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Job Displacement?**

William J. Carrington and Bruce C. Fallick



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The earnings of workers are reduced for many years after being displaced from their jobs, and those workers and their families face increased risk of other problems as well. The ills suffered by displaced workers motivated several recent expansions of government programs, including the unemployment insurance system, and have spurred calls for wage insurance that would provide longer-run earnings replacement. However, while the magnitude of the losses is relatively clear, the theory of why displacement matters is scattered and somewhat undeveloped. Much of the policy discussion appears to interpret displacement-induced losses through the lens of specific human capital theory, and there is considerable empirical support for that model. But there are several other theories of why job displacement is costly. This paper reviews theories of costly job displacement and discusses their consistency with the available empirical evidence. We find that theories of human capital and matching are an important perspective on the losses of displaced workers, but we cannot rule out important roles for other theories, some of which suggest different policy responses.

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“The majority of long-term losses are due to losses in the value of certain skills as industries decline; due to the loss of long-term career jobs; or due to slow wage-adjustment in the labor market.” (Till von Wachter, Congressional Testimony, June 10, 2010)

I. Introduction

The recession of 2007-2009 displaced millions of workers in the United States and left them with the largest earnings reductions since the BLS began the Displaced Worker Survey in 1984 (Bureau of Labor Statistics, 2014). Concern about the plight of displaced workers led to repeated expansions in the unemployment insurance (UI) program since 2007 and, partially as a result, federal expenditures on UI benefits averaged roughly \$100 billion per year or about 0.7% of GDP over the 2008-2012 period. Short-run UI payments account for most federal aid to displaced workers, but longer-term earnings replacement is available to some displaced workers through the Trade Adjustment Assistance (TAA) program. Several analysts have advocated that earnings insurance be extended to a much wider set of laid-off workers (e.g., Kletzer and Rosen, 2006; LaLonde, 2007).

The theory most commonly associated with the earnings losses of displaced workers is the specific human capital model of Gary Becker (1962) and Walter Oi (1962). In that model, job loss reduces earnings because job-specific human capital is lost or demand for that particular human capital declines, making it less valuable. Similar reasoning has been applied to human capital that may be specific to workers’ former locations, industries, or occupations – broader dimensions along which labor demand may fall. While the connection is rarely explicitly drawn, specific human capital theory appears to supply much of the logic behind efforts to assist displaced workers (e.g., von Wachter, 2010). That is, workers invest in human capital specific to their firms, occupations or industries, and the loss in the value of these investments that accompanies displacement is largely a matter of bad luck. Therefore, ex post transfers from those whose investments paid off to those whose investments did not pay off provide insurance to all and may encourage more investment in socially productive but privately risky specific human capital, as in Acemoglu and Shimer (2000).

However, the literature includes other theories that may explain why workers’ earnings tend to fall with displacement. Lazear (1979), for example, posits that wages rise with job tenure because firms defer some compensation so that workers build up *de facto* bonds with the firm.

These bonds serve as an incentive-compatibility mechanism to deter shirking by workers. In principle, the bonds are paid back in the form of wages for high-tenure workers that are higher than their instantaneous marginal products, but displaced workers are deprived of the repayment of some or all of their bonds. Similar effects are obtained in the model of Salop and Salop (1976) with neither specific human capital nor shirking. Firms in that model incur a fixed cost with each new worker and firms lose money when workers leave before the firm recoups that expense. As a result, firms backload compensation to attract more stable workers. Earnings fall with displacement in both of those models, but the mechanisms differ significantly from that of specific human capital theory.

This paper reviews these and other theories that have been advanced to explain the earnings losses of displaced workers and considers the extent to which each theory can explain the range of outcomes identified in the now-rich empirical literature on job displacement. Section II reviews economic theories in which job displacement is a costly event. For each theory, we examine, among other features, the causal mechanism behind costly displacement, whether losses vary by characteristics of workers, and whether the loss represents a social loss as well as a private loss to the worker. Section III confronts the various theories with the empirical experience of displaced workers. Section IV summarizes our findings and suggests some avenues for further research. We conclude that a full explanation of the experience of displaced workers must rest on more than just specific human capital theory.

II. Theories of Costly Job Displacement

The idea that job loss is costly is almost as old as empirical labor economics, and has been well-established in the modern literature on displaced workers (e.g., Ruhm 1991; Jacobson, Lalonde, and Sullivan 1993; Couch and Placzek, 2010; von Wachter, Song and Manchester, 2009).¹ The earliest work on human capital earnings functions posited that a worker's earnings rose with education, with general labor market experience and with the tenure on a specific job

¹ More recently, however, a few studies have called into question the notion that job loss itself leads to large and persistent earnings losses. See Fallick, Haltiwanger and McEntarfer (2012), Flaaen, Shapiro & Sorkin (2013), and Cooper (2013), whose findings suggest that presence or absence of displacement, at least as conventionally identified, is less important for earnings losses than the presence of an unemployment or nonemployment spell following separation.

(Becker, 1962; Oi, 1962; Mincer, 1962). While it was not typically emphasized, an implication of those studies is that being forcibly deprived of job tenure would, other things equal, entail a loss in earnings. That finding was initially accompanied by the theory of firm-specific human capital but over time a variety of other interpretations arose, the most prominent of which are summarized in Table 1. This section lays out the basic architecture of those theories and points out some of their empirical implications.

A. Theories Based on Specific Human Capital

The earliest theories of costly job loss are based on the notion of specific human capital. The idea is that workers have a component of “skill” that is only productive at the jobs they have been working on. In the original formulation of Becker and Oi, that specific skill is developed over time, either through formal on-the-job training or through learning-by-doing on the job. Theorists have been vague about the character of the specific skills being developed, which is appropriate given the wide range of skills and knowledge that can be productive only in particular jobs. To take a few arbitrary examples, knowledge of some specialized mathematics might be only useful in a missile manufacturer, being able to operate a specialized lathe may be most useful at a particular machine shop, or a set of personal connections may only be pertinent at a particular law firm.

The fact that a worker may be more productive at her current job than at any other, and that the magnitude of that wedge may change over time, spawned a modest theoretical challenge. In particular, there is no convincing theory of how those ex post rents are divided between firms and workers. The prevailing wisdom in the literature is that workers and firm split the investment returns, and, to the extent that there is an upfront training period in which productivity lags what it would be if no training took place, they may split the upfront costs as well. The joint nature of both the investments in and the returns to specific human capital creates an incentive for the worker and firm to preserve the employment relationship, leading to longer-tenured jobs than would exist in the absence of specific human capital.

The earnings loss associated with displacement is easy to see in these models. Workers develop a stock of firm-specific skills whose rental price is tied to the demand conditions for that firm’s product or services. If that firm fails or contracts, then the rental price for those skills

falls, perhaps to zero, and the worker is left with only whatever general human capital they might have accumulated through education or through work experience. The main implications of the specific human capital model are that job displacement results in diminished wages and earnings and that the magnitude of those earnings losses is tied to pre-displacement tenure. The most basic models of specific human capital predict that there should be no significant earnings loss to a job displacement for workers with very little tenure on the job. Those workers have simply not had time to accumulate a sizeable stock of specific human capital that could then be devalued by the layoff. Earnings losses should be instead concentrated in high-tenure displaced workers. What exactly it means to be “high tenure” is an empirical question, but the Bureau of Labor Statistics, for example, bases many of its tabulations on outcomes for workers displaced from jobs they had held for at least three years. That type of restriction has been used in much of the academic work on job displacement as well (e.g., Jacobson, LaLonde and Sullivan, 1993), but the choice of three years is somewhat arbitrary.

While the original models of specific human capital were clearly based on the notion on *firm* specificity, from the start it was obvious that skills could also be specific to the type of work being done, the type of firm in which the work was performed, or on other dimensions of specificity such as location. Those ideas later found expression in empirical work on occupations (e.g., Shaw, 1984), industries (e.g., Carrington 1993; Fallick, 1993; Neal, 1995), and locales (e.g., Howland and Peterson, 1988). At a mechanical level, there is little difference between these theories in how human capital comes to be specific. In any of these cases, workers’ skills become specialized either through formal training or, likely more important, through the accretion of knowledge that comes with working in a field. There are differences, however, in how earnings are likely to vary with time at a particular employer. In particular, employers are less likely to “pay” – in the form of pay that is above contemporaneous value marginal product - for learning that can be used at other employers. To do so invites workers to get training at an initial employer’s expense and to then take that knowledge to a second, similar employer that is now willing to pay more because it does not have to recoup the costs of the training. There is no implication in these models that a worker displaced from a particular job will receive lower earnings if he is able to find reemployment in a job in the same industry or occupation. However, theories based on specific human capital, along any dimension, have a hard time explaining why some workers’ earnings would *rise* with displacement.

We are not aware of any explicit theoretical analysis of the social costs of job displacement in the context of specific human capital models. Whether the earnings losses associated with loss of specific human capital upon displacement represent a social, as opposed to purely private, cost, depends upon the nature of the events that reduced the value of that human capital. It is possible to come up with examples with varying implications for social costs. For one, suppose that an inexpensive new machine is developed that completely obviates the need for occupation A. In the standard calculus, this development is a social improvement in that overall productivity is strictly increased, though of course the workers in occupation A might themselves be made worse off by their sudden obsolescence. As a second example, suppose that an industry cartel is formed that restricts supply and necessitates the displacement of some workers. This is now a social cost as well a private cost since overall productivity is decreased. The key distinction here is whether the reduced value of the displaced worker's marginal product at her old job is due to desirable changes in the underlying economic environment – due to technical change or changes in the terms of international trade, for example – or whether the value is reduced by economic changes – such as cartelization – that an informed social planner would not approve.²

B. Theories Based on Job Matching

A challenge to specific human capital theory is that people change jobs frequently for voluntary reasons and that, in many cases, those job changes lead to higher, not lower, wages. Indeed, Topel and Ward (1991) found that about one third of the total earnings growth of young men could be attributed to the earnings growth that occurred when they changed jobs. If specific

² A less conventional analysis of social efficiency might focus on workers' willingness – or lack thereof – to adapt to their straitened circumstances. Various socially efficient changes – e.g. labor-saving technical change – may reduce workers' productivity relative to what it was but still leave value marginal product above what it is at their next best alternatives. To fix ideas, suppose that a widget maker is paid \$15 per hour on a long-term job and that their next-best alternative is \$10 per hour. The long run value of an experienced widget-maker is then reduced by a change in widget-making technology so that their value marginal product is now \$12 per hour. If the workers would accept a reduction in their wage to somewhere between \$12 and \$10, then the socially efficient matches between worker and firm would continue (McLaughlin, 1991). But if workers or the employer are unwilling to accept such a reduction from their current employer, then displacements and attendant earnings loss may occur even though it would be socially efficient for the worker and firm to stay together. The literature explores various reasons why this may occur (e.g., Hall and Lazear 1984; Bewley 1999).

human capital that developed solely through work experience was the only source of earnings specificity, then how could so many workers improve their earnings by changing jobs and renouncing their old firm-specific human capital?

One important answer to that question has been the job matching model of Jovanovic (1979a). In that model, there is a productivity component that is specific to particular matches of workers and firms. That component could be a particular skill, a personality trait, or an ability to tolerate particular conditions, that is more valuable at some firms than at others. Unlike conventional specific human capital theory, however, that component is fixed and does not change over the course of a worker's stint with a particular employer. If information about the quality of a job match is revealed only through experience on the job - say because employers learn over time whether a new worker is good at the tasks they need performed or because workers learn about their preferences for various non-wage workplace attributes - then a job matching model can mimic many of the features of the specific human capital model. In particular, workers are most likely to quit a job within the first few years as they learn whether or not they are good matches with their jobs, and earnings rise with tenure because the only matches that survive are those where good news (about the match) has accumulated and where, as a result of the good news, earnings rise.

The implications of job matching theory for the experience of displaced workers are similar to those of specific human capital theory. Workers' earnings fall with displacement because they were, on average, in high-quality matches that, as of the date of their displacement, paid correspondingly well. Being deprived of that high-quality match is costly because the worker will be forced to begin the job-matching process anew and to test out another job that will typically be of lower match quality.³ Those losses are likely highest for highly experienced workers, as they have had the longest time to sort themselves into a high quality match prior to their displacement. The ability of job-matching to explain the tenure profile of earnings loss is less than obvious, however. Suppose that workers receive a steady or predictable flow of draws from a fixed job match distribution and that they choose to work at the highest match received to date. Then, as Topel (1991) points out, a worker's years of experience is a sufficient statistic for

³ Pawel (2014) demonstrates how such a model can reproduce many of the empirical features of displacement.

the highest draw received and, in contrast, job tenure only indicates the order in which the best offer was received. However, the value of specific human capital should be highest in high quality matches, as deliberate investments in human capital, such as training, are more likely to pay off in a durable match (Jovanovic, 1979b). Thus, the two theories are properly viewed as complements as well as substitutes.

An additional implication of matching theory, however, is that some of those forced to search for a new position will find a *better* match than the one from which they were displaced, and that their post-displacement earnings will be higher as a result. That cannot happen in the most straightforward models of specific human capital. As with specific human capital, job-matching theory can be extended, subject to some modifications, to specialization along the dimensions of industry, occupation, or locale. As Neal (1999) shows, young workers change occupations and industries more often than older workers in a way consistent with the view that workers search while young for a good occupation or industry match. Being displaced in one's youth is less costly, from this perspective, because a worker is less likely to have sorted themselves into their highest and best use at a young age, and because being displaced from a not-so-good match is less costly to the worker in the long-run.

Education may also play an important role in both matching and specific human capital theory.⁴ There are clearly some skills that can be accumulated through education that will only find productive expression with a handful of employers, perhaps because the relevant industry is dominated by a few firms. If demand from those employers should decrease, workers with these skills would likely see a substantial reduction in the demand for their services. This would have little to do, however, with human capital that was accumulated while working for those particular firms. Rather, the loss would simply be associated with specialization that occurred within the education system. As one example, Embry-Riddle University graduates the country's largest class of aerospace engineers, most of which likely find employment with the handful of airplane manufacturing firms in the United States. While aerospace engineering is extreme in that one company – Boeing - dominates that field to an unusual extent, there are many educational fields

⁴ There is some intrinsic ambiguity about whether education targeted toward employment with a specific employer should be viewed as a match or specific human capital. We focus here on the match interpretation, but in some cases, particularly where a firm pays for education in return for the promise of return employment, the conventional specific human capital interpretation is perhaps more valid.

of study where the successful use of the acquired skills is likely limited to a small set of prospective employers or by a larger set of employers – perhaps in the same industry - whose labor demand is highly correlated.

The implications of matching theory for how to interpret the costs of job displacement have not, to our knowledge, been formally worked out. However, it would seem that much of the same logic applies here as applied to specific human capital – workers are typically made worse off by a displacement, and the social costs hinge on whether or not the shift in labor demand away from the worker’s current employer is driven by socially efficient or inefficient events. There is one important difference, however. Specific human capital is acquired over time and is the product of decisions by workers on which jobs to hold and by employers on which types of training to provide. Those choices entail real opportunity costs in that other jobs were not pursued and in that other types of training were not provided. Thus, job displacement devalues human capital that could have been developed along other lines. This stands in contrast to the skills and preferences embodied in job matching models, where the attributes exist prior to the start of the employment relationship.

A problem with theories both of *firm*-specific human capital and of *firm*-specific matching is that there are relatively few skills – outside of personal connections to employees and customers – that are completely specific to a single firm, as opposed to a broader occupation or industry. Lazear (2009) addresses this problem by positing that a worker’s productivity at any particular firm is a function of the combination of an underlying set of skills – say, writing, computer programming and accounting. Any given skill is valued at a range of firms, so that no skill is completely firm-specific, but firms vary in the weights that their production function puts on various skills. If a worker knew that she would stay at a firm forever, she would accumulate skills along the dimensions most valued by that firm. But that is a risky strategy if the firm values an idiosyncratic combination of skills – say, being both a doctor and a statistician – because if the firm fails there is not likely to be a firm that values that combination of skills in precisely the same way. A worker laid off from such a firm is likely to sustain a significant loss in earnings capacity. In contrast, a worker laid off from a firm with less idiosyncratic skill needs is likely to have small or negligible costs from displacement.

A feature of this model is that workers face a choice in whether to invest in combinations of skills in thinly-traded portions of the skill distribution, i.e, those with few employers desiring those particular combinations of skills, or, alternatively, to invest in skill combinations that are more thickly traded. In equilibrium, investments in thinly-traded skill combinations have higher expected returns, but they also entail more risk than investments in thickly-traded skill combinations, as in Murphy (1986). The focus on the riskiness of specific human capital investment, and the expected premiums that accrue to workers that take on that risk, brings up an interesting issue of interpretation of earnings losses. In a model in which all workers invest in specific human capital with whatever firms they start with, the market for those skills is equally thick, and there is no variability in layoff risk, then workers start their careers on the same wage trajectory until such time as some of them are laid off, at which point those laid off workers sustain a significant reduction in their earnings capacity. In this case, the lifetime earnings of displaced workers are less than those of the non-displaced for no reason other than luck. However, in a version of the model in which firms vary in their propensity to lay workers off or in which skills vary in the thickness of their markets, the workers who would sustain the biggest drop in earnings upon layoff ex post are presumably compensated for that risk ex ante in the form of higher pay. This theory is supported by the findings of Topel (1984) and others who find that workers with high risk of layoffs are paid more than similar workers with low layoff risk.

These observations raise some interesting issues in regard to the design of UI programs, because they suggest that UI benefits are disproportionately directed to workers that received some ex ante compensation for layoff risk. As an example, a bidding war between Microsoft and a software startup for the same young programmer may force the startup to make a higher bid so as to compensate the programmer for the higher risk of being laid off. Absent UI, those workers would have received higher pay ex ante and in many cases those laid-off from high-risk jobs are not worse off from a lifetime income perspective than those *not* laid off from jobs with low risks. The presence of UI, however, likely reduces the compensating differential that accrues to high risk jobs. Topel (1984) also finds that more generous UI benefits lead to smaller compensating differentials associated with layoff risk – as workers require less ex ante benefit to bear layoff risk. In the extreme version of a UI program that provided complete layoff insurance – in the

sense that workers were indifferent to whether they were laid off or not – the compensating differential for layoff risk would be driven to zero.

C. Theories of Backloaded Compensation

The development of models of moral hazard and adverse selection in the 1970s gave rise to alternative theories that explain why workers' earnings might be tied to their specific employers. Spence (1973) reasoned that education could be viewed at least in part as a sorting mechanism that identified the subset of workers that could complete a college degree and, by extension, tasks that employers valued as well. Salop and Salop (1976) applied those ideas to the same set of facts that motivated specific human capital and job matching theory – high tenure workers had higher pay and were less likely to quit. In one formulation of this model, employers must pay some training costs for any newly hired worker and therefore have an incentive to attract workers that are unlikely to quit and thereby deprive the firm of a return on its investment. If workers vary in their intrinsic likelihood of quitting, then firms may offer wage-tenure profiles that are steeper than actual worker productivity. By doing so, firms can be viewed as requiring that workers post an upfront bond, in the form of foregone earnings, that is then repaid with above-productivity wages in later periods. If firms with high training costs use such tilted profiles while others do not, then the use of such profiles can efficiently sort high-mobility workers to those employers for whom that mobility is the least costly. Tilted earnings profile may also help firms select workers with other desirable attributes, such as patience or the ability to work in teams.

A similar mechanism is behind the agency models of Lazear (1979, 1981). In those models, employers are concerned about moral hazard on the part of their workers, in the form of theft, negligence or any of a number of other difficult-to-monitor forms of shirking.⁵ If firms are forced to pay all workers something close to their point-in-time marginal products, then workers – absent some other mechanism – will face little incentive to avoid shirking because the availability of other, similar jobs means that getting caught entails little punishment. Lazear points out that tilted wage-tenure profiles that generate an implicit bond provide an incentive for workers to avoid shirking, as the threat of being fired now carries a real penalty – the loss of their

⁵ See Dickens, Katz, Lang and Summers (1989) for a discussion of the prevalence of employee crime and its implications for employer compensation policies.

bonds. Lazear (1979) used that reasoning to explain the existence of mandatory retirement policies, as firms that pay workers more than their marginal product in the latter years of their career will not want workers to hang on too long and potentially more than recoup the present value of the bond they implicitly paid in their earlier years of employment.⁶

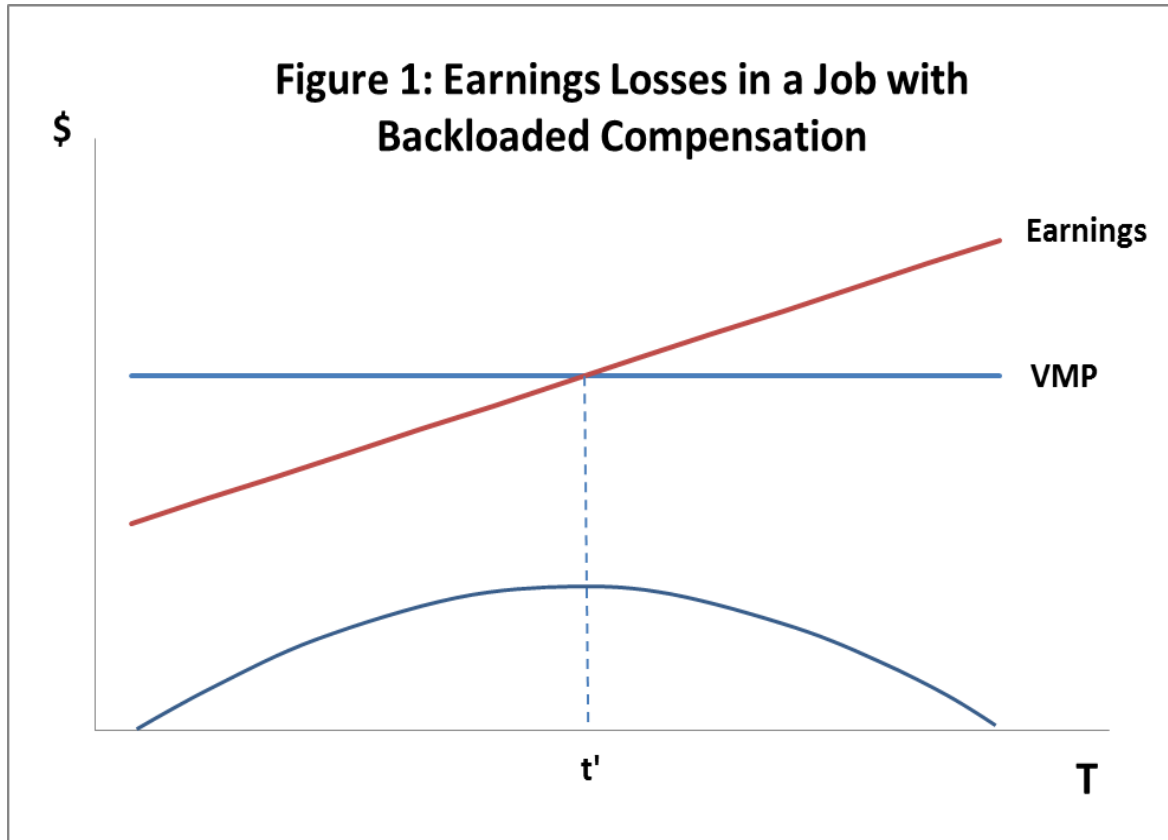
A distinctive feature of this class of models is that while experienced workers may be paid more at their current jobs than they would be if moved to other jobs, they are in fact no more productive at their current jobs than they would be elsewhere. Put differently, there is no first-order loss in economy-wide production from moving a worker from a long-term job to a job that she must start afresh. The worker will lose an amount that depends upon where he is in the process of recouping his bond, but that does not result in an economic loss to society. Another distinctive feature of these models is that the interpretation of the loss varies with how long the worker has been with the firm. Employment duration is non-stochastic in the original formulations of both models, but in fact there is always some uncertainty about how long any employment relationship will last. While the precise implications of randomly timed dissolutions have not (to our knowledge) been worked out in the literature, one possible solution would be that the time-paths of earnings are structured so as to, on average, leave the worker being paid back his bond with interest.⁷ This means that workers whose employment is terminated before the expected end date will get back, on average, less than the value of the bonds that they implicitly paid.

In figure 1, that loss starts at zero in the first period of employment and rises until the date t' , at which point the worker's pay begins to exceed her value marginal product. The implicit bond is fully paid in at that point and it is at that point when the cost of displacement is maximized. Thereafter, compensation includes a component that is interpreted as the gradual payback of that bond and the cost of displacement decreases as the remaining implicit bond shrinks. At date T ,

⁶ Some theorists (e.g., Shapiro and Stiglitz, 1984) posited that the wage effects of moral hazard were more likely to show up as an elevated equilibrium wage at which there was not full employment – in essence the equilibrium existence of an army of unemployed kept the employed feeling lucky to have jobs and therefore unlikely to engage in malfeasance. Murphy and Topel (1990) argued on theoretical grounds that firms using implicit bonds will be more profitable than those paying efficiency wages a la Shapiro and Stiglitz, and therefore that firms using implicit bonds will tend to prevail in inter-firm competition.

⁷ In the original Lazear (1979) model, the date of termination is nonstochastically set to be the date at which the opportunity cost of not working rises above the worker's value marginal product.

when the job was forecast to come to an end, there is no loss to the worker vis-à-vis her initial expectations, even though a worker displaced upon that date will be quite disappointed if she has to start back at a lower salary which is not above her marginal product.



There are, then, two notions of what might be lost in displacement in these models. The first notion is simply the decrement in earnings that a displaced worker might experience as a result of being laid off. As long as the gap between compensation and value marginal product continues to grow with job tenure, the loss in earnings upon reemployment after displacement is likely to increase steadily with tenure, and the highest tenure workers will experience the largest losses. But that does not mean that, ex post, the highest tenure workers were most damaged by having taken the jobs from which they were ultimately displaced. Workers would willingly take jobs from which they expected to be displaced at date T, for example – indeed, in the original model, mandatory retirement is functionally equivalent to a job displacement. And workers would happily accept jobs from which they expected to be displaced at a still later date, because at that later date of displacement they will have received back, in the form of extra pay, *more* than they implicitly paid in during their first years of employment.

This class of theories, as well as human capital and matching theories, share the property that the rising wage (tenure or experience) profiles that make displacement costly are tied to worker's productivity or costs to the firm. It is assumed that the workers themselves are interested in maximizing the discounted stream of utility or, in simplified models, earnings. Some survey and experimental evidence, however, suggests that workers do not seek to maximize the present discounted value of earnings. In particular, workers may *prefer* rising earnings profiles – both within and across jobs – even when those earnings profiles offer less net present value than profiles that do not rise as rapidly over time (Loewenstein and Sicherman, 1991; Loewenstein and Prelec, 1993). There are a variety of ways to modify the standard intertemporal choice model to account for these preferences – for example, by assuming a low or negative discount rate or by assuming that workers view rising earnings profiles as a way to regulate their own savings behavior (much like some workers deliberately have too much income tax withholding).⁸

The interpretation of displacement-induced earnings losses in this case is similar to that of the class of models where compensation is backloaded for reasons related to moral hazard (a la Lazear) or adverse selection (a la Salop and Salop). That is, any backloaded compensation scheme would seem to depend upon the expectations of employee and employer about the likely durability of the employment relationship. In that environment, employees who leave while the “bond” is still being paid in will have low contemporaneous changes in earnings while at the same time it is those same workers who are most damaged from a career-perspective, as in Figure 1. In contrast, the long-time workers who are highly-paid may experience large contemporaneous earnings losses even though they have stayed long enough to more than recoup any earlier periods of low pay. Thus, there is a substantial wedge between the economic loss incurred by displaced workers - defined as the gap between the discounted value they ultimately got from a job and the discounted value they expected upon accession -, and the loss as conventionally estimated in most studies of displaced workers' earnings losses.

⁸ There are obviously theoretical challenges to this interpretation of rising wage profiles – the main one being that there are several disadvantages to employees of having their employers serve as a savings bank. Doing so, for example, exposes employees to the prospect of being opportunistically fired by an employer that does not wish to repay the “savings” the employee accumulated and ties the repayment of the “savings” to the continued prosperity of the firm. Still, much of the recent economics and psychology literature suggests that consumers, under some circumstances, behave in ways at odds with conventional economic maximization.

The loss of implicit bonds in displacement also raises issues of social costs. Given the general feature of American employment law as employment at will, there is no guarantee from employers that employees who pay in a bond will be allowed to stay around long enough to recoup. This of course means that some employers may make such promises implicitly and then, either by plan or not, renege on those promises. That confiscation of an implicit bond generates a private transfer from the employee to the employer. But if the very existence of such contracts – which may be welfare-improving – relies on employers’ collective reputations to make good on the contracts except under extreme fiscal distress, then layoffs by one employer may raise costs for other employers because it makes their promises to repay employees’ bonds less credible, as in Klein, Crawford and Alchian (1978).

D. Rents

When a firm or industry is particularly profitable, those profits may be shared with workers in the form of pay higher than marginal product.⁹ Pay may also exceed workers’ marginal product at employers that are either heavily regulated or unionized. These rents, as opposed to the ex post quasi-rents implied by, say, human capital theory, are not a return on an investment that is embodied in the worker, nor, as in agency theories, do they reflect an incentive mechanism. When market conditions turn against these firms or sectors and workers lose their jobs, the rents they were enjoying are very likely lost to those workers. Although not models of rents, efficiency wage theories, as in Shapiro and Stiglitz (1984), also conclude that some workers are paid more than they would be were their current jobs to be eliminated, with similar implications for the workers.

It is useful to think of there being two versions of these types of models. In the first type, all employers pay rents or efficiency wages and not all the workforce is employed at any time. Lucky are those workers with the rent-paying jobs while those left out are unemployed. Displacement is costly in this setup because laid off workers are unemployed until such time as they are lucky enough to accede to a second rent-paying job. In the second type of model, some employers pay rents or efficiency-wages and others do not. Displacement from a rent-paying employer is again costly while displacement from a non-rent-paying employer is not. The

⁹ See, for example, Blanchflower, Oswald and Sanfey (1996).

average costliness of displacement would then depend upon the relative incidence of displacement from the two sorts of jobs. Note that there is no mechanism in either version that would lead the earnings loss associated with displacement to be correlated with job tenure. Also worth noting is that in these models those with the largest contemporaneous losses – i.e., the largest declines in earnings upon displacement – were those who were the luckiest *ex ante*.

There is no mechanism in these models whereby layoffs by one firm harm workers in other firms, or harm those other firms. Thus, the earnings losses in these models are purely private. There also appears to be no efficiency rationale for displaced worker assistance, either, as the presence of insurance does not induce workers to take jobs that are riskier but also more productive, as in the Acemoglu and Shimer (2000) model.

E. Theories Based on Revelation of Information

Another set of theories of costly job displacement is based on the idea that employers have private knowledge about their workers' attributes, a realistic assumption for most occupations. A job displacement may then reveal to future employers something unfavorable about the displaced worker, something that only someone with day-to-day experience with the employee would know. Prospective employers may conclude that the laid-off worker's marginal product at his prior firm was lower than that of the average worker with the same observable characteristics at the same firm. In this environment, being displaced is likely to lower future employers' estimate of a workers' productivity, much like being dismissed for cause. Indeed, given the reticence of some former employers to publicize the fact that they may have dismissed a former employee for cause, prospective employers may lump all employees with dismissals on their application as being, probabilistically, a weighted average of those who were fired and those who were laid off.¹⁰

The widely-cited “lemons” model of Gibbons and Katz (1991) is one application of these ideas. In that model, firms are not selective in whom they lay off when they close plants – all workers, good or bad, are let go. In contrast, employers are selective about who they let go in

¹⁰ There is surprisingly little known about the frequency with which workers are fired or the wage effects of being fired, largely because all government surveys of which we are aware make no effective effort to distinguish between dismissal with and without cause.

partial layoffs. In particular, a partial layoff takes place when a firm learns something unfavorable about the productivity of a subset of workers. Knowing that, prospective employers infer that workers displaced in a partial layoff event are of lower quality, and are willing to employ them only at wage rates lower than they had been receiving previously. In contrast, prospective employers draw no inference about a worker's quality when he is displaced in a plant-closing, as in those cases there was no selectivity as to who was let go. Subsequent research has documented instability in the empirical relationship between the earnings losses of those displaced in partial layoffs and plant closings, so the mechanics of the Gibbons and Katz setup may be questioned. Nevertheless, the basic idea, that current employers have some private information about their workers' productivity, has survived.¹¹

Even if one accepts that a worker's displacement is a bad signal to prospective employers, there are reasons to doubt the importance of a sharp dichotomy between plant closing and layoffs by continuing plants. Firms rarely move immediately from a state of either growing or stable employment growth to a state of decline or closure (Troske 1996). As firms start to fail, workers who are the least attached to the firm and whose pay is least elevated relative to their next-best alternative are those most likely to leave *before* the firm actually lays any one off or fails altogether. In contrast, those workers with poor outside opportunities relative to their current pay may stick with the firm until it completely shutsters its operations. Some of the difference between a worker's current salary and her outside opportunities may come from their accumulation of firm-specific human capital, but it may also be that some workers are simply paid more at their current job than is justified by their productivity at that or any other job. Again, extreme cases of overpaid workers are likely to be fired or have their salary cut, but moderately overpaid workers may persist in the presence of firing costs or firms' reluctance to cut nominal salaries. It is no longer clear then, from this perspective, that workers let go in plant closures are not selected on quality or on the ratio of or difference between their pay and their productivity. Rather, the least overpaid workers may find outside opportunities quite palatable and leave early in the firm's decline, while those who are the most overpaid will attempt to stay around until they have no choice.

¹¹ See, for example, Kahn (2013) and Michaud (2014).

Moreover, the behavior of employers may reverse the intuition about the order in which workers are laid off. Oyer and Schaefer (2000) argue that high costs of an explicit firing – either due to concerns about litigation or due to managers’ reluctance to take on the unpleasant task of firing - may motivate firms to retain somewhat overpaid employees for a time. In their model, firms hold off on firing marginally overpaid workers until such time as the firms both a) have a collection of such workers that they would like to fire, and b) experience a downturn to demand. When that happens, the firms “lays off” their collection of overpaid workers in a way that is less likely to directly insult workers, and therefore both less likely to lead to litigation and less stressful for the firing manager.¹² This reasoning suggests that a portion of the wage loss associated with displacement – either via layoff or through plant closure – might be due to the event being an implicit statement by the prior employer that the worker was a sub-par performer.¹³

The interpretation of earnings losses is obviously quite different in this type of model than in, say, the standard specific human capital model. Earnings losses occur here because workers were previously “paid too much” relative to their productivities. This is clearly a private cost to the laid-off worker, but there are offsetting gains for the employer. Thus, the social costs are not obvious, and depend upon whether the displaced workers are less productive at their subsequent jobs than they were at their previous jobs. It is even possible that some such displacements entail a social gain in the sense that workers are forced to relocate to jobs at which they are more productive even though they are paid less.

These considerations also raise important questions about how to define a displaced worker empirically. Conventional empirical work typically relies on one of two methods:

- a) Survey workers directly as to whether they were displaced (as in the Displaced Worker Survey)

¹² This process is similar to theories of “reallocation timing”, as in Davis’ (1987).

¹³The amount of information revealed in a layoff may well have changed over time. The erosion of the employment-at-will doctrine in American employment law and the evolution of anti-discrimination law have likely had the effect that it is now more expensive than before for firms to dismiss workers for cause (Krueger, 1991).

- b) Impute displacement based on a worker separating from an employer that coincidentally either closed or reduced employment substantially (as in most analyses of administrative data)

Either of these approaches may miss workers who leave a firm in decline before the displacement actually occurs, and omitting those workers from consideration may be potentially misleading.¹⁴ Indeed, workers who leave declining firms in the quarters prior to layoffs – and who would not be generally classified as having been displaced but are likely reacting to the same phenomena as workers who are eventually let go– appear to have higher earnings at the initial firm, higher earnings at subsequent employers, and much smaller reductions in earnings associated with leaving the failing firms (Bowlus and Vilhuber 2002; Schwerdt 2011). This suggests that those workers who stay with an employer with declining fortunes until it actually lays workers off may be an unrepresentative sample of the employer’s pre-decline workforce and, more particularly, may be the subset of workers who have the most to lose by being forced into new work. The combination of apparent reluctance to leave a sinking ship and large earnings losses could merely reflect those workers’ specific human capital, but, as noted earlier, it could also be that those workers are aware that they are over-placed or over-paid in their current positions and are appropriately concerned about their ability to find comparably lucrative work.

F. Intra-household reallocation

Most models of earnings losses of displaced workers focus on individual workers. But most displaced workers live in households with others, often with spouses, so it is natural to view displacement’s effects in the context of the household budget. The most basic models of intra-household consumption and risk-sharing suggest that the displacement of one household member is likely to increase the work hours of other members of the household. This may occur through both a household income effect – the household has less money and so other household members’ leisure falls if it is a normal good – and through a substitution effect whereby the household shifts collective hours worked towards those whose earnings capacity has not been diminished through displacement. There has long been a recognition of an “added worker

¹⁴ This point is related to, but distinct from, the oft-observed decline in displaced workers’ earnings prior to displacement.

effect” which occurs when a spouse temporarily enters the labor market to cover some of the income lost when a spouse was displaced (e.g., Lundberg, 1985). If there is some persistence in decisions about intra-household allocation of time, then the added worker’s participation may also be longstanding. In this case, a displaced worker’s earnings may not recover, as the increased spousal income leads to reduced labor supply on the part of the displaced worker, or to his selection of a less-onerous, lower-paying job.

Such a response alters the interpretation of displacement-induced earnings losses. To take an extreme case, in a one-earner household where the two spouses’ earnings capacities are equivalent and the two spouses’ leisure or household labor are perfect substitutes, then there would be little loss in utility from the displacement, despite a large and persistent reduction in the displaced worker’s earnings. In the opposite case, however, it would be costly for the spouses to switch work roles, and the loss in earnings of the displaced worker would be a useful guide to the household’s total losses.

The extent to which households divide roles is of course affected by the risk of displacement and the extent of social insurance. A family whose sole earner is a construction worker at significant risk for layoff and who lives in a state with low UI benefits runs a significant financial risk. That risk can be alleviated if the other spouse works or at least develops a readily marketable skill that could be called into use in the event of spousal displacement. In this view, the incidence of displacement in the economy – and specific occupations and industries – affect inter-household decisions on the accumulation of human capital and work experience. The opposite is also true. Households that have committed themselves to living off the earnings of a single member would suffer more in the event of that person’s displacement, and such sole earners have incentives to shy away from jobs and careers where the incidence of displacement is high.

Access to insurance can mitigate these considerations. Short-run insurance, such as the 26 weeks typically available through UI programs, reduces some of the risk of displacement in the short run, but does little to insure against long-term losses in earnings capacity due to displacement. Longer-term earnings insurance, of the sort advocated by Lalonde (2007), Kletzer and Rosen (2006), and others, provides more of this sort of insurance. Both short-run and long-run insurance protect workers against the loss of earnings due to displacement, perhaps inducing

additional efficient risk taking a la Acemoglu and Shimer (2000) as well as possibly reducing work incentives. But the availability of those benefits also reduces the value of income insurance that would, in some cases, be provided by spouses and other family members.

G. Health-Related Theories

Another view of displacement-induced earnings losses is that displaced workers are scarred by the experience, i.e., that workers' *general* human capital is impaired by the loss of a specific job. While we are unaware of any direct evidence on this score, it seems unlikely to us that displaced workers quickly lose general skills such as how to type, speak French, or apply rules of accounting. In contrast, displacement may well adversely affect health, as well as confidence, optimism, and other personality attributes associated with earnings success. More traditionally a subject for research by psychologists, there is a short but interesting literature within economics on the role of confidence, optimism and health in economic outcomes.¹⁵ To our knowledge, however, there has been no explicit theoretical development of the role of health in the earnings losses of displaced workers.

III. A Review of the Empirical Evidence

There are many studies of earnings and employment outcomes for displaced workers. In this section we review the findings of that literature with the goal of identifying empirical regularities that provide evidence for or against various theories of earnings losses from job displacement. We organize our discussion on a result-by-result basis and, after reviewing each result, outline what we perceive to be its implications for the relevance of competing theories. We have focused on what we perceive to be the most salient empirical regularities and on a (surely incomplete) selection of the papers that document them.

¹⁵ For example, in their study of self-confidence and motivation, Benabou and Tirole (2002) identify three benefits to having a good as opposed to an accurate view of one's abilities: consumption value (i.e., thinking well of oneself feels good), signaling value (i.e., thinking well of oneself helps convince others to take helpful actions) and a motivational value (thinking well of oneself improves one's willpower or, equivalently, decreases the cost of effort). Benabou and Tirole model self-confidence as a dynamic game played by different temporal versions of oneself, as in Laibson's (1997) hyperbolic discounting model. There can be both high and low self-confidence equilibria in the model and while "too much" overconfidence can be counterproductive, a limited amount of it is conducive to higher productivity. Bad luck, such as a displacement, can bump a person from a highly-productive/confident state of mind into a less-productive/unconfident state of mind. That lack of confidence can lead to lower earnings, potentially for a long period.

A. Earnings losses are persistent

The earnings of displaced workers are reduced, on average, for many years after the displacement occurs (Ruhm 1991; Jacobson LaLonde and Sullivan 1993; Schoeni and Dardia 1996; von Wachter, Song and Manchester 2009; von Wachter, Handwerker and Hildreth 2009; Couch and Placzek 2010; Davis and von Wachter 2011). The size of the estimated earnings loss over time depends upon the population and time frame studied, and upon the way in which displacements are identified. Measurements of earnings losses are also sensitive to how analysts characterize the worker's "non-displacement earnings," i.e., what the worker would have earned absent the displacement, which is obviously not observed. Among the sources of such counterfactual information have been extrapolations from the worker's pre-displacement wage trajectory and the experience of similar workers – sometimes from the same employer – who were not displaced, at least not contemporaneously. A common theme, however, is that displaced workers' earnings are reduced on average by roughly ten percent for more than 20 years after a displacement. The persistence of sizeable earnings losses is a challenge to most of the theories discussed above.

The ability of human capital theory to explain long-term earnings losses depends in part on the speed and the length of time over which specific human capital can be accumulated. Consider two workers who each had ten years of tenure at her employer in year t , at which time worker A is laid off and worker B retains her position. Suppose further that worker A quickly finds a second job that she retains for the next ten years. Empirical research suggests that, on average, worker A should earn substantially less than worker B even after this second 10 year period. For specific human capital to explain this, it would have to be that it takes *more than ten* years to attain the maximum level of specific human capital within a firm. That seems to us to be a long time in most jobs – though there may be exceptions – but the fact is that we have little independent information with which to assess the validity of such an interpretation. Such a long period may be more plausible for the occupation- or industry-specific versions of these models – it seems plausible that a biostatistician working for a drug firm, for example, is still learning new methods in biostatistics after ten years in the business. But, again, relatively little is known about the types of skills that constitute industry- or occupation-specific human capital, let alone

the speed with which those skills may be acquired, so there is a generous degree of speculation in any such judgment.

By the same token, for matching theories to explain such persistence in earnings losses it must typically take ten or more years to find a match that is near the top of the match-quality distribution. In the Jovanovic model, the speed with which workers find such matches is a function of both the variance in the distribution of job match qualities and in the speed with which employees and firms learn about the quality of matches. Our view is that relatively little is known about those parameters, however, and, further, they likely vary greatly across occupations.

The persistence of measured earnings losses is also interesting from the perspective of models of backloaded compensation. Each of these models entails an early pay-in period followed by a pay-back period in which compensation exceeds productivity. Consider a worker laid off from a job where he was at the start of the pay-back period and who immediately starts a new job where he had to go back to the start of the pay-in period. Such a worker's displaced earnings will fall short of his non-displaced earnings for as long as the backloaded compensation "contract" calls for increasing earnings. If that contract's period of rising pay is very long, then earnings losses could continue for an equally long time. But if the term of the implicit pay-in and pay-back periods are relatively short, as one might expect given the short median duration of new jobs in the United States, the long duration of lower earnings is a challenge for this class of theories. To our knowledge, however, there has been little effort to calibrate these periods, so there is relatively little basis on which to assess whether these models can explain long-term losses. It is worth noting, however, that Lazear's (1979) original model of backloaded compensation was designed to explain the existence of defined benefit pension plans and mandatory retirement rules that only come into play in long-term employment relationships. Also worth noting, of course, is that both defined-benefit plans and mandatory retirement rules are now much less common than they were in the 1970s.

Other theories considered here are more easily squared with long-term earnings losses. In some information-revelation models, displaced workers were, prior to their displacement, overpaid in relation to either their general or specific ability. The displacement revealed to them and to future employers that their productivity was not commensurate with their prior pay and, as

a result, their pay may never catch up that of observationally similar but more productive workers that were not laid off.

Theories based on rents can also generate persistent earnings losses for displaced workers. As noted above, a simple version of such models may have two employment sectors – a high-paid “rent” sector and a lower-paid “competitive” sector – and workers are periodically shuffled between the two sectors due to displacements and hires. Some workers displaced from the rent sector may ultimately regain their position, but displaced workers will on average be paid less in perpetuity as long as some of them are forced to work in the lower-pay competitive sector. Note that the costliness of displacement in such a model is contingent on the rate of displacement being higher in the rent sector. Displacements that simply shift an equal number of workers between the rent and the competitive sectors would not lead to an average cost of displacement in either the short or the long term.

Theories based on health effects and household reallocation also offer some promise of explaining long-run effects. Given that health has been demonstrated to affect earnings, there is a fairly direct transmission mechanism from the job displacement to long-term earnings losses from this perspective. There are two related mechanisms that can lead an adverse health effect of displacement to long-term earnings losses. First, displacement may have a direct, i.e., not mediated through earnings, long-run effect on health, and diminished health may lead to lower earnings in the long run. Second, displacement may directly have only a short-run effect on health, but that short-run effect can propagate longer-run adverse effects on earnings because of lost opportunities to develop work experience. Those longer-run earnings effects may in turn lower health levels in the long-run.

Also, there has long been a recognition that job displacement may alter the distribution of work within households – the added worker effect – though most of that research appears to have studied short-run responses of spouses and other family members to layoffs of others. One study of this effect found that the labor response of wives, i.e., their increased earnings, offset 25 percent of the earnings losses of their displaced husbands (Stephens, 2002). Those effects might be quite persistent, however, as household roles may permanently mold to changes in relative earnings capacities.

B. The distribution of earnings losses is wide.

Many displaced workers have greatly reduced earnings while many other displaced workers earn *more* after their displacement (Carrington, 1993; Schoeni and Dardia 1996; Fallick, Haltiwanger and McEntarfer 2012). The wide range of outcomes cannot be explained solely by a model in which human capital is only specific to a firm; within the confines of that model a displacement cannot lead to higher earnings. A wide range of outcomes is more consistent with models in which human capital is specific to industries or occupations. In this case, workers that lose their jobs at a particular firm but who find similar work elsewhere are not really displaced on any dimension that matters to them (Neal, 1995), so the stability of earnings in response to some displacements is not surprising. However, even here there is no natural explanation for why some workers' earnings would *increase* after a displacement – the best that could be hoped for would be a lateral move that left earnings unchanged.

The wide range of outcomes is more favorable to theories of matching. If the distribution of potential job-worker matches is wide, then so will be the distribution of displacement-induced earnings changes, including gains as well as losses.¹⁶ This occurs because, on the one hand, in the matching model a worker does not search for the absolute best match available, but rather has a stopping rule for further search whereby he stops further search if he finds a job whose match quality exceeds his reservation quality. Thus, some displaced workers are lucky and find an exceptional match quickly after displacement.

Theories of backloaded compensation can explain a range of outcomes if workers are displaced at varying tenures relative to their “pay-back” points, and some move to jobs with a degree of back-loading that is different from the job from which they were displaced. To take a very simple example, suppose that there are two types of jobs available – backloaded-pay jobs where pay steps up linearly from \$10 to \$20 per hour over a course of ten years, and standard-pay jobs that pay \$15 per hour at all times. A worker laid off in the ninth year of a backloaded-pay job would see her hourly wage fall from \$19 per hour to either \$15 or \$10 per hour depending upon the type of new job that she takes. A worker laid off in the third year of a backloaded-pay job, however, would see his hourly wage either rise to \$15 or fall to \$10

¹⁶ There is reason to believe that the distribution is, indeed, quite wide. See Low, Meghir and Pistaferri (2010).

depending upon the type of new job he took. In contrast, theories of information-revelation, the idea that being displaced signals low worker quality to potential future employers, are hard to square with an increase in earnings and wages.

Theories of health and household reallocation are consistent with a wide range of losses if there is heterogeneity in the effect of displacement on workers' health or heterogeneity in the degree to which households reorganize themselves in response to a displacement, both of which are reasonable propositions. Such theories, however, also have trouble explaining how earnings could rise with displacement. We are aware, for example, of no theory of how job displacement improves health and, by extension, earnings capacity. Similarly, we are aware of no simple model of household reallocation that would predict that displacement by a spouse would lead to substitution towards more work by that same spouse. While more of a measurement issue than a theory, another partial explanation for observed earnings gains is that some displaced workers take new jobs whose non-wage amenities are worse but whose earnings are higher. The available evidence does not support this as an explanation for average losses – but it may help explain why a subset of workers see their earnings rise. A hypothetical example would be a worker displaced from a low-wage job in Hawaii (high non-wage amenities) that then moves to high-wage Alaska (low non-wage amenities). Such a worker could be worse off even if their earnings rose.

Theories of rent could explain variability if the level of rents varies from job to job but, again, to explain earnings gains would require that workers be displaced from a low-rent job and then to find reemployment at a high-rent job. That is clearly possible, but it would not seem to be a common event, whereas earnings gains following displacement are fairly common. Virtually any theory of costly displacement can accommodate a range of outcomes if the theory is assumed to apply to some displaced workers but not to others. Meaningful use of any such “partial” theory, however, requires the development of an understanding of when the theory applies and when it doesn't. There is some tradition within the empirical literature that recognizes this possibility, as some analysts have, for example, chosen to exclude workers displaced from the construction industry from their analyses, on the grounds that there are relatively few persistent employment relationships in that industry (Kletzer, 1996). Some analysts (e.g., Carrington 1993) have examined variability in earnings losses across industries in

the hope of pinning down the specific portions of the economy where particular theories might apply, but it seems accurate to say that the literature has not successfully paired off particular displaced workers with particular theories.

C. Earnings losses increase with the “degree” of displacement.

Displacement is often viewed as a dichotomous outcome – a worker is either displaced or she is not based on the nature of her separation from her employer. But the literature has considered whether there are degrees of displacement, where the degree is determined by either pre-displacement job tenure or a measure of the distance between the pre-and post-displacement jobs.

- Many studies have shown that earnings losses are highest for workers that had high tenure on their pre-displacement jobs, although the literature is not in complete agreement on this point (Kletzer, 1989; Topel, 1990; Carrington 1993; von Wachter, Song, and Manchester 2009). Also, pre-displacement job tenure is positively correlated with post-displacement earnings levels (e.g., Addison and Portugal 1989; Kletzer 1991).
- Many studies have shown that earnings losses are larger for workers who switch industry, occupation, or region than for measurably similar workers who find new work in the same general area as their former jobs (Addison and Portugal 1989; Ong and Mar 1992; Jacobson LaLonde and Sullivan, 1993; Carrington 1993; Neal, 1995; Couch and Placzek, 2010). Moreover, post-displacement earnings rise more with same-sector tenure than with other-sector tenure (Neal 1995; Kletzer, 1996), and post-displacement earnings of workers re-employed in the same industry rise with pre-displacement tenure to a similar degree as did pre-displacement earnings (Ong and Mar 1992; Neal, 1995).
- Industry-switching is less common from industries with more specialized occupations, suggesting that specialized workers are particularly reluctant to learn new work that may entail starting out at a low wage (Kletzer, 1992; Kletzer, 1996).
- The earnings loss/job tenure relationship is attenuated in circumstances where the local conditions – defined by industry, occupation or locale – are themselves not bad,

i.e., there are other similar employers that continue to offer employment (Carrington, 1993).

- Displaced workers who are unexpectedly recalled to their pre-displacement employers saw substantial earnings reductions, although not as large as did those who were not recalled. (Kodrzycki 2007; Fujita and Moscarini 2013).

The results on tenure are most directly consistent with specific human capital and job matching, theories that were in part constructed to explain rising wage/seniority profiles. High-tenure workers have had time to accumulate (and then lose) the most human capital that was specific to their pre-displacement employer, and high tenure workers may be those who are most well-matched to their jobs and for whom the loss of the job is therefore most costly. The result on unexpected recalls also seems most consistent with depreciation or obsolescence of human capital. Models in which human capital or match-quality is specific to an industry or occupation, rather than to a single firm, are more consistent with the other findings on gradations of displacement.

The increase in losses with tenure also has a direct interpretation within models of backloaded compensation. The tie between losses and industry- or occupation-switching and between losses and same-sector tenure, however, suggests that backloaded compensation models cannot be the whole story, because in those models it is of no consequence whether or not any subsequent employer is similar to the prior employer – even an identically-situated new employer will feel no obligation to repay an employee’s implicit bond that has been paid in to and then lost from a prior employer. In a similar fashion, the degree of displacement has little interpretation within theories of earnings loss based on information revelation. If a prior employer signals that laid off workers are of low quality, then that signal would seem to be roughly as informative to all potential new employers, not just those in dissimilar areas of activity. Indeed, a prior employer’s signal that their former worker was low-quality might be most important to similar employers, whose production processes are most similar to those of the pre-displacement employer.

The role of health in this context is unexplored to our knowledge, though it seems possible that the loss of a long-term job is more depressing than the loss of one held for a shorter time-

period. In contrast, it appears that theories of household reallocation have no implications for the relationship between earnings losses and the degree of displacement.

A switch in emphasis from displacement from job to displacement from industry or occupation may still be too simple a categorization of the circumstances facing displaced workers. In a manner similar to Lazear's (2009) generalization of specific human capital theory, some recent work has examined the "skill portfolio" -- the mix of skills used -- of both pre- and post-displacement jobs, and measured the "distance" between the two (Poletaev and Robinson, 2008). The results suggest that switching industry or occupation *per se* is less important than switching skill portfolio. Earnings losses tend to be larger when the post-displacement job requires a different skill portfolio than the old job. This perspective, too, would seem to favor human capital or matching theories.¹⁷

D. Earnings losses vary by schooling and training

Earnings of college graduates fall by less, proportionally, than do the earnings of the less educated or those with specialized degrees (e.g., von Wachter, Handwerker and Hildreth 2009; but also see Stevens 1997). Education does not play a central role in any of the theories discussed above, so the implications of this result for various theories are not obvious. There is a branch of human capital theory, however, which hypothesizes that an important benefit of education is that it enables educated workers to respond more easily to changes in technology in particular and to the economic environment in general (e.g., Welch 1970, Schultz 1975). Relatedly, there is some evidence that wage rates tend to rise more steeply with education in industries with more rapid technical change (Gill, 1989). The result that displacement is less costly for more highly educated workers thus fits well within a suitably broadened theory of human capital. Several studies have found that earnings losses of displaced workers are higher in industries where on-the-job training is common (Jacobson LaLonde and Sullivan, 1993; Carrington and Zaman, 1994; Schoeni and Dardia, 1996), which is most readily interpreted

¹⁷ In a related vein, if displacements due to technological change induced the greatest earnings losses, this would argue in favor of a human capital explanation. Aaronson and Housinger (1999) and Song (2009) suggest that the "position abolished" category in the Displaced Worker Survey is more likely to be associated with technological change, and more likely to be associated with higher levels of human capital. At this point, however, an interaction between technological change and lost human capital has not been established.

within the context of specific human capital models. However, these studies also found earnings losses to be higher in industries where average wages are high, where many workers are unionized, and where firms are large, and all of which are most suggestive of rents or backloaded compensation models.

E. Earnings losses depend upon macroeconomic conditions.

The long-run effect of displacement on earnings depends upon both general and local economic conditions. Workers displaced during recessions typically have larger initial earnings losses than do workers displaced during better macroeconomic times (Topel 1990; Farber 1993; Couch and Placzek 2010; Couch, Jolly and Placzek 2011). The macroeconomic effect on outcomes is not fleeting either, as might be expected if displaced workers' earnings were simply depressed along with those of all other labor market participants. Instead, the effect is quite persistent even after macroeconomic conditions improve (Couch, Jolly and Placzek, 2011; Davis and von Wachter, 2011). Displaced workers' earnings losses are also related to the local economic conditions in which the displacement took place. Numerous studies have shown that earnings losses are lower when the displacement occurs in better labor demand conditions defined at the "local" (as defined by industry and/or geography) level (Howland and Peterson 1988; Jacobson, Lalonde and Sullivan, 1993, Carrington 1993; Kodrzycki 1995; Davis and von Wachter 2011).¹⁸ So, losing a job in bad times and places is worse than losing a job in good times and places.

The long-lasting effects of macroeconomic conditions at the time of displacement on earnings losses are not strongly differentiating among the theories reviewed here, but may be most favorable to matching theories, as bad times may force a displaced worker to re-start the matching process from a lower rung on the job ladder. However, this finding may also be consistent with the Oyer and Schaefer (2000) model of information-revelation, in which employers retain their marginally overvalued employees until such time as they can lay them off and credibly claim that the dismissals were due to weak demand. In that case, prospective subsequent employers may be particularly suspicious about the quality of workers laid off in

¹⁸ Note, however, that Nakamura (2008) contends that average wage losses are lower when the unemployment rate is higher because the pool of displaced workers is of higher quality.

periods of weak demand, because those are the times when firms lay off their weak performers. The finding would seem to tell most against theories of backloaded compensation, as we see no obvious reason why generally worse times should be associated with job losses concentrated in jobs with backloaded compensation schemes.

In a related vein, tighter labor market conditions have persistent positive effects on earnings at a continuously held job which are lost upon displacement. In particular, wage rates or weekly earnings at a job are higher when the minimum (state) unemployment rate during the worker's tenure at that job was lower (e.g., Beaudry and DiNardo 1991; Grant 2003). Relatedly, earnings losses following displacement are larger when the minimum unemployment rate during the pre-displacement job was lower (Schmieder and von Wachter 2010). In short, rates of pay within a worker's tenure on a job appear to ratchet up when labor markets are tight, but this gain is lost upon displacement. This finding may be consistent with theories of firm-specific human capital, matching, or rents: Tighter labor markets during one's tenure at a job may put the worker in a better bargaining position, leading to the quasi-rents from specific human capital investment or good matches, or, indeed, true rents, to be split more in favor of the worker.

It is also true that tighter labor markets would be consistent with a larger number of outside opportunities, in which case continued tenure at a job signals a better match in cross-section comparisons. However, the probability of displacement from a job also rises with the minimum unemployment rate during the time at that job (Schmieder and von Wachter 2010), which does not favor a pure matching explanation.¹⁹ Thus, these combined findings would be more consistent with theories of rents or quasi-rents (from specific human capital or perhaps match quality) if combined with some kind of downward wage rigidity.

F. Part of earnings losses is due to reduced employment

Displaced workers spend less time employed following displacement than does the general working population (Farber 1993). The differences are smaller in good times than bad, and fade away in four or so years following displacement (Ruhm, 1991). This result is consistent with any theory of earning losses, at least provided that reservation wages are slow to adjust following

¹⁹In addition, the probability of quitting falls (Grant 2003), which is consistent with any of these three theories.

job loss. That is, if displaced workers do not fully adjust their reservation wages to the lower earnings opportunities that follow from loss of human capital, match quality, tenure, reputation, or health, then more time spent nonemployed would be an expected outcome.

One of the costs of displacement is a greater chance of future displacement, which exacerbates long-term earnings losses (Stevens 1997). Theories of matching or of specific human capital (as a glue that prevents job loss) can explain both future displacements and why these future displacements prevent workers from recovering lost earnings. However, although models of deferred compensation can explain an increase in future separations in general, they do not explain an increase in future displacements. Nor do theories of information-revelation or rents explain greater future job losses. In the case of information-revelation, future employers have an opportunity to observe the re-employed displaced worker, once hired, and so need not continue to infer quality from the displacement event.

These adverse employment outcomes appear to be mitigated by advance notice of job loss. In particular, lengthy written advance notice and informal advance notice result in lower turnover in post-displacement jobs and also higher post-displacement earnings (Nord and Ting 1991, Ruhm 1994). Advance notice or anticipation of a reduction in force is also associated with greater chance of moving directly into another job (Kessel and Maher 1991; Addison and Portugal 1992; Burgess and Low 1992; Ruhm 1992; Ruhm 1994;). At first glance, this result favors a matching or perhaps a human capital theory. But then one must ask why pre-displacement search is more effective than post-displacement search, as is implied by the effectiveness of advance notice. Are notified workers unrepresentative of displaced workers in general (Fallick 1994, Ruhm 1994, Jones and Kuhn 1995)? Or is the real benefit of advance notice coming from the other forms of assistance that employers tend to provide along with notice, such as job search assistance (e.g., Ruhm 1994)?

There is disagreement in the literature about the importance of reduced employment relative to lower wage rates and shorter workweeks in accounting for earnings losses. Davis and von Wachter (2011) and Ruhm (1991) find that long-term losses in earnings are concentrated in lower wage rates and shorter workweeks, not in lack of full-time employment; Schoeni and Dardia (1996) find that losses are concentrated in reduced workweeks and employment, not in lower wage rates; Kessel and Maher (1991) found no effect on weekly hours in a case study in

Vermont.²⁰ Even a clear answer to the margins along which losses occur in the aggregate would probably not be of much help in distinguishing among theories. However, temporary and part-time jobs after displacement tend to be steps in a transition path to new regular and full-time jobs (Farber 1999). This finding is most favorable to models of job matching, but is consistent with other theories as well.

G. Differences by degree of firm's distress

Gibbons and Katz (1991) found that among white-collar workers but not blue-collar workers, those displaced by plant closings had smaller wage losses and shorter unemployment spells than those displaced from continuing firms, which they interpreted as favorable to theories of information-revelation. Hu and Taber (2011) found that this holds for white men, and is reversed for black men and women, for whom other factors (such as discrimination) may play a larger role. Somewhat more generally, Flaaen, Shapiro and Sorkin (2013) found that persons who are displaced as judged both by self-reporting and by mass employment reduction at the firm suffer smaller earnings losses than when there was no mass employment reduction at the firm.

However, Stevens (1997) found that the smaller earnings losses for those displaced by plant closings came because such workers experienced larger earnings reductions prior to displacement, during which time information-revelation theories may not apply. Similarly, Song (2007) found that the smaller losses for those displaced by plant closings even among white-collar workers resulted from those workers having higher earnings than other displaced workers (from steeper wage-tenure profiles) at their pre-displacement jobs rather than from those workers having lower earnings at their post-displacement jobs. Krashinsky (2002) found that the smaller earnings losses for those displaced by plant closings is a result of plants that close tending to have been smaller and having paid less to begin with, in accordance with the well-known size differential in wage rates. Finally, Song (2007) found that the appearance of the white-

²⁰ The roles of reduced employment and reduced wage rates varies substantially across developed countries. See Burda and Mertens (2001); Kuhn (2002); and Hijzen, Upward and Wright (2010).

collar/blue-collar distinction in Katz and Krueger's study resulted from recall bias in the 1984 and 1985 Displaced Worker Surveys , and that no plant-closing differential was present in the 2000 and 2002 Surveys.

In sum, the evidence on difference in earnings losses following more severe firm distress has been mixed, but, on our reading, is mostly not favorable to theories of information-revelation.

G. Demographic differences.

Among workers aged 55 and above, reduced levels of employment following displacement are often permanent, suggesting that displacement hastened retirement -- this is especially true among married women, while the opposite may be true among older men (Chan and Stevens 1999; Chan and Stevens 2001; Rodriguez and Zavodny 2001; Chan and Stevens 2004). Unmarried women have post-displacement outcomes that are similar to men's, whereas married women, especially those with young children, have less employment and shorter hours post-displacement. Otherwise, there are no sex differences in wage losses (Rodriguez and Zavondy 2001). These demographic differences in accelerated retirement and other reductions in employment and hours suggest that intra-household reallocation is at work, but the impetus for this may stem from reductions in earnings opportunities due to any of the theories of earnings loss.

Young displaced workers experience earnings losses similar to those of older adults upon displacement, but their relative losses become smaller as time goes by. Unlike for older workers, lower subsequent earnings growth (relative to the control group) is the major component of losses for young adults (Kletzer and Fairlie 2003). This finding suggests that rents are not the explanation for young adults, at least.

H. Displacement harms health

There is now ample evidence that displacement adversely affects health. Sullivan and von Wachter (2009) found significant differences in death rates and life expectancy between displaced workers and a control group. For high-tenure male workers, they found that mortality rates were increased by 50% to 100% in the year after displacement. Mortality rates were less elevated in years further removed from the displacement, but their results suggest that

displacement reduces a worker's life expectancy by 1 to 1½ years for mid-career males. Further, the increases in mortality rates are highest for workers whose earnings decreased the most. These results admit to two non-exclusive interpretations. First, the lower earnings induced by displacement – via some non-health-related mechanism possibly – increases mortality because mortality is negatively correlated with income (e.g, Deaton and Paxson, 2001). That is, displacement makes you poorer and being poorer reduces life expectancy. Second, displacement may harm health and those events may in turn reduce income. In short, displacement makes you sick, and that reduces your earnings. Of course, both mechanisms may be at work and mutually reinforcing.

The mechanics of how job displacement affects mortality are not well-understood, but the empirical literature suggests a strong role for mental health. Though not directly tied to job displacement per se, Davis and von Wachter (2011) documented a large increase in anxiety among workers during the recent recession, and, in an earlier study, Kessler, House and Turner (1987) found heightened incidence of mental health issues in recently laid-off workers. Krueger and Mueller (2012), in a survey of workers from New Jersey, found that unemployed workers report high levels of sadness and that their mood improves significantly upon reemployment. In a study of Norwegian workers, Black, Deveraux and Salvanes (2012) found that displacement is associated with an elevated incidence of coronary disease, in part precipitated by an increase in smoking. In a study of Swedish workers, Eliason and Storrie (2009) found that workers displaced in plant closures are at increased risk of alcoholism and, for men in particular, at increased risk of traffic accidents and self-harm. Charles and Stephens (2004) found that job displacement leads to a heightened risk of divorce, whereas, in contrast, the onset of disability does not, even though both lead to reduced earnings. These results are consistent with the view that job displacement has consequences for mental health that are not themselves the result of reduced earnings.

The mental health effects of job displacement may be one reason that displacement has an adverse effect on the children of displaced workers (Oreopoulos, Page, and Stevens 2008). Children's earnings, of course, is generally increasing in their parents' income, so part of the effect of job displacement on the adult outcomes of the displaced worker's children may be due to the fact that the reduced parental income reduces children's adult earning (see, e.g., Lee and Solon 2009)s. But it is reasonable to suppose that part of the effect of parental job displacement on children's later earnings may be due a reduction in effective parental inputs into, loosely

speaking, the child's human capital. This latter view is supported by the work of Rege, Telle and Votruba (2011), who found that the displacement of Norwegian fathers had an adverse effect on their children's school performance independent of its effect on family income. The same effect was not found for mothers.

There is clearly, then, a strong nexus between health (particularly mental health), earnings and job displacement. Although the causality between health and earnings outcomes probably runs in both directions, our reading of the literature indicates that at least a substantial part runs from reduced health to reduced earnings. Most policy interventions studied by economists have tended to focus, not surprisingly, on the issues most commonly studied by economists – job search assistance, job training, and unemployment and earnings insurance. But if a primary driving factor behind the difficulties of displaced workers is mental health, then more direct intervention in that vein may be more effective. One study, for example, found that job-search assistance paired with more traditionally psychological interventions such as problem-solving training and social reinforcement worked better than job-search assistance alone (Caplan, Vinokur, Price and van Ryn, 1989).

IV. Implications

Table 2 summarizes the empirical findings and their implications for the theories. As we have emphasized, a range of theories have something to say about why earnings fall for displaced workers, but little of the evidence is strongly differentiating no theory provides a full explanation on its own. Models of specific human capital, for example, do well at explaining tenure-profile of earnings losses, but they are hard to square with earnings gains upon displacement. Moreover they rely on the assumption that there is a significant component of earnings power that is truly firm- or industry-specific, an assumption that in some cases seems hard to credit. Models of matching can explain the tenure-profile of losses and can also explain earnings that increase with displacement, but, like specific human capital models, they have trouble explaining the extremely long duration of earnings losses. Models of backloaded compensation also explain the tenure profile of earnings losses, but they are intrinsically models of firm-specific earnings capacity and do not easily explain the role of industry-switching or local market conditions in the losses of displaced workers. Models of worker rents can explain

the persistence of reduced earnings among displaced workers, but cannot easily explain wage gains upon displacement, the variation of earnings losses with “degrees” of displacement, or, obviously, the presence of losses among workers who were likely not receiving pre-displacement rents. Models of information-revelation can explain the persistence of earnings losses but do not directly explain the tenure profile of losses. Intrahousehold reallocation can explain substantial long-term losses for displaced workers whose household arrangements change with displacement, but research finds substantial earnings losses for people for whom such arrangements are unlikely to be important, so this too is an incomplete explanation. Finally, the decline in health – both physical and mental – that often accompanies a displacement can potentially explain a wide range of post-displacement outcomes, but it, too, cannot easily explain wage gains, and is unsatisfactory as a standalone explanation in part because we then need a theory of why displacement harms health. In sum, then, it appears that no single theory can be called upon to be the explanation for why earnings fall with job displacement.

The relative weights one puts on the various models matters from several perspectives. First, while it is clear that most displaced workers’ earnings fall relative to what they would have earned in the absence of the displacement, it is less clear that, relative to the expectations with which they began the job from which they were displaced, that they came out worse than they expected upon accession to those jobs. No job is expected to last forever when it begins, and so workers presumably make some forecast about how long jobs are expected to last. In the models of specific human capital, matching or, especially, backloaded compensation, those who remain on the job the longest lose the most instantaneously upon displacement but were, at the same time, more fortunate than those who might have been displaced at earlier stages of their career at the employer. Thus, whether displaced workers were unfortunate in the totality of their experience on the job from which they were displaced depends greatly on the point in their anticipated job tenure path that they were displaced.

Theories of information revelation also alter one’s perspective on whether displaced workers with the largest earnings losses were the most unlucky. In those models, displaced workers with the largest losses are those who were most overpaid at their prior job. A worker may be overpaid prior to displacement because his employer made a mistake in its initial salary offer, or because the worker’s performance deteriorated over his tenure. If workers’ overpaid status is a function

of mistakes made in the hiring process, then workers displaced because they were overpaid may have had the most luck in finding the job from which they were ultimately displaced. This is true even though their earnings fall with displacement, a few years of overly high pay is better than no such years.

Second, the extent to which displacement entails a social loss varies from theory to theory. In our experience – clearly an unscientific poll - most economists who favor human capital explanations believe that most displacements are efficient in the sense that while specific human capital is lost, there is a social gain as aggregate work effort is reallocated towards more productive uses. In addition to its more direct insurance value, some analysts (e.g., Lalonde, 2007) view wage insurance as a price that should be paid to the economic losers so as to make such socially desirable reallocations more palatable. But if displacements have long-term health effects that are not considered or fully appreciated by either firms (in their decisions on when to displace workers) or workers (in their decisions on whether to accept lower wages in lieu of displacement), then displacements may be inefficient. Displacements may also, at the margin, be inefficient in models of long-term contracting in that firms that lay workers off may confer a negative externality on other employers by making workers less likely to accept such arrangements.

Third, the types of policy responses that are appropriate would seem to hinge on one's understanding of why earnings fall with displacement. Much of the policy discussion, appropriately in our view, focuses on the role of short-run policy interventions such as unemployment insurance. But there is clearly a longer-run issue. Two of the most often discussed – and occasionally attempted – approaches to long-run earnings losses for displaced workers are job training, often provided by community colleges, and longer-term wage insurance. Both of these policies seem to be motivated by the specific human capital view. But other perspectives on earnings losses potentially suggest alternative responses. Earnings losses driven by family reallocation, for example, would not seem to motivate much of a policy response at all. Earnings losses driven by information revelation, i.e. a statement by the displacing employer that the displaced worker was previously overpaid, also do not immediately suggest a policy response on either equity or efficiency grounds. And earnings losses driven by health, particularly mental health, suggest a different type of policy response. Our best guess

is that most economists embrace a view similar to that expressed by Till von Wachter in the quote at the beginning of this paper. That is, workers in most firms work their way up “job ladders” that reflect some combination of specific human capital acquisition, matching and backloaded compensation, and that getting knocked off a ladder that has been partly climbed is costly to workers. We largely agree with that view, but we also believe that more widespread reflection about the range of potential interpretations would be useful, and that this reflection should include the other models discussed here – information revelation, household reallocation and health. As a profession we have many pieces of the puzzle for the mechanics by which earnings fall as a result of displacement, but we have not yet fit them together into a convincing narrative.

Some refocusing of future empirical research on evidence that would help differentiate among theories would also be useful. One obviously fruitful direction would be to replicate with other data some of the results discussed above in cases where the evidence is currently thin, perhaps taking advantage of recent and ongoing advances in matched employer-employee and longitudinal administrative data, among other sources.

A few other directions for future empirical work suggest themselves to us, of which we note just a few. One might be to study of the full path of earnings, over previous and subsequent jobs, with an eye toward a more rigorous evaluation of matching theories. Under matching, as opposed to human capital or agency theories, we would expect to see wage increases both before and after displacement concentrated during changes of employer or occupation.

A second, quite ambitious, agenda would identify and value sets of skills possessed by workers before displacement, and examine whether earnings losses upon displacement are associated with a change in the general market value of those skills. This would help to evaluate those theories that associate both displacement and the subsequent loss of earnings with declines in the value of particular skills in either aggregate or local labor markets, and distinguish them from matching theories in which the human capital itself has not depreciated in value, but earnings losses stem solely from the difficulty in finding a post-displacement match that conforms to a worker’s set of skills.

Third, we think that further research into the experience of displaced workers who are unexpectedly recalled to their pre-displacement holds promise. As noted above, such workers

appear to experience substantial earnings reductions. However, interpretation of this result as favoring human capital theories over others depends upon whether these workers were recalled to their previous jobs in the traditional sense, or were treated as new hires, that is, brought back into a new (possibly two-tiered) wage structure, as some anecdotal evidence would have it. Perhaps such new structures could be identified for sufficiently large employers by discrete changes in the patterns of earnings of new hires.

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Table 1
Models of Costly Job Displacement

Model Class	Source of costly job loss	Representative theoretical papers
Specific human capital	Specific training or learning-by-doing creates human capital that is only valuable at the current employer or at a subset of firms or jobs. Reduction in the rental price of that human capital, to zero, entails an income loss.	Becker (1962), Mincer (1962), Shaw (1984), Neal (1995) Fallick (1993)
Job matching	Workers matched to some jobs better than others	Jovanovic (1978)
Backloaded compensation	High tenure workers receive pay that exceeds productivity as part of a tilted wage/tenure profile that firms use either to constrain moral hazard or to make the job unattractive	Lazear (1981), Salop and Salop (1976)
Revelation of information	Displacement reveals to potential new employers that the displaced worker is low quality on some dimension, thereby reducing their prospective earnings	Gibbons and Katz (1991), Oyer and Schaefer (2000)
Health	Job displacement reduces mental and physical health, which in turn reduces earnings	Kessler, House and Turner (1987)
Intra-household reallocation	Families substitute towards work performed by non-displaced family members	Lundberg (1985)

Table 2
Consistency of Models with Empirical Results

Model	Summary
Specific human capital	Most consistent with reduced subsequent employment, and the variation of earnings losses with “degree” of displacement and training. Has difficulty with the wide range of earnings changes.
Job matching	Most consistent with the wide range of earnings changes; variation of losses with “degree” of displacement and with macroeconomic conditions; and reduced subsequent employment. Has difficulty with variation of losses with training.
Backloaded compensation	Most consistent with the wide range of earnings losses. Has difficulty with variation of losses by training and macroeconomic conditions, and with reduced subsequent employment.
Rents	Most consistent with the persistence of losses and variation of losses with macroeconomic conditions. Has difficulty with the wide range of earnings losses; variation with “degree” of displacement, training, and degree of firm’s distress; and with reduced subsequent employment.
Information revelation	Most consistent with persistence of earnings losses. Has difficulty with the wide range of earnings changes; variation of losses with “degree” of displacement and training; and reduced subsequent employment.
Intra-household allocation	Most consistent with the persistence of losses and demographic differences. Has difficulty with the wide range of earnings changes, and variation of losses with “degree” of displacement and training.
Health	Most consistent with the persistence of losses, reduced subsequent employment, and evidence of health effects. Has difficulty with the wide range of earnings changes and variation of losses with training.