Have New Human Resource Management Practices Lowered the Sustainable Unemployment Rate?

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The way work is organized in the United States has undergone a radical change in the last 20 years. Job stability has declined for long-tenured workers, there has been a large increase in the use of contract and temporary workers, especially on the manufacturing shop floor, and there has been widespread adoption of new forms of workplace organization.[1] The business press and industrial relations experts who have traced and documented these trends often associate them with an increasingly competitive environment for U.S. business, driven by international trade and technological change.

The effects of these transformations on income distribution and productivity have been studied, but almost no attention has been paid to the effect they may be having on the ability of the economy to maintain low unemployment. This is surprising considering the coincidence of these changes with an extended decline in unemployment that seems to have produced little inflation, and evidence of a striking improvement in efficiency with which workers are matched with jobs. The combination of low unemployment and inflation suggest a decline in the Non-Accelerating Inflation Rate of Unemployment (NAIRU).[2] Several authors have argued that such a change has taken place over the last five to 15 years. The most popular explanations suggested for such a decline ignore the changes in the organization of work and focus instead on developments on the supply side of the labor market. The possibility that there is a link between the decline in the NAIRU and the adoption of these new practices has not been developed.

In this paper we discuss recent changes in how U.S. firms hire, train, fire, compensate, and manage workers. We then develop explanations for the motivations behind these changes using interviews with human resource executives from U.S. manufacturing.[3] Finally, we use these components to suggest how the major changes in American corporations' human resource management (HRM) practices could have led to a drop in the NAIRU.[4] A decline in labor rents that has made queuing for high wage jobs less attractive, is an important part of our story. This decline in rents occurred even as returns to skill (and therefore wages) rose for some workers. In fact, we show that inter-

[1] The adoption of these methods of production has been remarkably widespread within U.S. firms. For instance, Osterman (2000) finds that by 1997 57.2% of the firms in his survey had adopted Total Quality Management practices involving more than 50% of their core workforce.

[2] We use the term NAIRU in this paper for conformity with the rest of the volume and common usage. As we use that term here we mean it to be synonymous with the term LSRU or "lowest sustainable rate of unemployment," which encompasses the NAIRU/Natural Rate concept of a unique unemployment rate consistent with constant inflation, as well as the concepts described by Akerlof, Dickens and Perry (1996, 2000) in which a range of unemployment rates can be consistent with constant inflation.

[3] Although we have only interviewed human resource management executives from manufacturing for this paper, we believe that our theory of the restructuring that has taken place within these firms is applicable to other sectors as well. Manufacturing was the trend-setter, though the changes have spread widely. In future work, we plan to interview executives from service-producing industries as well.

[4] The formal model, which is just described here, is presented and analyzed in Cohen and Dickens (2001).

industry wage differences, a measure of rents, declined in a two-step sequence with a similar shape and timing to parallel movements in the Beveridge curve – a measure of matching efficiency. These co-movements also match in some important ways the available spotty data on the adoption of innovative work practices.

This last point of parallel timing is a key criterion of explanatory success.[5] Any full account of the decline in the U.S. NAIRU should explain the timing and cause of the two periods of sharp discrete inward shifts in the Beveridge curve that took place in 1985-1989 and since 1994. Explanations for the decline in the NAIRU which rely on unbroken long-term trends (e.g., decline in unionization, the aging of the workforce), or on factors only evident in the 1990s (e.g., the explosion of the internet), must be viewed as partial at best. Our emphasis on how changes in the practices of firms have affected labor demand and matching efficiency not only take into account important facts overlooked in most studies of matching, but allow us to generate such a time path for changes in the NAIRU.

It is possible that some slow-moving long-term forces, such as demographics, could build over time, but only have abrupt observable effects once some threshold was reached. Such effects, however, usually require an observable institutional shift and/or a centralized (policy) decision following the threshold being met, which is difficult to reconcile with the recent developments on these fronts. It is also hard to reconcile a threshold explanation with the two discrete periods of improvement the data show. This is not to say that we believe the decline in the NAIRU has a single cause – there are a few strong candidate explanations for developments in the 1990s that may be complementary to ours. The idea that workers' perceptions of productivity gains, and therefore their real wage demands, lagged behind actual gains seems plausible to us (Ball and Moffitt, this volume). The positive supply shocks of declining health care costs, lower import and oil prices, and the productivity effects of information and communications technology (ICT) each had their turn in the 1990s.[6] Nevertheless, the evidence that the improvements in the Beveridge and Phillips curves predates the 90s suggests that these are only partial explanations for the changes.

Our story links the radical restructuring in firms' management and hiring of labor, and the two-step decline in the NAIRU. Starting in the early to mid 1980s, the wave of international competition and technical change resulted in greater competitive pressures for customer specialization, cost reductions and quality. One effect of this change in product market structure was a move by firms to more frequent switching between and turnover of products – the so called "flexible specialization." In response to the demands of their product markets many companies began experimenting with a wide range of practices known collectively as high performance work organization (HPWO). Examples of these practices include: job rotation, pay for knowledge, autonomous teams, total quality management (TQM) and quality circles. A key characteristic of nearly all these HPWO systems is that core production workers' jobs are broadened and those workers are more interchangeable between tasks. This increasing ability to move workers within firms between jobs or production lines and the easier matching of hires that accompanied

[5] Dickens' (1999) comments on Katz and Krueger (1999) first raise this challenge.

[6] Allowing for all of these positive shocks and the effects we argue for here, would seem to explain all of the change in the NAIRU and then some. However, we will also argue that some causes that have been cited by others are not likely to have made important contributions to reducing the NAIRU.

such substitutability, may be part of the explanation for improved labor market efficiency.

At the same time, a more flexible production process means that many of the task-specific skills workers use must be relearned frequently. If workers with greater endowments of general human capital (or learning skills) can make such adaptations more quickly and cheaply, the increased depreciation rate of specific human capital should increase the demand for general human capital. With implicit or explicit wage bargaining, increasing the level of general human capital may increase the firm's relative wage. But, increasing demand for general skills and the falling value of specific skills reduces worker rents since bargaining leads firms and workers to share the returns on capital that either bring to the job. As these changes take place, the return on the capital that workers bring to the table becomes a larger fraction of the wage, and the return to the firm's capital becomes a smaller portion. When rents are reduced, workers become less willing to wait unemployed for these jobs and instead apply to lower-wage jobs where the vacancy rate is higher. This reduces both the unemployment rate and the vacancy rate shifting the Beverige curve in.

The process we just described affects mainly the more skilled blue-collar workers – the firm's "core" workforce. However, firms also employ a large number of less skilled workers who don't invest as extensively in specific human capital and their jobs are not affected as much by the demands for flexibility. An equity constraint links the pay of these workers to the pay of the more skilled core workers. As the firm demands more general skills from its core workforce, but not these other workers, the equity constraint becomes more costly. Eventually, the cost of maintaining pay parity between these different types of workers exceeds the costs of reorganizing and coordinating with outside contractors and the less skilled workers are moved outside the firm through contracting and using workers provided by temporary help firms. A wave of consolidation and downsizing in U.S. business in the early 1990s left in its wake a greatly revised view of what tasks should be done inside the firm and what should be contracted.[7] Although the use of outsourcing, contracting and temporary workers has been increasing over the entire period in which we are interested, there appears to have been a concentration of restructuring activity during the "mean leaning" of the early 90s. During this time in particular, an increasing number of firms pursuing such practices created economies of scale in contracting and temporary services, increased the acceptability of the practices, and increased the competitive pressures on those who had not adopted the practices. Thus growing use of these practices produced pressures for them to spread further and faster.

Several factors are probably responsible for the apparent halt in the progress toward increasing labor market efficiency between 1990 and 1994. The poor performance of the Japanese economy during this period may have taken away some of the motivation to copy their practices, while the U.S. recession left firms with fewer resources to experiment with new ways of organizing. Data presented below suggest a slowdown, and

[7] Where companies may have run their own cafeterias in the past, today over 90% of corporate food service is provided by contractors (with half of that 90% provided by the three biggest contracting companies). And food service is only the tip of the iceberg. While it is very common for firms to have outsourced such services as security, grounds keeping and payroll, some firms have outsourced everything from their computer services to their mail rooms. See the more detailed discussions below.

possibly even regression, in the use of HPWO during this period. The recession of the early 90s probably also gave firms both the motive and opportunity to pursue restructuring of their workforce. The transitory rise in turnover and churning associated with this process, and the slow adjustment of some workers' wage expectations to their reduced opportunities, may help explain the relative stability of the Beveridge curve during this period.

By the mid-1990s, however, the transition to what we will term "confident deployment" of the new high performance work techniques began. No longer were these practices viewed as experimental. High performance work organization, utilizing worker flexibility and broader jobs, had become widespread in manufacturing. Firms that had not adopted them viewed themselves as having fallen behind the norm. During this period, firms continued to upgrade general human capital for their core workforces, and to outsource for lower skilled labor. Temporary help workers have grown from less than ½% of employment in the early 1980s to over 2 ½ % today, with a large share of this increase coming in manufacturing temps. Since most temporary workers are looking for permanent employment while temping, and since they seldom count as unemployed, the growth in their numbers reduces measured vacancies and unemployment.

Recapping, we see three important routes by which the changes in the way firms use labor have improved the efficiency of the labor market: First, the increasing demand for generally skilled workers has made workers more interchangeable and this may have improved matching efficiency. Second, the falling number of good high wage jobs (caused by restructuring), and the increasing extent to which the wages in the remaining good jobs reflect workers' skills instead of job-specific rents, means that fewer people are willing to wait unemployed to get one of these jobs. Instead, people apply for lower wage jobs where the vacancy rates are higher. The slight increase in the vacancy rate for the remaining good high wage jobs is more than outweighed by the decline that occurs in the vacancy rate for the low wage jobs. Similarly the large decline in the number of people waiting unemployed for good jobs is considerably greater than the small increase in the number of people waiting unemployed for the low wage jobs. Thus the Beveridge curve shifts in. Third, the increased use of temporary workers, who search for jobs like the unemployed while not counting as unemployed, also leads to a decline in vacancies and unemployment.

The paper proceeds in five parts. Section I surveys the literature, drawing together facts that our story will synthesize. Section II describes the results of our interviews with human resource managers at several manufacturing firms and executives at a contracting and temporary help firm. Section III presents our analysis of inter-industry wage differences showing that, despite increasing wage inequality in general, inter-industry wage differences have fallen at the same time that the Beveridge curve has been shifting in and the new work practices have been adopted. This combination of stylized facts, interviews, and data analysis motivate the model described in Section IV. Section V recaps our argument, with a look at areas for future research and some policy implications.

I. What has been Changing in American Labor Markets?

Since 1980, facing increasing competitive pressure from abroad, pressure from financial markets to cut costs, and significant technological change, American firms have done a great deal to adapt their human resource practices.[8] Most notably, firms have changed how they hire and pay workers of different skill levels, and how they use firm-specific and general skills. These adaptations have arguably had a marked effect on both the nature of labor demand and compensation, which could have caused shifts in the Phillips curve. This section reviews the literature on these changes. It first establishes that an inward shift in the Beveridge curve occurred in two distinct periods, separated by intervening years of corporate restructuring. It is much harder to discern the timing of changes in the Phillips curve, but it appears to have begun to shift about the same time as the Beveridge curve (see the contribution of Staiger, Stock, and Watson in this volume).

This coincidence of the changing Phillips and Beveridge curves with the introduction of the new human resource management practices points us toward demand-side explanations for the change in the NAIRU. The remaining subsections discuss the changes in various aspects of employers'—particularly manufacturing employers'—hiring, compensation and management of workers. These include the changes in job turnover, layoffs, and insecurity; the rising reliance on temporary workers and contracting of business services; the development of compensation flexibility and wage decompression; and the adoption of high performance work organization practices. These stylized facts are then summarized as the basis for a story that can explain the drop in the NAIRU.

The Beveridge curve's inward shifts

In the past, unemployment rates below 5 to 6% have been associated with increasing rates of inflation. In the last several years, however, we have seen unemployment rates consistently below those rates with almost no increase in core inflation. Adding to the phenomenon to be explained, a measure of job vacancies computed from the index of help-wanted advertising was near its all time low in 1998, even before internet job search and advertising became widespread, despite the low unemployment. That we have maintained a low level of unemployment while keeping a large fraction of jobs filled and inflationary pressures in check suggests a vast improvement in the efficiency of the labor market.[9]

It is useful to think of the Beveridge curve – a convex relation between vacancies and unemployment – as representing the efficiency of the labor market in pairing workers and jobs. The closer the curve to the origin the more efficiently workers and jobs are being matched.[10] For the U.S., where no official government vacancy data exists, the

[8] This sense of greater competitive pressure is commonly expressed by American business managers and the financial press. We note that this sense is difficult to reconcile with the rapid growth in corporate profits in the 1990s, and the rise in consensual mergers without anti-trust intervention since 1980. Looking for the sources of both this sensibility and the actual HRM changes is a primary topic for future research.

[9] Katz and Krueger (1999) also suggest that the auspiciously timed movements in the U.S. Beveridge curve point toward a matching efficiency explanation for these improvements.

[10] Blanchard and Diamond (1989) develop a theoretical model to support such a link.

vacancy rate has been proxied by the ratio of the Conference Board's help wanted index of classified newspaper advertising to non-farm payroll employment. The ratio is adjusted using a method developed by Abraham (1987) to account for shifts in newspaper circulation and for the influence of the EEOC on job advertising.[11] This measure has done rather well at matching up with fluctuations seen in micro (e.g. state-level) data on actual vacancies.

Figure 1 is the U.S. Beveridge curve for 1960-98.[12] Abraham (1987) documents an outward shift of the U.S. Beveridge curve in the 1970s, and attributes it largely to geographic factors, such as the disparity of regional economic conditions. Blanchard and Diamond (1989, 1990) focus on incidence of unemployment when a recession occurs, arguing that that particular outward shift in the U.S. happened because workers, including females and non-whites, experienced long-term unemployment which made them less likely to be rehired. But it is clear from examination of the scatter plot that while there was a stable Beveridge curve from 1975-1985, the curve shifted inward markedly from 1986-1989, then drew a new stable curve from 1990-1994, and has shifted significantly inward again since 1995. In short, there were two distinct episodes of considerable improvement in labor market efficiency.[13]

The gaps in research to date on the employers' role in the labor market become even more important as we tackle the question of why the U.S. Beveridge curve has now shifted in. In line with the standard explanations of the Beveridge curve's outward shift in the 1970s, if there was a wholesale sectoral shift of worker demand by firms in the U.S. New Economy, say because of the expansion of an IT sector requiring new skills and/or new locations, this should have increased churning and turnover. Given even a positive technological shock, we would expect the Beveridge curve to have shifted *outward* again by the mid-1990s, but there is no evidence of that. An overly straightforward IT explanation also would have difficulty with the first shift occurring in the 1986-1989 period, given the vanishingly small ratios of IT per worker or IT as a share of total business equipment at the time; as Sichel (1997) and more recently Mincer and Danninger (2000) document, the most important increases in IT investment did not begin until 1993, and then from a very low base.[14]

Other prominent explanations suggest that the Beveridge curve changes should have been considerably more gradual than what we observe. Demographic changes, emphasized by Shimer (1998) and Katz and Krueger (1999), seem too gradual to account for the Beveridge curve shift and, as Burtless (1999) points out, most of the aging of the American workforce took place between 1979 and 1989. Thus it began before the first shift we identify here, and precedes by several years the other. The fraction of the

[11] See also Zagorsky (1998) for a discussion of the validity of this proxy. Note that the development of internet advertising, search, and placement services may presently be transforming this process, as well as decreasing the reliability of newspaper ads as a measure, as argued by Autor (2000a).

[12] We do not attempt to plot the Beveridge curve after 1998 because of the widespread use of the internet after this date makes us suspicious of the Help Wanted Index as a measure of vacancies. Were we to do so the plot would show *both* unemployment and vacancies declining in 1999 and 2000.

[13] Note that it is unlikely that any measurement problems with the Help Wanted Index could have caused such a pattern.

[14] This does not rule out productivity-enhancing effects of IT in the last few years, or even going forward. It simply points out that the labor market developments which we believe are the main motivating force for the decline in the NAIRU pre-date the growth in IT investment.

workforce that is unionized has been declining since about 1950. The rate of decline accelerated in the 1970s and again after the PATCO strike, but most of the decline in unionization rates was complete before the beginning of the period in which the Beveridge curve is shifting.

Rising job turnover, layoffs, and insecurity

Even without taking the precise timing of the shifts in the Beveridge curve into account, making sense of the apparent increasing efficiency of the U.S. labor market is all the more difficult because of one of the most discussed recent developments in American labor markets: the slight but clear downward shift in job stability for at least some workers in the 1980s and 1990s. Greater job turnover would normally be expected to lead to higher frictional unemployment, especially if much of the turnover was involuntary. Though it is clear that press reports from the early 1990s bemoaning downsizing and the end of lifetime employment were exaggerated, a plethora of research on trends in job stability have finally converged on a broad picture.[15] The main finding in this literature of interest here is the decreasing job stability and security in the 1990s for men who are older, and have longer job tenures. This fits with case evidence of a long period from the mid-1980s to the mid 1990s of corporate downsizing, especially in the manufacturing sector. For example David Neumark (2000) comes to the conclusion that four year and eight year retention rates fell for higher tenure older men in the 1990s, and there has been some general "weakening of worker-firm bonds" in the decade. His findings are significant given his earlier skeptical views on these changes.

Accompanying this general decline in job stability for longer-tenured workers in the 1990s, have been some adjustments in the experience and use of layoffs in manufacturing. As shown by Katz and Meyer (1990), the number of unemployed workers expecting recall was always higher than the number who actually were recalled. The perceived likelihood of recall had a significant effect on the unemployed workers' search behavior. On the occasion of redesigning the CPS, Polivka and Miller (1995) pointed out that perceived likelihood of recall had dropped across the board following the periods of restructuring in the 1980s and early 1990s. Survey questions had to be changed because the word "layoff" was now associated in the public's mind with permanent job loss. This change in perception was coincident with an increase in actual layoffs found by the survey (even after accounting for a change in the counting of re-entrants). Idson and Valletta (1996) document that, through the early 1990s, the positive influence of job tenure on recall probability from layoff was declining.

The explosive growth of contracting out and blue collar temporary employment

At the time that these shifts in job stability and security occurred in the 1980s and 1990s, American firms also changed their hiring behavior in another way. They massively increased their hiring of temporary workers, and expanded their use of outside

[15] Including the CPS Displaced Worker Surveys (Farber 1997, 1998) and tenure supplements (Neumark, Polsky, and Hansen 1997, Neumark 2000), the PSID (Jaeger and Stevens, 1999) the NLSY (Monks and Pizer 1998, Bernhardt, et al. 1998), and the SIPP (Bansak and Raphael 1998).

contractors to replace in-house staff. Outsourcing of business support services, and the accompanying shifts in employment and firm compensation, is an understudied phenomenon. Our interviews with human resource and strategic planning managers in large corporations indicate that the move to outsourcing is an important part of their workplace reorganization (see next section), and we argue below that it plays a critical role in the chain of events linking changes in the firms' management and compensation of labor to the decline in the NAIRU.

One study directly discussing firms' use of outside contractors is Abraham and Taylor (1993). Using Industry Wage Surveys from 1986 and 1987, they document that the share of establishments contracting out services in their sample rose in several areas after 1979.[16] The motivations for contracting out appear to have been a combination of: savings on wages and benefits for lower skill workers, dealing with fluctuations in demand, and taking advantage of economies of scale or specialized management techniques (e.g., food service inventory management). One effect has been to reduce the access of lower skilled workers to employment with industrial (as opposed to business service) companies. As Burtless (1999) conjectures, "Unskilled workers become less numerous on big company payrolls, but they still find jobs. The jobs are in smaller companies and offer worse pay and fewer fringe benefits." As one would expect, this also applies to temporary workers.

Figures 2-5 show the growth of employment in sectors, and a few specific industries, we have identified with the contracting of business services. The pattern of growth in the fraction of contractor employees in total business employment shows significant accelerations in the mid to late 1980s and again in the 1990s after the recession. The rapid growth in the 1990s precedes the second shift in the Beveridge curve, but coincides with the wave of downsizing that may have temporarily increased equilibrium unemployment. On our rough accounting, the gains in employment over the relevant period are considerable, amounting to several million workers.

The similar expansion of temporary employment has recently received a great deal of academic attention. Otoo (1999) calculates that temporary employment tripled from the mid-1980s (around 0.7% of total non-farm payroll employment) to 2.3% of total employment by end of 1998 (see Figure 5). In theory, businesses using temporary help service companies to find permanent employees could directly improve the matching process if these temporary agencies help overcome information difficulties or achieve economies of scale in job search/hiring. Otoo (1999) attributes 0.25% of the decline in the NAIRU to improvements in matching efficiency due to the growth of the temporary help industry. Katz and Krueger (1999), offering similar intuition for benefits to matching from temporary help services through provision of screening and training, as well as lowering hiring costs and alleviating bottlenecks, estimate that the growth of temporary help services has taken 0.39% off of the NAIRU in the 1990s.

We believe that the increasing use of temporary help services has improved labor market efficiency, but not primarily because firms are using them to screen new hires. Permanent hiring of temps is rare except for clerical workers, and even then not all that frequent (Houseman and Polivka 1999). Instead of screening, the hiring firms seem to

[16] The number of companies in their survey contracting out janitorial services increased by 18% between 1979-1987, contracting out of machine maintenance increased by 6%, drafting services by 12%, accounting by 11%, and by computers/technical support by 12%.

benefit more from the flexibility temps offer to both staffing levels and compensation programs.[17] Segal and Sullivan (1995, 1997) establish that the cyclical variability of employment of these workers is very high, as one might expect if part of firms' motivation is to deal with excess demand without hiring permanent staff. Otherwise, why would temporary employment fluctuate so much, and why would temporary employees be more likely than permanent employees to change employment, become unemployed, and even leave the labor force as Houseman and Polivka (1999) demonstrate they do?[18] As with the decline in job stability discussed above, under normal conditions the direct effect of a greater number of workers in temporary jobs, moving in and out of active employment, should be to raise the NAIRU. Houseman and Polivka (1999), for example, estimate that the rise in flexible staffing arrangements from 1986 to 1996 *raised* the average rate of unemployment by 0.3% through increasing turnover and friction, an effect equal and opposite to those hypothesized above.

Of most interest to us in explaining the inward shifts of both the Beveridge and Phillips curves is that the growth in temporary employment in the 1990s was concentrated in blue collar jobs in manufacturing. While from 1977-1997, every non-agricultural sector showed a rise in the use of temporary workers, Estevao and Lach (1999b) estimate that, up to 1997, growth in use of temps in the manufacturing and service sectors made up 85% of the growth in total temps in U.S. employment in the 1990s. In fact, manufacturing sector use of temps rose from 1% of sectoral employment in 1992 to 4% in 1997, catching up with the level in services. Blue collar employees went from 6% of temporary help services in 1985 to 25% in 1995 according to Estevao and Lach (1999b). Similarly, in Autor's (2000b) 1994 survey of a large sample of temporary help services firms, blue collar workers made up 45% of the temp population. Segal and Sullivan (1997) date the increase in the proportion of male and blue collar temporary workers to the end of the 1980s and beginning of the 1990s.

That dating puts the sharp increase in manufacturing reliance on temporary employees coincident with the decline in direct hiring by manufacturing from peak employment in 1989.[19] Estevao and Lach (1999a) go so far as to put bounds on their estimates of the increase in temporary labor outsourcing in U.S. manufacturing 1992-1997 at 340,000 minimum and 510,000 maximum; in other words, the entire decline in manufacturing employment over the period is essentially matched by their estimate of the rise in temporary help services blue collar employment. This is consistent with the popular view that not all of the hires into temporary services came out of unemployment or even short-tenure employment, but that some came out of "good" jobs. A similar

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[17] As another source for rising temp demand, Autor (2000c) argues that the new "Unjust Dismissal Doctrine" adopted in the majority of American states has induced part (20%) of the growth in temps, because firms wish to retain their discretion to fire workers who have the least firm-specific skills.

[18] Houseman and Polivka (1999) explicitly downplay the role of screening for permanent hires as a major motivation for the move to flexible staffing arrangements. In their words, "Only a small minority of employers stated that they often move workers in flexible arrangements into regular positions…" Our corporate interviews (next section) indicate that employers are very much deterred by the (perceived) large fees charged by temporary help services for so doing.

[19] As Estevao and Lach (1999b) point out, this implies that the growth in temporary help services was due to a shift in the hiring behavior of firms, not due to a rise in employment in those sectors which were disproportionate users of temps at the start of the 1990s. FIRE and TCU sectors have shown a slow though steady rise in temporary help services use since the early 1980s, and in construction the use of temporary help services has been stable since 1987.

replacement phenomenon came up during our interview with an executive from a contracting firm who volunteered that in many cases the contracting firm will hire the workers let go by a company when they sign a contract to replace an in-house service.

It is worth emphasizing how different these manufacturing temporaries are from the lingering stereotypical image of the temp as "Kelly Girl" or other young pink-collared female clerical worker. In Estevao and Lach's (1999a) assessment, the typical manufacturing temp is a male, 35-50 years old, with some college, working full-time in the Midwest. This happens also to be the type of worker who traditionally has the largest within occupation wage differentials, meaning in all likelihood rents from a "good job" in a high wage firm and/or firm-specific skills. In Autor's (2000c) sample, 62% of blue collar temps were classified as "handlers/equipment cleaners/labor" and 24% were "operators/assemblers/inspectors."

Autor (2000b) explores the phenomenon of 'free general skills training' by temporary help firms, but in his sample from a 1994 survey, the 45% of temp workers classified as blue collar were markedly less likely to get that training: while 81% of clerical temps received some training, only 59% of blue collar temps did; 74% of clerical temps were given computer training versus only 14% of blue collar temps. Only on the soft skill of 'business conduct' did a comparable proportion of clerical (68%) and manufacturing (60%) temps receive training. It is not a surprise, therefore, that in Autor's (2000c) wage regressions showing the positive effects of training for white and pink collar temps, the blue collar category shows no significant positive effects of training. In fact, the wage equations have a notably poor fit for those workers.

While it may be unusual for temporary workers to be hired permanently by the firms that employ them, most temporary workers are looking for permanent work and are temping only because it is the best opportunity available to them. Krueger and Katz (1999) note that 70% of temporary help services employees in the February 1997 CPS supplement said they were temping for "economic" reasons rather than by choice.

To get to a story where these major shifts in corporate personnel practices could be associated with the declining NAIRU, we have to take seriously the motivations for the rise in temporary hiring and in contracting —and as we have seen, these are not primarily screening workers for permanent employment nor benefiting from someone else's worker training. The efficiency gains pursued by firms must be those which arise for the other widely-recognized reasons: the possibility of decompressing wages between higher- and lower-skilled workers; the advantages of scale economies and specialized skills in outsourcing some non-core tasks; and the flexible adjustment of company labor forces to swings in demand.[20] Secular growth in temporary help services employment could thus account for some of the shifts in the Beveridge curve, if hiring temps substitutes for what would previously have been listed as vacancies, and for the Phillips curve, if some of those who became temps previously would have been unemployed.

[20] Abraham and Taylor (1993), Estevao and Lachs (1999a), and Houseman and Polivka (1999) all come up with essentially this same list of three, plus training/screening, as potential motivations. As will be seen in the next section, those of our corporate interviewees who discussed the motivations for moving to flexible staffing volunteer the same three reasons (but not training), while the one (clerical) temp agency executive interviewed largely denies there being migration from her agency to permanent employment by client firms.

The efforts to decompress wages within firms

Unionization and internal equity constraints have generally led to the compression of wages within firms. This is inefficient for firms, who have little choice but to pay the going rate for needed high skill workers, and then find themselves constrained to reward other employees in relation to that wage rather than to the individual worker's productivity. In recent years, there have been a number of developments in compensation practices which have the potential to increase within firm wage dispersion (see Lebow, et al. 1999 based on surveys done in Federal Reserve "Beige Books"): increased use of lump-sum payments, profit-sharing and stock options extending below top management, merit pay raises (outside of seniority), wider bands within wage levels for large corporations, pay for skills and outsourcing. Of course, the broader shift to temporary and contract workers to whom the establishment need not pay usual wages and benefits, increases the wage dispersion of the firm's effective labor force, even as the internal payroll gets more concentrated.[21]

Widespread adoption of high performance work organization

Workplace organization, i.e. the definition, organization, and supervision of workers' tasks, has also undergone considerable change in the last 20 years. Worker involvement in quality control, the design of products and production processes, job rotation, and team production have become widespread in manufacturing and beyond.[22] Appelbaum and Batt (1994) set out a view of an American economy beset by international competition and deregulation, as well as worker frustration and fear, which compelled businesses to produce higher value-added, higher quality, more customized products, on a faster product cycle. These non- or less-standardized goods erode the benefits of mass production and standardized (or Taylorite) job descriptions. Instead, the workplace is shifted to high performance work organization (HPWO), seen in American forms of lean production and team production.[23] In the early 1980s, such practices were essentially non-existent in U.S. firms. As of 1992, however, when Appelbaum and Batt completed their research, HPWO practices were already adopted by a growing minority of American manufacturers.

Osterman (1994) presents the results of a 1992 survey for the spread of four such practices sampled from non-agricultural establishments with more than 50 employees. He finds that 40.5% of firms surveyed have team production for half or more of their core

[21] While to an economist, compensation is compensation, be it wages or benefits, there is reason to think that in practice the divide between wages and benefits, and the absence of them in many temp jobs, is significant in workers' minds. On the one hand, it is even harder from an internal moral/equity point of view to justify giving different workers different health coverage than different wage premia for seniority. There are also important tax considerations mandating that benefits being offered to some workers be widely shared within the firm for them to qualify as deductions from pre-tax earnings.

[22] Whether these practices significantly increase worker productivity and production efficiency net of labor costs is subject to dispute, (though no responsible observer appears to claim evidence they harm productivity). See Lynch and Black (1997), Cappelli and Neumark (1999), and Black and Lynch (2000).

[23] American forms because, as Appelbaum and Batt (1994) along with others note, many of these other practices were already implemented in different forms or combinations in Germany, Japan, Sweden and elsewhere, and the American firms and workers were very conscious of the international examples.

workers, job rotation at 26.6% of firms, Total Quality Management (TQM) at 24.5% and quality circles at 27.4%.[24] Reprising the survey in 1997, Osterman (2000) finds that the share of establishments with 50% penetration of self-managed teams has largely stagnated (38.4%), but the incidence of the other three practices has risen: 55.5% have job rotation; 57.2% have TQM; and 57.7% have quality circles. Table 1 presents the results of several surveys of such practices, including Osterman's. In longitudinal data on firms in both of Osterman's surveys, 81.5% of those establishments which had at least two HPWO practices in 1992, still had two or more in 1997, while 53.5% of those establishments with one or none of the HPWO practices in 1992 had two or more in 1997.

Figure 6 plots the change over time in the percentage of firms using job rotation (the practice for which we have the most observations) and an index of the position of the Beveridge curve.[25] As can be seen in the admittedly spotty data, the adoption of job rotation in Osterman's surveys and others displays the same two-step shift as the Beveridge curve, increasing in the late 1980s, plateauing or going back slightly from 1990-1994, and rising again in the late 1990s.[26] This coincidence in the development of HPWO and the shifts in the Beveridge curve is of great interest, because none of the other explanatory variables for changes in matching efficiency show this rise-flat-rise sequence.

These practices, particularly those involving team work and job rotation, usually require some stability of the relevant workforce – a fact that would seem to be at odds with the evidence on job instability. What appears to have happened is that employers have identified "core employees" who are retained, and are expected to be the ongoing participants in these practices. This does not deny that some of the firms adopting HPWO are also many of the same firms laying off workers and restructuring in the last two decades. In fact, Osterman (1994, 2000) finds that firms facing international competition that engaged in layoffs are more likely to have adopted HPWO.

In short, despite layoffs, employers have retained their "core employees," who are presumably those who embody most firm-specific human capital and who, in the new structure, are required to have the most general skills as well. This would be consistent with the desire for increased within-enterprise wage dispersion, and for employment of temps and outside contractors. In a recent study, Burgess, Lane, and Stevens (2000) establish that churning (firms' hiring and firing workers at the same time) takes place in all phases of demand-driven job cycles, consistent with the empirical literature on job flows documenting that even shrinking firms hire and growing firms fire. Using firm-level data from Maryland, they show that for most firms there exists a stable core of workers which does not change, even when churning takes place. Interestingly, they find

[24] Osterman (1994) distinguishes between responses of those establishments that have had these practices penetrate at least 50% of their core workforces, and those where these practices were merely adopted somewhere within the (sometimes large) organization. The numbers for those merely adopting somewhere were 54.5% for teams, 43.4% for job rotation, 33.5% for TQM, and 40.8% for quality circles.

[25] The Beveridge curve index is computed as the unemployment rate at a 1.5% vacancy rate in a given year (assuming the Beveridge curve had a constant slope), subtracted from 10, and then multiplied by 10 to put it on the same scale as the fraction of firms using job rotation.

[26] We have reasonable confidence in the 1992 and 1997 data points since, as noted, Osterman (2000) used a genuine panel, resurveying previous respondents, to get the results, which were consistent with his new full survey.

evidence of a declining churn rate overall, and a steady decline in the churn rate of the highest quintile of churn establishments, over their 1985-94 sample – which would be consistent with firms shedding without replacing non-core workers over this period.

Finally, it is in the adoption of HPWO that information technology (IT) makes an appearance in our discussion of changes in how U.S. firms have hired, fired and compensated employees in the last two decades.[27] In a thought-provoking case study of a bank adopting the image processing of deposited checks in 1994, Autor, Levy, and Murnane (2000) describe how the adoption of the particular IT advancement of optical character recognition led to substitution for the (low skilled) check clearing labor, but increasing demands for integrated/flexible work and self-management from the (higher skilled) "Exceptions Department" labor dealing with misprocessed checks. While consistent with the usually invoked trend toward skill-biased technological change, there is more to the story: as IT investment occurs, lower-skill jobs are moved out of the firm, while higher-skill jobs are switched to HPWO and, presumably, greater stability.

Lindbeck and Snower, (1996, 2000) assert that such an interaction between what they perceive as advances in technology, worker preferences for jobs with variety requiring versatility (meaning HPWO), and a steady rise in human capital and training, constitutes a general OECD-wide shift from "Taylorite" to "Holistic" organization of production. In such a world, workers' initially unobservable abilities to work flexibly and in teams are revealed in tandem with wage decompression to reward those increasingly valuable general skills. Lindbeck and Snower (1996, 2000) suggest that this shift explains the increasing dispersion of wages within worker types in the U.S. and of job opportunities (given nominal wage rigidities) in Europe. This dynamic is supported by evidence from firm-level panel data studies, including Bresnahan, Brynjolfsson, and Hitt (1999), Black and Lynch (2000), Dunne, et al (2000), and Osterman (2000), which find a positive correlation between IT, HPWO practices across firms, and human capital.

Yet, for all of this explanation's appeal, and particularly its potential as a description for a force likely to increase as adoption of IT moves forward, the empirical evidence for it being central in American, or even European, wage developments to date cannot be deemed entirely convincing. Bresnahan, Brynjolfsson and Hitt's (1999) model and data emphasize white collar industries, not manufacturing where the shifts in employment practices have been greatest, and where IT adoption was not yet widespread by the time of their survey data in 1995-96; Dunne, et al (2000) find only weak statistical support for the direct link between IT investment and wage dispersion across firms, given the very small quantities and variation in IT investment by the time of their mid-1990s sample.

Many of Lindbeck and Snower's (1996, 2000) claims do not fit well with the facts more broadly: their claim that production capital, like machine tools, has become more flexible, while plausible, is at odds with the ongoing occurrence of layoffs when firms change production lines;[28] the claim that IT induces HPWO is difficult to reconcile with,

[27] In the future, there is likely to be a direct effect of IT on employer and employees job search efficiency, and perhaps even on outsourcing via telecommuting as described in Autor (2000a), but these effects were felt in 1997-98 at earliest, about when the apparent new level of the NAIRU was reached (when employment pushed up wage inflation), and long after the Beveridge curve shifted. Thus, to repeat an earlier point, IT cannot be held responsible for the improvement in matching already evident by 1995.

[28] A practice attested to by many we interviewed (see the next section).

albeit not strictly contradicted by, the fact that many of the countries which preceded the U.S. in such practices, such as Germany and Japan, have remained behind the U.S. in IT investment; the claim that workers' previously imperfectly observed ability to work flexibly and in teams has become a source of widening pay differentials would seem to imply that churning and mismatch should have gone *up* for the firm's core workforce until the firm learns to screen and train for those skills, but the opposite has been observed. On this last point linking IT and matching, Mincer and Danninger (2000) provide a useful caution that usually turnover and unemployment duration rise for several years after a technological shift, as workers with skills to use the new technology are rewarded with higher wages while others have to train and catch-up. In their estimation, this cycle is just likely to be beginning in the U.S., where computer equipment per worker only started rising markedly in 1992 or 1993, and computer equipment as a share of total equipment only accelerates after 1994, both from very low bases.[29]

So, though we share some objects of concern with Lindbeck and Snower (1996, 2000), we see differently the role of technology in leading to the widespread use of HPWO. In our view the effect has been much less direct as only one of several factors – along with international competition, financial market pressures, and growing customer sophistication – leading to an increased turnover of products and, as a result, both a faster depreciation rate of specific human capital and a higher value placed on general skills. We believe that this change in the structure of product markets may have led firms to organize their production so that core workers invest less deeply and more broadly in task or firm specific skills. We see this as being the primary salient characteristic of the new modes of work organization for our approach to explaining the decline in the NAIRU.

Summary of the changing American workplace 1980-1998

The significant changes in American business' HRM practices in the 1980s and 1990s are promising candidates to explain the NAIRU's decline, though the macroeconomic implications of these developments have been largely unexamined as yet. The remainder of this paper builds on these changes to tell a story synthesizing the major developments in U.S. firms' hiring, firing, and compensation of workers of different skills, and the aggregate trends in labor market efficiency and wage dispersion. This effort is much in the spirit of Lindbeck and Snower's attempt, but fitting better the actual sequence of developments, including the aspects of firms' contracting out and increasing use of temps, as well as the accumulation of IT investment to meaningful levels. As set out in this review, the elements of such a story should be:

- an explanation for why the changes should have taken place at the same time as the two abrupt changes in the Beveridge curve and the adoption of HPWO;[30]

[29] See also Oliner and Sichel (1994, 2000).

[30] We have empirical work underway to test whether the changes which appear obvious from visual inspection of the Beveridge curve can also account for the shifts in the Phillips curve. We are estimating a multiple-indicator model of the error processes in the two curves in a way which will allow us to test whether a common error component shares the time pattern evident in the Beveridge curve shifts and completely accounts for the movement of both curves. Developments in HPWO and inter-industry wage differentials (discussed in Section III) also feed into this multiple indicator model.

- the decline in job stability and security for older and high tenure male workers in the 1990s;

- a relatively constant use of layoffs by manufacturing employers, controlling for cyclical conditions, but a greater perception by workers that layoffs, when used, constitute permanent dismissals;

- increased insecurity in the early-1990s which declines, but remains abnormally high even as employment increases in the middle of the decade;

- a mounting use of temporary workers and outside contractors by employers, who generally do not bring them into permanent employment, with an explosive growth in blue collar temp employment in manufacturing in the 1990s;

- significant changes in corporate compensation practices designed to increase wage dispersion and flexibility within firms' workforces (not just firms' employees alone, once temps and contractors are included), and some evidence of such an increase;

- the spread of HPWO, especially of job rotation and TQM, in the mid-1980s and mid-1990s for core employees;

- and the expectation that worker rents, due to the eroding value of firm-specific investments and internal equity constraints, as well as lower-skilled workers' diminished access to "good" jobs, will shrink.

We believe that a combination of greater product market competition—due to trade, deregulation and technology—has led to a speeding up of the product cycle and to an increase in the demand for customization. We believe it is these changes which underlie these changes in employer hiring behavior.[31] Analyzing the often overlooked impact of changes in employer behavior on the demand side of the labor market should contribute to understanding the decline in the U.S. NAIRU.

II. Interviews with Human Resource Managers

We undertook nine interviews with senior executives in private corporations in order to get additional insight into trends in the way firms have organized labor in the 1980s and 1990. All but two of our interviews were conducted with executives in either human resources or strategic planning. Seven of the interviews were with multinational

[31] Appelbaum and Batt (1994), Duca (1998), and Lindbeck and Snower (1996, 2000), along with many others, point to these forces of competition and pressures for high-value-added production as one of the major factors behind the shift to HPWO and to contracting out/wage decompression. A strict interpretation of these changes as being driven by a shortening of the narrowly defined product cycle are not supported by the one source of data we could find. Moulton and Moses (1997) do not find any significant change in the fraction of items leaving the CPI product survey between 1983-84 and 1995. However, these are the only dates for which data are available and the years are not at comparable points in the business cycle.

manufacturing firms, ranging from low- to relatively high-tech, though none in the IT sector – our focus on "Old Economy" manufacturing firms was in line with our hypotheses. If the labor market gained in matching efficiency in the 1990s sufficiently to explain part of the drop in the NAIRU, it must have taken place in those sectors most subject to worker separations and delays in rehiring. The other two interviews were with executives from a multinational contracting firm and from a small temporary employment agency. We undertook these interviews to gain some insight into whether the developments in the demand for their services matched up with our understanding of the changes that have been taking place in their client establishments.[32]

Some clear patterns emerged across the interviews with manufacturing executives about the general trends in how their companies have used labor. Five of the seven stressed both a shift to team production and the use of HPWOs, and a trend toward increased contracting out of tasks which they did not consider core competencies[33] ("The most significant change in the way that the company uses manufacturing labor has been in the transition to team production"; "The manufacturing which is left in the U.S. does take a team approach"; "Many of the tasks which are not core competencies of the company are outsourced"; "The company now outsources or has sold off many areas that are not core to the business"). One of the remaining two manufacturers has been a trend-setter in team work practices since the early 1980s, but did not volunteer any discussion of contracting out. The lowest tech and most unionized firm of the seven was an exception to both trends ("The company is about 10 years behind in innovative work organization practices such as team production.") though even this company had begun experimenting with new production practices in its newer plants and expressed an intent to "catch-up."

Increases in worker flexibility, including the broadening of tasks which were previously quite narrow, were mentioned by five of the seven firms often, but not always, as part of the move to worker teams:[34] "The highly specialized/segregated individual is gone. Team production and job broadening happened after several rounds of layoffs."; "The idea is to be as flexible as possible in what jobs are done, in moving people from one product line to another." Significantly, none of the firms attributed the increase in flexibility to improvements in technology which made labor supply more substitutable (neither IT specifically, nor technology in general). Instead, they attributed it to demand factors such as the need to keep up with just-in-time inventory and customer expectations.

While only four of the firms interviewed mention a change in the skills for which they screen to "broader" or "more general" skills—and two firms explicitly denied that their screening process had changed at all—there was certainly a general thrust toward demanding more from the workers who were already there. Only one of the seven

[32] These interviews were conducted with a guarantee of complete anonymity, and all quotations given here have been cleared with the interview subjects.

[33] Lisa Lynch has pointed out to us that HRM managers are more likely to be excited about HPWO practices than average management, and may overstate their actual implementation. In future research, we intend to interview managers of production to document the extent of HPWO usage beyond HRM beliefs.

[34] Interestingly the lower-tech/higher unionization firm was part of the majority here: "The significant increase in the variety of products produced has led to increased demand for workers with a broader skill base. In the older plants, workers always rotated between machines…in the newer plants, workers are reassigned almost on a daily basis."

manufacturing company executives interviewed said that his/her firm gives its workers greater training opportunities now, while another explicitly said they offer fewer. Discussion of IT skills or of machines that relied on a more common set of controls and processes did not arise.

Most of the firms indicated that there had been a significant, single wave of workforce reductions within the last 15-20 years ("Automation and technological changes have reduced the number of manufacturing jobs overall"; "First, the company employs far fewer employees than in the past, due to layoffs, technology, and downsizing"). All but one (again, the lowest tech/most unionized) did indicate that they rely less, sometimes significantly less, on temporary layoffs of their remaining core workforce than in the past: "The permanent employees are left with much more employment stability"; "The company still uses temporary layoffs when dealing with low demand (though they try to avoid them)"; "They no longer layoff manufacturing workers as frequently as they used to". But only one firm of the seven indicated that they had made no use of layoffs at all in recent years, and did not expect to do so again when cyclical demand slowed.

The reduction (but not elimination) of layoffs was accompanied by an increase in the use of temporary workers, according to our interviewees. Many temps are production workers, hired on during times of high demand, and let go during slack periods. These are cheaper, lower-skilled workers, to whom the company can pay less than permanent employees ("The use of temps has increased dramatically in the last 15 years…Temporary workers are useful during periods of rapid growth because they fill-in and the company does not have to pay them benefits"; "The company has become more disciplined in using temporary help when it is needed, and then letting the workers go"; "Much more use of contingent workers than in the past. Less rehiring of those laid off."). According to our interview with a temporary employment agency executive, demand has been increasing for the last 20 years, but "Why now and not 20 years ago is: nobody thought of it. There are no obvious changes in the ways that temp firms organize themselves to explain the increase in demand for their services."

These temporary workers range from 5% to 20% of the high-demand workforce at the companies we interviewed. Even the contracting services firm relies on temps for 20% of its workforce, laying them off during low seasons (university jobs in the summer, grounds-keeping jobs in the winter, etc.). None of the companies indicated that more than a tiny fraction are considered for permanent hiring. In fact, none of the companies interviewed mentioned their use of temporary workers as a screening device for hiring, except for a couple of instances of clerical hires.

Contracting out has become the norm. Almost all the firms in our interviews mentioned outsourcing cafeteria and janitorial services, but four mentioned IT services as well, while three mentioned each of medical and child care, real estate (both selling buildings and the engineering services), and some administrative tasks. The now familiar phrases about "competitive pressures" and the need to narrow production to "core competencies" were invoked repeatedly as explanations for the shedding of labor: "All of the tasks which are not core competencies of the company are outsourced – if it is not a task which it is desirable to be good at, it is not worth investing in the task"; "So if they cannot make a particular area of their business more productive, and it is not a core competency, they contract out." The contracting firm executive with whom we spoke stated that the trend toward outsourcing has shown particularly strong growth in the last

three years in the U.S.—while the firm has expanded hiring to meet rising corporate demand, none of the factors influencing its costs or production structure have recently changed.

The contracting firm lists three main benefits that, in its own estimation, it provides to client firms: expertise in managing specific services; willingness to invest in upgraded facilities (in return for a long term contract with the client); and cost savings from economies of scale (materials purchasing and, more important, investment in systems of administration). While our corporate interviewees generally attributed the trend in contracting out to reductions in labor costs, two of the interviewees went further and articulated a more complicated motivation:

> "Part of the reason is that benefits no longer have to be spread across occupations. Instead, certain occupation areas can be contracted out or outsourced, so that lower skill workers will no longer reap the benefits of being in the 'right industry.'"

> "When cost reductions are required, and labor is a fixed cost, there has been a shift to contracting out (not just in this industry). The primary factor has been that internal equity constraints made the company pay some low-skilled jobs more than they are worth, and it was difficult to cut compensation because of those constraints, which leads to contracting out the positions."

This process did not result in wage increases (beyond the secular trend) for the remaining higher-skilled workers employed by these companies. Three of the executives interviewed specifically stated that their company's pay remained roughly at the median for their industry. However, since these firms are comparing themselves to other high-wage firms, it is difficult to tell from these statements whether their pay has remained unchanged relative to the pay of comparable workers in the economy as a whole. In fact, over the period that these firms were restructuring, the real wages of male workers with high school degrees was steadily declining.

Unions would normally be expected to play a role in decisions regarding the breadth of job descriptions and work rules, the use of temps and layoffs, and the effect of contracting out on wage differentials in American manufacturing industries. More than any other topic covered in our interviews, however, there was a wide range of views on the role of unions. Three executives did not mention them at all, having little unionization in their plants, while the remainder split over whether unions supported or opposed tight job descriptions ("The company was responsible for the proliferation of job titles in union plants…because laying off by seniority was within job class…Then the union would respond by insisting on people only doing what their job description said they should do." Versus "The unions and the company had always agreed to broad job descriptions, so rotating workers within plants was never a problem."). Only one executive, in the most unionized industry among our interviewees, made a direct connection between contracting out and union disapproval. Clearly, much of what went on in the 1980s and 1990s could not have taken place without these firms being only partially- or non-unionized. Equally clear from our interviews, however, was that the role of unions, and even their decline, had already been taken as given by the time these trends began, rather than being volunteered by our interview subjects as a causal factor.

The causal factors for the joint movement toward HPWO, contracting out, reduced use of layoffs, and increased use of temporary workers in production, which our interviewees did cite were threefold: First, as already discussed, the cost pressures on these manufacturing firms—felt in just-in-time inventory and the pressure to respond to customer demands for immediate shipping—forced changes in work practices (cited in one form or another in five of the seven manufacturing interviews). Second, there was some mention of a "speeding up of the product cycle" by four of the interviewees, usually attributed to increased competition (including that due to globalization) and/or the demands of customers. Third, there was clearly an intellectual or fashion component, especially with regard to the adoption of HPWO and contracting out of non-core services (e.g., "The change was due to an effort to follow the Japanese model, with increased flexibility and team production.").

Strikingly, a couple of interviewees explicitly denied an independent role for advances in information technology as a motivating force, and most of the others either did not mention it or played it down as limited in effect to the administrative side: "The transition to team production was not significantly driven by technological changes…technology could be more productive even in a more traditional work environment." One of the seven subjects did draw the connection that "E-commerce has been important in speeding up the business cycle." There was no mention by any of the executives interviewed of direct links between the adoption of information technology and the increase in the flexibility of workers and/or the use of temps and contracting out. Both the temporary agency executive and the contracting firm executive also denied that information technology had played a major role in the past changes in their operations, instead attributing their (and their industries') success to their cost advantages from economies of scale, and their expertise in relevant practices.

III. Have Labor Rents Eroded?

The erosion of labor rents in high-wage jobs, and the disappearance of worker rents in low-wage jobs, played a key role in the connection we made in the previous two sections between changes in the organization of work and improved labor market efficiency. If our story is correct, we would expect that changes in rents would parallel shifts in the Beveridge curve and in the adoption of HPWO. Moreover, if the motivations for adopting HPWO and increasing the use of contractors and temps do indeed include the desire to loosen the equity constraint, as described in our interviews, then rents should have eroded in step with these developments.

The identification of labor rents is less than straightforward. For one thing, their very existence is controversial among some economists. While few would question whether unions are able to bargain a share of company rents for themselves, the notion that non-union workers should be able to secure higher wages for themselves, either by bargaining or through the implicit threat of collective action, has not been fully accepted. Dickens (1986) argues that even non-union workers with the potential to collectively bargain should benefit from that threat, but Krueger and Summers (1987) question whether this in fact happens.

If rents do differ between workers, one might think of measuring rents using the extent of wage dispersion. However, the growth in overall wage inequality in the U.S.

during this period – widely attributed to growing returns to human capital – would confound this method of measuring rents. Given that residual inequality[35] has been growing along with overall inequality, even the dispersion of wages net of observable human capital would not work as a measure of rents. A feasible indicator of the magnitude of worker rents is the dispersion of inter-industry wage differences. Dickens and Katz (1987a&b) and Katz and Summers (1989) have proposed that inter-industry wage differences primarily measure worker rents.[36] Below we examine changes in the dispersion of inter-industry wage differences for evidence that changing rents may be driving the observed changes in the efficiency of the economy.

To measure inter-industry wage dispersion, we analyze the outgoing rotation groups of the Bureau of Labor Statistics' monthly Current Population Survey from 1982 through 1999. We group together all workers surveyed in each calendar year. We use as our measure of wages the hourly wage if workers are paid hourly, or their normal weekly earnings divided by their normal weekly hours if they are not. We include all workers for whom wage data is available in our analysis. Figure 7 presents the time series of the standard deviation of the natural log of wages. It shows the familiar pattern of rising inequality, conforming with prior work.

Figure 8 presents our first measure of inter-industry wage differences along with our index of the shifting Beveridge curve.[37] Inter-industry wage differences are measured as the standard deviation of the average log wage within three digit industries. Given the extent of increasing inequality, the significant decline in raw inter-industry wage differences is remarkable. Even more remarkable is the timing of these changes. Like the movements in the Beveridge curve, the declines in the raw inter-industry wage differences are concentrated in the same two periods – the late 1980s and the late 1990s – with a flat period between them. The correlation of the levels of the two series is .93 (statistically significant at the .01 level). Figure 9 shows that nearly the same pattern can be seen in the dispersion of what is usually considered the preferred measure of rents – the industry fixed effects from an elaborate human capital regression including controls for a wide range of personal characteristics and workers' occupations. The pattern is nearly identical to that of the raw inter-industry wage differences in Figure 8. The correlation with the index of the Beveridge curve is .91 (statistically significant at the .01 level).[38]

These results tell us two things, in surprisingly strong support of the story presented so far. First, on timing, there is a near perfect coincidence of the two periods of

[35] Measured by the dispersion of the residuals of a human capital wage equation, after controlling for individual characteristics such as age, gender, education, location and occupation.

[36] Krueger and Summers (1987) interpret inter-industry wage differences as indicating the presence of efficiency wages while Murphy and Topel (1987) argue that inter-industry wage differences may reflect compensating wage differences or unobservable human capital. See Dickens and Lang (1993) for a review of the evidence.

[37] The latter being the unemployment rate at a 1.5% vacancy rate in a given year, subtracted from 10, and then multiplied by 10.

[38] Very recent work by David Levine, et al (2001), with survey and firm data, finds in contrast to these results that the variance and persistence of employer wage effects appear to be fairly stable in the 1990s. We have not yet had the opportunity to examine, and perhaps thereby reconcile, their results in light of the clear (and opposing) ones that emerge from our use of a standard methodology on wage data. But, we would note that to the extent that firms are specializing in employing either low or high wage workers there would be a tendency for firm differences to grow at the same time that industry differences might decline.

decline in both inter-industry wage difference series with the shifts in the Beveridge curve and in HPWO adoption. This lock-step motion is not easily attributed to artifacts such as coincidence with the business cycle. The 1990 recession was officially over by 1992 and a robust recovery was underway by the end of 1993 – the first year that unemployment fell. Yet the changes in the Beveridge curve and in the dispersion of inter-industry wage differences did not commence again until 1995 and 1996 respectively. As described previously, this hiatus corresponds as well to the period of retrenchment in the deployment of the high performance work organization apparent in Figure 6.

IV. Connecting the coincident changes into a coherent story

This section of the paper will first summarize our theory of the changes that have been taking place within high-wage manufacturing firms. We will describe how a speeding up of the rate of introduction of new products can lead to an increase in demand for general skills, an erosion of worker rents, and, ultimately, to the decision to hire contracted and temporary workers for a substantial fraction of jobs within the firm. Second, we present our explanation of how these changes have led to improved labor market efficiency and provide some illustrative calculations of potential gains. The firm and market models discussed in the two sections below are described in greater detail in Cohen and Dickens (2001). The purpose of the model at this point is simply to demonstrate our ability to tell a consistent story about how changes in the way firms use labor has affected the NAIRU. In future work we hope to develop a model we can estimate which might be used to test our hypotheses directly.

Inside the firm

In order to analyze the role of shortened product cycles and greater flexibility on the increased demand for general skills and the use of contracted and temporary workers, we consider a representative primary sector firm's behavior when the possibility of contracting out some of its workforce exists. The firm earns a fixed revenue for a fixed output so profit maximization requires it to minimize the present value of expected total costs. This minimization problem involves two decisions: the firm must choose the level of general skills of its workforce, and it must decide whether to operate with all tasks performed in-house or to contract out and use temporary workers for some of those tasks. As illustrated below, the firm's decision to outsource some fraction of its jobs rather than to operate all jobs within the firm is a discrete choice by the following logic. We assume that there is a fraction of workers for whom the firm can profitably invest in specific human capital and the firm will not use contracted or temporary labor for those positions. The firm must decide whether to outsource/temp or operate the remaining jobs in-house. The firm's choice is discrete rather than continuous because the difference between the marginal cost of a non-contracted, unskilled worker and the marginal cost of a contracted worker is unaffected by the total number of these types of workers employed. Thus the firm either uses contracted and temporary workers for all of the jobs which must be filled by unskilled workers, or it operates these jobs in-house.

The firm faces two expected total cost functions, one for the "no contracting (nc)" state and another for the state in which the firm contracts out and uses temporary workers for some fraction of its jobs.

$$(1) \qquad E(PVTC_{nc}) = \frac{w_{nc}}{d} + \frac{fc(g)(d+d)}{d}$$

$$(2) \qquad E(PVTC)_c = \frac{fw_c}{d} + \frac{fc(g)(d+d)}{d} + \frac{(1-f)}{d}(mw_s + (1-m)w_T) + Q$$

In Equation (1)—the expectation of the present value of the firm's total costs if it does no contracting—the firm incurs costs from the wage bill (w_{nc}) and from training its workers. The function *c* represents the cost per unit of labor of investing in firm-specific human capital and is assumed to be declining in *g*, the level of general training possessed by the worker. The *d* parameter is the rate of depreciation of task-specific human capital, which can also be thought of as the speed of the product cycle. The parameter f is the fraction of required efficiency units of labor in which the firm can profitably invest in specific human capital. We assume that the firm discounts future earnings over an infinite future at the rate d .

We assume that w_{nc} is a collectively bargained wage which satisfies the Nash bargaining solution with bargaining power. The wage satisfying the Nash bargaining solution is a weighted average of the reservation wage and the rents due to the firm's investment in specific human capital (with weights determined by relative bargaining power). Note that the firm pays the wage w_{nc} to each of its workers. There is strong evidence of wage compression within firms, due both to unionization and equity constraints. This latter source of wage compression was commonly cited in our interviews as a motivating factor in firms' decisions to outsource. We simplify the representation of this phenomena by assuming that all workers receive w_{nc} .

Equation (2) represents the expectation of the present value of total costs when the firm contracts out. The bargained wage w_c (derived in a similar manner to w_{nc}) is paid to the core workforce in the firm—that is, to f workers. Of the remaining jobs (performed by the (1 - f) workers), m of them are contracted out and (1 - m) of them are filled with temporary workers, to whom the firm must pay w_T . The distinction between temporary and contract workers is not important for our analysis of the firm's decisions, but will become important when we examine the causes of the declining unemployment in our market equilibrium model. The contracted workers are compensated with wage w_s , the wage paid in the secondary sector which the firm takes as given. We assume that when the firm decides to contract out some of its jobs it must pay a fixed, one-time coordination and restructuring cost of *Q*. The fixed cost of contracting can result from, for instance, the potentially substantial cost of reorganizing production so that some jobs

can be kept in-house and others contracted, and the cost of negotiating complex contracts required to specify job requirements to the contracting firm.

Assuming a functional form for $c(g)$—the cost function to investing in specific human capital—which is declining at an increasing rate in g, and assuming a functional form for the reservation wage which is increasing in the flow cost of g, we can derive the optimal level of general human capital that the firm will desire of its workforce (g^*). As demonstrated in Cohen and Dickens (2001), the optimal value of g for both regimes is increasing in the deprecation rate of specific skills (d). As the length of time over which the firm can amortize its investment in specific skills decreases (i.e. as the firm is required to invest in specific skills more frequently) it is induced to reduce the cost of this investment by increasing g.

For sufficiently large values of the coordination cost Q, at low levels of d a firm will prefer to operate all of its jobs in-house (i.e. $E(PVTC)_{nc} < E(PVTC)_c$). When the product cycle is relatively lengthy, the firm's investment in the specific skills of its f core workers depreciates less quickly. Less general human capital is needed by core workers and the equity constraint is less costly. Thus the firm will prefer to face the cost of the equity constraint (paying less productive workers the same wage as the skilled workers) to the cost of coordination and restructuring.

Figure 10 plots the present value of expected total costs for the contracting and non-contracting regimes (Equations 1 and 2) for a particular set of parameter values with the depreciation rate of specific human capital (d) ranging from .3 to .6.[39] We assume: 1) the firm invests in specific human capital for 75% of its workforce, and divides the remaining 25% evenly between contractors and temps; 2) only half as many workers with specific training are required as workers without specific training to produce the same output; 3) workers and firms have equal bargaining power; 4) w_T and w_s are both 3% higher than the reservation wage (which is normalized to 1); 5) the coordination cost is 15% of annual earnings; and 6) the discount rate is 5%.

At very low levels of d, the expected total costs to contracting and using temps for the non-core jobs are higher than to operating the non-core jobs in-house. As d increases the equity constraint becomes more costly. This is because as the product cycle quickens, the firm demands a more generally-skilled workforce, so that core workers can quickly learn new tasks as they are moved between production activities. This increase in the demand for g leads to an increase in the bargained wage paid to all workers (both skilled and unskilled). Note, however, that, although wages are increasing with g, since the wage is bargained, both the firm and the worker share the return on the increased value of the worker's general skills. Thus workers' wages rise less than their reservation wages and rents decline.[40] Figure 11 plots the increase in g^* and the decrease in rents per worker as the depreciation rate of specific human capital (d) increases. Note that there is a discrete jump up in g^* and jump down in rents per worker when the firm shifts from the no contracting to the contracting regime at d^*. When the firm begins to contract and use temporary workers for the tasks that do not require specific skills, the level of general

[39] If the time period of analysis is assumed to be one year, one can interpret a value of d = .3 to mean that workers must be retrained to learn a new task roughly once every three years.

[40] Rents are defined as wages minus reservation wages.

skills required of its remaining core workers will increase sharply and, thus, the portion of core workers' wages which can be attributed to their general training increases, decreasing rents.

From firm to market

Cohen and Dickens (2001) describes the market equilibrium model in which the firm model is embedded in order to calibrate the potential effects of the changes we describe on the efficiency of the labor market. Here we describe the essence of how the firm level changes translate into changes in overall labor market efficiency.

Think of the American economy as starting out in the early 1980s with a high-wage primary sector where decisions about demand for general human capital and whether or not to contract are made as described above. We imagine at this time that there is little use of temporary help or contracting. There is also a low-wage secondary sector which pays a fixed minimum or an efficiency wage.

Unemployed workers choose to apply for jobs in either the primary or secondary sector and allocate themselves between search in the two sectors so as to equate the expected income from searching in both sectors with the reservation wage. Secondary sector workers can search for primary sector employment while on their jobs, but with a reduced efficiency compared to unemployed workers.

Once primary sector firms make the move to contracting out on a large scale, a temporary help sector is added to the economy. We can assume that all workers—including the unemployed—who want to temp can, and that they will never count as unemployed while in that sector. Nonetheless, we assume that temps will search for primary sector employment with efficiency between that of a secondary sector worker and an unemployed worker.

Our model describes the improved efficiency of the labor market as deriving mainly from the decline in rents in the primary sector and the increased use of temporary workers. Prior to the rise of contracting out and temporary help services, an increase in the depreciation rate of human capital increases the primary sector's demand for general human capital and causes the rents in those jobs to fall (see above) making them less attractive. Unless primary sector vacancies are filled only through on-the-job-search of secondary workers, this decline in the attractiveness of the primary sector will lead some unemployed workers to shift their search efforts from the primary to the secondary sector. In that sector the vacancy rate is higher and equilibrium unemployment lower so these workers will spend a larger fraction of their time employed. They will also contribute to lowering the vacancy rate in the secondary sector so that both the overall unemployment rate and the vacancy rate will decline.

When the depreciation rate of specific human capital rises high enough, primary sector firms switch to outsourcing non-core jobs as described above. When they do, there is a further abrupt decline in rents, as well as a decline in the number of jobs available in the primary sector. These factors combine to make primary sector jobs relatively less attractive, even if their wages remain high relative to the secondary sector. This causes the unemployment rate in the primary sector to drop further and more workers to search for the relatively easier to find jobs in the secondary sector. Further, the increased number of secondary workers searching for a smaller number of primary sector jobs—combined

with the even more effective search of the temporary workers—displaces still more unemployed workers from the queue for primary sector jobs. This further lowers unemployment and vacancies. Any ongoing increase in the speed of the product cycle and/or the value of flexibility in the primary sector, will also increase the rate of depreciation of specific human capital, and will continue to cause a decline in rents – and this translates into a decline in the NAIRU through these channels.

The parameters chosen yielded an unemployment rate of 6.9% when the vacancy rate was 1.5%. Unemployment resulted mainly from workers queuing for primary sector jobs which were assumed to make up about 2/3 of the jobs in the economy. The unemployment in the primary sector is created by rents equal to about 15% of the reservation wage of an unskilled worker. The job destruction rate in both the primary and secondary sector is assumed to be 10% a year and the rate of depreciation of task-specific skills three times that.

Starting from this point, a 50% increase in the rate of depreciation of task-specific skills in primary sector jobs investing heavily in such skills results in a reduction of labor rents in the primary sector wage of about 30%. It also leads to a reduction in the rate of unemployment at a vacancy rate of 1.5% to 4.7% if no temporary workers are added to the labor force, or to 4.0% if there is an increased use of temps amounting to 2.5% of the workforce. Thus, in this scenario, the reduction in rents reduces the unemployment rate associated with 1.5% vacancies by over 2 percentage points while the increased use of temporary workers accounts for another 0.7 percentage points of decline.

An increase in the rate of depreciation of specific skills of 50% may seem large, but it may not be, given the dimension of the changes in work practices described in the literature and evident at the firms we interviewed. Further, it is the decline in labor rents that is the crucial intermediate variable between the increased depreciation rate and the decline in unemployment, and the change produced by the model is commensurate with the changes in inter-industry wage differences documented in the previous section.

There seems to be considerable sensitivity of the results to parameters that are not known with precision. Thus the actual effects could easily be much larger or smaller. However, the results do show that we are able to tell a story consistent with the facts.

V. Conclusion

There is considerable agreement that the lowest sustainable rate of unemployment has declined in the United States in the last 15 years. Examination of data on unemployment and vacancies suggests that the improvements in market efficiency were concentrated in two discrete periods. The first runs from 1985 to 1989. The second, which began in 1995, may still be continuing. These abrupt changes in the vacancy-unemployment relation, or Beveridge curve, contrast starkly with the time path of changes that have been proposed by past authors to explain the improvement in the inflation-unemployment relationship, but they seem to mirror the time pattern of adoption of a host of new human resource management methods – particularly in manufacturing where a disproportionate share of unemployment is concentrated. The changes in efficiency also parallel declines in workers' rents as measured by inter-industry wage differences.

We propose an explanation for improved overall efficiency of matching in the U.S. labor market since 1985 that links these synchronized changes in a sensible fashion. This approach has 6 steps, drawing on important developments in human resource management by U.S. manufacturing firms, which altered the demand side of the labor matching function:

1) Technological innovation and increased competitive pressures (including those coming from abroad) have led to a speeding up of the rate at which product lines are switched and production (levels and lines) are adjusted for primary sector firms.

2) This speeding up of the product cycle causes investments in firm specific human capital to have a higher rate of depreciation. We view this as the main cause of the adoption of the new human resource management policies. These policies emphasize generality of skills and the ability to move between jobs over deep investment in a narrow set of skills. These policies also make more demands on workers' general skills and flexibility since they require more substituting between tasks by workers.

3) Higher demand for general skills means higher wages for those core workers who remain, but because bargained wages do not increase one-for-one with reservation wages, the increased demand for general skills also lowers rents to workers. Internal equity constraints force firms to pay higher wages not just to core employees utilizing flexibility, but also to those lower skilled workers who have narrowly defined jobs. This creates a tension which mounts as demands for general human capital rise along with cost pressures.

4) Eventually the tensions between the rising demand for skills and the equity constraint lead primary sector firms to adopt new forms of organization in which they contract out all jobs for which investments in specific human capital are not important (i.e., jobs that are not part of the firm's "core competency"). This relaxing of the equity constraint leads to a further decline in rents for all workers, both those who now seek employment outside the primary sector, and those in good jobs.

5) Falling rents make high wage jobs relatively less desirable and reduce worker willingness to wait unemployed to get such jobs. Vacancies in the primary sector decline as well. More workers then apply for jobs in lower wage sectors where jobs are easier to find due to the presence of more vacancies. This lowers both the unemployment rate and the vacancy rate.

6) The growth in the market for temporary help services leads to the development of a large temporary help sector in which workers have considerable freedom to search for jobs while still being employed most of the time (and almost never counting as being unemployed). These workers displace still more unemployed workers from the queue for high wage jobs who again switch their search to lower wage jobs. This too reduces both the unemployment and vacancy rates.

Our story is, admittedly, more an intriguing linkage of hypotheses with stylized facts, than a directly tested model at present. Our two-step alignment of shifts in inter-industry wage differentials, the Beveridge curve, and the adoption of HPWO, combined with complimentary developments in American labor markets requires supplementation with additional empirical analysis to be fully convincing. And while we offer our story in opposition to certain classes of explanations for the NAIRU's decline, such as those relying on gradual forces without clear institutional transmission mechanisms, we do not claim this breakdown of firms' internal equity constraint is the only cause of the NAIRU's decline.

Nevertheless, we believe our approach to explaining the decline in the NAIRU offers promising aspects, in addition to being able to match with the specific time-series sequence of relevant shifts in the 1980s and 1990s:

- First, we are able to synthesize several of the most notable developments in firms' use of workers into a coherent story – the widening use of high performance work organization and the increasing demand for broader, more *generally* skilled employees in firms' core workforces; the particular rise in temporary workers' share in blue-collar manufacturing employment; the sudden expansion of contracting out of non-core activities, despite no apparent change in the supply curve of those services; the "mean leaning" downsizing movement of the early-1990s; the lower tenure and the sense of layoffs' permanancy among workers in good jobs; the increased competitive pressures on American firms for flexible quality production, starting in the 1980s; the increasing flexibility of compensation; and the decline in inter-industry wage differentials – all of which have been largely ignored in considerations of the NAIRU to date.

- Second, we are relying on what we believe to be a more realistic view of the importance of technological improvement, and IT specifically, than some of the more vague "New Economy" hypotheses do. In our view technological changes result in a speeding up of the rate at which firms switch between products and a general increase in the demand for flexibility from the workforce. This change results from international competition, technological change, cost-cutting financial pressure, and increased customer demands. Workers must now make shallower investments in specific human capital more frequently and this can be accomplished faster and at less cost if the workers have more general skills. Thus it is the change in work organization, and not the need to operate IT equipment, that drives the increased demand for general human capital.

Finally, we should note that although we believe that the process of restructuring and the increase in temporary and contract workers may have facilitated today's low unemployment and inflation, we do not claim that it has taken place without cost. There is no doubt that at least part of the widening of the income distribution can be attributed to the changes we describe, and that many individuals have had their lives severely disrupted by displacement from good paying jobs that they had worked at for many years. But, our work does suggest that there may have been some overlooked benefits, accruing both in the aggregate and to individual workers, from these changes beyond the

improvements in productivity (and profitability) that others have already argued occurred.

A full cost-benefit analysis is well beyond the scope of this paper, but would at a minimum have to balance the falling wages of less skilled workers and the lost rents of workers displaced from good jobs with the gains of increased employment. If our story is right, the United States did get something beyond a redistribution of income for the changes that have been made.

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Table 1

Percentage of Firms Adopting New Methods of Labor Organization

	Teams	TQM	Quality Circles	Job Rotation	*Source*
1987			28%	15%	Lawler, et al.*
1990			32%	16%	Lawler, et al.
1992	40.5%	24.5%	27.4%	26.6%	Osterman**
1993	32%	46%	15.8%	24.2%	BLS***
1994	29%			21%	Census****
1997	38.4%	57.2%	57.7%	55.5%	Osterman

*Companies reporting some use or more (excludes those reporting no or almost no use); Job rotation numbers are fraction of companies reporting that they use pay for skill compensation systems for at least "some" of their workers
**Greater than 50% of “core employees” involved
*** Presence measure only—no cut-off for % of employees involved
**** Approximation to Osterman's definition

Figure 1


Annual Vacancy-Unemployment Data 1960-1998
Vacancy Rate
Unemployment Rate
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
3
4
5
6
7
8
9
10
69
68
66
67
73
72
74
79
78
65
70
71
77
80
88
87
85
84
64
86
81
89
61
76
63
1960
62
75
90
83
1998
97
94
95
96
93
82
91
92

Figure 2

Total Employment in Business Services as a Fraction of Total Non-Farm Employment

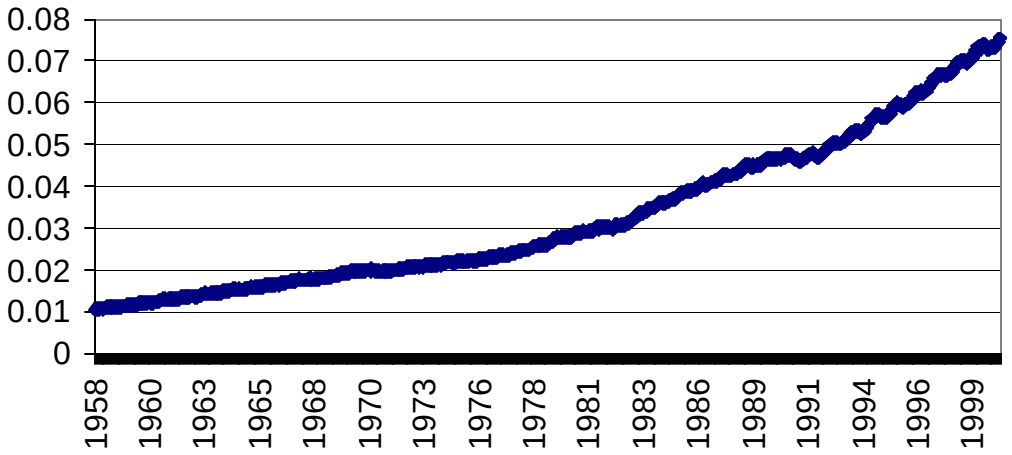

Figure 3

Employment in Computer and Data Processing Services as a Fraction of Total Non-Farm Employment

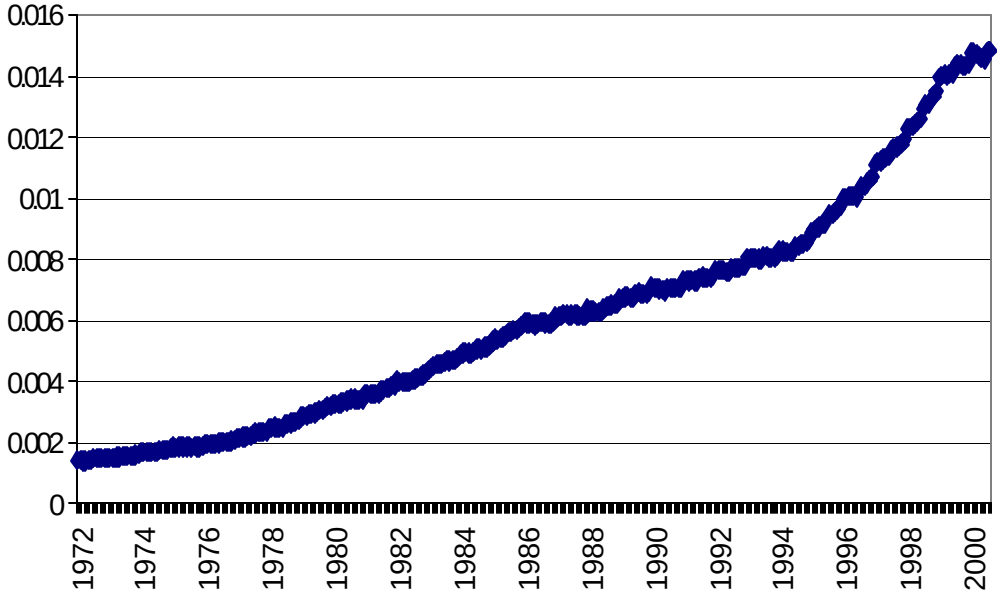

Figure 4

Employment in Services to Buildings as a Fraction of Total Non-Farm Employment

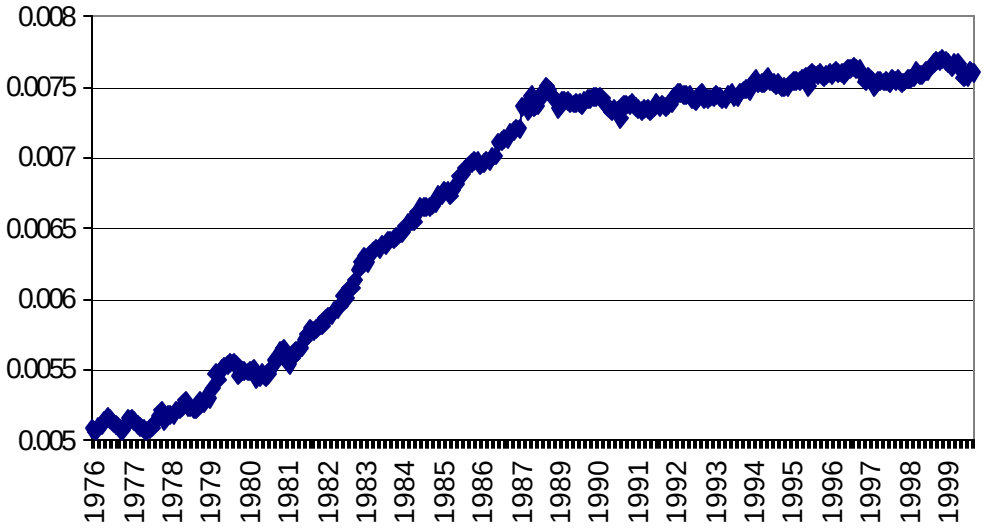

Figure 5

Employment in Help Supply Services as a Fraction of Total Non-Farm Employment

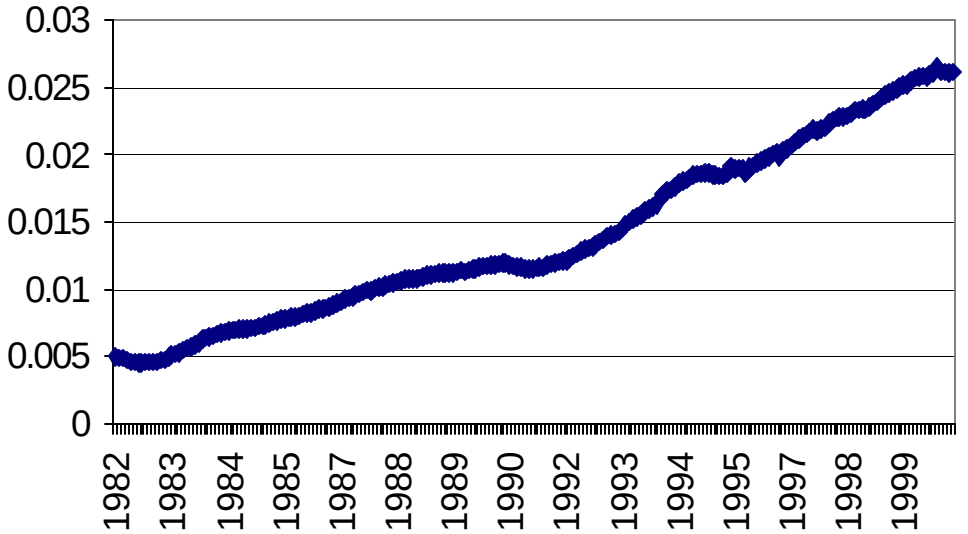

Figure 6

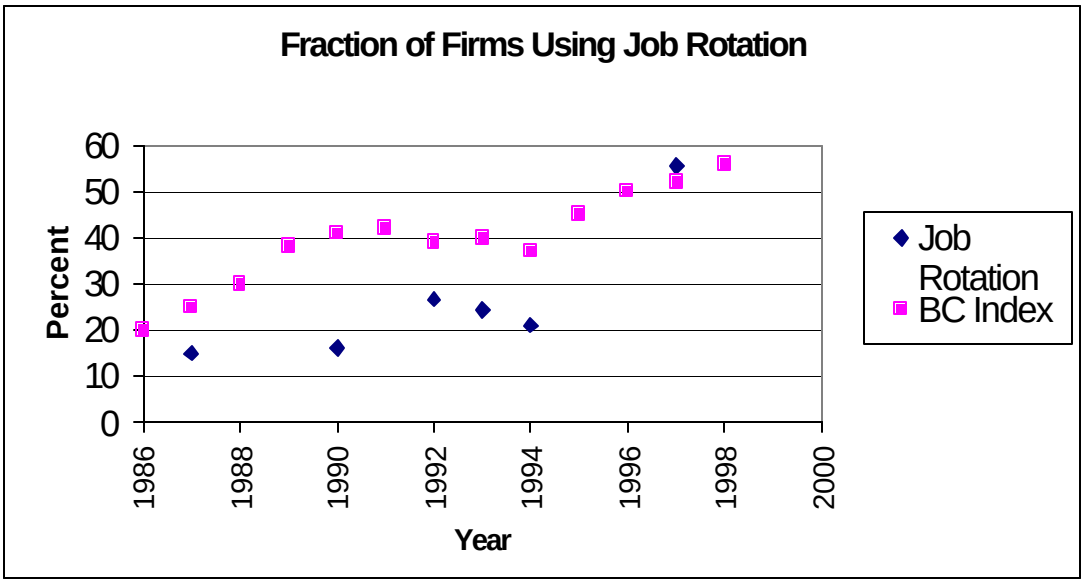

Figure 7

Time Series of the Standard Deviation of Ln (Wages)

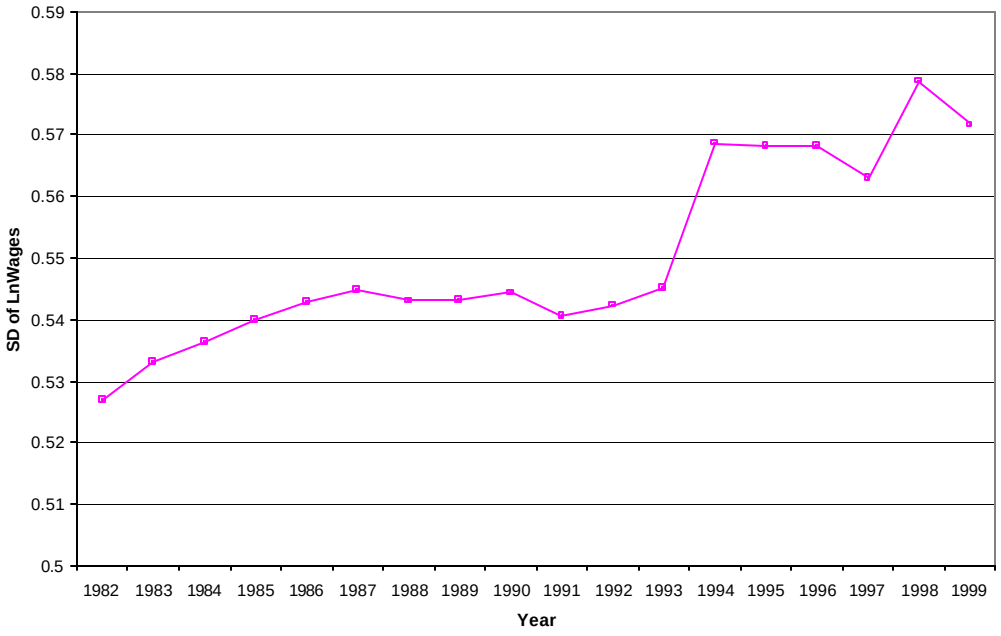

Figure 8

Time Series of Beveridge Curve and Average Wage

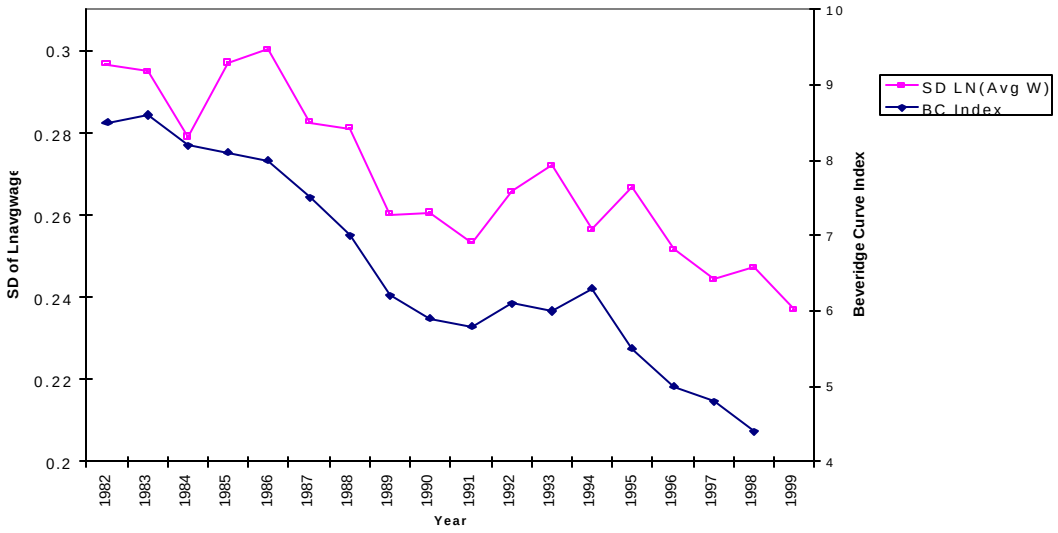

Figure 9

Time Series of Beveridge Curve Index and Fixed Effects Variable

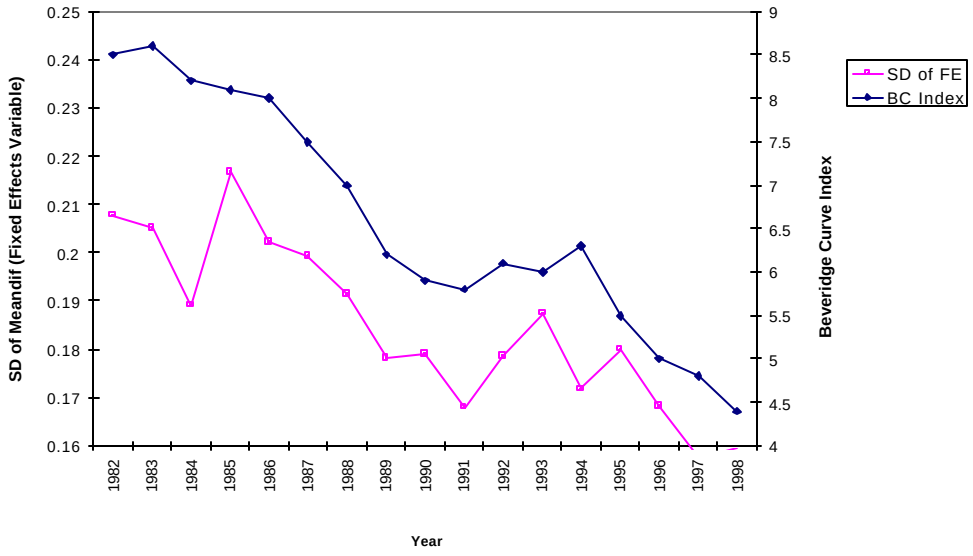

Figure 10

Expected Total Costs for Contracting and Non-Contracting Regimes

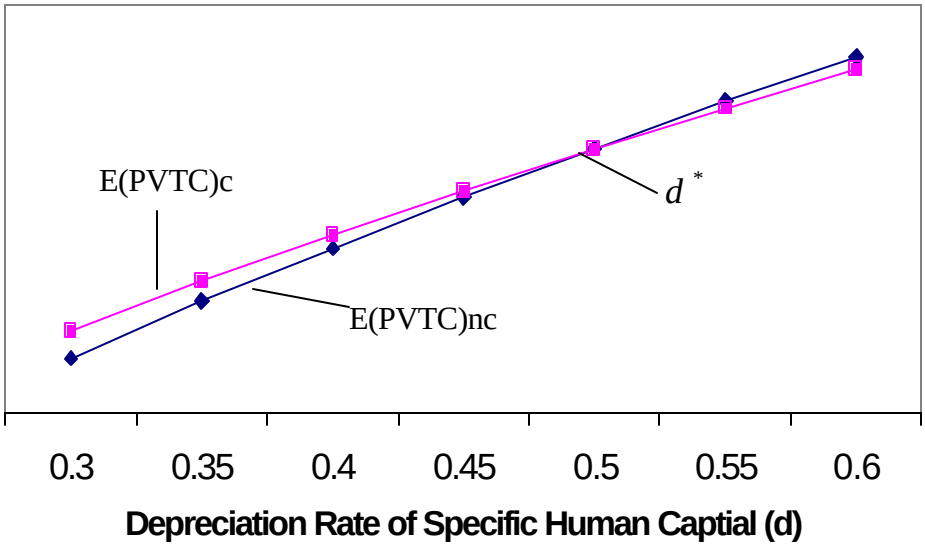

Figure 11

Rents Per Worker and General Human Capital (g^*)