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Procyclical Skill Retooling and Equilibrium

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Procyclical Skill Retooling and Equilibrium Search*

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Abstract

We argue that more workers choose to switch occupations in booms than in recessions. That is, skill retooling is procyclical. This view is consistent with Lucas and Prescott's (1974) equilibrium search model modified with aggregate shocks and unemployment insurance. Empirical support is found in a unique Canadian administrative data set that measures the annual flow of workers (from 1979-1993) who separate from their jobs to "return to school". This flow is strongly procyclical.

JEL Codes: J24, E32

Key words: business cycles, schooling, equilibrium search

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1. INTRODUCTION

Choosing an occupation is one of the most difficult and important decisions that most people make. This is particularly true in economies where occupations are highly specialized and require specific human capital investments. The returns to most occupations are affected not only by aggregate business conditions but also by conditions that are specific to particular occupations; there is inherent uncertainty about the future payoffs that any occupation promises. When the payoff in an occupation falls, due to either technological change or changes in consumer demand, workers in that occupation face the choice of either accepting the reduction of the payoff, or switching to an alternative occupation with a higher expected payoff. Occupational switching, which typically requires some retooling of skills, is a costly feature of modern developed economies.

Lucas and Prescott's (1974) theory of labor reallocation (or "equilibrium search") is a natural candidate for analyzing occupational switching and skill retooling. In their model workers choose their locations from among many local labor markets, where the demand for labor in each market is a function of an independent Markov process. Moving from one local market to another is costly for workers, and they must calculate the expected values of staying and leaving in equilibrium. It is straightforward to interpret occupations as local labor markets in Lucas and Prescott's model, where workers are eligible to participate in these occupations only if they have the specific skills required. In this view, switching occupations requires some retooling of skills, which is costly, and can be interpreted as the equilibrium search activity in that model.

Work by Jovanovic (1987) and Gouge and King (1997) has shown that, as long as unemployment benefits are not procyclical, (as they typically are not) then equilibrium labor reallocation in the Lucas-Prescott model is procyclical in the presence of aggregate shocks. Thus, if the Lucas-Prescott framework is used to analyze occupational switching and skill retooling, then one of its key predictions is that these variables will be procyclical. This stands in contrast to the commonly held view that recessions are times when more reallocation occurs, and the economy is "cleansed" of unproductive activities.[1]

[1] Lilien (1982) refers to the Lucas-Prescott model when arguing that recessions are times when workers switch with higher intensity. However, his argument is not based on aggregate shocks as the driving force behind business cycles. Rather, in his view, cycles are generated by changes in the local switching probabilities over time. Following Davis and Haltiwanger (1990), several authors have examined the cleansing effect of recessions. For an alternative view, see Barlevy (2002). See also, DeJong and Ingram (2001).

Some indirect evidence, consistent with procyclical skill retooling by the employed, already exists. Murphy and Topel (1987), using CPS data to follow individuals, found that *industry*-switching is "strongly procyclical". If, as argued by Neall (1995), there is substantial value in industry-specific human capital, then switching industries requires at least informal (on-the-job) retooling. It is also well known that quits are procyclical (see, for example, Mortensen (1994)). Quits, however, can occur for many different reasons, many of which are unrelated to retooling.

In this paper we use a unique Canadian administrative data set to evaluate the cyclical properties of retooling by employed workers that return to formal education. It measures the annual flow of workers who separate from their jobs in order to return to school from 1979-1993. We focus our attention on workers over 25 years old that have been employed for more than 20 weeks (to filter out "summer jobs"), and whose stated reason for separating from their job is to "return to school". As far as we are aware, this is the only consistently defined measure of the work-to-school transition available for a large sample over a long period. We find that, for both sexes, the rate at which workers leave existing jobs to return to school is strongly procyclical.

Most previous empirical studies of the dynamics of educational attainment, for example Hauser (1993), and Cameron and Heckman (2001), have been concerned with high school graduation, college entry and/or college completion. In contrast, we focus on the business cycle dynamics of the employment to school transition where the pre-separation labor force attachment is substantial, so that the transition can be interpreted as retooling. Work by Light (1995a, 1995b) begins to address the decision to return to school, but she studies the return from any source and does not look at the impact of changing macroeconomic conditions. Our results should also be differentiated from those that look at cyclical patterns in enrolment such as Betts and McFarland (1995). Enrolment can vary over the business cycle as a result of the behavior of several different groups. In particular, individuals never in the labor market may extend their duration of education in a recession because they cannot find employment. Thus, enrolment's aggregate business cycle pattern likely reflects the business cycle patterns of multiple underlying groups and this aggregate is not appropriate for the theory.

The paper is organized as follows. Section 2 describes the data set that is used. Section 3 presents the empirical results relevant to the issue at hand, and Section 4 provides concluding comments and policy implications.

2. DATA AND DESCRIPTIVE STATISTICS

In Canada, whenever a job separation occurs, employers are required to file a "Record of Employment" (ROE) form with the federal department of Human Resources Development (HRD) stating the reason for the separation. We had access to a 10% random sample of this national, and consistently defined, annual count of the number of firm-worker separations for the years 1979-1993. In accord with the coverage of this collection process, the population under study is all paid workers who are not self-employed. This information is relatively reliable since firms in Canada are not experience-rated for Unemployment Insurance premiums as they are in the United States, and therefore firms in Canada do not have any incentive to misreport. Also, over the period, workers had no incentive to try to influence the report, since any unemployment insurance payments were unrelated to the reason for the separation.[2] This data source allows a unique look at the issue since it covers an extended (15 year) period and provides a very large sample, which is necessary since the transition probability from employment to school in any period is low.[3]

The age and sex of the workers, and the length of the jobs prior to separation, can be identified for each separation, although other demographic identifiers are not available (including, unfortunately, geographic variables). This sample spans a period during which there were almost no institutional changes to the Canadian Unemployment Insurance system. In contrast, the years following the sample have witnessed a series of legislative changes that have substantially altered it. Thirteen possible "reason for separation" categories, one of which is "return to school" are on the ROE form, and only one reason is recorded for each separation.[4] If a worker, for example, is laid off, dismissed for cause, or voluntarily quits to take another job and subsequently decides to return to school, then she is not counted in this measure. The "return to school" reason is only observed where the declared intention of the worker at the time of separation is to return to school.

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[2] This changed in 1994, after which workers became ineligible for benefits if they quit voluntarily.

[3] We attempted to look at this issue using the Canadian Labor Force Survey (LFS – similar to the U.S. CPS), but the number of respondents leaving work to return to school is too small to allow reliable inference, and it is difficult to screen out those returning to school after "summer" jobs.

[4] The 13 categories are: short work (layoff), labor dispute, return to school, injury/illness, voluntary departure, pregnancy, retirement, work-sharing, apprenticeship, age 65, dismissal, and other. Over the period, this list has remained remarkably stable; the major exception is the addition of the dismissal (for cause) category in 1990.

It seems reasonable to argue that the "return to school" category comprises two important types of worker-firm separations: first, those resulting from what are effectively limited term jobs (for example, "summer" jobs) held by students in the ongoing process of education; second, those by workers who are not in the midst of an ongoing educational program or sequence of programs. To examine retooling, we are clearly interested in the second type of separation. For this reason, we make an effort, based on age and pre-separation job duration, to isolate these different subclasses in the "return to school" category. Prime age workers (25-54) are, therefore, the focus of the empirical work.[5] By age 25, most individuals have completed their first postsecondary degree or certificate; focusing on this group therefore provides a measure that is less contaminated by summer job availability across the business cycle.

A histogram of the pre-separation job lengths for workers of all ages, censoring pre-separation job lengths at 50 weeks for clarity, can be seen in Figure 1. A high fraction of jobs ending in "return to school" last less than 20 weeks; many of these are likely summer jobs held by students since 20 weeks is quite close to the length of many universities' summer break, and is longer than that for most high schools. By looking at pre-separation jobs with a duration of greater than 20 weeks, we also alleviate under-reporting and focus on workers with greater labor force attachment. Although this is, in a sense, stratifying the sample on an endogenous variable, we perform the exercise in an attempt to isolate two "types" of jobs.

Panel A of table 1 presents summary statistics for the distribution of job lengths for the years 1983 and 1989, which are at the trough and close to the peak of the return to school series. For both males and females the average pre-separation duration is substantially less for the sample including the younger subgroup. Further, for all except the prime age males, the duration is much shorter in the boom. Females have longer pre-separation jobs in all years and age groups. Panel B presents the age distribution of workers returning to school. Males and females have remarkably similar age distributions and a high fraction (above 50%) of separations of both job lengths studied are younger than 25. For workers aged 25-54, over 50% of separations to return to school are by workers aged 30 or younger. This is not surprising and accords with the idea that significant investments in human capital are more likely to occur when an individual's time remaining in the labor force is large.

[5] Adjusting the age group employed generates results that are substantially similar.

Summary statistics of the return to school series are presented in Table 2, stratified on job length. Figures are also given for each series divided by the age-specific employment level, to produce rates for use in analyzing the dynamics. Focusing first on jobs of all lengths, each year, on average, approximately 125,000 males aged 15 and over, and approximately 20,000 aged 25-54, leave a job and return to school. This represents approximately 1.80% and 0.42% of employment respectively.[6] The rates for females are lower than for males at conventional levels of significance: 1.28% and 0.27% for the two age groups respectively, which translates into annual averages of approximately 89,000 and 13,000. For those whose pre-separation job was at least 20 weeks long, the overall levels are reduced, and the gap between the male and female rates is slightly smaller. The females' rate is approximately 26% less than that for the males in that group, whereas it is 36% less for the group with any number of weeks worked. Variation across years, resulting from both trend and cyclical factors, is also substantial. For men, approximately twice as many individuals return to school at the maximum compared to the minimum year observed. For women, the difference is even larger.

While the fraction of prime age workers who return to school is small in any given year, these individuals represent an important segment of the workforce and, cumulatively, the number of workers involved is not insignificant. Overall, the average annual return-to-school rate for the male 25-54 age group is 0.42% for any number of pre-separation weeks, and 0.19% for those with greater than 20 weeks of tenure. This suggests that, if each worker who returns to school does so only once over the 30 years covered by the age grouping, roughly 12.6% (8.1%) of males (females) aged 25-54 do so. While some workers undoubtedly transit to school repeatedly so that these are upper bounds on the lifetime return-to-school rates, the rates are substantial.

3. THE EMPIRICAL RESULTS

To gauge the cyclical properties of the return-to-school series, we contrast it with four reference variables: the age-specific unemployment rates (UR), the help wanted index (HWI), and the natural logarithm of both gross domestic product (GDP) and investment (I).[7] To discern the cyclical properties of the return-to-school series, we first present simple plots, and then cross

[6] The rate for those 55 and over is effectively zero.

[7] Statistics Canada's CANSIM series D10421, D21251, D767137, D770464, D767874, D768019, D767140, D770467, D767898, D768008, D736321, and D738874 are employed.

correlation coefficients for the Hodrick-Prescott residuals of each set of variables. Figures 2, for males, and 3, for females, compare the return-to-school series for prime-aged (25-54) workers whose pre-separation job lengths were greater than 20 weeks, with the different reference variables.[8] The upper half of each figure plots the unadjusted data, while the lower half plots the residuals from the detrended series.

The picture that emerges, from the plots, is quite clear. The return-to-school series, for both males and females, moves in the opposite direction to unemployment, and in the same direction as the help-wanted-index, investment, and GDP. Moreover, the movement of the return-to-school series over the cycle is quite significant. For example, for males, the percentage of separations due to a return-to-school is more than 60% higher at the peak (1990) than in the trough (1983). This evidence suggests that the return-to-school series is strongly procyclical.[9]

Cross correlation coefficients of the HP residual series are presented in table 3. Heteroskedasticity and autocorrelation consistent standard errors are included, although they should be viewed with great caution due to the sample sizes.[10] For all the groups studied, there is a large negative contemporaneous correlation between the detrended return-to-school and unemployment rate series (approximately -0.80), which is consistent with what is observed in the graphs. The contemporaneous correlation coefficients for the return-to-schooling residuals and each of the other reference residuals (the help-wanted-index, investment, and GDP) are positive and quite large (in the order of 0.60 to 0.80), lending further support to the hypothesis that the return-to-school series is procyclical. When the series are lagged or forwarded one year, the correlation is closer to zero in almost every case. In a small number of cases it grows larger, as in Table 3 for prime-aged males, with the lag of GDP suggesting that returning to school may lag

[8] Plots for the 15 and over age group are available upon request. We tried a wide variety of values of the smoothing parameter in the HP filter. The results were robust to any values above very small numbers. In order to be comparable with other studies using annual data, for example Backus and Kehoe (1992), the parameter was set to 100 for all the results presented in this paper. Of course, since we are limited to 15 annual observations for the return-to-school series, the HP filtered series can only be seen as suggestive. As a robustness check, we also performed the analysis detrending each series using ordinary least squares with a linear time trend. The results (not shown) are remarkably similar to those presented.

[9] Note that the return-to-school series for females appears to be trending upwards over time, unlike the series for males. The females' rate is approximately 45% of that for the males in the first few years of the period, but it is approximately 75% that of the males near the end. Despite this difference in trend, the cyclical aspect of the series appears very similar. HP residual plots in the lower panels serve to confirm this observation. A remarkably similar pattern is visible for the alternative job lengths and age groups we attempted.

[10] Correlation coefficients for groups beyond those illustrated graphically are presented since they are more compact.

GDP slightly. Correlations two years away from contemporaneous are almost everywhere small and frequently close to zero.

4. CONCLUSIONS

According to this evidence, more workers choose to retool their skills in booms than in recessions; returning to school appears to be is strongly procyclical. Lucas and Prescott's (1974) labor reallocation theory, supplemented with aggregate shocks, offers an explanation: booms are times when workers have the strongest incentive to abandon their low productivity occupations in order to gain access to high-paying occupations, since the difference in the value of these jobs is greater in booms. Moreover, as stressed in Gouge and King (1997), the presence of unemployment insurance mitigates the "opportunity cost effect" by reducing the variance of wages in low productivity occupations over the cycle. In this view, retooling is an investment that workers make in their skill sets, and it is procyclical for much the same reason that capital investment is.

We see three main policy implications. First, as demonstrated in Prescott (1975), equilibrium reallocation is *efficient* in Lucas and Prescott's model if workers are risk neutral. Moreover, if workers are risk averse, this could generate either too much or too little reallocation, depending on the form of preferences (King, (1989)). Thus, if this model captures the essential features of the skill retooling process, then there is no clear efficiency role for its subsidization. Second, governments that are moving from "passive" income maintenance programs towards more "active" policies such as subsidies for retraining should expect more participation in these schemes in booms rather than recessions -- reversing the pattern associated with passive policies.[11] Finally, the comforting belief that recessions are the primary times of "cleansing" may be misleading, at least from the point of view of the labor market, if more workers leave low productivity occupations in booms than in recessions.

[11] Some evidence of this already exists. See Park *et al*. (1996).

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Table 1 - Distribution Near the Peak and Trough of the Cycle

Panel A: Job Lengths (Weeks Worked) Prior to Returning to School

	15+		25-54	
	1983	1989	1983	1989
Males				
Centiles				
5	3	3	3	3
25	9	8	11	12
50	15	14	18	17
75	24	18	51	45
95	112	83	210	214
Avg.	29.1	24.7	50.5	50.1
(Std. Err.)	(.601)	(.422)	(2.472)	(1.978)
Females				
Centiles				
5	4	4	4	5
25	10	9	13	12
50	15	14	31	22
75	33	21	99	70
95	144	111	274	329
Avg.	36.2	30.4	74.1	68.9
(Std. Err.)	(.897)	(.587)	(3.947)	(2.653)

Panel B: Age Distribution of Those Who Returned to School

	> 20 weeks worked				All job lengths			
	15+		25-54		15+		25-54	
	1983	1989	1983	1989	1983	1989	1983	1989
Males								
Centiles								
5	18	17	25	25	17	16	25	25
25	20	20	26	26	19	19	25	25
50	22	22	28	28	21	21	27	28
75	25	26	32	32	23	23	31	32
95	33	35	42	41	30	31	42	41
Avg.	23.4	23.7	29.7	29.9	22.0	21.6	29.5	29.6
(Std Err)	(.118)	(.108)	(.227)	(.170)	(.056)	(.042)	(.158)	(.110)
Females								
Centiles								
5	18	17	25	25	17	17	25	25
25	20	19	27	26	19	19	25	25
50	22	22	29	30	21	20	29	29
75	25	26	34	35	23	23	34	35
95	38	39	46	45	32	33	45	44
Avg.	23.6	24.0	31.4	31.6	21.9	21.7	31.0	31.1
(StdErr)	(.162)	(.130)	(.330)	(.206)	(.076)	(.051)	(.239)	(.146)

Table 2 - Summary Statistics of Returns to School

	>20 weeks worked			All job lengths		
	Avg/yr	Min	Max	Avg/yr	Min	Max
Males						
Counts						
25-54	8,891	5,920	11,120	20,045	12,630	25,590
	(1,446)			(3,319)		
15+	29,718	20,350	39,190	124,760	70,270	158,500
	(4,498)			(22,070)		
% of Empl.						
25-54	.19	.14	.24	.42	.29	.49
	(.03)			(.05)		
15+	.43	.31	.59	1.80	1.08	2.41
	(.06)			(.31)		
Females						
Counts						
25-54	6,771	3,990	9,530	12,869	7,030	18,340
	(1,792)			(3,771)		
15+	24,247	14,790	31,820	88,693	45,030	113,670
	(4,711)			(18,013)		
% of Empl.						
25-54	.14	.09	.18	.27	.16	.35
	(.03)			(.06)		
15+	.35	.23	.43	1.28	.70	1.54
	(.05)			(.22)		

Notes: Standard Deviations are in parentheses. Estimates are weighted to represent the population based on the 10% sample.

Table 3 - Cyclical Behaviour of Returns to School and the Unemployment Rate, Investment, GDP and HWI Correlations of Deviations from H-P Trend (At least 20 weeks worked)

	Cross Correlations of Quit to School Rate				
Variable x	x(t-2)	x(t-1)	x(t)	x(t+1)	x(t+2)
Males 25-54					
UR	-.30	-.74	-.78	-.31	.15
	(.285)	(.166)	(.122)	(.209)	(.238)
INV	-.01	.48	.72	.50	.25
	(.325)	(.232)	(.158)	(.178)	(.210)
GDP	.50	.83	.68	.05	-.29
	(.272)	(.151)	(.149)	(.167)	(.167)
HWI	.48	.77	.61	.15	-.20
	(.299)	(.167)	(.162)	(.198)	(.193)
Males 15+					
UR	-.13	-.63	-.82	-.40	.01
	(.265)	(.198)	(.103)	(.155)	(.219)
INV	-.19	.34	.66	.57	.36
	(.299)	(.261)	(.170)	(.141)	(.204)
GDP	.31	.75	.73	.15	-.19
	(.267)	(.188)	(.130)	(.141)	(.165)
HWI	.28	.68	.64	.24	-.08
	(.295)	(.207)	(.139)	(.178)	(.188)
Females 25-54					
UR	.21	-.40	-.78	-.64	-.17
	(.250)	(.164)	(.066)	(.176)	(.251)
INV	-.22	.34	.71	.59	.36
	(.300)	(.240)	(.088)	(.178)	(.202)
GDP	.27	.81	.84	.33	-.13
	(.198)	(.126)	(.098)	(.145)	(.155)
HWI	.31	.74	.77	.35	-.03
	(.258)	(.147)	(.107)	(.185)	(.203)
Females 15+					
UR	.13	-.47	-.80	-.58	-.15
	(.242)	(.170)	(.092)	(.159)	(.200)
INV	-.24	.33	.63	.58	.32
	(.309)	(.235)	(.116)	(.156)	(.176)
GDP	.21	.77	.78	.27	-.16
	(.252)	(.124)	(.114)	(.150)	(.138)
HWI	.25	.71	.68	.31	-.07
	(.306)	(.177)	(.131)	(.178)	(.179)

Notes: All of the lags or leads involve lagging or leading the UR, INV, GDP or HWI series so that all 15 years of education data can be employed. Numbers in parentheses are Newey-West (1987) standard errors from artificial regressions, with no intercepts, of one standardized variable on the other.

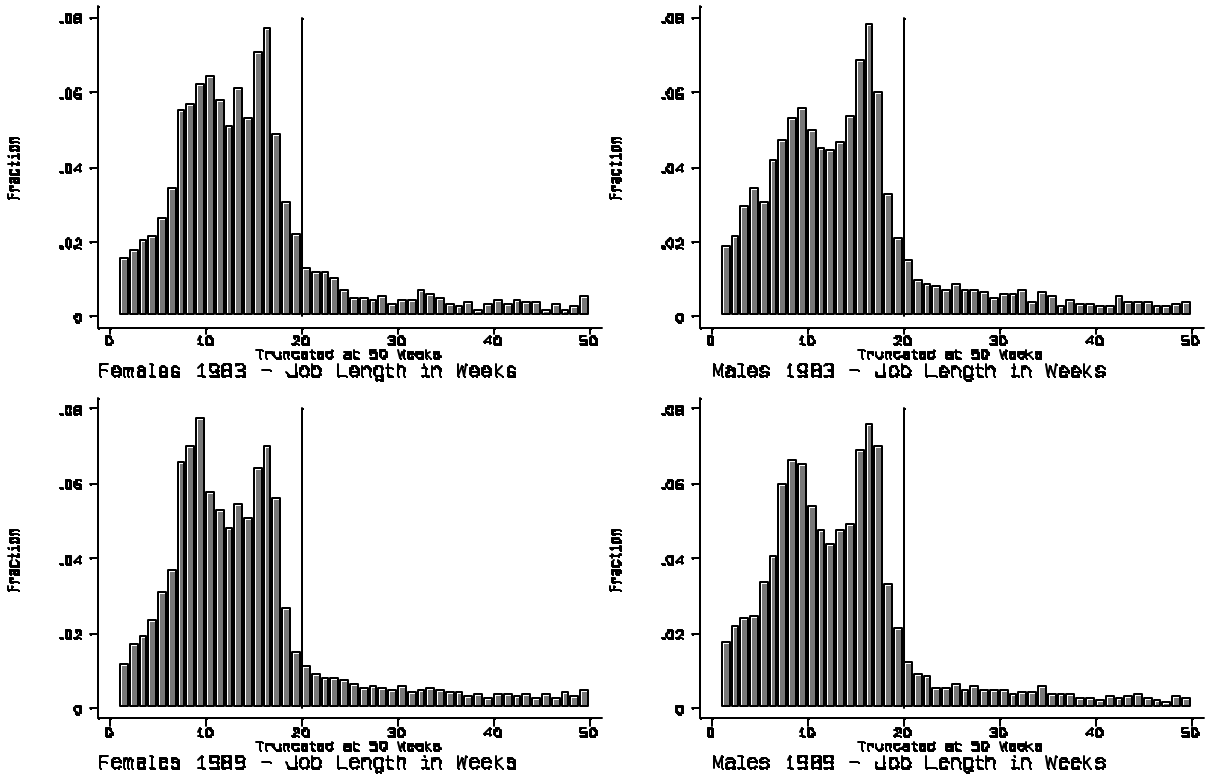
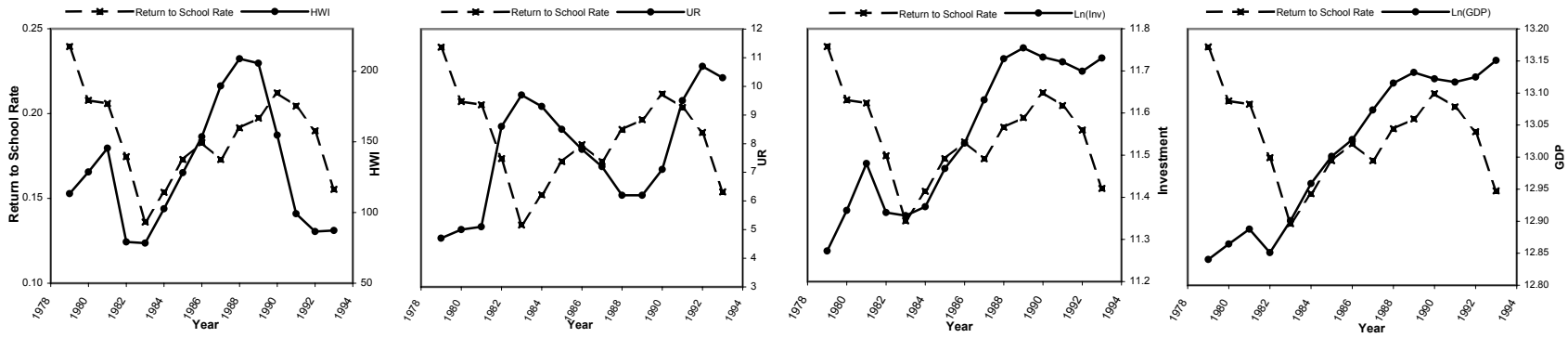


Figure 1 - Job Length at Peak and Trough of Cycle
for jobs lasting 50 weeks or less

Unadjusted Series



Detrended Series

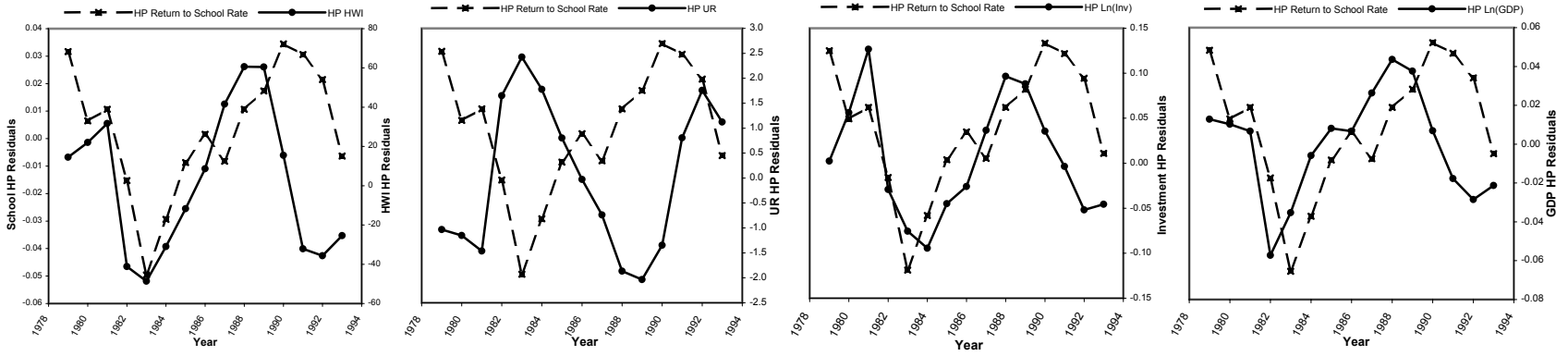
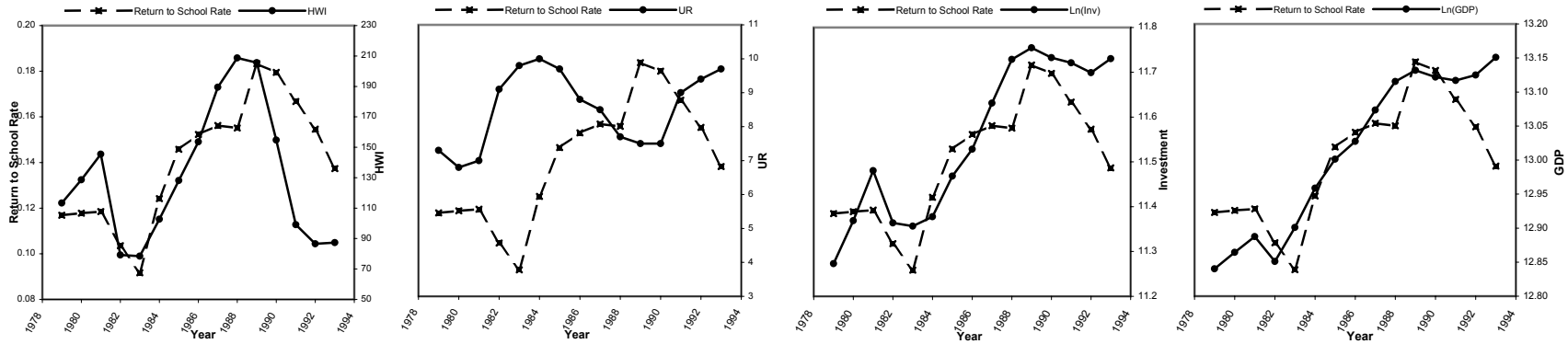


Figure 2 Return to School, HWI, UR, Investment and GDP Series: Males 25-54, > 20 weeks worked.

Unadjusted Series



Detrended Series

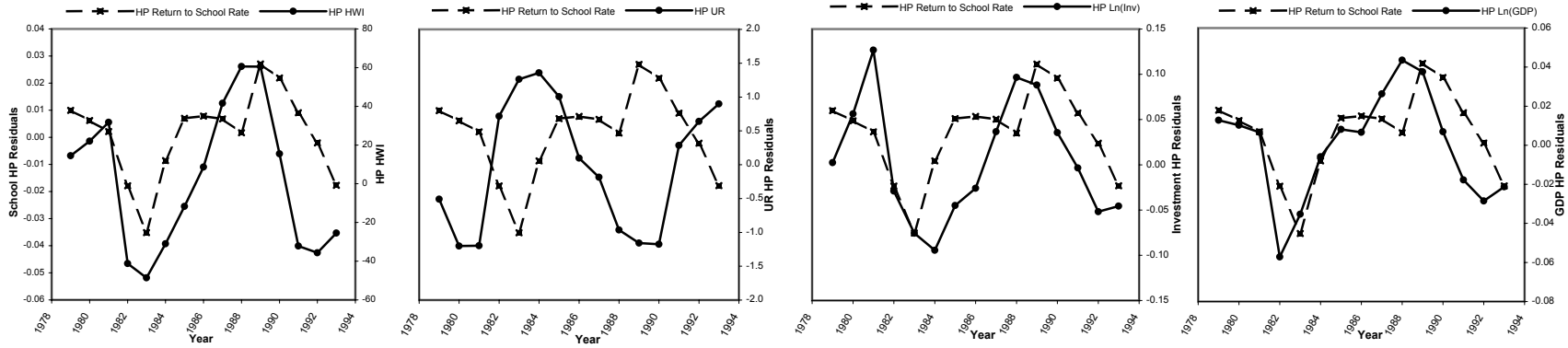


Figure 3 Return to School, HWI, UR, Investment and GDP Series: Females 25-54, > 20 weeks worked.