities are also ignored by all of the surveys. In this paper, explicit consideration is given to the omissions listed in the text, but no direct attention is given to the potential availability of military jobs.
- ¹⁹ Only the Wisconsin JOLTS program produced estimated manufacturing vacancy rates which averaged below the relevant estimated overall vacancy rates. In the data produced by the BES/BLS 1965-1966 pilots, the Minnesota JOLTS, the BLS 1979-1980 pilots, and the Canadian JVS, the estimated manufacturing vacancy rates averaged above the estimated overall vacancy rates.
- ²⁰ The sources of the raw vacancy rate data and unemployment rate data used in this study are detailed in the footnotes to Table 2.
- ²¹ In fact, one would find an inverse relationship between the unemployment rate and the vacancy to unemployment ratio even if the Beveridge Curve were flat or slightly upward sloping.

²² Results similar to those presented in Table 3 except based on regressions of UR (ln UR, 1/UR) on VR (ln VR, 1/VR) were also prepared. Excluding the results for the BLS 1979-1980 pilot project, the implied mean vacancy to unemployment ratios for the periods spanned by the various surveys averaged roughly 20 percent lower and the implied unemployment rate such that number of vacancies equal number unemployed averaged roughly 30 percent higher. None of the vacancy rate variable coefficients in the BLS 1979-1980 regressions were even close to significant and one model actually produced a rather large negative estimated average vacancy to unemployment ratio.

²³ The 1964 Chicago feasibility study is discussed by Elizabeth J. Slotkin, "Problems in the Collection of Data on Job Vacancies: Chicago Pilot Study," in The Measurement and Interpretation of Job Vacancies (New York: National Bureau of Economic Research, 1966), pp. 331-347; see especially pp. 334-336. The response analysis surveys which followed the 1964-1965 BES/BLS pilot projects and the 1966 BLS pilot efforts in Baltimore and Hartford are discussed in Harrington, "The Experimental Programs of 1964-1966;" see in particular pp. 19-20, 29 and 87-88. Discussion of record keeping practices among firms participating in the 1966 Canadian RAS can be found in Part III of Dominion Bureau of Statistics, Department of Manpower and Immigration, "Report of Committee on Job Vacancies Feasibility Survey," December 20, 1966. (Hereafter "Report of Committee on Job Vacancies Feasibility Survey".)

²⁴ The statement cited comes from Chapter 5, "Job Openings Pilot Program," p.13; the percentage figures appear in Appendix C of the same report.

²⁵ See Slotkin, "Problems in the Collection of Data on Job Vacancies: Chicago Pilot Study."

²⁶ See Chapter 5 and Appendix C of "Job Openings Pilot Program."

²⁷ The concern that the existence of multi-establishment firms might cause problems is voiced in "Report of Committee on Job Vacancies Feasibility Survey," which dealt with the 1966 Canadian pilot project experience. This report recommended that a profiling procedure be used for the JVS. However, no data were ever collected to show how vacancy estimates obtained after profiling would differ from those obtained without profiling.

²⁸ See Harrington, "The Experimental Programs of 1964-1966," pp. 53 and 85.

²⁹ A discussion of these reinterview studies can be found in Chapter 3 of "Job Openings Pilot Program."

³⁰ See "Report of Committee on Job Vacancies Feasibility Survey."

³¹ The JVS tapes used for these calculations were made available by Eric Van der Wolt of Statistics Canada. A detailed description of my treatment of the data can be supplied upon request.

³² See Harrington, "The Experimental Programs of 1964-1966," pp. 16, 48 and 83.

- ³³The proportion of total manufacturing sector employment represented by firms on the JOLTS panel who provided vacancy information is reported for March of 1969, 1970, 1971 and 1972 in U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, various issues. The Minnesota figure was reported in Research and Planning Branch, Minnesota Department of Employment Services, "Job Openings in Minnesota 1968-1974, with Emphasis on the Demand for Specific Occupations," a Job Openings Labor Turnover Program report, undated; and the Wisconsin figure was based on information sent to me by Kenneth Siemers of the Wisconsin Department of Industry, Labor and Human Relations.
- ³⁴See Chapters 2 and 4 of "Job Openings Pilot Program."
- ³⁵See Harrington, "The Experimental Programs of 1964-1966," p. 53.
- ³⁶See "Report of Committee on Job Vacancies Feasibility Survey."
- ³⁷The JVS microdata cannot be used to generate independent estimates of vacancy rates for nonrespondents as compared to respondents because no information on unit employment is coded. The JVS total vacancy estimates are constructed by assuming that surveyed units have the same number of vacancies, not the same vacancy rate, as the units they are representing.
- ³⁸This figure came from unpublished tabulations supplied by Carol Utter of BLS.
- ³⁹This figure also came from unpublished tabulations supplied by Carol Utter of BLS.
- ⁴⁰See David E. Gower, "Undercount of Vacancies Caused by New Establishments," Job Vacancy Survey Analysis Paper JVA-1 (Ottawa: Dominion Bureau of Statistics, July 1970).
- ⁴¹See Chapter 5 of "Job Openings Pilot Program."
- ⁴²These figures were derived from tabulations contained in Appendix A to "Job Openings Pilot Program."
- ⁴³See David E. Gower, "The Effect of the Reference Date on the Job Vacancy Estimates," Job Vacancy Survey Analysis Paper JVA-9 (Ottawa: Dominion Bureau of Statistics, December 1970).
- ⁴⁴See Chapter 5 of "Job Openings Pilot Program."
- ⁴⁵Two examples of statements made by union officials asked to comment on vacancy data collection are given by Marvin Freidman, commenting on several papers, in The Measurement and Interpretation of Job Vacancies (New York: National Bureau of Economic Research, 1966), pp. 132-137, and Lazare Teper, commenting on Frumerman's paper, in Frumerman, "Job Vacancy Statistics in the United States," pp. 66-71.
- ⁴⁶See Employment and Training Report of the President, 1980.

- ⁴⁷ Results similar to those presented in Table 6 except based on regressions of UR ($\ln UR$, $1/UR$) on VR ($\ln VR$, $1/VR$) were also prepared. Excluding the results for the BLS 1979-1980 pilot project, the implied mean vacancy to unemployment ratios for the periods spanned by the various surveys averaged roughly 20 percent lower and the implied unemployment rate such that number of vacancies equal number unemployed averaged roughly 20 percent higher. As was true with the similar models based on unadjusted vacancy data discussed in footnote 22, none of the vacancy rate variable coefficients in the BLS 1979-1980 regressions were even close to significant and one model actually produced a rather large negative estimated average vacancy to unemployment ratio.
- ⁴⁸ The BLS actually draws a distinction between what they call temporary layoff, which includes workers who expect to return to their employers within 30 days, and indefinite layoff, which includes everyone else on layoff who indicates a possibility of returning to their original employers. Following previous research, the term "temporary layoff" here refers to both of the above groups.
- ⁴⁹ These data are reported in Kim B. Clark and Lawrence H. Summers, "Labor Market Dynamics and Unemployment: A Reconsideration," Brookings Papers on Economic Activity, 1:1979, p. 48.
- ⁵⁰ Clark and Summers, "Labor Market Dynamics and Unemployment: A Reconsideration," pp. 48-50, discusses data on this point taken from the linked CPS files for the period from May 1976 through August 1976.
- ⁵¹ The one cell for observations where the unemployment rate averaged between 1.6 and 2.0 percent shows a vacancy to job seeker ratio of 6.102, which is very much out of line with any of the other estimated ratios. This undoubtedly reflects underprediction of the job seeker rate for observations in that cell resulting from extrapolating too far out of the range of the data on which equation (15) was based.
- ⁵² The procedure used for obtaining the estimated unemployment rates such that vacancies equalled job seekers was to first solve the equations expressing VR ($\ln VR$, $1/VR$) as a function of JSR ($\ln JSR$, $1/JSR$) for the rate level such that VR equalled JSR, then to translate the resulting job seeker rate into an unemployment rate. The equation for doing this was estimated using monthly aggregate U.S. data for the period from January 1970 through December 1980 and expressed the unemployment rate as a function of the job seeker rate and its square.
- ⁵³ Results similar to those presented in Table 8 except based on regressions of JSR ($\ln JSR$, $1/JSR$) on VR ($\ln VR$, $1/VR$) were also prepared. Excluding the results for the BLS 1979-1980 pilot project, the implied mean vacancy to job seeker ratios were on average approximately 15 percent lower and the implied unemployment rate such that number of vacancies equal number of job seekers approximately 10 percent higher. As was true with the similar models discussed in footnotes 22 and 46, none of the vacancy rate variable coefficients in the BLS 1979-1980 regressions were even close to significant and one model implied a large negative estimated vacancy to job seeker ratio.

- ⁵⁴ Edward Sekscenski of BLS supplied the tabulations from which these numbers were derived.
- ⁵⁵ The relevant unadjusted labor turnover program new hire rates can be found in U.S. Department of Labor, Employment and Earnings, various issues.
- ⁵⁶ See Winn Oughtred, "Job Vacancy Duration," unpublished paper, 1973.
- ⁵⁷ See Chapter 5 of "Job Openings Pilot Program."
- ⁵⁸ See Utah Department of Employment Security, Job Service, "Utah Job Openings Survey Research Evaluations FY 1980," report submitted to the Bureau of Labor Statistics, December 1980.

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