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ABSTRACT

This paper examines the effect of a husband's job loss on the labor supply of his wife, an effect known as the "added worker" effect. Unlike past added worker effect studies which focus on the effect of the husband's current unemployment status, this paper analyzes the wife's labor supply response in the periods before and after her husband's job displacement in order to examine the short- and long-run adjustments to an earnings shock. Using the Panel Study of Income Dynamics, small pre-displacement effects are found along with larger and persistent post-displacement effects. The timing of the wives' responses differs by the type of displacement (plant closing vs. permanent layoff), possibly due to differences in the information wives acquire prior to the displacement. In addition, the response is found to increase with the magnitude of the husband's wage loss, to have changed over time (70's vs. 80's) and to vary by the husband's pre-displacement earnings. The long-run increases in the wife's labor supply account for over 25% of the husband's lost income.

Melvin Stephens Jr.
H. John Heinz III School of Public Policy and Management
Carnegie Mellon University
4800 Forbes Avenue
Pittsburgh, PA 15213
and NBER
mstep@cmu.edu

1. Introduction

Numerous economic studies over the past decade have detailed the negative earnings effects of a job displacement (See the surveys by Hamermesh 1989 and Fallick 1996). Displaced workers suffer annual earnings losses in the year of displacement which range from 25% to 40% (Topel 1990, Stevens 1997). Instantaneous hourly and weekly wages losses are only 12% and 17%, respectively, with much of the initial lost earnings due to unemployment (Stevens 1997, Topel 1990, Ruhm 1991). More importantly, displaced workers face substantial permanent earnings losses. Although Ruhm (1991) finds that the increase in unemployment disappears within four years of displacement, hourly wages are still 10% below expected levels six years after the job loss (Stevens 1997).

While much continues to be written about the earnings and unemployment effects of job loss at the individual level, much less is known about the effects of displacement at the household level. Models of family utility maximization suggest that reduced family income due to the earnings losses of one family member may be offset by increases in the labor supply of others. Due to the large permanent earnings shock, a job loss presents a situation where such a response is likely to occur. Given that a majority of displaced workers are married (Seitchik 1989), increased labor supply of spouses may be an important household consumption smoothing response to displacement. This paper analyzes married women's labor supply responses to their husbands' job displacements.

Dating back to Woytinsky (1942), economists have been interested in understanding the "added worker effect" which is an increase in married women's labor supply in response to their husbands' unemployment spells. The studies in this literature use individual-level data to examine the contemporaneous effect of a husband's unemployment spell on his wife's labor supply.[1] While some studies find no evidence of an effect (e.g., Layard, Barton, and Zabalza 1980; Maloney 1987, 1991), the studies which do uncover some evidence find only small magnitudes for the added worker effect (e.g., Mincer 1962; Bowen and

[1] Earlier studies which rely primarily on city-level or Statistical Metropolitan Area level Census data find that higher levels of area male unemployment reduce the labor force participation of wives (Long 1958; Mincer 1962; Bowen and Finegan 1965, 1968; Cain 1966). The results are taken as evidence of a "discouraged worker effect" whereby poor labor market conditions for husbands either are correlated with poor conditions for wives or discourage wives from entering the labor force.

Finegan 1968; Heckman and MaCurdy 1980, 1982; Lundberg 1985; Spletzer 1992; Gruber and Cullen 1996). Under the assumption that unemployment is a transitory reduction in earnings, the literature generally concludes that such small responses are an optimal response within a life-cycle framework.

Due to the methodological approach used in the the added worker effect literature, however, these results are not directly applicable to understanding how married women adjust their labor supply in response to their husbands' job displacements. First, not every unemployed worker is a displaced worker. As mentioned above, the earnings losses during a spell of unemployment are quite substantial for displaced workers. However, those who become unemployed due to quits or seasonal employment may not have their earnings adversely affected. Thus, while the former type of unemployment may call for changes in the spouse's labor supply, the latter may not require any adjustments. Estimates of the added worker effect which treat all of the unemployed the same will likely underestimate the magnitude of the true effect for involuntary job losers.

Second, not every job loser suffers a spell of unemployment. Workers who learn about an upcoming displacement, possibly due to advance notice given by the firm, may be able to find new employment prior to termination.[2] Even with an advance notice, the earnings losses suffered by these workers may still be substantial. In the Panel Study of Income Dynamics sample used in this study, only 60% of the married men who say they have been displaced within the past year report any unemployment during the same period. Thus, a substantial portion of job losers may be excluded from previous added worker estimates since these studies focus on unemployment alone.

Finally, by examining the wife's labor supply response to her husband's current unemployment, the previous literature ignores any response before or after the job loss occurs. If a family perceives an increase in the likelihood the husband will become displaced, the wife's work effort should also increase prior to the displacement. Once a displacement occurs, the reduction in permanent family earnings should increase the wife's labor supply in subsequent years. Furthermore, there may be post-displacement learning about

[2] E.g., see Addison and Portugal (1992) for evidence of the effects of advance notice on reducing unemployment spells.

the long-run impact on the husband's earnings which may also influence work decisions. The increased income earned by the wife both before and after a displacement may be an important aspect of the consumption smoothing families undertake. Therefore, an understanding of the labor supply adjustment dynamics needs to be included in an analysis of the added worker effect.

The purpose of this paper is to examine the added worker effect as a response to a permanent earnings loss caused by a displacement rather than as an adjustment to a temporary earnings loss caused by a spell of unemployment. The theoretical analysis highlights the implications of displacements on spousal labor supply in a household life-cycle model. In this framework, a husband's job loss will result in a permanent increase in his wife's work effort following his displacement. New information about increases in the job loss probability prior to a displacement will increase the wife's labor supply before a job loss occurs. Furthermore, the magnitude of the response will depend upon the household's belief about the probability of job loss as well as the magnitude of the husband's wage loss.

This paper uses the Panel Study of Income Dynamics (PSID) to test these implications of the added worker effect in a life-cycle model. Large and persistent post-displacement increases in the wives' labor supply are found. The analysis also finds an increase in pre-displacement labor supply, which is consistent with families learning about an increased likelihood of a job loss before one occurs and optimally adjusting their labor supply.

The importance of information concerning the husband's job loss probability is also examined. The impact of new information on pre-displacement work effort is analyzed by examining the differences in responses for plant closings and permanent layoffs. Stevens (1997) finds significant wage losses for workers prior to plant closings but not in the case of layoffs. To the extent that these wage losses indicate increases in the job loss probability to the household, there are differences in the pre-displacement information available between the two types of job loss. The empirical analysis finds a larger pre-displacement increase in the work effort of wives for plant closings relative to layoffs although the difference is not significant. In addition, the prediction that the magnitude of the post-displacement response depends upon the husband's job loss probability is examined. Finally, extensions which analyze the difference in the added worker response by the the magnitude of the

husband's wage loss, by the husband's pre-displacement earnings level, and by the time period of the job loss (1970s vs. 1980s) are also reported.

The paper is set out as follows. The theoretical model in the next section briefly motivates examining the added worker effect within a life-cycle model. The model also indicates how differences in information that households have before a displacement occurs may affect the timing and the magnitude of the added worker response. The empirical specification and methodology is then discussed followed by a description of the dataset used in the analysis, the 1968-1992 waves of the PSID. The results are then presented followed by a summary of the paper. A simple calculation shows that in the long-run, the increased work effort of wives helps offset over 25% of their husbands' lost earnings. The added worker response is important in terms of long-term household consumption smoothing since income maintenance programs designed to help job losers, e.g. unemployment insurance, only provide short-run support to families of displaced workers.

2. A Family Life-Cycle Labor Supply Model

The family life-cycle labor supply model with uncertainty which is examined here is an extension of the single worker model studied by MaCurdy (1985). The model assumes that the household jointly maximizes utility which depends on the leisure of the husband and the wife, M_t and F_t, respectively, and total household consumption, C_t, over a $T+1$ period household lifetime. The price of consumption goods is normalized to 1 for all periods while wages for the husband, W_{Mt}, and the wife, W_{Ft}, follow an exogenous process. The household's utility function is assumed to be strictly concave and intertemporally separable, M_t, F_t, and C_t are assumed to be normal goods, and capital markets are assumed to be perfect.

In an uncertain world, the household updates its expectations with any new information it has received since the prior period and maximizes utility over the remainder of its lifetime. The family's optimization problem in period t is

$$\text{Max } \mathcal{U}_t = \mathrm{E}_t \left\{ \sum_{k=t}^{T} \left(\frac{1}{1+\rho} \right)^{k-t} U(C_k, M_k, F_k) \right\} \tag{1}$$

$$s.t. \;\; A_{t+1} \;=\; (1+r) \left[A_t + W_{Mt}(\bar{L} - M_t) + W_{Ft}(\bar{L} - F_t) - C_t \right], \tag{2}$$

$$\text{and } A_{T+1} = 0$$

where A_t is the household's stock of assets in period t, ρ is the household's subjective discount rate, r is a constant real interest rate, and $\bar{L}$ is the constraint on the total time each household member can divide between work and leisure. The conditions for optimality are

$$U_C(C_t, M_t, F_t) = \lambda_t \tag{3}$$

$$U_M(C_t, M_t, F_t) \geq \lambda_t W_{Mt} \tag{4}$$

$$U_F(C_t, M_t, F_t) \geq \lambda_t W_{Ft} \tag{5}$$

$$\lambda_t = \left(\frac{1+r}{1+\rho}\right) \mathrm{E}_t\{\lambda_{t+1}\} \tag{6}$$

Strict concavity of the utility function implies the wife's leisure demand equation can be written as

$$F_t = \begin{cases} F(\lambda_t, W_{Mt}, W_{Ft}) & \text{if } U_F(C_t, M_t, F_t) = \lambda_t W_{Ft} \\ \bar{L} & \text{if } U_F(C_t, M_t, F_t) > \lambda_t W_{Ft} \end{cases} \tag{7}$$

The inequality in the wife's leisure demand equation (7) reflects the constraint on total available leisure time.

With uncertainty, the family forms beliefs over the distribution of future variables, including the wage offers the husband and wife may receive. The decisions a family makes in each period will reflect both the expectations of future variables and the amount of uncertainty surrounding these variables. As time progresses, the family may update their priors about the moments of these distributions given past realizations of the variables. Both the realizations of past variables, e.g., a job loss, and the changes in beliefs about future distributions, e.g. the probability of a job loss, will enter a family's decisions as shocks to the marginal utility of wealth, λ_t. The familiar Euler Equation (6) describes the evolution of λ_t over the life cycle.

Wife's Response to Her Husband's Displacement

To examine the impact of a displacement, assume that a displacement can be represented as a low wage realization which occurs in one period, t^*, and a spread-preserving reduction in the mean of all future wage offers.[3] In terms of the wife's labor supply function, two arguments, W_{Mt} and λ_t, will be affected by the displacement. The cross-wage effect (i.e. the change in the wife's labor supply due to a change in the husband's wage holding λ_t constant) influences the wife's labor supply only in the period of displacement t^*. The impact of the husband's displacement on the wife's labor supply through the cross-wage effect is ambiguous since it depends upon whether the couple's leisure times are substitutes, complements, or strongly separable.

The main effect of a displacement on the wife's labor supply comes from the decline in the mean of future wage offer distributions which reduces expected lifetime wealth. In terms of the model, the loss in lifetime wealth increases λ_t in all periods once the family learns of the job loss and causes the wife to work more in every future period. Thus, holding constant the husband's wage, an increase in λ_t will lead to an increase in the wife's labor supply. Since the cross-wage effect only affects labor supply decisions in period t^*, the theoretical predictions for the impact of displacement on the wife's labor supply can best be conveyed by understanding the time path of the change in λ_t.

The wife's labor supply response will depend upon both how far in advance that the family learns of an impending job loss and the magnitude of the resulting wealth loss. If a displacement "surprises" the family in period t^*, λ_t will increase $\forall\ t \geq t^*$. The permanent earnings loss due to a displacement will permanently increase the wife's desired labor supply. However, if the family learns of the displacement before it occurs, the wife will increase her hours not only once the displacement occurs, but even before her husband's job loss. In addition, the wife's response will depend upon the magnitude of the impact on λ_t. The wife's labor supply should increase the most in families that suffer the largest permanent wealth losses due to displacement.

[3] This theoretical interpretation of a displacement in the life-cycle model is consistent with evidence on the time path of wages following displacement in Stevens (1997). Analogous comparative dynamics for a single worker life-cycle model with uncertainty are discussed in Killingsworth (1983).

Since families form expectations over future variables, the perceived probability of a displacement is an important determinant of the magnitude of a wife's response when her husband is displaced.[4] When the displacement occurs, the magnitude of the shock to λ_t, and thus the magnitude of the wife's response, will depend upon how likely the family believed that a displacement would occur. If the family believed it was highly likely the husband would be displaced, then the wife's labor supply will change only slightly. However, if a family believed that it was very unlikely a displacement would occur then the change in the wife's labor supply will be much larger. Intuitively, when a husband is employed in an industry subject to many layoffs, his wife will have adjusted to this high probability of displacement long before a job loss occurs. On the other hand, in families where the husband's job is thought to be very secure, a displacement is more likely to cause significant adjustments.

Changes in the probability of a job loss can affect both the magnitude and the timing of the response. Bad news about the husband's job, such as rumors of a possible downsizing by his company or a poor local economy, may increase the perceived probability of a future displacement. This change will lower future expected earnings and increase λ_t in the period when the family's expectations change.[5] In these households, we would expect the wife to increase her work effort prior to a job loss. For a family in which the husband subsequently suffers a displacement, any additional adjustments at the time of displacement will again depend upon how likely the family perceived the displacement to occur.

To quickly summarize the theoretical implications, the added worker response can vary greatly across families depending upon the timing of the information arrival, the magnitude of the wealth loss, and what information families already possess. The subsequent

[4] A variable for the probability of a job loss can be explicitly incorporated into the model. The resulting analysis is similar, although as discussed below, the results are not always the same without additional restrictions on the impact on the variance of the future earnings distributions.

[5] This response will be generated by a decrease in the expected value of the wage distribution, holding the spread constant. Increases in the variance of future wages, holding the mean constant, have an ambiguous effect on the model without the addition of more assumptions (see Killingsworth 1983). Presumably, assumptions about the precautionary motives of families could be invoked to sign the direction of the effect (Kimball 1990), but there currently do not exist (to my knowledge) precautionary savings results for utility functions with multiple commodities. However, if the model includes an explicit variable for the probability of a displacement, an increase in such a probability will unambiguously lower expected future earnings.

regression analysis will average these responses across heterogeneous households. Still, unless job losses are perfectly forecast by households, there should be a permanent increase in the wife's labor supply following the husband's job loss. In addition, if some families learn of or begin to anticipate impending job losses, there will be evidence of increased labor supply in the years prior to the displacement.

3. Empirical Methodology

In order to derive an estimable leisure demand function, assumptions must be added to the general theoretical model presented in the previous section. The empirical model presented here imposes the assumption of intratemporal separability between consumption and the leisure goods as is standard in the life-cycle labor supply literature (e.g., Heckman and MaCurdy 1980; MaCurdy 1981, 1985; Altonji 1986; Jakubson 1988). In addition, the model assumes intratemporal separability between the husband's and wife's leisure times. The latter assumption does not allow the response to be delineated between wealth and cross-wage effects.[6] With these assumptions, the objective function becomes

$$\text{Max } \mathcal{U}_t = \mathrm{E}_t \left\{ \sum_{k=t}^{T} \left(\frac{1}{1+\rho} \right)^{k-t} \left(A_{Ck}[C_k]^{\sigma} + A_{Mk}[M_k]^{\psi} + A_{Fk}[F_k]^{\omega} \right) \right\} \tag{8}$$

where A_{jt} for $j = C, M, F$, are taste modifiers of their respective goods. These taste modifiers are typically written as functions of observable respondent characteristics. Taking logs of the first order condition for the wife's leisure demand and rearranging terms yields

$$\ln F_t = \Phi_{Ft} - \delta_F \ln W_{Ft} + \delta_F \ln A_{Ft}, \tag{9}$$

where $\delta_F = [1/(1-\omega)]$ and $\Phi_{Ft} = \delta_F(\ln \omega - \ln \lambda_t)$.[7]

Estimation of (9) requires some substitutions be made to yield an empirical specification. The log of the marginal utility of wealth, $\ln \lambda_{it}$, varies across time for each individual

[6] This assumption is discussed in more detail below.

[7] Although strong separability of the utility function implies that the demand functions do not depend directly on the prices of the other goods, they *indirectly* depend on these prices because these prices affect λ_t.

due to the continual updating a family makes as new information arrives. Using an approach similar to MaCurdy (1985), $\ln \lambda_{it}$ can be written as

$$\ln \lambda_{it} = \ln \lambda_{i0} + \alpha_t + \sum_{k=0}^{t} \varepsilon_{ik} \tag{10}$$

where

$$\alpha_t = \sum_{k=0}^{t} \left[(\rho - r) - \ln \left[\mathrm{E}_{t-1}\{\exp(\varepsilon_{it})\} \right] \right] \tag{11}$$

and ε_{it} represents the shock to the log of marginal utility with $\mathrm{E}\left[\varepsilon_{it}\right] = 0$.[8] Thus, λ_{it} is a function of the initial marginal utility of wealth λ_{i0} as well as the subsequent forecast errors. As the number of periods increases, the average of these forecast errors will approach zero.[9]

As discussed in the theoretical section, the husband's displacement can change $\ln \lambda_{it}$ not only in the period of displacement, but also in periods before and after the displacement occurs.[10] Changes in $\ln \lambda_t$ reflect both realizations of past variables and changes in expectations of future variables. To capture the portion of these changes which is correlated with a displacement, a set of dummy variables D_{it}^k, $k = k_l, \ldots, k_u$ are included in the regressions. $D_{i\tau}^k$ receives a value of 1 if the worker is displaced k periods before the current period τ. k can also take on negative values in order to capture the effects in the pre-displacement years.

In all empirical specifications, these dummy variables will capture the average change in the labor supply of wives due to the shocks to $\ln \lambda_t$ caused by their husbands' displacements. It is important to note that these coefficients represent the *cumulative* effect of

[8] This specification assumes that ρ and $\ln[\mathrm{E}_{t-1}\{\exp(\varepsilon_{it})\}]$ are constant across families and years, while r is allowed to vary by year. If r is also assumed to be constant, then the terms on the right-hand side of (11) would be a time invariant constant α and we could instead write $\alpha_t = \alpha t$.

[9] However, as Jakubson notes, there is no reason to believe that in short panels the forecast errors should sum to zero. An excellent discussion of estimating labor supply models with uncertainty can be found in MaCurdy (1985).

[10] The theoretical discussion referred to λ_t. However, since λ_t is strictly positive, $\ln \lambda_t$ will always change in the same direction as λ_t.

the displacement and *not* the incremental effect. E.g., three years after a displacement, it is possible that no new information related to the displacement is gained by families. However, the coefficient on D_{it}^3 may be non-zero because past shocks related to the displacement will have effects on the wife's current labor supply.

The above empirical specifications can be inserted into the wife's labor supply equation (9) to yield

$$\ln F_{it} = \Phi_{Fi0} + \alpha_t^* + \sum_{k=k_l}^{k_u} \eta_k D_{it}^k - \delta_F \ln W_{Fit} + \delta_F \ln A_{Fit} + \nu_{it} \tag{12}$$

where $\Phi_{Fi0} = \delta_F(\ln \omega - \ln \lambda_{i0})$ is a household specific effect, $\alpha_t^* = \delta_F \alpha_t$ is a year specific effect, and ν_{it} is an an individual and year specific error term. Finally, the remaining components of the wife's leisure demand equation are given empirical counterparts. Following the past literature on female life-cycle labor supply, the wife's wage is assumed to be a function of her potential experience and its square, while the leisure modifiers are a function of the total number of kids in the household and the number of kids younger than six.

This paper does not differentiate between the wealth effect and the cross-wage effect when estimating the added worker response. Since the earnings losses of displacement vary across families, the observed wage change in the husband's wage may be correlated with the wealth shock across families. Including the husband's wage in the regression may pick up the heterogeneity in these wealth losses and lead to biased estimates of the cross-wage effect. In addition, the specification which allows for non-separable leisure requires the husband have a positive wage observation. This requirement results in the loss of some observations and will tend to underestimate the wife's response since presumably those workers with a zero annual wage are those who are hardest hit by a job loss. Finally, since the theoretical model assumes that utility is intertemporally separable, the impact of the husband's job loss on the wife's labor supply after the initial year of displacement is due only to the wealth effect. Estimating the cross-wage effect will not provide much additional insight into understanding the added worker effect.

Before preceding, it should be made clear that while this study remains faithful to the female life-cycle labor supply literature along many dimensions, the estimates presented

here only represent structural parameters under the very strong assumptions laid out above. The results should be regarded as reduced form estimates of the model with the measured effect of a displacement on spousal labor supply incorporating both the wealth and cross-wage effects.

Econometric Methods

Since the term Φ_{Fi0} in the leisure demand equation is a function of $\ln \lambda_{i0}$ which is in turn a function of initial assets, the interest rate, and wages in all periods, Φ_{Fi0} cannot be considered orthogonal to the other independent variables. Estimation of (12) requires using a fixed effects specification to handle this source of heterogeneity. Baseline estimates are generated using a linear fixed effects (or within) estimator. The coefficients from OLS regressions using a censored dependent variable are asymptotically equivalent to the true Tobit coefficients times the proportion of non-limit observations in the population (Greene 1981).[11] In the Tobit model, the marginal effect of a change in an independent variable on the unconditional mean of the censored dependent variable is also computed as the Tobit coefficient times the non-limit proportion in the sample. Thus, inferences about the marginal effect of displacement on the wife's hours of work can be made directly from the linear regression coefficients. Results from the linear regressions will be used in the majority of the analysis to derive the effects of displacement on the wife's labor supply. The standard errors for the linear fixed effects regressions are generated using a generalization of Huber (1967) and White (1980) which allows the error terms for a given household to be arbitrarily correlated across time periods.[12]

Honoré's (1992) trimmed least squares censored regression estimator for panel data is also implemented since it allows for an unbalanced panel and is robust to heteroskedasticity

[11] This result relies on the assumption of joint normality between the regressors and the dependent variable. Greene reports that Monte Carlo evidence for non-normal regressors finds that the results appear to be robust to some forms of non-normality.

[12] Although methods have been developed for panel data sets for these specific issues (e.g., Kiefer 1980, Chamberlain 1980), these methods require balanced panels.

across families and non-normality of the error terms.[13] To eliminate the fixed effect from estimation, each observation is differenced with other observations for the same household. Assuming that the errors for the *latent* dependent variable are i.i.d. for each household, the *difference* of two latent error terms will be symmetrically distributed with an expected value of zero. Although the difference of the *observed* error terms will not be symmetrically distributed, Honoré develops a method by which the difference of the observed errors can be trimmed to create new symmetrically distributed differenced errors which have an expected value of zero.[14] These trimmed differenced error terms are used to form moment conditions which are in turn used as the first order conditions in building this estimator. Because the fixed effect has been eliminated from estimation, consistency of this estimator is obtained as $N \to \infty$, rather than as $T \to \infty$ as in the maximum likelihood case. The results from implementing this estimator will serve as a useful test of the robustness of the inferences based on the linear regressions. Since consistency of Honoré's estimator relies on the assumption of no serial correlation, results using both estimators will be presented below.

4. The Data

This study uses the first 25 waves (1968-1992) of the Panel Study of Income Dynamics (PSID). For this analysis, the sample is restricted to families where both the husband and the wife are between the ages of 25 and 65. The sample is created by following a couple from their first usable observation until they either leave the sample or have an unusable observation.[15] Split-offs of original sample households, where a child from

[13] Past studies in the life-cycle female labor supply literature have either used a fixed effects Tobit maximum likelihood estimator or a correlated random effects Tobit estimator. The maximum likelihood estimator is subject to multiple sources of inconsistency due to short panels (Heckman and MaCurdy 1980), heteroskedastic errors (Brown and Moffitt 1983), and non-normal errors (Arabmazar and Schmidt 1982). The correlated random effects estimator requires a balanced panel. Assessing the long-term effects of displacement before and after it occurs requires following workers for long periods of time. Balancing the data with a sufficient time frame results in a severe reduction in sample size, and a very small number of displacements.

[14] This approach is the panel data analog to Powell's (1986) symmetrically trimmed least squares estimator for the cross-sectional Tobit model.

[15] A usable observation simply means that the observation does not have missing data for any of the variables used in the analysis. The list of these variables as well as a description of how variables are created from the PSID data files can be found in the Appendix.

an original household moves out and forms their own household, are also used in the analysis. The resulting unbalanced sample of couples with at least three usable observations contains 57,180 observations on 5422 couples, with 1665 of these couples experiencing a displacement. Since marital break-up and sample attrition are possible results of a displacement, limiting the sample to families with long data histories may fail to capture some of the interesting dynamics due to displacement.[16]

Displacements are determined from a question which asks "What happened to that employer (job)?" The two categories of responses used to identify displacements are plant closed/employer moved and laid off/fired. The latter category does encompass workers who are not generally considered displaced, those workers who report that they have been fired. Boisjoly, Duncan, and Smeeding (1994) report that only 16% of the PSID workers in the laid off/fired category have indeed been fired. To the extent that a firing is also a shock to family income that would require adjustments in labor supply, including this small set of fired workers is likely not a problem.

The year of displacement is measured with some error. The earnings and employment questions are designed to elicit information for the previous calendar year. However, questions about job loss are not specific to calendar years. For the first sixteen waves of the PSID, the survey asks what happened to the last job for those reporting job tenure which is less than one year. Subsequent surveys ask what happened to the previous job if the current job started since January 1 of the previous calendar year. Since the PSID surveys nearly all of its respondents between March and May, job displacements may have occurred either during the previous calendar year or during the first few months of the current calendar year. For this study, a recorded displacement is assumed to have occurred during the previous calendar year to match the earnings and employment data given in the same survey. It is important to note for interpreting the results in this study that the PSID survey design will result in reported displacements which on average occur in the latter part of the previous calendar year.

[16] Imposing multiple forms of panel balancing as well as eliminating the poverty subsample has minor effects on the qualitative results.

The empirical analysis focuses on the wife's response to the husband's first displacement since the couple has been together. Displacements recorded in the 1968 (first) survey are counted as first displacements, but these couples are not used in the analysis because these displacements may have occurred anytime in the ten years prior to the survey. For families which first appear in the 1968 survey, the displacement is either the husband's first displacement since the household was formed, or his first one in at least ten years. For families which are split-offs of the original sample, the recorded displacement will be the first one since the household was formed.

5. Results

Descriptive Statistics

Table 1 compares the characteristics of displaced families in the year of the husband's job loss with the average characteristics of families which never experience a displacement. Displaced families have slightly more children at home, including more children under six. The remaining demographics are comparable to the results found in previous displaced worker studies. The displaced men are less educated and earn less than never displaced men. In addition, they are more likely to be blue collar workers and work in the manufacturing sector.

Figure 1 presents the effect of a displacement on the husband's earnings in the sample used here. These results are derived from a regression of the log of the husband's earnings on a quartic in the husband's experience, year effects, and a series of dummy variables which represent the number of years before or after the husband's displacement. Since the use of log earnings requires observations with zero earnings to be dropped, it is likely that these results understate the true impact of a displacement on earnings. The figure plots the percentage effect of a displacement on the husband's earnings using the coefficients for the displacement dummy variables.[17]

The husband's earnings begin to decline the year prior to displacement and then drop dramatically in the year of displacement. Notice, however, that the husband's earnings

[17] Percentage changes are determined as $e^{\beta} - 1$ where β is the regression coefficient.

decline the most in the year immediately following the job loss. The reason for this delayed trough can be traced to the design of the PSID as mentioned in the Data section. On average, a reported displacement will have occurred in the latter half of the previous calendar year while earnings data refer to that entire prior calendar year. Thus, earnings in the year immediately following displacement is more likely to be impacted by both the unemployment suffered by the head as well as lower wages on subsequent jobs.[18] Earnings recover somewhat in later years, but remain permanently reduced relative to expected levels.

A descriptive analysis of the wives' work effort before and after displacement provides evidence about the timing of the added worker response to a job loss. Figure 2 examines the time series movements in the wives' employment rates and annual hours of work. Since displacements occur in different calendar years across families, the year of displacement for each husband is denoted as year t. The time series movements are scaled such that all values are relative to their level four years before the husbands' displacements occurred. The long-dashed line representing the wives' employment rates shows that the employment rate increases in the years leading up to and including the year of displacement.[19] The employment rate is fairly constant across the post-displacement period. This pattern is consistent with the response patterns presented in theoretical sections, where some families adjust before displacement occurs while others respond at the time of the job loss.[20]

The changes in the wives' annual work hours are similar to the movements in employment rates. The short-dashed line for hours worked in Figure 2 shows that hours increase through the year of job loss and remain above their pre-displacement levels. One noticeable difference between movements in employment rates and annual hours is that the former increases until the year of job loss while the latter continues to increase for

[18] This result differs from Stevens (1997) who finds the largest decline occurs in the year of displacement. However, examining the unemployment experience of displaced workers in Figure 2 suggests that assigning the displacements to the previous calendar year rather than the survey year is the correct assignment.

[19] Employment rates are determined as whether or not the wife's reported hours of work are positive.

[20] The sample size varies across years due to sample attrition, family dissolution, and displacements which occur near the either end of the sample period. As previously mentioned, controlling for any one or all of these issues results in similar patterns.

one additional year. This difference is likely due to the survey design which generates displacements which on average occurred in the latter part of the previous calendar. This timing of displacements leaves fewer months for *annual* hours of work to adjust in the year of displacement. Thus, it is not surprising that annual hours of work continue to increase during the year following displacement.

Comparing these measures of wives' labor supply with the unemployment experience of the husbands during the same time frame reveals the problem inherent in analyzing the added worker effect by using the husband's current unemployment to measure job loss. This comparison is illustrated in Figure 2 which also includes the time series for the husbands' unemployment rate as the solid line.[21] In the years prior to displacement, increasing work effort by wives occurs with only modest changes in the fraction of husbands experiencing some unemployment. In the year of displacement, unemployment more than doubles, but the change in the wives' labor supply is smaller than the total change found in the years leading up to displacement. As the unemployment rate of husbands immediately falls after the year of displacement, wives' work effort continues to increase. These results further illustrate why past added worker effect studies, especially those which use within individual variation, have found little evidence of a response.

Regression Analysis

Regressions of the wife's leisure demand equation (12) are presented in Table 2.[22] Both the linear fixed effect and Honoré's Tobit estimators are presented.[23] The coefficients at the top of the Table are consistent with results found in prior studies. Higher levels of

[21] A husband is considered unemployed if he reported any hours of unemployment. Using the actual hours of unemployment results in the same pattern in terms of the timing and relative magnitudes of increases and decreases.

[22] Annual leisure hours are generated by subtracting hours of work from 8760, which is the maximum number of hours available in a year. Using 4000, 5000, 6000, and 7000 as the annual hours maximum gives similar results.

[23] Since Honoré's estimator is designed for dependent variables censored below at zero, the dependent variable for the Tobit estimation is $-(\ln L - \ln \bar{L})$ where L is the wife's observed hours of leisure and $\bar{L}$ is the maximum leisure available ($\bar{L} = 8760$). The resulting coefficients are opposite in sign from the coefficients for using an upper censored Tobit for $\ln L$. For consistency with the linear regressions, the reported coefficients have been multiplied by -1.

experience increase the wife's labor supply. Increases in the number of children in the household as well as increases in the number of young children reduces the wife's labor supply.[24]

The patterns exhibited by the displacement dummies shown at the bottom of Table 2 are consistent with the patterns predicted by the theoretical model. To better illustrate the magnitude and significance of the changes in the wives' labor supply before and after the job loss, the implied effects on the wife's hours of work using the OLS estimator, along with the 95% confidence bands, are graphed in Figure 3.[25] Beginning three years before the job loss occurs in year t, the wives' hours of work increase slightly but insignificantly. In the year of displacement, there is no additional increase in work hours. As previously discussed, the lack of an immediate change is likely due to the survey timing in addition to any labor market constraints which may exist. In the year immediately following displacement, hours of work increase significantly. The estimated effects are significant for all the post-displacement years. Evaluated at the sample average, the average post-displacement increase in annual hours of work is 108 hours, which is an 11% increase in work effort. This estimate incorporates changes at both the intensive and extensive margins of work and thus is not directly comparable to the income effects estimated in the prior female labor supply literature summarized in Killingsworth and Heckman (1986). In their survey, Killingsworth and Heckman report income elasticities which range from -0.5 to 0. Using the long-run decline in earnings of nearly 20% illustrated in Figure 1, the results here would be consistent with an income elasticity on the larger (in absolute terms) end of that range.

Although a direct comparison with past added worker effect studies is difficult due to differences in the methodological approaches, there is some indication that the results here are larger than the previous literature would suggest. Evaluating the Heckman and

[24] Note that the coefficients display the effect on *leisure* hours and not on hours of work. The estimated effects of both child variables on leisure hours evaluated at the sample average lie between the effects estimated by Heckman and MaCurdy (1980) and Jakubson (1988).

[25] If β is the marginal effect of a regressor X on log leisure ($\ln L$), the marginal effect on the level of hours H is determined by $\partial \ln L/\partial X = \beta \rightarrow \partial L/\partial X = \beta L = -\partial H/\partial X$. Mean leisure hours in the sample is 7780.

MaCurdy (1982) estimates at their sample averages indicates that women increase their work effort by 7 hours for every 100 hours of their husbands' unemployment. The average of the husbands' hours of unemployment in the current sample peaks at 354 hours in the year of job loss. Thus, the Heckman and MaCurdy estimates would suggest hours of work should initially increase by 25 annual hours in the year of displacement and much less in subsequent years. Gruber and Cullen (1996) find that wives' employment rates and average hours of work are insignificantly reduced during their husbands' spells of unemployment. However, they do find a significant 5.5% increase in work hours conditional on working during the unemployment spells. Thus, applying past results to displaced workers by using their unemployment experience will understate the added worker response to a displacement.

The Tobit coefficients and marginal effects are also presented in Table 2. These estimates show the same general pattern as the OLS estimates. Since the Tobit estimator is dependent upon the assumption of no serial correlation in the errors, the similarity across the two sets of estimates is encouraging.

To examine differences in the wives' response by reason for displacement, the effects are divided between layoffs and plant closings in Table 3. When examined separately, the results indicate that the responses do indeed differ.[26] The layoff effects are displayed in Figure 4, again with the 95% confidence bands. The effects on the wives' hours are insignificant through the year of displacement. Hours of work increase beginning in the year following displacement, although the estimated effect is only marginally significant in this year. Hours of work peak two years following displacement and decline in all subsequent years, but remain marginally significant in these years. The estimated pattern is the same when examining the Tobit estimates, but the estimated magnitude of the effects is slightly smaller as can be seen by examining the average post-layoff effects shown near the bottom of Table 3. However, the hypothesis that the post-displacement effects are jointly zero can be rejected at the 6% level for the OLS estimator and at the 1% level for the Tobit estimator.

[26] A Wald test of the hypothesis that the layoff and plant closing coefficients are the same rejects this hypothesis at the 5% level for the linear fixed effects estimator and at the 1% level for the Tobit estimator. The assumption of no serial correlation in the error terms is responsible for the higher level of significance for the Tobit test statistic.

As previously mentioned, the delayed increase in the hours of work following a layoff may be due to labor market frictions such as search costs. Another possibility is that the discouraged worker effect, under which poor labor market conditions for husbands are correlated with poor conditions for wives, may have a countervailing effect in the short-run. An additional explanation may be the short-run crowding out of work effort found by Gruber and Cullen (1996) due to unemployment insurance (UI) benefits. However, as Figure 4 shows, there is still an increase in labor supply beyond the periods of high unemployment shown in Figure 2.

It is interesting to note that the post-displacement pattern for layoffs is somewhat consistent with the presence liquidity, or borrowing, constraints. If liquidity constraints were introduced into the model, wives would no longer smooth their labor supply response over all post-displacement periods. Rather, they would increase their labor supply the most in the periods in which the husbands earnings losses are the greatest.[27] In fact, the results for layoffs show exactly this pattern. However, the unavailability of measures which can specifically delineate between constrained and unconstrained families significantly reduces the plausibility of testing for the impact of these constraints.[28]

The response pattern generated by plant closings in Table 3 differs in an interesting way from the layoff results. As shown in Figure 5, there is a much larger but still insignificant pre-displacement increase in wives' work effort. Hours increase (marginally) significantly in the year following displacement. Quite surprisingly, hours of work take a substantial

[27] In terms of the model, the presence of a liquidity constraint makes families unable to smooth consumption according to the traditional Euler Equation. The Euler Equation between two periods where there exists a binding liquidity constraint can be written as $U_{C_t} = [(1+r)/(1+\rho)]\, U_{C_{t+1}} + \mu_t$, where μ_t is the non-negative Kuhn-Tucker multiplier for the borrowing constraint. Thus, the marginal utility of an additional dollar in period t is increased due to the presence of the constraint. See Zeldes (1989) for a more detailed discussion of liquidity constraints in the presence of uncertainty.

[28] One possible approach would be to split the sample between low asset and high asset households as done by Zeldes (1989). Sample splitting by Zeldes is based on the assumption that low asset households are far more likely to be constrained households. These households should show a sharper increase in labor supply due to displacement. However, the difference here is that these low asset households are also more likely to face higher displacement risks. The theoretical model predicts that families facing a higher risk of displacement should have smaller adjustments in labor supply when the displacement occurs. Thus, testing between low asset and high asset households does not generate an *a priori* clean prediction for the difference in the response between these two groups. However, since asset levels are highly correlated with earnings levels, the estimates presented below for differences in the response by the husband's pre-displacement earnings are likely a good guide for differences by asset levels.

dip between years $t+1$ and $t+2$. Hours remain insignificantly affected in years $t+2$ and $t+3$, but then significantly rise beginning in four years after displacement, and remain (marginally) significantly higher in all subsequent years. The Tobit estimator reveals a similar pattern with the exception that the marginal effects are larger than with the OLS estimator. In addition, the average post-plant closing effect is only marginally significant for the OLS estimator but is significant at the 5% level for the Tobit estimator. For both estimators the Wald test statistic shows that the post-plant closing effects are jointly significant at the 5% level.

Several potential explanations for the post-plant closing "dip" are examined by expanding the empirical specification for the wives' leisure demand. The discouraged worker effect suggests that increases in local unemployment rates may reduce the wives' labor supply. If these local employment conditions are poor enough, it may induce families to relocate which could temporarily reduce wives' annual work hours. Also, displacements may cause changes in the husband's employment status, such as causing early retirement in addition to increasing unemployment. However, the inclusion of these variables has no effect on the estimated displacement effects even though these variables enter significantly into the regressions.[29] Crowding out due to transfer payments is another possibility. However, in unreported tables, both the dollar amount and the fraction of families receiving transfer payments peak in years t and $t+1$ and then decrease in the years when the dip in labor supply occurs. Sample attrition is also ruled out since the dip also appears in a figure (not shown here) analogous to Figure 2 that is restricted to couples who appear in all years of the figure. One final possibility is that this dip is simply due to sampling variation.

Effect of Heterogeneity in the Husband's Wage Loss

While Figure 1 shows that the average earnings loss following a job displacement is rather substantial, the literature on displaced workers has found much heterogeneity across households in the magnitude of the wage and earnings losses due to displacements (Fallick 1996).

[29] These results are available from the author upon request. One other possibility is that wives face labor market constraints which do not allow them to freely change their hours of work. However, although the PSID only included questions asking if the wife was constrained from increasing her hours of work from 1971-1976 and 1985. Examining these data do not suggest that such constraints are important in explaining the dip in work effort.

In the sample used in this paper, comparing the wages of displaced workers one year before their job loss with their wages one year after indicates that more than one-third suffer wage losses of 25% or more while roughly 40% of job losers have zero or even positive wages changes.[30] This wage loss heterogeneity should be reflected in the labor supply responses of the wives. The larger the husband's wage loss, the more his wife should increase her work effort.[31]

The differences in the labor supply responses to the heterogeneity in the wage losses is reported in Table 4. The regression reported in column (1) uses the change in wages between $t-1$ and $t+1$ to separate the responses between households where the husband suffers a negative wage change and those households with a zero or positive wage change.[32] The results for negative wage changes in the top of the table show a time pattern of response similar to that found in the baseline results reported in Table 2. The estimated response in each of the post-displacement periods is at least 50% larger than the previous estimates. The post-displacement results for those households with positive wages changes at the bottom of the table show no significant effect on labor supply. Thus, as expected, in households with larger wage losses there is a larger labor supply response by the wives.

The regression in column (2) of Table 4 exploits the heterogeneity in the magnitude of the wage losses. For each displaced worker, the absolute value of the percentage wage change is interacted with the displacement variables from column (1). The resulting coefficients can be interpreted as the impact of the effect on the wife's labor supply if the husband's wage changes by 100% between years $t-1$ and $t+1$. A comparison between the results in column (2) and those in column (1) is suggestive of a positive relationship between the magnitude of the wage loss and the amount of the increase in the wife's work

[30] Displaced workers who do not work at all during the year after displacement are considered to a have a 100% wage loss. The pattern for earnings losses is similar.

[31] Of course, there may be some endogeneity between the husband's earnings losses and the wife's work effort. If the wife is able to find adequate employment quickly, it may effect the husband's job search behavior and therefore his earnings. The use of wage losses rather than earnings losses may mitigate this bias to some extent although it is likely still present in the results presented in this section.

[32] Dividing the sample by earnings changes rather than wage changes gives does not affect the results in Table 4. Also, using different years before and after the job loss to measure the change in wage yields comparable results.

effort. For the households where the husband suffers a wage loss, the magnitude of the post-displacement effects in column (2) is larger than the results in column (1). Thus, the mean effect on work effort for these households (column (1)) is smaller than the effect for households in which the husband suffers a 100% wage loss. Also, the results for the positive wage changes in column (2) are less negative (i.e., less work effort) than those shown in the first column although the magnitude of these differences is quite small. Thus, there does appear to be some suggestive evidence that there is a larger labor supply response for larger wage losses.[33]

Impact of Pre-Displacement Information

The difference in the pre-displacement responses across the types of displacement is consistent with the prediction that households respond when they receive new information regarding the probability of a job loss. The information differences can be seen in the changes in pre-displacement wages reported by Stevens (1997, Table 5). Stevens finds that wages of workers displaced in plant closings begin to decline in the pre-displacement years while the wages of laid off workers do not. These pre-plant closing wage decreases may be due to wage freezes or even wage cuts at troubled firms. No matter the exact reason, these wage changes convey information which wives may use to adjust their labor supply decisions prior to the plant closings. On the other hand, the fact that wages are relatively unchanged in the pre-displacement years for those who experience layoffs indicate that it is likely that far less new information is available to these families prior to the displacement. Consistent with the prediction that an increase in the job loss probability will increase the wife's work effort, the results in Table 3 indicate that there is a larger pre-displacement response for a plant closing relative to a layoff although this difference is not significant.

Additional analyses were undertaken to examine the impact of the household's pre-displacement job loss probability on the magnitude of the wife's post-displacement response. First, the job loss probability is predicted for each displaced household in the year

[33] A true test of this hypothesis would be to include the indicator terms from both columns - the level effects and the interaction with the wage loss effects - into one regression. Performing this test leads to results which are of the right sign to support the theory but are not statistically significant due to the large number of parameters that are estimated.

immediately preceeding job loss by regressing a variable for job loss next year on the husband's experience, tenure, occupation and industry in addition to the non-displacement variables in the wife's leisure demand equation.[34] The added worker response is then allowed to differ for households below the median predicted probability and households above the median predicted probability. The estimated average long-run response is the same for both groups.[35] However, the estimated probability of a job loss is correlated with the type of displacement, with plant closing households more likely to be in the lower probability group and laid off households disproportionately in the higher group. Thus, the time paths of the responses resembles the plant closing and layoff responses.

As a further test, the sample of displaced workers is restricted to those at the 25th percentile and below of the job loss probability (low probability group) and those at the 75th percentile and above (high probability group). Again, the groups are disproportionately represented by plant closings and layoffs, respectively. When using a linear probability model to predict the job loss probability, the low probability group exhibits a large and significant post-displacement response while the high probability group shows a small and insignificant response. However, when a probit model is used to predict the job loss probability, the response for the high probability group becomes much larger in magnitude although the point estimates are still insignificant. Thus, while the results are favorable to the hypothesis that pre-displacement job loss probabilities affect the post-displacement added worker response, it appears the sample of displaced workers is not large enough to provide any conclusive support of this prediction.

Further Heterogeneity in the Response to Displacement

As seen above, the wife's response to displacement differs significantly depending upon the magnitude of the wage loss and the type of job loss. In this section the wife's response is examined by year of the displacement and the husband's pre-displacement earnings level.

[34] The estimating sample includes all observations of never displaced households as well as all pre-displacement observations of displaced households.

[35] Results are available upon request from the author.

In both cases the *a priori* expected response is theoretically ambiguous which leaves the resolution to each question as an empirical matter.

Throughout the duration of the PSID there have been substantial increases in the labor force participation of women (Juhn and Murphy 1997). How this trend in labor supply should affect the measured added worker effect is unclear. On the one hand, increased participation may increase the measured response since women may be more knowledgeable of job opportunities, have more employable skills, or simply be more able to adjust hours on a job at which they are currently employed. On the other hand, increased participation may mean that more women are likely to be employed full-time and unable to adjust hours without finding a new job. In addition, the women who remain out of the labor force will have the highest reservation wages and may be less likely to be induced into working by their husband's job loss.[36]

To examine the changes in response over time, column (1) of Table 5 divides the responses between job losses occurring in 1969-1980 and those which occur in 1981-1992. The middle section of the column reveals that the effects for the earlier period are all insignificant and have no discernible pattern. The results for the latter period are consistent with the predicted life-cycle response. There is an insignificant pre-displacement effect followed by a large and highly significant effect in the post-displacement period. However, these differences do not appear to be caused by changes in the costs of job loss. In regressions not shown here, there does not appear to be significant differences in the earnings losses across the two periods, especially not large enough to account for the observed differences across the time periods in column (1).

The differences in the response due to the husband's pre-displacement earnings level are also of interest. If income is a reasonable proxy for wealth, then low income households should be more likely to respond because they are less able to smooth their earnings losses. But these same low earning households may be more susceptible to negative labor market events and, knowing this fact *ex ante*, should be less likely to respond. Rather, this information should be incorporated into the level of hours wives choose to work. In

[36] I thank David Lam for making this last point.

addition, the magnitude of the earnings losses faced by low earning households is smaller which will reduce the response to a job loss.

The response to a job loss depending upon whether the husband's pre-displacement earnings are above or below the sample average are shown in column (2) of Table 5.[37] There is no evidence of a response by low income households to a job loss. The response in the high income households is large and significant throughout the post-displacement period. These results are consistent with both the hypothesis that high income households have large losses which require a larger response and the hypothesis that job loss for these high income households is more likely to be a surprise.

Do Wives' Earnings Help Families Smooth Income Shocks?

Although wives increase their labor supply in response to their husbands' displacements, the estimated hours responses do not directly indicate how much family income fluctuates in response to a displacement or what fraction of the husbands' lost earnings are compensated for by increases in the wives' work effort. Examining the movements in wives' earnings can uncover the economic significance of the estimated added worker effect. Given the persistent effects of displacement on the husband's earnings, the long-run increased earnings of wives' can potentially play an important role in smoothing family income.

Dynarski and Gruber (1997) find that while transfer payments and taxes help families smooth earnings shocks, wives' earnings do not respond to changes in their husbands' earnings.[38] In their analysis, they regress first differences of the variable of interest (transfers, taxes, and wife's earnings) on first differences of the husband's earnings. Although this approach can help us understand immediate responses to an earnings shock, it is not useful for understanding the long-run adjustments families must make in response to a permanent earnings loss such as a job displacement. Also, short-run changes in the wife's earnings

[37] Displaced households which do not have an observation for the pre-displacement year are deleted from this regression. The deletions result in the loss of 2715 observations from 318 couples.

[38] This result appears in their Table 9, p.265. When instrumenting for the husband's earnings with "unexpected" unemployment (Table 10, p.267), they find no evidence of a response in wife's earnings in the PSID, but they find some evidence of a response in the Consumer Expenditure Survey.

will understate the true magnitude of the response if wives either anticipate earnings losses or they do not immediately adjust their work effort. While transfers may be an important source of short-run smoothing, the limited duration of unemployment insurance benefits and other government programs renders these payments incapable of smoothing persistent earnings losses.

To roughly gauge the magnitude of the additional income gained by the increased work effort of wives, Table 6 determines the percentage of lost earnings which are compensated by increased work during the first five years after a displacement. The lost earnings of displaced husbands are determined by multiplying the effect of displacement on the husband's earnings found in Stevens (1997) by the average earnings of displaced workers two years prior to displacement.[39] The increased earnings of wives are determined by multiplying the estimated effects on hours found in Table 2 by the average wage of working wives. As shown in Table 6, wives' earnings initially cover less than 10% of the lost earnings. Gradually, increases in wives' work effort compensate for over 25% of lost earnings. Although the recovery of the husband's earnings after displacement help increase this percentage, wives earnings do provide a source of long-run income smoothing for displaced families.

6. Summary

This paper examines the added worker effect by focusing on the long-run response of a wife's labor supply to her husband's job loss. The use of displacement rather than unemployment is appropriate for analyzing the added worker effect due to the persistent earnings losses found in the displacement literature. Theoretical predictions for the response are generated examining the added worker effect in the context of a family life-cycle labor supply model. In this model, wives adjust to a displacement by permanently increasing their desired labor supply once news of a displacement arrives.

The empirical analysis finds that wives respond to their husbands' displacements with small increases in their labor supply prior to displacement and much larger increases once the displacement occurs. These patterns are consistent with the theoretical predictions

[39] Since earnings begin to decline prior to displacement, this pre-displacement figure is used.

generated by the life-cycle model. Examining the responses by the type of displacement yields different labor supply patterns. The results for layoffs are consistent with the liquidity constrained model although no direct tests of this model are attempted here. For plant closings, pre-displacement and the long-run post-displacement effects are consistent with the predictions of the model. The differences in the responses by type of displacement are consistent with the different pre-displacement information which wives may learn through their husband's wage changes. The analysis also finds that the added worker effect varies by the magnitude of the husband's wage loss, has increased over time, and that wives of high earning men are more likely to generate an added worker response. Increases in wives' earnings are a long-run source of income which can help families smooth consumption in response to permanent earnings losses caused by husbands' job losses. However, even with the increase in spousal labor supply, the loss of family income due to displacement remains quite substantial.

Appendix: Data Description

The data used is this study is from the first twenty-five waves (1968-1992) of the Panel Study of Income Dynamics (PSID). The sample of couples used in this study has been created in three steps. First, every individual who is ever a head or a wife/"wife" and not in the Latino subsample is extracted from the PSID's individual file. For each year the individual is a head or a wife/"wife" and between the ages of 25 and 65 inclusive, information from the respective PSID family file is merged to the individual dataset. Couples are created by merging together individuals with the same family identification number in each year. This results in a sample of 64,268 couple-year observations.

The final data set is created by first deleting observations with missing data. Starting with the first non-missing data observation for a couple, all consecutive observations for the couple are kept until either a missing data observation is encountered or the couple leaves the samples. Couples with at least three consecutive observations are used in the final data set. The reasons for deleting observations are as follows along with the marginal number of deleted observations:

1) Wife's hours of work are a major assignment. (A major assignment means that the value has been imputed, likely using a value from an assignment table.) For 1985-1992, delete if wife's main job hours are a major assignment. (529 deleted observations)

2) Head's education is missing. (307)

3) Head's wage is missing. (26)

4) Wife's experience is missing. (225)

5) Delete observations which are not consecutive with the first observations for each couple. (3557)

6) Delete observations from couples which do not have at least three observations. (2444)

The resulting sample contains 57,180 observations on 5422 couples. This sample is used in the majority of the analysis.

While many of the variables used in the analysis are taken directly from the PSID files, some variables must be created from the available data. Years of education may change during the sample period. However, it is forced to be constant for this study. Education

of heads and wives appears on the family file from 1975 to 1984 and on the individual files in 1968, 1972, and from 1975 to 1992. Years of education is created by taking the most recent, non-missing observations from the family file. If years of education are still missing, then the most recent, non-missing observation from the individual file is used. Since for a majority of the survey years of education is top-coded at 16 years, the final education variable used in the analysis is top-coded at 16 years. Potential experience is then created as Age-Education-6. However, if an individual has less than 12 years of education, then experience is created as Age-18. By this method, individuals with very little schooling are not assigned large amounts of labor market experience.

The number of children, number of young children, and age of youngest child are created from the individual file by examining every individual within a given household each year. Cross-tabulations of these child variables for the 1968 and 1969 surveys found major inconsistencies with these generated PSID variables. To be consistent throughout the analysis, these variables were recreated from the individual data file.

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Table 1: Comparison of Never Displaced and Displaced Families[a]		
	Never Displaced[b]	**Displaced[c]**
Husband's Age	41.9	36.9
Husband's Education	12.2	11.7
Wife's Age	39.1	34.6
Wife's Education	12.3	12.0
% White	74.2	64.8
Number of Children	1.53	1.72
Number of Young Kids	0.46	0.63
Husband's Annual Earnings ($)	35,100	28,800
Husband's Hourly Wages ($)	16.22	13.91
Husband's Occupation[d]		
% White Collar	44.8	34.5
% Blue Collar	49.4	64.0
Husband's Industry[e]		
% Manufacturing	25.2	31.1
% Non-Manufacturing	68.1	66.2

[a]Unweighted tabulations using the 1968-1992 PSID surveys. Only using the worker's first displacement from the 1969-1992 surveys. Dollar figures are in 1992 dollars using the CPI-U-X1.

[b]Averages include all observations for every never displaced man.

[c]Averages are for year of displacement. Pre-displacement industry, occupation, wages, and earnings are taken from the survey year prior to the reported displacement. Couples not in the sample prior to the displacement year are excluded from these calculations.

[d]Missing values are included in the determination of percentages.

[e]Industry information was not asked until 1971. Averages here are based on years when the information is observed. Missing values for these years are included in the determination of percentages.

Table 2: Estimates of Wife's Leisure Demand[a]
Displacements Combined

	OLS		Tobit[b]		
Ind. Variable	Coeff	Std Err	Coeff	Std Err	Marginal Effects[c]
Wife's Experience	–.0052	.00098	–.0075	.0018	–.0050
Wife's Experience^2/100	.0099	.0010	.0157	.0017	.0105
Number of Kids	.0112	.0010	.0196	.0017	.0131
Number of Kids Age<6	.0240	.0012	.0390	.0019	.0261
Displacement Variables					
Four Years Before	–.0007	.0040	–.0021	.0058	–.0014
Three Years Before	–.0068	.0045	–.0096	.0067	–.0064
Two Years Before	–.0076	.0045	–.0092	.0067	–.0062
One Year Before	–.0068	.0047	–.0132	.0071	–.0088
Year of Displacement	–.0073	.0047	–.0106	.0070	–.0071
One Year After	–.0122	.0050	–.0207	.0077	–.0139
Two Years After	–.0152	.0053	–.0223	.0079	–.0149
Three Years After	–.0125	.0054	–.0174	.0081	–.0116
Four Years After	–.0143	.0057	–.0207	.0084	–.0139
Five Years After	–.0143	.0061	–.0228	.0090	–.0152
6+ Years After	–.0155	.0062	–.0190	.0093	–.0127
Average of post-displacement effects	–.0140	.0052	–.0205	.0078	–.0137
Wald test statistics (p-value):					
All displacement effects	14.2 (.2245)		17.8 (.0859)		
Post-displacement effects[d]	12.1 (.0974)		15.3 (.0322)		

[a] All regressions also include year effects.

[b] To use Honoré's estimator designed for lower censoring at zero, the dependent variable in the analysis is $-(\ln L - \ln \bar{L})$ where L is the wife's observed hours of leisure and $\bar{L}$ is the maximum leisure available ($\bar{L} = 8760$). The resulting coefficients are opposite in sign from the coefficients for using an upper censored Tobit for $\ln L$. For consistency with the OLS results, the reported coefficients have been multiplied by -1.

[c] Marginal effects are derived by multiplying the coefficient by the proportion of non-limit observations, P = .669

[d] Includes the year of displacement along with the post-displacement years.

Table 3: Estimates of Wife's Leisure Demand[a]
Displacements Separated by Type

	OLS		Tobit		
Ind. Variable	Coeff	Std Err	Coeff	Std Err	Marginal Effects
Wife's Experience	–.0052	.00099	–.0075	.0018	–.0050
Wife's Experience^2/100	.0099	.0010	.0157	.0017	.0105
Number of Kids	.0112	.0010	.0196	.0017	.0131
Number of Kids Age<6	.0240	.0012	.0391	.0019	.0261
Layoff Variables					
Four Years Before	.0021	.0056	.0051	.0082	.0034
Three Years Before	–.0047	.0064	–.0049	.0099	–.0033
Two Years Before	–.0055	.0063	–.0011	.0094	–.0007
One Year Before	–.0059	.0064	–.0085	.0095	–.0057
Year of Displacement	–.0083	.0066	–.0071	.0099	–.0048
One Year After	–.0124	.0070	–.0146	.0107	–.0098
Two Years After	–.0211	.0074	–.0264	.0109	–.0176
Three Years After	–.0180	.0075	–.0222	.0111	–.0149
Four Years After	–.0145	.0078	–.0161	.0116	–.0108
Five Years After	–.0154	.0081	–.0209	.0119	–.0140
6+ Years After	–.0157	.0081	–.0143	.0120	–.0095
Plant Closing Variables					
Four Years Before	–.0042	.0056	–.0094	.0080	–.0063
Three Years Before	–.0097	.0061	–.0141	.0088	–.0094
Two Years Before	–.0109	.0063	–.0183	.0092	–.0123
One Year Before	–.0089	.0066	–.0182	.0104	–.0122
Year of Displacement	–.0063	.0064	–.0139	.0093	–.0093
One Year After	–.0131	.0069	–.0280	.0106	–.0188
Two Years After	–.0059	.0071	–.0141	.0107	–.0094
Three Years After	–.0040	.0072	–.0079	.0108	–.0053
Four Years After	–.0149	.0076	–.0257	.0110	–.0172
Five Years After	–.0134	.0083	–.0237	.0122	–.0159
6+ Years After	–.0160	.0083	–.0242	.0124	–.0162
Average of					
post-layoff effects	–.0162	.0071	–.0191	.0107	–.0128
post-plant closing effects	–.0112	.0068	–.0206	.0102	–.0139
Wald test statistics (p-value):					
All displacement effects	31.9 (.0803)		44.2 (.0034)		
All layoff effects	16.9 (.1102)		20.4 (.0405)		
Post-layoff effects	13.9 (.0536)		15.0 (.0363)		
All plant closing effects	16.0 (.1433)		24.4 (.0112)		
Post-plant closing effects	14.2 (.0473)		22.2 (.0023)		
Layoffs = Plant closings	19.5 (.0530)		27.8 (.0034)		

[a]See notes to Table 5.

Table 4: Estimates of Wife's Leisure Demand[a]
Displacements Separated by Positive and Negative Wage Changes[b]

	(1)		(2)	
Ind. Variable	Coeff	Std Err	Coeff	Std Err
Wife's Experience	–.0053	.0010	–.0054	.0010
Wife's Experience^2/100	.0098	.0011	.0099	.0010
Number of Kids	.0107	.0010	.0107	.0010
Number of Kids Age<6	.0242	.0012	.0244	.0012
Negative Wage Changes				
Four Years Before	–.0020	.0056	–.0065	.0116
Three Years Before	–.0072	.0063	–.0134	.0124
Two Years Before	–.0051	.0065	–.0061	.0126
One Year Before	–.0058	.0066	–.0009	.0123
Year of Displacement	–.0104	.0066	–.0146	.0133
One Year After	–.0195	.0069	–.0326	.0132
Two Years After	–.0259	.0073	–.0430	.0149
Three Years After	–.0211	.0074	–.0453	.0147
Four Years After	–.0203	.0077	–.0377	.0150
Five Years After	–.0193	.0083	–.0291	.0171
6+ Years After	–.0217	.0082	–.0315	.0166
Positive Wage Changes				
Four Years Before	.0029	.0062	–.0030	.0031
Three Years Before	–.0039	.0072	–.0045	.0036
Two Years Before	–.0103	.0070	–.0062	.0041
One Year Before	–.0082	.0075	–.0077	.0058
Year of Displacement	–.0011	.0073	–.0002	.0045
One Year After	–.0045	.0076	–.0015	.0042
Two Years After	–.0017	.0079	–.0017	.0040
Three Years After	.0002	.0082	–.0037	.0048
Four Years After	–.0039	.0084	–.0030	.0041
Five Years After	–.0059	.0090	–.0002	.0060
6+ Years After	–.0084	.0087	–.0010	.0053
Displacement Variables are:				
Zero-One Indicators	Yes		No	
Interacted with % Change in Wage	No		Yes	

[a]Only OLS regressions are presented here.

[b]Wage changes are calculated by comparing wages the year before displacement with wages the year after displacement.

Table 5: Estimates of Wife's Leisure Demand[a] Displacements Separated by Year and Earnings[b]

	By Year (1)		By Earnings[c] (2)	
Ind. Variable	Coeff	Std Err	Coeff	Std Err
Wife's Experience	−.0052	.00098	−.0050	.0010
Wife's Experience^2/100	.0099	.0010	.0098	.0010
Number of Kids	.0112	.0010	.0108	.0010
Number of Kids Age<6	.0240	.0012	.0242	.0012
	1969-1980 Displacements		Low Earnings Displacements	
Four Years Before	−.0033	.0069	.0087	.0059
Three Years Before	−.0015	.0071	−.0046	.0069
Two Years Before	−.0037	.0074	−.0025	.0067
One Year Before	−.0032	.0075	−.0001	.0068
Year of Displacement	.0063	.0079	−.0001	.0068
One Year After	−.0002	.0082	−.0031	.0073
Two Years After	.0036	.0084	−.0015	.0076
Three Years After	.0051	.0085	.0005	.0079
Four Years After	.0050	.0087	.0007	.0081
Five Years After	.0027	.0091	−.0025	.0088
6+ Years After	−.0011	.0088	−.0022	.0086
	1981-1992 Displacements		High Earnings Displacements	
Four Years Before	.0033	.0047	−.0082	.0052
Three Years Before	−.0061	.0057	−.0073	.0058
Two Years Before	−.0067	.0055	−.0108	.0058
One Year Before	−.0056	.0057	−.0112	.0061
Year of Displacement	−.0127	.0057	−.0100	.0063
One Year After	−.0167	.0062	−.0224	.0068
Two Years After	−.0259	.0067	−.0306	.0072
Three Years After	−.0226	.0068	−.0256	.0074
Four Years After	−.0267	.0072	−.0279	.0077
Five Years After	−.0247	.0077	−.0242	.0082
6+ Years After	−.0289	.0080	−.0293	.0082

[a]Only OLS regressions are presented here.
[b]Pre-displacement earnings are taken from the year before displacement.
[c]Sample is divided around $28,800.

Table 6: Percentage of Lost Earnings Replaced by Increases in Wives' Work

Average earnings of husbands two years before displacement = $30,000
Average wage of working wives = $10.41

Years since displacement	% Husband's earnings lost	$ Lost earnings	Increased Wife Earnings	% of husband's lost earnings
0	22%	$6,600	$590	8.9%
1	27%	$8,100	$991	12.2%
2	16%	$4,800	$1234	25.7%
3	14%	$4,200	$1012	24.1%
4	13%	$3,900	$1158	29.7%
5	13%	$3,900	$1160	29.7%

Figure 1 - Effect of Displacement on Husband's Earnings

Figure 2 - Relative Movements in Wives' Employment Rates, Wives' Hours of Work, and Husbands' Unemployment Rates (t-4=100)

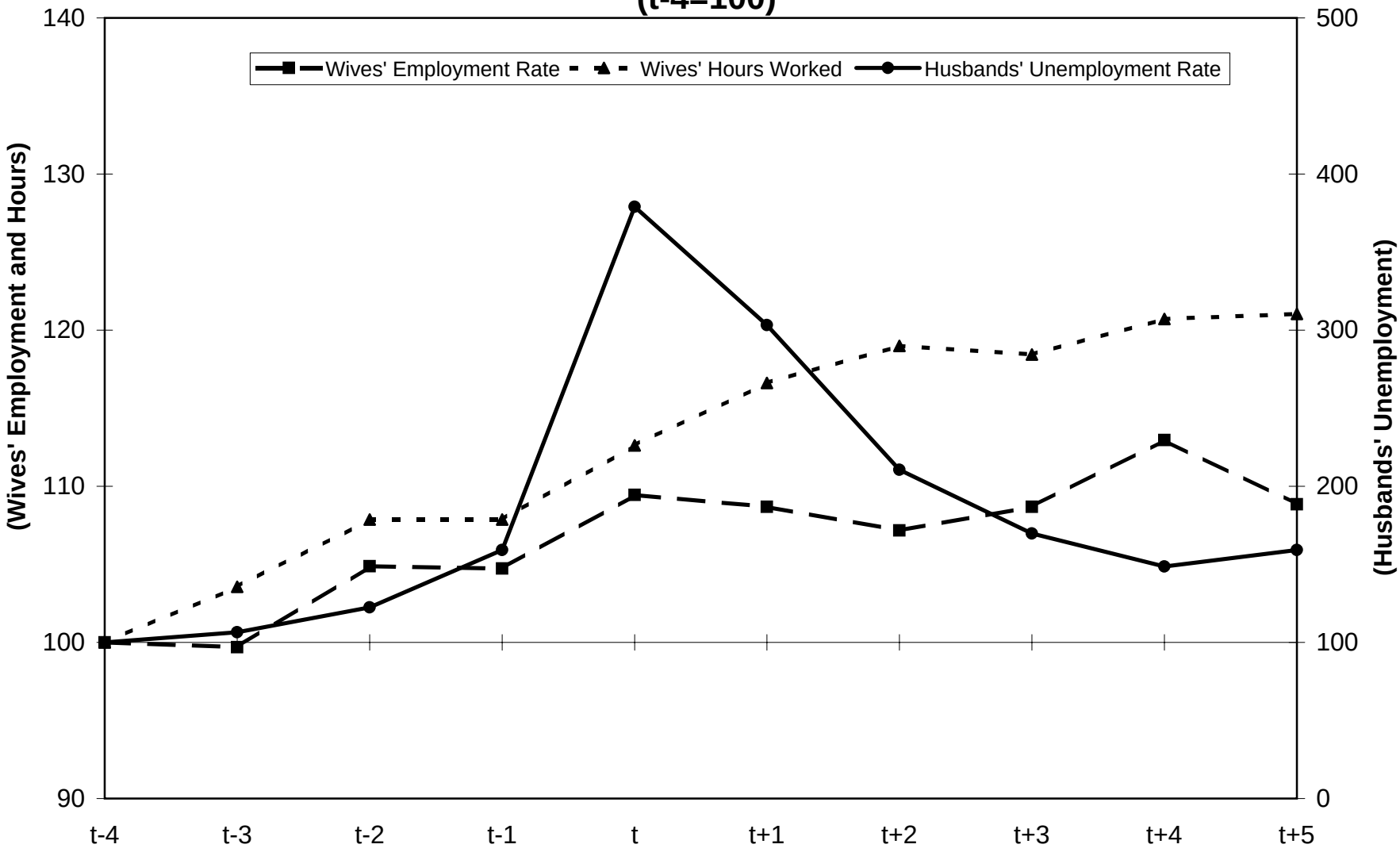

Figure 3 - Effect of Displacement on Wife's Hours of Work
Layoffs and Plant Closings Combined

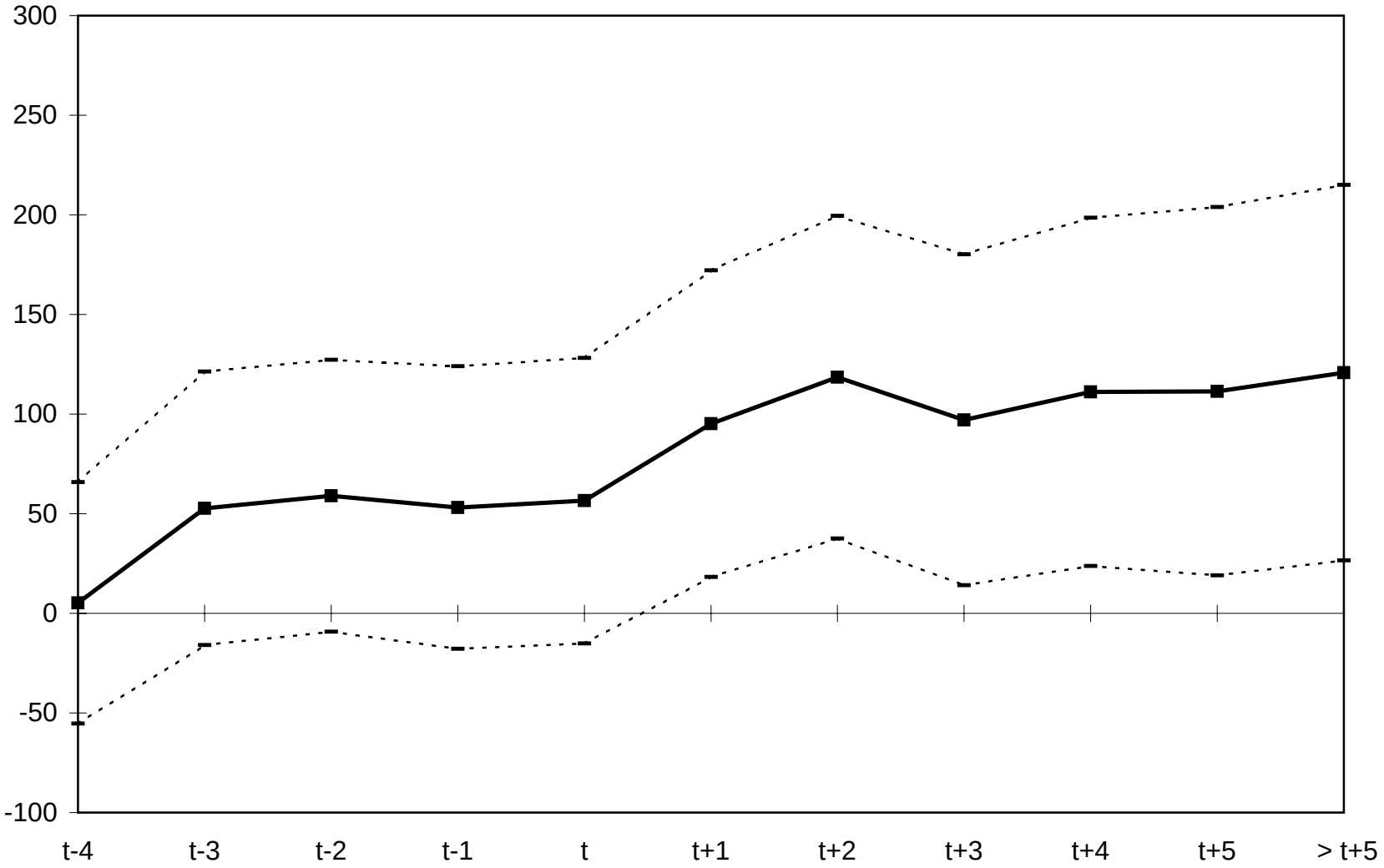

Figure 4 - Effect of Displacement on Wife's Hours of Work
Layoffs Only

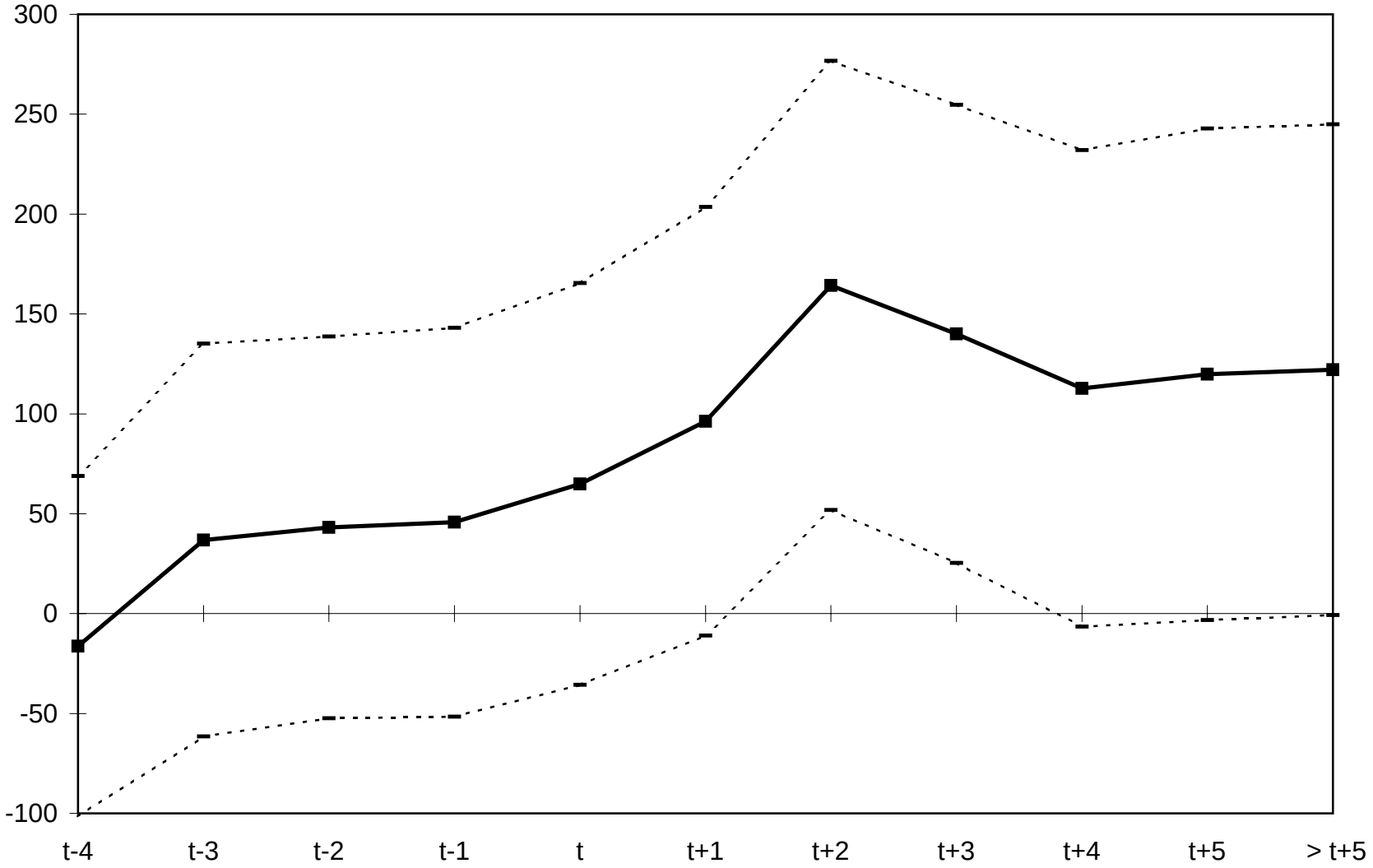

Figure 5 - Effect of Displacement on Wife's Hours of Work
Plant Closings Only