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Working Paper 2007-16
July 2007

WORKING PAPER SERIES

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Abstract: The purpose of this paper is to determine whether any empirical evidence exists for the contribution of employer, or demand-side, determinants of the labor market intermittency penalty. The documented negative relationship between the size of the penalty and labor market strength is interpreted as evidence that labor market intermittency is viewed as an undesirable characteristic that employers penalize more severely when the labor market is weak.

JEL classification: J31, J22

Key words: intermittent labor supply, time allocation, wage determination

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The authors thank Francine Blau and Solomon Polachek for helpful comments. The views expressed here are the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Julie Hotchkiss (contact author), Research Department, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, GA, 30309, 404-498-8198, julie.l.hotchkiss@atl.frb.org, or M. Melinda Pitts, Research Department, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, GA, 30309, 404-498-7009, melinda.pitts@atl.frb.org.

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I. Introduction and Background

The existence of a wage penalty for intermittent labor market behavior is well-established. Individuals (usually women) who leave and re-enter the labor market suffer an earnings penalty, compared to workers with continuous labor market attachment. Estimates range from 14 percent (Jacobsen and Levin 1995) to 34 percent (Sorensen 1993) lower wages among women with intermittent behavior compared with women with continuous attachment. There is also evidence that women are penalized at fairly low levels of intermittent behavior (Hotchkiss and Pitts 2005) and that once a woman re-enters the labor market, she regains much of her lost earnings position, but that a small penalty persists for a relatively long period of time (Mincer and Ofek 1982 and Jacobsen and Levin 1995).

The bulk of the intermittent wage penalty literature confines itself to documenting the penalty's existence, and quantifying its size, rather than offering much evidence for its source. In spite of the absence of testable hypotheses, however, speculation and theories abound. On the supply side, human capital theory predicts that workers who anticipate intermittent attachment should have lower levels of investment in human capital due to a shorter period of time in which to earn a return on their investment; in addition, the human capital that is acquired may atrophy during periods of absence (Polachek and Siebert 1993, ch. 6). Furthermore, during periods of absence from the labor force, these individuals also forego the gains in experience and human capital that would lead to higher wages (Jacobsen and Levin 1995). On the demand side, employers view intermittent attachment as a signal that the worker may exit the labor force again. As employers lose any hiring and training expenses incurred when workers leave, employers are less willing to provide the investment necessary for higher paying jobs to workers

they believe are not attached to the labor force (Albrecht et al. 2000).

The purpose of this paper is to move in the direction of providing some empirical evidence for the contribution of employer, or demand-side, determinants of the intermittency penalty. The supply-side contributions should manifest themselves in lower observed formal education among those with the highest intermittency tendencies, and/or the concentration of more highly intermittent workers in occupations in which human capital atrophy would be lowest (Polachek 1981). If lower educational attainment and occupational crowding were the only explanation for the observed lower wages of intermittent workers, then the penalty should be fairly uniform across the business cycle.[1] However, if employer preferences (against intermittent behavior) contribute to the observed penalty, we would expect to observe employers exploiting labor market weakness to act on those preferences.

The inclination and ability of employers to be more selective in hiring and wage determination decisions during times of labor market weakness (or, the relative advantage of "low-quality" workers when the labor market is tight) has been documented across a number of dimensions of worker characteristics. Tight labor markets have been linked to improved employment outcomes among blacks and disadvantaged youth (Tobin 1965, Heckman and Payner 1989, McLennan 2003, and Couch and Fairlie 2005); lower rates of return to schooling (Kniesner et al. 1978); higher earnings among all workers, especially black workers (Boushey 2002); improved employment opportunities among welfare recipients (Holzer and Stoll 2003); and improved earnings of women relative to men (Kandil and Woods 2002).[2]

[1] This does not imply that the penalty should stay constant over time, as intermittent tendencies may vary across worker cohorts.

[2] Much of this research, and others, have also shown that while demand-side factors are important, they are clearly not the only contributors to observed wage gaps, employment outcomes, or speculated discrimination (e.g., see Freeman 1973, Bernard 1976, and Cherry 2002).

Identifying a link between the labor market penalty associated with intermittency and the strength of the labor market places intermittency in the same category as other behaviorally-determined characteristics, such as educational attainment, that employers reward or punish to the extent that the market will support. And just as varying returns to education across the business cycle has direct implications for labor market outcomes of workers that are over-represented among the less-educated (such as blacks and Hispanics), an intermittency penalty that varies across the business cycle will directly impact the labor market outcomes of women, who exhibit significantly higher levels of intermittent behavior than men. The ability of firms to employ workers of differing "qualities" at different prices is a natural consequence of supply and demand forces across the business cycle. The degree to which this firm behavior warrants policy intervention depends on whether the qualities on which the firm is making hiring and pay decisions are directly related to worker productivity or merely represent employer preferences. Determining the relationship between intermittent behavior and worker productivity is beyond the scope of this paper, but identifying a penalty for intermittency that is higher during weak labor markets will help to inform women about the ramifications of their decisions to be intermittent labor market participants.

II. Empirical Methodology

A. Wage Determination

A standard linear log wage equation is specified to describe how characteristics translate into observed wages in the labor market. Human capital theory suggests that wages will vary across workers as a result of different levels of educational attainment, labor market experience, and on-the-job training. Wages will also vary as a result of different demand and supply

conditions across occupations, industries, and geographic regions. Institutional factors, such as unions, internal labor markets, and compensation policies, have also been shown to affect wages. Wages may also be affected, perhaps through discrimination, by demographic characteristics, such as race and marital status.[3]

In addition to these traditional determinants, a regressor indicating a woman's past intermittent labor market experience is included. Since decisions regarding intermittent behavior may be endogenous to the determination of wages (e.g., the decision to be absent from the labor market might be affected by the woman's expectation about how such behavior will affect future wages), an instrument is constructed from a first-stage OLS estimation of intermittent behavior. To gauge the way in which the wage penalty for intermittent behavior might vary across the business cycle, the intermittency instrument is interacted with a dummy variable for each year of earnings data availability. Earnings data are available every two years between 1992 and 2004. 1992 was a year of economic recovery, followed by consistent expansion through 2000, followed by recovery years of 2002 and 2004. Since job characteristics are only observed for workers, results presented here are all conditional on current labor market activity.[4]

The log wage equation is specified as follows:

$$(1) \qquad W_i = X_i'\beta + \gamma \hat{I}_i + \sum_t (\varphi_t \hat{I} \times t) + \varepsilon_i$$

where W_i is log hourly wage; X_i represent all demographic, geographic, and job characteristics; $\hat{I}_i$ is the instrument for individual *i*'s intermittency experience; and $\hat{I}_i \times t$, t = 1994, 1996, 1998, 2000, 2002, 2004, are the interactions of the intermittency index with each year in which the

[3] The analysis is restricted to women, as the incidence of labor market intermittency among men is infrequent enough to make it difficult to identify any systematic variation in its impact on wages.
[4] Previous similar research that accounts for selectivity into the labor market correction finds that the results are essentially the same as those that do not control for selectivity. We believe this has something to do with the advanced age of the women in the sample.

woman's earnings are observed. The degree to which the coefficients on the interaction terms differ significantly from γ will indicate how sensitive the intermittency penalty is to labor market strength.[5]

B. Measuring Intermittency

The measure of intermittency used in this paper is an index developed by Hotchkiss and Pitts (2005, 2007) and reflects the amount of time spent out of the labor force, the frequency of intermittent spells, and a measure of time since the last spell of intermittency. The use of an index allows us to synthesize and simplify the multi-dimensional impact of intermittent behavior. Combining the components that determine the characterization of intermittency is also likely to be more consistent with the way in which employers view these components in making hiring and pay decisions; it is the combination of component values that matter, not their values independent of each other. The index takes the following form:

$$(3) \qquad I_i = \left[N_i \left(\frac{1}{T_i} \sum_{j=1}^{N_i} L_{ji} \right) \right]^{\omega_i},$$

where T_i = the total amount of time since first recorded labor market activity for person *i;*
N_i = the number of spells of absence for person *i;*
L_{ji} = the length of spell *j* for person *i;* and
ω_i = the percent of work life accumulated since last spell of absence for person *i.*

This measure will capture the penalty associated with lower investment or atrophy of skills, as well as any penalty employers place on intermittent behavior. As the number of spells and/or the length of spells increases, the measure of intermittency increases. As the total amount of time

[5] An alternative test might be designed by comparing the earnings immediately following a period of absence across women who re-enter the labor market at different points of the business cycle. Since the data at hand provide only current earnings for women in the sample, not earnings associated with each labor market episode, this test design is not possible.

since the woman first entered the labor force increases, or the time since the last intermittent spell increases, the measure of intermittency decreases.[6] A spell of absence, N_i, is defined as any period of consecutive years with no labor market activity sandwiched between years with some employment, and is scaled by the maximum number of periods observed in the data set, ensuring that each component of the index ranges between zero and one.[7] Requiring complete absence from the labor market in a given year to be considered part of an intermittent spell protects against short term leave, such as maternity leave or seasonal employment, or short periods of involuntary absences from the labor force being counted as a spell of intermittency.[8]

An instrument of the intermittency index is constructed from a first-stage regression of the index on a set of regressors from the wage determination equation that can be argued are truly exogenous to observed outcomes, such as demographic characteristics, as well as current job characteristics, such as occupation, that are likely highly correlated with the decision to be intermittent. In addition, the first-stage regression will include regressors expected to influence the intermittency decision, but are not expected to influence a woman's current wage. These will include a set of individual life history characteristics.

III. The Data

The data sets used for the empirical analysis include the Health and Retirement Study (HRS) for the years 1992,1994, 1996, 1998, 2000, 2002, and 2004, along with the 2004

[6] A worker with no spell of absence would have a value of 100% of work life since last spell. While instrumenting for all index components at the same time in a wage equation would be impossible, we did estimate the wage equation with each component separately and confirmed the expected contribution of each component on wage determination. In addition, the separate estimations show that the measured impact of each component separately would over-state the role that component plays in wage determination (also see Hotchkiss and Pitts 2007). Estimation results are available upon request.

[7] This index does not account for delays in entrance into the labor force, only the penalty associated with intermittent attachment once the individual has chosen to enter the labor force.

[8] See Baum (2002) for an analysis of the impact of maternity leave on wages exclusively.

Permissions: Summary Earnings Information and the RAND HRS Data file.[9] The HRS is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. The first wave was administered in 1992 to 12,645 individuals who were either born in the period of 1931-1941 or are the spouse of an individual who is age-eligible, with these respondents being administered follow up surveys every two years. In 1998, the AHEAD (Asset and Health Dynamics Among Oldest Old) survey, which interviews those born between 1914 and 1923; the War Baby (WB) sample, individuals born between 1942-1947; and the Children of the Depression (CODA) sample, individuals born between 1924 and 1930, were added. A new sample called the Early Baby Boomers (EBB), born between 1948-1953, was added in 2004.

The Summary Earnings Information database includes annual data on earnings for the years 1937 through 2003. After limiting the sample to working women under the age of 65 and dropping observations for which there was no earnings history we are left with a sample which, with non-missing regressor values, contains 8,141 observations, distributed fairly uniformly across the years 1992 through 2004. The fewest observations are found in 2002 (9 percent of the sample), and 1992, the first year of the survey, contributes the greatest number of observations (20 percent of the sample). Since women in the sample may be observed multiple times, the standard errors in the analysis are adjusted for intragroup (person) correlation.

The sample means are presented in Table 1. The average age of the women (about 55 years) reflects the sampling design of the survey. The Summary Earnings Information file was used to calculate the index of intermittency (and its components). On average (across all years), working women have spent 21 percent of their potential working life absent from the labor

[9] The RAND HRS Data file is an easy to use longitudinal data set based on the HRS data. It was developed at RAND with funding from the National Institute on Aging and the Social Security Administration.

market; they have had 1.5 spells of absence; and about half of their working life has passed since their most recent spell of absence. Their average intermittency index is 0.31. This index ranges from zero to one, but is difficult to translate into a strict percentage because it is constructed from multiple components.

[Table 1 here]

The multiple years of data allow us to look more closely at how intermittency behavior has evolved for women over time. Figure 1 plots the average intermittency index for working women under the age of 65 for each year of the sample. After the mid-1990s, there has been a steady decline in the average level of intermittency among working women. Since each year of the sample is made up of different cohorts of women, it's instructive to look at intermittency behavior by cohort, as well. Figure 2 plots the average intermittency values for women of different birth cohorts, both for working women and for women not working at the time of the surveys. Across cohorts, it is not surprising that working women have lower levels of intermittency; however, the difference in intermittency across work status has gotten smaller in subsequent cohorts. This suggests there may be more fluidity into and out of workforce among more recent cohorts, whereas in the past there were primarily two types of women, workers and non-workers.

[Figures 1 and 2 here]

IV. Estimation Results

Table 2 contains three sets of estimates. The first column contains the OLS results from the first-stage estimate of the intermittency index, the second column presents the results from the second-stage estimation of the log wage equation with the instrumented intermittency index,

and the third column contains the OLS estimation of the log wage equation with the non-instrumented intermittency index.

The determinants of intermittency behave in expected ways. The older the woman, the higher is her intermittency index. Black and less educated women have lower levels of intermittency. Women in all occupational groups have higher intermittency levels than women in managerial and professional occupations. Women who have smoked, have had more children, have more severe physical limitations, and who have spent a greater proportion of their lives married also have greater levels of intermittency. The parameter estimates from this regression are used to predict an instrument for inclusion in the second-stage log wage equation estimation, found in column 2 of Table 2. The regressors unique to the intermittency index equation pass the test of over-identifying restrictions (Wooldrige 2002: 122) and exogeneity of the intermittency index is rejected via the standard Hausman test (1978). One may question the inclusion of a physical limitation index as an instrument in construction of the intermittency index because of the well-known correlation between wage and disabilities (for example, see Hotchkiss 2003, ch. 3). However, given the importance of the link between physical limitations and intermittent behavior and the success of the standard IV tests, we have decided to include it as a regressor in the first-stage regression. We do include a different measure of disability in the wage equation and also present the non-IV results to illustrate that the use of specific instruments do not change the conclusions of the analysis.

Except for the coefficients on labor market intermittency and its interaction with the year dummies, the regressors behave similarly across the instrumented and non-instrumented specifications.[10] In addition, the estimates are what one would expect with education; job

[10] The results presented correspond to movements in the real wage, although the results for nominal wages are very similar and available upon request.

tenure; and union, insurance, and pension coverage all contributing positively to higher log wages. In addition, workers in managerial and professional occupations and in service and professional-oriented industries earn the highest wages. The coefficient on the unemployment rate is positive, likely reflecting the more dramatic response of labor force participation decisions (for which we do not control) among older women to changes in the unemployment rate (see Hotchkiss and Robertson 2006)

Turning to the focus of the paper, Figure 3 plots the marginal effect of a percentage point change in the intermittency index on real wages over time (the heavy dashed line) along with the movement of the unemployment rate (solid line) over the same time period. If intermittency is seen as an undesirable employee characteristic, then it will result in less of a penalty when the labor market is tight (the unemployment rate is low). This is exactly the relationship between the intermittency index penalty and the unemployment depicted in Figure 3.

[Figure 3 here]

Specifically, in 1992, as the economy was recovering from one recession and the unemployment rate was relatively high (7.5%), the wage penalty for intermittency was about one percent for every percentage point higher level of intermittency. When the economy was at its peak and the unemployment rate had fallen to four percent in 2000, the wage penalty shrank to about 0.1 of a percentage point (about one tenth of what it was in 1992). As the economy entered and started recovering from the next recession (2002 and 2004), the penalty grew again and was not significantly different from what it was in 1992.

Because choice of instruments is always an easy target for skepticism, Figure 3 also plots the impact of the non-instrumented intermittency impact over time; the relationship is the same. This exercise also illustrates that the penalty associated with the instrumented intermittency

index is more severe than the non-instrumented penalty. The bias toward zero of the non-instrumented intermittency penalty suggests that labor market intermittency is positively correlated with unobservable determinants of the wage. This could be expected to be the case if women who are more productive in the labor market also marry more productive men and/or make more savvy non-labor income investment decisions over her lifetime, both of which would reduce the marginal cost of an intermittency decision at any given point in time.

There is also a fairly established result that women may choose their occupation partially as a result of their expectations regarding earnings in that occupation or how that occupation may penalize their expected behavior, such as intermittency (see Polachek 1981 and Pitts 2003). In consideration of this, and in the absence of any reasonable instruments for occupation, the analysis was repeated separately by occupation. While the power of the estimates (due to small sample sizes) was diminished considerably, the basic relationship between the unemployment rate and the intermittency impact over time was the same across occupations. These results are available upon request.

V. Implications and Conclusions

This paper provides evidence that labor market intermittency is a worker characteristic that employers find undesirable and one that is penalized more heavily during times of weak labor markets. To the extent that the penalty for past intermittent behavior reflects supply and demand factors operating in the labor market there is not necessarily any call for policy intervention. However, knowing that the penalty varies over the business cycle may induce women with greater amounts of intermittency to time their labor supply decisions more closely to labor market strength. If women have internalized the cyclicality of the intermittent penalty,

we may observe the negative correlation (*ceteris paribus*) between labor force participation and the value of the intermittency index become stronger during periods of labor market weakness; as the penalty grows the opportunity cost of leaving the labor market or not entering the labor market declines.

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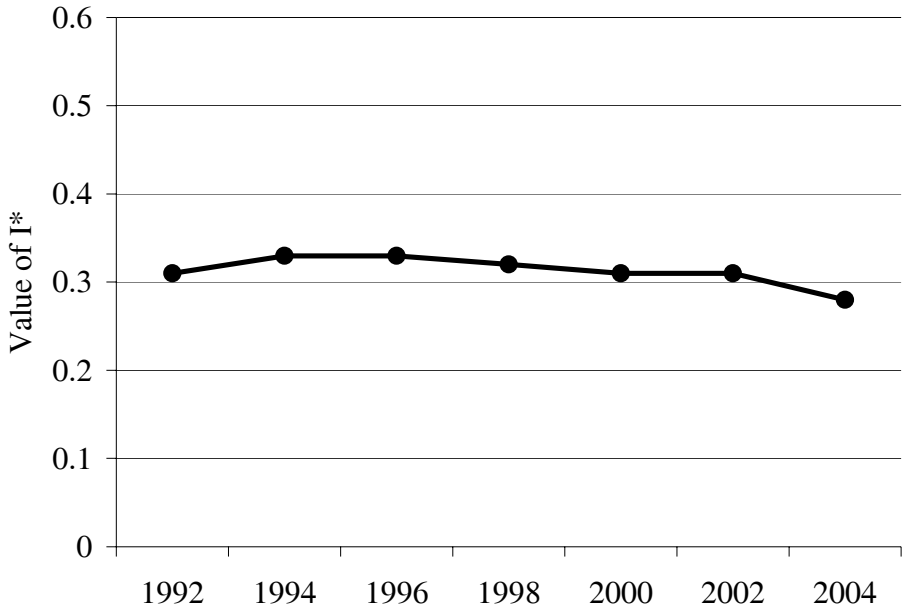
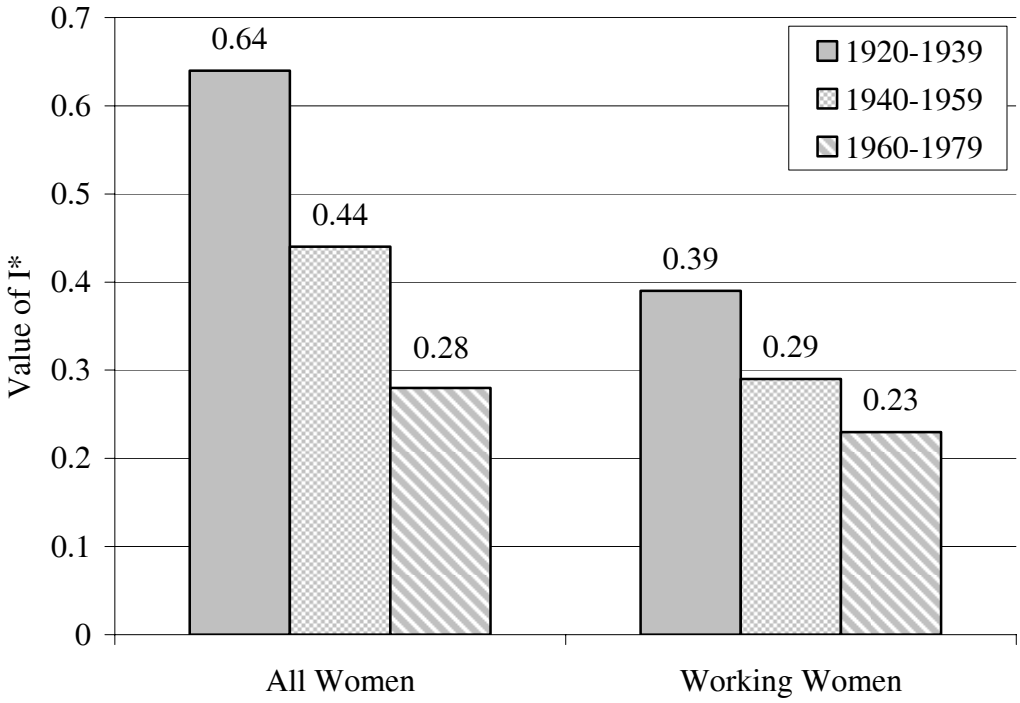
Figure 1. Intermittency Index for Working Women Over Time



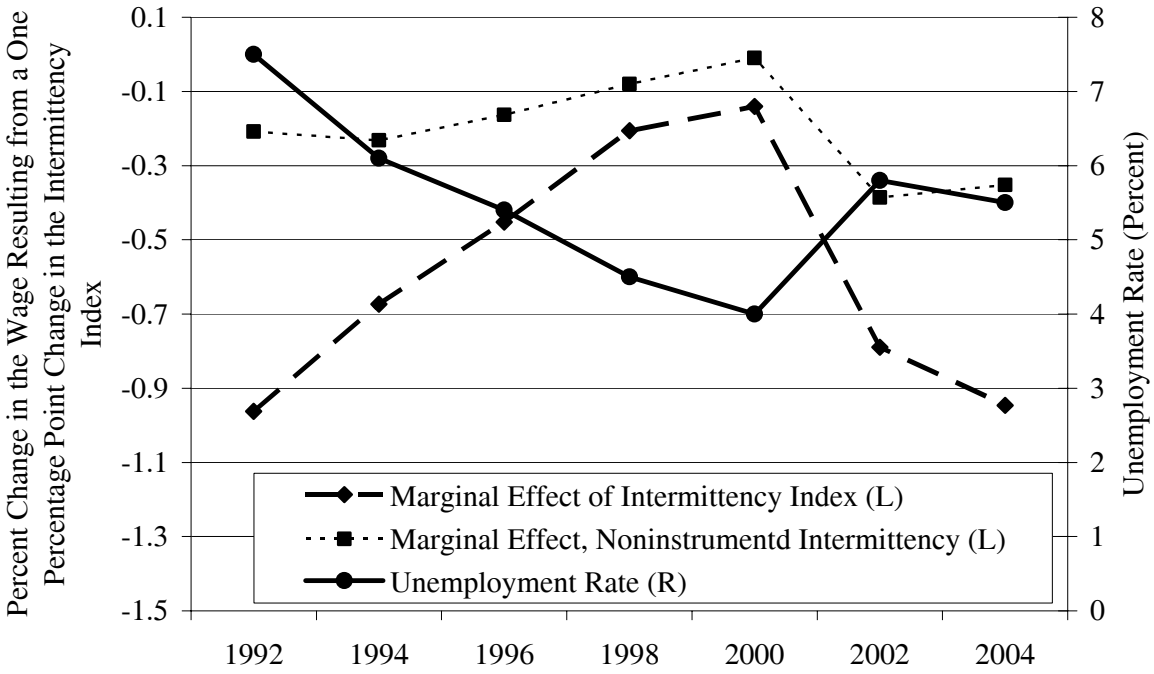
Notes. Index plotted for women less than 65 years of age.

Figure 2. Intermittency Index for Women by Birth Cohort.



Notes. Index plotted for women less than 65 years of age. "All Women" include women who have had at least one year of labor market experience.

Figure 3. Marginal Effect of the Intermittency Index on Real Wages and the Unemployment Rate.



Notes. Index plotted for women less than 65 years of age. "All Women" include women who have had at least one year of labor market experience.

Table 1: Sample means.

Variable	Means (st. dev.)
Log Wage	2.345 (0.897)
Age	54.929 (5.705)
Black = 1	0.137 (0.343)
Married = 1	0.729 (0.444)
Less then HS = 1	0.138 (0.345)
High school graduate = 1 (omitted group)	0.340 (0.474)
College graduate = 1	0.225 (0.418)
Northeast (omitted group)	0.165 (0.372)
Midwest	0.236 (0.425)
West	0.165 (0.372)
South	0.364 (0.481)
Part-time = 1	0.350 (0.477)
Job tenure (number of quarters/100)	0.114 (0.097)
Occupation1 = 1 (omitted group)	0.339 (0.473)
Occupation2 = 1	0.346 (0.476)
Occupation3 = 1	0.207 (0.405)
Occupation4 = 1	0.105 (0.306)
Industry1 =1 (omitted group)	0.168 (0.373)
Industry2 =1	0.142 (0.349)
Industry3 = 1	0.680 (0.466)
Union = 1	0.093 (0.291)

Employer health insurance = 1	0.580 (0.494)
Employer pension plan = 1	0.569 (0.495)
Any physical limitation = 1	0.542 (0.498)
Unemployment rate	5.704 (1.100)
Ever smoked = 1	0.517 (0.500)
Percent of adult life spent married	0.777 (0.306)
Total number of living children	3.297 (1.963)
Index of Physical Limitation	10.516 (14.178)
Intermittency Index (I_i)	0.310 (0.350)
Proportion of Potential Work Life Spent Absent $\left(\frac{1}{T_i}\sum_{j=1}^{N_i} L_{ji}\right)$	0.211 (0.229)
Number of Periods of Absence (N_i)	1.460 (1.324)
Proportion of Work Life Since Most Recent Spell of Absence (ω^i)	0.567 (0.364)
Year = 1992	0.195 (0.396)
Year = 1994	0.183 (0.387)
Year = 1996	0.139 (0.346)
Year = 1998	0.137 (0.344)
Year = 2000	0.115 (0.319)
Year = 2002	0.093 (0.290)
Year = 2004	0.138 (0.344)
Number of Observations	8,141

Notes: Standard Errors are in parentheses. Sample includes women currently in the labor market and less than 65 years old.
Industry1 = 1 if Agriculture, Forestry, Fishing; Mining and Construction; Manufacturing; Transportation
Industry2 = 1 if Wholesale; Retail
Industry3 = 1 if Finance, Insurance, and Real Estate; Business and Repair Services; Personal Services; Entertainment and Recreation; Professional and Related Services; Public Administration

Occupation1 = 1 if Managerial specialty operation; Professional specialty operation and technical support
Occupation2 = 1 if Sales; Clerical, administrative support
Occupation3 = 1 if Service
Occupation4 = 1 if Farming, forestry, fishing; Precision production and repair; Operators; Armed Forces
The index of physical limitation is on a scale from 1 to 100 and represents the degree of difficulty an individual has in performing seventeen activities of daily living and instrumental activities of daily living.

Table 2. Estimation Results

Variable	First Stage OLS Estimation of Intermittency Index for Construction of Instrument (1)	Second Stage OLS Estimation of Wage Equation with Instrumented Intermittency Index (2)	OLS Estimation of Wage Equation with Non-instrumented Intermittency Index (3)
Age	0.006*	0.023	0.021
	(0.001)	(0.021)	(0.021)
$Age^2/1000$		-2.173	-2.208
	--	(2.005)	(1.986)
Black	-0.031	-0.054	-0.038
	(0.022)	(0.035)	(0.034)
Married		-0.022	-0.039
	--	(0.025)	(0.026)
Less than HS	-0.022	-0.098*	-0.093*
	(0.022)	(0.035)	(0.034)
College Grad	0.083*	0.204*	0.170*
	(0.020)	(0.042)	(0.035)
Midwest	0.002	-0.135*	-0.118*
	(0.019)	(0.032)	(0.031)
West	0.125*	0.017	-0.021
	(0.022)	(0.058)	(0.037)
South	0.031^	-0.172*	-0.163*
	(0.018)	(0.032)	(0.030)
Tenure/100		1.782*	1.703*
	--	(0.402)	(0.406)
$Tenure^2/10000$		-3.733*	-3.623*
	--	(1.324)	(1.338)
Part-time		0.007	0.026
	--	(0.026)	(0.025)
Occupation2	0.017	-0.289*	-0.301*
	(0.017)	(0.032)	(0.032)
Occupation3	0.117*	-0.381*	-0.451*
	(0.021)	(0.056)	(0.038)
Occupation4	0.040	-0.359*	-0.386*
	(0.025)	(0.051)	(0.049)
Industry2		-0.207*	-0.207*
	--	(0.046)	(0.046)
Industry3		0.023	0.024
	--	(0.040)	(0.040)
Union		0.105*	0.110*
	--	(0.031)	(0.030)
Health Ins.		0.126*	0.111*
	--	(0.025)	(0.025)
Pension		0.327*	0.307*
	--	(0.029)	(0.028)
Any Phys Limitation		-0.018	-0.038^
	--	(0.025)	(0.021)
Unemployment rate		0.099*	0.037*
	--	(0.030)	(0.010)
Index (I)		-0.962+	-0.208*
	--	(0.393)	(0.064)

I x 1994	--	0.289^ (0.155)	-0.024 (0.067)
I x 1996	--	0.510+ (0.215)	0.045 (0.077)
I x 1998	--	0.756* (0.289)	0.128 (0.087)
I x 2000	--	0.821+ (0.337)	0.198+ (0.097)
I x 2002	--	0.172 (0.200)	-0.178^ (0.100)
I x 2004	--	0.016 (0.220)	-0.144 (0.098)
Ever smoked	0.027+ (0.014)	--	--
Percent of adult life spent married	0.027 (0.023)	--	--
Number of living children	0.007+ (0.003)	--	--
Index of physical limitation	0.002* (0.000)	--	--
Year = 1994	-0.003 (0.007)	--	--
Year = 1996	-0.024+ (0.010)	--	--
Year = 1998	-0.034* (0.011)	--	--
Year = 2000	-0.048* (0.013)	--	--
Year = 2002	-0.044* (0.015)	--	--
Year = 2004	-0.029+ (0.014)	--	--
Intercept	-0.174* (0.066)	1.319+ (0.602)	1.728* (0.554)

Notes: Number of observations is 8,141. Clustered standard errors are in parentheses. * indicates significant at the 99% confidence level; + indicates significant at the 95% confidence level; ^ indicates significant at the 90% confidence level.