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Okun Revisited:
Who Benefits Most From a Strong Economy?[@]

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Abstract

Previous research has shown that the labor market experiences of less advantaged groups are more cyclically sensitive than the labor market experiences of more advantaged groups; in other words, less advantaged groups experience a high-beta version of the aggregate fluctuations in the labor market. For example, when the unemployment rate of whites increases by 1 percentage point, the unemployment rates of African Americans and Hispanics rise by well more than 1 percentage point, on average. This behavior is observed across other labor-market indicators, and is roughly reversed when the unemployment rate declines. We update this work to include the post-Great Recession period and extend the analysis to consider whether these high-beta relationships change when the labor market is especially tight. We find suggestive evidence that when the labor market is already strong, a further increment of strengthening provides a modest *extra* benefit to some disadvantaged groups, relative to earlier in the labor-market cycle. In addition, we provide preliminary evidence suggesting that these gains are somewhat persistent for African Americans and women.

[@]The views stated in this document are those of the authors and may not be shared by the members of the Board of Governors of the Federal Reserve System, the other members of its staff, or the Federal Reserve Bank of San Francisco. We are grateful to Francisca Alba, Neil Gerstein, Bo Yeon Jang, and Morgan Smith for excellent research assistance and to Tomaz Cajner and Chris Nekarda for providing already-constructed datasets and data dictionaries for some of the CPS data used in our analyses.

> "The difference between unemployment rates of 5 percent and 4 percent extends far beyond the creation of jobs for 1 percent of the labor force."
>
> Arthur Okun, *BPEA* 1973

1. Introduction

In 1973 Arthur Okun wrote an iconic paper asking whether a "high-pressure economy" could contribute to the upward mobility of U.S. workers. Okun's hypothesis was simple. In a high-pressure economy—defined by resource utilization running beyond its longer-run sustainable rate—firms would find it difficult to fill vacancies at a given wage and would react by relaxing hiring standards and reducing their use of statistical metrics for evaluating candidates in favor of more intense personal screening.[1] He argued that these changes had the potential to improve the economic circumstances of less advantaged workers, allowing them to find employment, build their skills, and climb the job and income ladder. Looking at the data, he found that these benefits were indeed a feature of high-pressure periods in U.S. economic history; during high-pressure episodes, men moved up the job ladder, creating room for women and teenagers to move into the labor market. On the basis of these findings, Okun concluded that though not a panacea, a high-pressure economy complemented other policies working to achieve the social objective of upward mobility.

Nearly fifty years later, Okun's analysis remains relevant.[2] The current economic expansion is on track to become the longest in U.S. history and the labor market is tight by most

[1] See Okun (1973), p. 240.

[2] In the fall of 2016, the minutes of FOMC meetings and then-Federal Reserve Chair Yellen noted the emerging debate about the potential of running a "high-pressure economy." This discussion has continued in the media and publicly since that time and has been among the topics at the series of Fed Listens events held in 2019:

standards. Moreover, inflation has been muted, running consistently below the 2 percent target of the Federal Open Market Committee (FOMC). As shown by the black line in Figure 1, the unemployment rate, a standard measure of labor market strength, is currently about as low as it has been since 1969. Moreover, it is well below the Congressional Budget Office's (CBO) estimate of its longer-run sustainable value (blue line).[3]

Looking ahead, based on the median of the FOMC's March 2019 Summary of Economic Projections (SEP), indicated by the dot symbols on the black line in Figure 1, the unemployment rate is expected to remain below 4 percent through 2021.[4] If that forecast is borne out, the U.S. unemployment rate will spend much of the next few years ½ percentage point or more below the CBO's estimate of its long-run sustainable level. Although the unemployment rate does move below the CBO's estimate of its sustainable level (a negative unemployment gap) with some regularity, a high-pressure expansion of that duration would border on exceptional.

The experiences of a high-pressure economy at various points over the past 40 years afford an opportunity to revisit Okun's question and to document who benefits most from a strong economy. In particular, we are interested in the degree to which less advantaged groups of workers see disproportionate improvements in employment and income when the labor market is especially tight. We add to the existing literature by updating the analysis to include the

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https://www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications-fed-listens-events.htm.

[3] The CBO's views are well aligned with private sector forecasters (as measured by the Blue-Chip consensus) and the FOMC Summary of Economic Projections (SEP); as of March 2019 the CBO's estimate of the natural rate of unemployment was about 4½ percent, while the medians from private forecasters (Blue Chip) and the SEP were at 4¼ percent—all quite a bit higher than the actual unemployment rates that have prevailed over the past year. The labor market strength seen by economists and policymakers is also reflected in surveys of households and firms. In the Conference Board's Consumer Confidence Survey, for example, a much larger percentage of respondents stated that jobs are plentiful than said that jobs are hard to get, while in the National Federation of Independent Businesses survey of small businesses, the percentage of companies reporting that jobs are hard to fill is at an historically high level.

[4] See FOMC (2019).

current expansion, to focus specifically on whether the dynamics of key variables differ during hot labor markets, and to consider both the short- and longer-term impact of high-pressure periods on less advantaged groups. We also consider whether rural areas do better or worse than urban areas and whether the results hold in metropolitan-area-level, rather than national, data.

The analysis demonstrates several important points. We reaffirm the earlier findings of other authors that the labor market outcomes of blacks, Hispanics, and those with less education are more cyclically sensitive than the outcomes of whites and those with more education. We find that this greater cyclical sensitivity holds in both cold period (those with a positive unemployment gap) and hot periods (those with a negative unemployment gap). Moreover, we find suggestive evidence that when the labor market is already strong, certain groups of disadvantaged workers benefit even more than usual from further strengthening. In other words, for these groups the last increments of strengthening appear to reduce labor market disparities by even more than earlier increments of strengthening had done. Notably, for prime age workers, these gains appear to be at least somewhat persistent along the participation rate dimension.[5]

The bulk of our enquiry focuses on individuals age 25 to 64 years; however, we also briefly examine data for younger persons, age 16 to 24, and find that the labor-market experiences of young black workers are more cyclically sensitivity than are the experiences of white youths and blacks age 25 to 64.

In contrast to the results for unemployment and participation, we find little evidence that gaps in hourly wages, annual own earnings, and household income vary over the labor-market cycle; when they do change, they tend to widen. These results are consistent with previous

[5] Reifschneider, Wascher, and Wilcox (2015) show that the presence of hysteresis is a relevant consideration for monetary policy makers.

research including Hoynes (2000), Parker and Vissing-Jorgensen (2010), Daly, Hobijn, and Pedtke (2019), and Doniger (2019).

The remainder of the paper is organized as follows. Section 2 provides a summary of the existing literature. Section 3 describes the data and measurement of key variables. Section 4 reviews the results on the relative sensitivities of important groups across key labor market and income indicators including unemployment rates, labor force participation rates, wages, and household incomes. Section 5 discusses some potential costs of running a high-pressure economy that policymakers should consider, while Section 6 offers some tentative conclusions from our investigations.

2. Previous Literature

Following Okun (1973), many authors have investigated elements of the high-pressure hypothesis. A number of studies written in the wake of the strong economy of the late 1990s documented that disadvantaged workers, including blacks and low-skilled workers, experienced greater cyclical variation in their labor market outcomes. One example is the paper by Hoynes (2000), who examines how the employment, earnings, and income of less-skilled men vary over the business cycle. She finds that men with lower levels of education and nonwhites experienced greater cyclical fluctuations in employment and earnings than high-skilled white men, but that earnings of other family members and government transfers muted the impact on family income.[6] Another prominent example is the Katz-Krueger (1999) exploration of whether the distributions of wages and incomes tighten systematically as the economy strengthens. They find that the wage growth of lower-wage individuals is more responsive to reductions in the

[6] See also her literature review for a discussion of prior studies focusing on the relative labor market outcomes of workers by race and education.

unemployment rate than is the wage growth of higher-wage individuals, and that the tight labor market of the late 1990s produced more widespread benefits for the disadvantaged than did the tight market of the late 1980s, though this partly resulted from the expansion of the Earned Income Tax Credit during the later period.[7] Romer and Romer (1999) confirm that U.S. poverty rates decline during economic expansions, but they argued, based on cross-country data, that these are merely short-term benefits and that efforts by monetary policymakers to keep the unemployment rate low at the expense of higher inflation are detrimental to the long-run well-being of the poor. More recently, Jefferson (2008) has examined the behavior of employment-to-population ratios over the business cycle by level of educational attainment. He finds that the cyclical sensitivity of employment was greater from 1968-2005 for individuals with lower levels of educational attainment. Similarly, Cajner et al. (2017) finds that both unemployment rates and patterns of labor force entry and exit for blacks and Hispanics are more cyclically sensitive than for whites.

Fewer studies have focused on the question we address here of whether the dynamics of key labor-market variables differ when the economy is hot. One exception is Bradbury (2000), who, using data from the 1970s through 1990s, finds that the difference between black and white male unemployment rates is about ½ percentage point smaller in periods when the unemployment rate falls below 5 percent, even after controlling for the state of the business cycle using the GDP gap.[8] She does not find a similar, separate effect on the unemployment rate gap between black and white women. Wilson (2015) compares the 1990s with several less-robust expansions and shows that with respect to both unemployment and earnings, African Americans

[7] Katz and Krueger also caution that the wage and income gains among low-wage workers and low-income families were not sufficient to overcome the trend increase in inequality over the preceding decade.
[8] Page 24.

particularly benefited from the high-pressure economy of the late 1990s. Hotchkiss and Moore (2018) analyze panel data from the National Longitudinal Surveys of Youth and find evidence that high-pressure economies lead to lower rates of unemployment and higher labor force attachment among disadvantaged groups, but that the effects are not particularly long-lived. Similarly, simulations conducted by Fallick and Krolikowski (2018) indicate that a hot labor market has modest but short-lived benefits for the labor market outcomes of less-educated men.

In trying to understand these various findings, it is helpful to think about the specific channels through which a high-pressure economy could lead to improved labor market outcomes for more marginalized workers. As conceived by Okun in his seminal work, employers may upgrade workers into more productive jobs during a high-pressure economy, with the result that more marginal workers (women and teenagers in Okun's analysis) increase their employment. A number of studies provide evidence of this phenomenon. Holzer et al. (2006) finds that during the tight labor market of the 1990s, employers were more likely to hire workers with some stigma, including welfare recipients and those with little experience, although they were not more likely to hire those with a criminal record. Employers also demanded fewer general skills. This latter finding is confirmed in Modestino et al. (2016), who, using job posting data, find that in the immediate aftermath of the Great Recession, employers increased skill requirements listed in job postings, such as education and prior experience, and reduced them as the expansion gathered strength. Devereux (2002) provides evidence that new hires tend to have lower educational attainment when the unemployment rate is low and that low-skilled workers experience the greatest occupational improvement in tight labor markets. This result is consistent with the model of vacancy chains developed by Akerlof et al. (1988), whereby as the unemployment rate falls workers move into jobs that provide better matches. These studies all

suggest that the benefits of a high-pressure economy are greater than those that would result simply from the fall in the unemployment rate.

3. Data and Measurement

Most of the data we use come from the Current Population Survey (CPS)—the survey of households used by the Bureau of Labor Statistics (BLS) to construct estimates of the labor market outcomes. We focus our attention on 25-64 year olds because this age group consists of individuals who are most likely to be finished with schooling and below normal retirement age.[9] Within this group we examine the relative outcomes of historically less advantaged groups defined by race, gender, and educational attainment. We define three mutually exclusive groups for race and ethnicity: African Americans or blacks (we will use the terms interchangeably); Hispanics or Latinos (again, we will use the terms interchangeably); and non-Hispanic whites. We do not show results for Asian Americans, Native Americans, and others separately due to the statistical unreliability of results for smaller sample sizes. We define three levels of educational attainment: a high school degree or less; some college (which includes individuals with post-high school education who did not graduate from a four-year college, including those who earned an associate degree); and a four-year college degree or more. For annual household income, we take the demographic characteristics of the reference person or "householder" for each household in the Annual Social and Economic Supplements of the CPS.[10] All earnings and income series are deflated by the headline Personal Consumption Expenditures (PCE) price index.[11]

[9] We also provide a more limited analysis of unemployment rate gaps for 16-24 year olds.
[10] We exclude "group quarters" households where the householder is not identified.
[11] In all our statistical investigations, we use *gaps* in income between two different groups, constructed as 100 times the difference in log incomes. The choice of price index does not affect these gaps, but it does affect the levels shown in Figures 4 and 5.

We also do some robustness checks using data at the metropolitan statistical area (MSA) level. For this MSA analysis, we use the outgoing rotation group files of the CPS beginning in 2004, when the U.S. Census switched to designating geographic areas using the core-based statistical area (CBSA) classification system, and ending in 2018. To ensure that we get a sufficient sample to calculate group-specific labor force status by CBSA, we pool the data to the annual frequency, include men and women together, and include areas with at least 500,000 individuals and at least 75 observations for the particular race/ethnicity/education group being analyzed

Finally, we define cold and hot periods as those when the aggregate unemployment rate is respectively above or below the natural rate as estimated by the CBO—in other words, when the unemployment rate gap is positive or negative. For the MSA analysis, we define the natural rate in each metropolitan area as the average unemployment rate in the period from 2004 to 2008.

4. Results

Among the myriad possible labor market outcomes, we focus on six measures: unemployment rates; labor force participation rates (LFPR); employment-to-population ratios; average hourly wages (which include the wages and salaries of employees, but not the self-employed); annual own earnings (including income from self-employment) and annual household income (from all sources). We compare outcomes for black and Hispanic men and women with outcomes for white men and women; similarly, we compare outcomes for men and women with a high school degree or less and some college to outcomes for men and women with a college degree or more.

(a) Evidence on the "high-beta" experience of disadvantaged groups

To set the stage for the results it is useful to describe the trends in each of the key outcome variables. Figures 2 through 5 plot, in time-series format, each of the outcome variables for each of our key groups. The gray bars denote periods when the unemployment rate was below the natural rate as estimated by the CBO.

A key feature evident in figure 2 is that fluctuations in the unemployment rates for African Americans and Hispanics—both males and females—are roughly synchronized with fluctuations in the unemployment rate for whites (top two panels). However, the rates for African American and Hispanic men and women are uniformly higher than the rates for white men and women, and they exhibit considerably greater amplitude. As a result, when the labor market weakens, the gaps between these rates widen markedly; they then shrink again when the labor market tightens.

Compared with the unemployment rate, the LFPR (middle panels) is considerably less cyclically sensitive. A much greater fraction of the variation in the gaps in the LFPR across different races and ethnicities appears to reflect secular trends. Overall, black men have a lower LFPR than do white or Hispanic men. Among women, Hispanics participate at a lower rate than do either blacks or whites.

Finally, the employment-to-population ratio (EPOP), which combines the information in the unemployment rate and the labor-force participation rate, also varies considerably over the business cycle.[12] In terms of levels, black men and Hispanic women have lower EPOPs than

[12] EPOP can be linearly approximated as: $EPOP \approx LFPR - \overline{LFPR} * U$, where $\overline{LFPR}$ is the average LFPR over the sample period. Thus, the employment ratio inherits its average cyclical sensitivity from a combination of the average cyclical sensitivities of the labor force participation rate and the unemployment rate.

their counterparts, reflecting both their lower rates of labor force participation and higher unemployment rates.

Figure 3 presents similar information for groups at different levels of educational attainment. On average, the unemployment rates (top two panels) of individuals without a college degree are more cyclically sensitive, rising by more in downturns and falling by more in expansions. At all times, the unemployment rates for those without a college degree are higher than the rate for those with a college degree.

The LFPR and EPOPs (the middle and lower panels) are lower for those with less education. Similar to the results by race and ethnicity, the LFPR exhibits very little observable cyclical sensitivity. EPOPs are slightly more cyclical. The gaps in both the LFPRs and EPOPs by educational attainment between those with a high school degree or less and the other two groups are large and persistent.

In his original paper, Okun noted that a high-pressure economy helps workers find employment and upskills the types of jobs they can obtain, translating into better wages, earnings, and household incomes. Figures 4 and 5 present analogous information with respect to real average hourly wages, annual own earnings (which accounts for both hourly earnings and hours of work), and annual household income. There is some cyclicality in all three measures, with all three rising faster in strong periods than in weak periods. That said, there is very little visual evidence that the strength of the labor market affects the gaps in these variables across less advantaged and more advantaged groups. In general, these aggregate income measures for blacks and Hispanics are far lower than the analogous measures for whites; similarly, the average incomes of those with lower educational attainment are well below those of persons with higher educational attainment.

To document the greater cyclical sensitivity of the labor-market and income experiences of less advantaged groups, on average, over the entire labor-market cycle, Tables 1 and 2 report estimates from a simple regression equation of the following form:

(1) $y_{gt} = \alpha_0 + \alpha_1 * ugap_t + \varepsilon_t$

In Table 1, the left-hand-side variable in each equation (denoted y_{gt} in equation (1)) is the difference between a labor-market or income-related variable for the race/ethnicity and gender group (g) that is named in the line and column of the table, and the same variable for whites of the same gender. Thus, for example, the upper left block of coefficients pertains to a regression in which the left-hand-side variable is the unemployment rate for black men minus the unemployment rate for white men. Similarly, in Table 2, the left-hand-side variable in each equation is constructed as the difference between a labor-market or income-related variable for the education and gender group that is named in the line and column of the table, and the same variable for individuals of the same gender and with a college degree or more. The regressions are run over the period from 1976Q1 to 2018Q4. Importantly, to simplify the task of keeping track of signs, we define the nonparticipation rate as 1 minus the participation rate and the nonemployment rate as 1 minus the employment ratio; similarly, for the earnings/income variables we redefine the left-hand-side variable as 100 times the log of earnings/income for the reference group (for example, white women) minus the log of earnings/income for the comparison group (for example, black women). With this transformation, all the variables on the left-hand-side of regression equations are defined such that higher values represent worse outcomes, and a positive sign on the coefficient for *ugap* indicates that the relatively disadvantaged group benefits more from each increment of labor-market strengthening.

The coefficients of most interest to us in these tables are the ones that appear under the columns headed "Ugap." In the top-most block of results of Table 1, the uniformly positive coefficients in these two columns replicate the finding of previous authors that, on average, when the labor market strengthens (i.e., Ugap decreases), the unemployment rates for blacks and Hispanics decline by more than the unemployment rate for whites. Similarly, Table 2 shows that the unemployment rates for individuals with a high-school education or less and for individuals with some college education decline by more than the unemployment rate for individuals with a college degree or more. Moreover, in each of the tables all eight of these slope coefficients are significantly different from zero at the 1 percent level.

In the blocks reporting results for the nonparticipation rate, a positive coefficient on Ugap indicates that as the labor market strengthens, the LFPR for the relatively marginalized group increases by more than the LFPR for the reference group—i.e., the relatively marginalized group experiences a greater benefit as its relative nonparticipation rate falls. In this case, the slope coefficients are generally smaller in magnitude than they were for the unemployment rates and are of mixed sign and statistical significance—a result that may not be surprising given the moderate cyclicality of this variable (cf. Aaronson et al, 2014). For blacks, the coefficients are positive but not statistically significant, while the two coefficients for Hispanics are negative (indicating that white participation has been more cyclically sensitive, on average, than has Hispanic participation). By educational attainment, all of the coefficients are positive, though only statistically significant for women with some college at the 10 percent level. In the non-employment block, the strong cyclicality of the unemployment rate dominates, so six of the eight coefficients have the positive sign (and statistical significance) that is associated with relatively

marginalized groups benefiting by more, at the margin, as the labor-market strengthens; the exceptions are Hispanic men and women.

The bottom three blocks of Tables 1 and 2 report results for the three income-related measures that we examine (with the reminder that a positive slope coefficient is associated with the relatively disadvantaged group benefitting more from each increment of labor-market strengthening). The gaps in average hourly wages are not particularly cyclically sensitive; none of the eight estimated slope coefficients shown in Tables 1 and 2 is significantly different from zero, and all are negative. This result could reflect the changing composition of employment as the economy improves and more-marginal workers with lower pay become employed (Daly and Hobijn, 2017). It could also be that more of the relative improvement in labor income for less advantaged groups comes in the form of hours worked rather than hourly pay (Doniger, 2019). Consistent with the latter hypothesis, 15 of the 16 coefficients in the bottom two blocks (annual own earnings and annual household income) of Tables 1 and 2 are positive, and 12 of these are significant at the 10 percent level or better.

Overall, these results confirm those from previous studies, namely that less advantaged groups experience a high-beta version of the cyclical sensitivity of labor-market outcomes of more advantaged groups. Next we consider whether that sensitivity differs significantly when the labor market is tight.

(b) Are hot periods different from cold periods?

To begin our examination of whether the average experience documented in Tables 1 and 2 differs between hot and cold periods, Figures 6 and 7 display scatter plots showing the differential unemployment experiences of our eight comparison groups relative to their white or

more-highly-educated counterparts. In these figures, the variable plotted against the vertical axis is the difference between the unemployment rate for the comparison group relative to the unemployment rate for either whites or individuals with at least a college education; each differential variable is constructed separately for men and for women. The variable plotted against the horizontal axis is the aggregate unemployment rate gap; thus, observations further to the right in the figure come from periods when the labor market was looser (more slack) and observations further to the left come from periods when the labor market was tighter (less slack). To show average tendencies, we draw trend lines through the datapoints, noting that a flat line would indicate that the unemployment rate gap between the two groups is not sensitive to the tightness of the labor market. To ascertain whether the relative unemployment experience is different when the economy is operating in high-pressure mode, we allow each trend line to have a kink where the unemployment rate gap equals zero. If the responsiveness is the same in both hot and cold periods, the trend lines will be linear with no observable kink.

Figure 6 shows results for the unemployment rate by race and ethnicity. Pooling the roughly four decades in our sample, the lines are kinked downward for black women (upper right panel) and Hispanic men (bottom left panel), indicating that as the labor market moves into high-pressure mode, not only do the unemployment rates of black women and Hispanic men continue to decline by more than the unemployment rate of their white counterparts, but the multiplier increases. In the econometric specification used to construct these panels, the process goes into reverse once the unemployment rate gap has reached its nadir. (Due to the limited number of data points we did not test whether there was an asymmetry depending on whether the economy was expanding or contracting.) As the unemployment rate comes back up toward its natural rate, the unemployment experience of black women and Hispanic men deteriorates more sharply than

it does for their white counterparts, and by a wider margin than is estimated to occur once the unemployment rate moves above its natural rate. There is no discernible difference between hot and cold periods in the high-beta behavior of the unemployment rate of black men compared to white men, or for Hispanic women compared to white women.

Figure 7 compares the unemployment experience of individuals either with a high-school diploma or less, or with some college education, to that of individuals with a college degree or more. In no case is there evidence that hot periods are better for those with less than a college degree. In fact, as the aggregate unemployment rate moves below its natural rate, the unemployment rates for men either with a high school degree or less, or with some college, decline by less than they did earlier in the labor-market cycle (indicated by the fact that the line is less steep to the left of Ugap=0 than it is to the right). For women with a high school degree or less, or with some college education but not a college degree, hot and cold periods appear to differ little.

A natural question to ask is whether the basic relationships displayed in Figures 6 and 7 have been stable over time. To answer this question, we divided our sample period into four labor-market cycles—with each cycle defined as beginning in the quarter when the unemployment rate first exceeds the natural rate and ending in the quarter when the unemployment rate last falls below or equals the natural rate. Figure 8 provides the graphical analogue of the statistical tests that we conducted to determine whether the cyclical experiences were stable over time, using the unemployment rate differential between Hispanic and white men as an example. As shown in the figure, we estimated different trend lines for each of the four labor-market cycles, but—for the sake of simplicity—not allowing for a kink in the trend line when the Ugap goes negative. We then conducted simple F-tests to determine whether the null

hypothesis of equality across the four slope coefficients can be rejected.[13] In the overwhelming majority of cases, the null hypothesis is rejected at the 5 percent level or better.

Tables 3 and 4 accordingly report coefficient estimates for regressions taking the following form:

$$(2)\quad y_{gt} = \alpha_0 + \alpha_1 * ugap_t + \alpha_2 * hot\ dummy_t * ugap_t + \varepsilon_t$$

where the regression is run separately for the sample as a whole and for each of the labor-market cycles. As in equation 1, the left-hand-side variable in the regression is the difference between the labor market outcome (in this case the unemployment rate) for the comparison group, g, and that of their more advantaged counterparts (whites or those with a college education or more). The variable *hot dummy* takes a value of 1 when the overall unemployment rate is less than its natural rate and 0 otherwise.

The top row of Table 3 reports results for the entire sample period taken as one—the same results as were shown in Figure 6—while the remaining rows report results for each labor market cycle separately. Looking across the four cycles and the four race/ethnicity/gender pairs, in 15 of the 16 cases the trend line is estimated to have had a positive slope during cold periods (when Ugap>0), confirming that these groups endured a high-beta version of the unemployment rate experience of their white counterparts.

Next, we turn to the question of whether that high-beta experience evolved once the labor market was tight: In a pattern that will be repeated in later analyses, the relative improvement in the unemployment rates of black men and black and Hispanic women did not intensify during

[13] Throughout the paper, we conduct hypothesis tests using covariance matrices that are robust to serial correlation and heteroscedasticity.

the high pressure period of the late 1980s; this is reflected in the table by the fact that the estimated coefficients on the interaction term in those three cases are negative. However, in 10 of the other 12 cases (the exceptions being Hispanic men during the cycle of the early 2000s and Hispanic women during the current cycle), the coefficient on the interaction term is estimated to have been positive, meaning that the high-beta experience of the studied group intensified as the unemployment rate moved below its natural rate. In fact, in 5 of those 10 cases, the coefficient estimates suggest that the relative improvement when the labor market was tight was more than double the relative improvement when the labor market was slack. The coefficient on the interaction term is statistically significant and positive in five cases.

As shown in Table 4, the results are somewhat weaker for the relative unemployment rates of groups stratified by educational attainment. The slope of the trend line in cold periods is estimated to have been positive in 15 of the 16 cycle-specific cases shown in the table. However, the increment to the slope during a hot labor market is of mixed sign, positive in nine cycle-specific instances and negative the other seven times. That said, the overall slope during high-pressure economies typically remained positive. Thus, though less-educated individuals also undergo a high-beta version of the unemployment experience of those with at least a college education, there is little evidence that the beta has increased in hot labor markets, with the possible exception of women with a high school degree or less.

With regard to the nonparticipation rate, shown in Figures 9 and 10 and in Tables 5 and 6, the evidence is less tidy. As we noted previously, the nonparticipation rate is less cyclically sensitive overall than is the unemployment. As shown in Table 5, in the first two labor market cycles in our sample, the trend line is estimated in almost every case to have been negatively sloped, signifying that the gap in nonparticipation rates during those two cycles actually widened

as the recovery proceeded. In contrast, during the most-recent two labor-market cycles, the trend line is estimated to have been positively sloped for black and Hispanic men (and statistically significant for Hispanic men), and for black and Hispanic women in one of the most recent cycles each.

With respect to whether the dynamics of relative nonparticipation rates differ in a high-pressure economy, the results are broadly similar to those for the unemployment rate. The 1980s again appear to have been a particularly perverse cycle, with black men and black and Hispanic women falling further behind in terms of labor force participation when the economy was operating in high-pressure mode (as signified by the negative coefficients shown under the columns labeled "slope when Ugap $\leq$ 0"). However, the late 1990s seem to have brought widespread relative improvements in nonparticipation rates: the increment to the slope during the hot period of that labor market cycle is positive for all racial/ethnic groups, and these coefficients are statistically significant. In the more recent two labor market cycles, the evidence is more mixed as to whether hot periods are better than cold periods: the increment to the slope for black women is substantial in both periods (though not statistically significant); of mixed sign for black men and Hispanic women; and of the wrong sign for Hispanic men. Nonetheless, as shown in the columns labeled "slope when Ugap $\leq$ 0," positively sloped trend lines during tight labor markets outnumber negatively sloped ones, indicating that most nonparticipation gaps continued to narrow as the labor market tightened further, even after U had moved below U*.

For relative nonparticipation rates by educational attainment (Table 6), the point estimate of the trend line during cold periods is more likely to be negative than positive (11 out of 16 cases), indicating that in the four labor market cycles we consider, nonparticipation rates for less-educated individuals tended to fall by less, as the overall labor market tightened, than did

nonparticipation rates for those of the same gender but with a college degree. That said, the trend lines tended to become more positively sloped in hot labor markets, except for men with some college education. In the labor market cycles of the 1980s and 1990s, these increments are statistically significant in four of eight cases; moreover, the overall slope of the trend line for less-educated women is estimated to have been positive when the unemployment rate was below the natural rate in both cycles, indicating that nonparticipation rates for these groups declined by more than did their college-educated counterparts when the labor market was tight. However, this pattern has tended to weaken over time, especially for women, and mostly is not evident in the current labor market cycle.

Figures 11 and 12 and Tables 7 and 8 bring together the unemployment rate and the LFPR by displaying results for the nonemployment gaps. By and large, as noted before, the non-employment gap inherits its cyclical characteristics from the unemployment rate. As shown in Table 7, the trend line is positively sloped for most of the groups in most time periods (12 out of 16 cases) when the labor market was in slack condition, indicating that each increment of labor-market tightening disproportionately benefited the relatively marginalized group as measured through the lens of the EPOP (and each increment of labor-market loosening disproportionately harmed them). And, as shown in the "increment" columns, that high-beta experience is estimated to have intensified in 9 of the 16 cases—in seven of those cases significantly so. Again, the cycle of the 1980s appears to be an outlier, as for most groups the trend line is estimated to have been statistically significantly more negatively sloped than during the cold portion of the cycle, while the high-pressure economy of the late 1990s appears to have brought broad-based relative gains, with positive and statistically significant coefficients for the increment term for every group. In the last two cycles the evidence is more mixed, except for

black women, who appear to have experienced consistently greater relative improvement in their employment rates during high-pressure economies.

Turning to the results for educational attainment in Table 8, the trend line is positively sloped in the slack labor market episodes in 12 of the 16 cases (all 8 cases for men and 4 of the 8 cases for women), consistent with a high-beta employment experience for less-educated individuals. However, as for the unemployment rates, there is mixed evidence that the high-beta experience intensifies when the labor market is hot. There is some support for this hypothesis for less-educated women in the labor market cycles of the 1980s and 1990s and in the 1990s for less-educated men, likely driven by the participation margin, but little evidence for it for women or men in the most recent two labor market cycles we consider.

Table 9 provides a compact summary of the results from all these regressions. In the table, a single asterisk in a cell denotes that the estimated increment to β was positive in at least three of the four labor-market cycles. A double asterisk adds the requirement that in at least two cases, positive increments were estimated to have been significantly different from zero at the 10 percent level of confidence or better. For completeness, we use an "at" sign to denote intermediate cases (four in number), in which two increments are estimated to have been positive and statistically significantly different from zero, but the other two increments were estimated to have been negative.

As can be seen in the first column of the table, the results (as noted above) in the case of the unemployment rate are suggestive but not conclusive: Half of the cells in this column are blank, meaning that in those cases, either fewer than three of the estimated increments to β were positive or fewer than two were statistically significantly different from zero. In two of the eight cells, at least two increments were statistically significantly different from zero. In the

nonparticipation column, six of the eight cells earn some form of marking—an interesting result, given that through most of the labor-market cycle, the gaps in nonparticipation rates are noticeably less cyclical than are the gaps in unemployment rates. Nonetheless, our results suggest that once the labor market is operating in high-pressure mode, relatively marginalized persons are drawn into the labor market proportionately more than are relatively advantaged persons. Indeed, the late 1990s seem to have brought widespread relative gains in participation rates: the increment to the slope during the hot period of that labor market cycle is positive for all racial and ethnic groups that we study, and these coefficients are statistically significant. [Could add something here about EPOP results.]

More generally it is clear that labor market dynamics vary significantly across cycles, making it difficult to tell a simple story about the role of high-pressure economies. With that caveat, however, we read the evidence reported in Table 9 as indicating that as the labor market has strengthened, the employment experiences of African Americans and Hispanics age 25 to 64, as well as that of those with less than a college degree, have improved relatively more compared to whites and college-educated individuals of the same gender. Moreover, this observation holds true regardless of whether the labor market is operating in "cold" or "hot" territory. The evidence with respect to whether the relative experiences of disadvantaged groups have differed materially between cold and hot episodes is less clear, but leans in the direction of suggesting that there is a difference that skews in favor of these groups, particularly blacks and women with some college education or less. The relative improvement enjoyed by disadvantaged groups appears to have been particularly strong during the high-pressure labor market of the 1990s.[14]

[14] While our assumption that the kink in the slope occurs when the unemployment gap is zero is intuitively appealing, in principle the kink could occur above our below that point. To assess this possibility, we also experimented with threshold specifications that allow the data to choose the point at which the kink occurs. For

(c) Estimates with MSA data

To test the robustness of these results, we use metropolitan-level data to look for evidence of the "high-beta" relationship between the labor market outcomes of disadvantaged groups and more advantaged groups and also for evidence that this relationship changes as the labor market enters a high-pressure period.[15] We define the natural rate in each metropolitan area as the average unemployment rate in the period from 2004:Q3 to 2008:Q4 and run the panel regression over the period from 2009:Q1 to 2018:Q4, including year and metropolitan-area fixed effects.[16]

The results, shown in Table 10, are consistent with the time-series analysis. The coefficients are of similar magnitude in absolute value and show some evidence that high-pressure economies are particularly beneficial for disadvantaged groups. For example, the unemployment rates of the disadvantaged groups are more cyclical, and this relationship is statistically significant. Moreover, during the high-pressure phase of the cycle this relationship appears to intensify for all groups except Hispanics, and it is statistically significant for blacks

most groups, this version of the model chose a kink point that was between 1 and 2 percentage points above the natural rate; the exception was the unemployment differential for black men, for which the chosen kink point was ½ percentage point below the natural rate. For the unemployment and nonparticipation rate gaps, the slope coefficients during cold periods were similar to those shown in Tables 3 and 4 despite the differences in the kink points. These specifications also tended to show an intensification of the high beta experience for blacks and Hispanics below the chosen kink point (9 out of 12 cases for unemployment gaps and 7 out of 12 cases for nonparticipation; we were unable to run this model for the 2001-07 period). And, as was the case for the specifications assuming a kink at ugap=0, the threshold results were weaker for relative unemployment gaps and nonparticipation gaps by educational attainment.

[15] This analysis is similar in spirit to Kiley (2015), Leduc and Wilson (2019), Leduc and Wilson (2017), and Smith (2014), all of which use cross-metropolitan area or cross-state variation to test the sensitivity of wage or price inflation to labor market slack.

[16] Ideally, we would use a longer-length lag or some other filtering to compute the natural rate, but the time series of metropolitan-level data is not very long. As an alternative, we tried using a backward-looking 7-year moving average of the unemployment rate. In this case, the coefficients on the unemployment rate gap are attenuated and statistically insignificant, likely because this measure puts too much weight on the high unemployment rates of the Great Recession in calculating the natural rate. The coefficients on the hot labor market interaction were more typically statistically significant in this specification.

and those with some college education. With regard to the nonparticipation rate, the results using the metropolitan-level data are weaker---the slope coefficient in cold periods is positive only for blacks, and even then it is not statistically significant. When the economy is in a high-pressure state the evidence suggests that the participation rate gap closes by more, for blacks and for those with some college education, but it is only statistically significant for the latter group. Finally, the cyclicality of the non-employment gaps (not shown) appears mainly to reflect the unemployment margin. The slope coefficient during cold periods is positive for all four groups (and statistically significantly in two cases). And for all groups except high-school graduates, there is an additional relative improvement in employment when the unemployment rate falls below its natural rate (though this is only statistically significant for those with some college education).[17]

d) *Earnings and income*

Figures 13 and 14, together with Tables 11 and 12, present the evidence with regard to hourly wages. Pooling the data from all four labor-market cycles, Figure 13 and the first row of Table 11 provides some weak evidence that during the initial phases of a labor-market recovery (when the unemployment gap is still positive) there is some narrowing of the hourly wage gap between the comparison groups and the reference groups.[18] However, in all four cases shown in Figure 13, when the unemployment gap turns negative, the gaps *widen* as the unemployment rate descends further below the estimated natural rate, as indicated by the negative values shown in

[17] We would note two caveats to this analysis. First, we don't break out men and women separately, and so the results cannot speak to the differences by gender that are evident in the time-series analysis (for instance the high cyclicality of the employment-to-population ratio for Hispanic men and black women). Second, the data used for this analysis are all from the final labor market cycle of our time-series analysis.

[18] Recall that for the wage and income variables, we define the gaps as the wage/income level for each relevant group relative to that for whites or college graduates, so that a positive coefficient signifies a narrowing of the gap.

the column labeled "Slope when Ugap<0". Inspection of the individual labor-market cycle experiences by race and ethnicity (rows 2 through 5 in Table 11) does not reveal much greater evidence of cyclical sensitivity or of a material change when the labor market is relatively tight. Similarly, as shown in Table 12, the coefficients on the wage gaps by educational attainment are all negative in the regression that pools data from all four labor market cycles, indicating wage gap *widening* as the unemployment rate moves further below its natural rate. For the individual labor market cycles, the estimated increments to the slope of the trend line are about evenly distributed between positives and negatives, with 7 of the 16 hot-period trend lines are positively sloped.

Figures 15 through 18, together with Tables 13 and 14, report results based on own annual earnings and household annual income. As noted earlier, these series are computed at an annual rather than a quarterly frequency using data covering the years 1987 through 2017; accordingly, we do not break out results for individual labor-market cycles. Two main findings stand out. First, all of the coefficients are positive when the unemployment rate is above its natural rate, indicating that as the unemployment rate comes down toward its natural rate, these earnings/income gaps narrow on average, again reaffirming the basic high-beta experience of these groups (both by race or ethnicity and by educational attainment). Moreover, three-quarters of the estimated cold-period coefficients are significantly different from zero. Second, hot labor markets were not particularly favorable to most of these groups. In 12 out of the 16 cases shown in Tables 13 and 14, the coefficient is negative when the unemployment rate was below its natural rate. In 9 of the 16 cases, the negative coefficient was large enough to cause the overall slope of the line to be negative—indicating that, on average, in those cases, further tightening of

the labor market beyond the point where Ugap was equal to 0 was associated with a widening in the earnings/income gap between the comparison group and the reference group.

Table 15 provides a scoring of results for the three relative income variables that we inspect, based on average hourly wages, annual own earnings, and annual household income. For average hourly wages, we use the same method that we used to construct the scoring reported in Table 5. For the own earnings and household income variables, we use a simpler method because the underlying data are annual: We award one asterisk if the estimated coefficient (by construction, over the whole sample period) is positive, and two asterisks if it is significantly so.

The contrast between Tables 10 and 15 is plain: Whereas a slight majority of cells in Table 10 showed some marking, the great majority of cells in Table 15 are blank, signifying that when the labor market is tight, β generally does not shift in a manner that is favorable to the relatively marginalized group. Indeed, the results shown in Tables 12-14 go a step further and demonstrate that, in fact, relative income gaps actually widen in about half the 24 cases that we examine (eight demographic pairs and three relative income variables).

The results on earnings gaps are broadly consistent with previous research that finds lower wage cyclicality among less advantaged groups than among more advantaged groups. For less advantaged workers, institutional constraints such as the minimum wage are more likely to bind in cold periods (Hoynes 2000), and in hot periods, more advantaged workers, with higher skills, are more likely to see rapid wage increases (Daly and Hobijn, 2017; Doniger 2019). In terms of household earnings and income, previous research has shown that families smooth through income variability, including variability induced by unemployment rate shocks, using the social safety net and changes to family labor supply (cf. Dynarksi and Gruber, 1997). This

behavior puts a floor under families in cold periods. In hot periods, the relatively larger wage gains going to more advantaged workers are likely amplified by patterns of household formation that result in the presence of multiple advantaged workers in the same household (Eika, Mogstad, Zafar, 2018). To sum up, in a hot economy, less advantaged groups improve relative to more advantaged groups in their employment experiences; in contrast, more advantaged groups experience relatively larger gains in hourly wages and income. Future research linking these findings to broader implications for economic welfare is needed.

(d) Results for individuals between the ages of 16 and 24

Okun's hypothesis particularly focused on the advantage of hot labor markets to young workers, and indeed, the labor-market experience of individuals at the lower end of the age spectrum may differ importantly from the labor-market experience of people age 25 to 64. To ascertain whether differences across age groups are important, we briefly review results that are analogous to those we have already shown for 25 to 64 year olds, but in this case for people between the ages of 16 and 24.

Table 16 presents the relative cyclical sensitivities of the unemployment rate gaps of young adults for each of the four demographic pairs in our focus, in the same format as Table 3. For African Americans, these results are reasonably straightforward to characterize. In all the episodes we considered, the unemployment rates of young African Americans were more cyclically sensitive than the unemployment rates of their white counterparts, and they became even more so as the unemployment rate moved below the CBO's natural rate. (This result is signified by the fact that all 8 cycle-specific point estimates reported in the first and second columns for young African American men and women are positive.) Looking across age groups, the fact that the point estimates are generally larger, in absolute value, than the point estimates in

Table 3 shows that young blacks also experience more relative cyclical variation in their unemployment rates (relative to their white counterparts) than do blacks ages 25 to 64.

For young Hispanics, the results are a little more uneven. Young Hispanic men exhibiting greater cyclicality in their unemployment rates in all four labor market cycles, while young Hispanic women exhibit greater cyclicality in unemployment rates in three of the four. The evidence is mixed on whether the benefits of a strengthening labor market skew more in favor of young Hispanics relative to whites once the economy is operating in high-pressure mode. Of the eight interaction coefficients for young Hispanic men and women, only five are positive (only two of which are statistically significant).

(e) Urban vs. rural differences

We examine one final divide of interest: the difference in economic performance between more and less urbanized areas, or what the CPS denotes metropolitan and nonmetropolitan areas.[19] Weingarden (2017) has documented that labor force participation rates in non-metropolitan areas have decreased relative to those in metropolitan areas, going back at least a decade. More recently, the improvement in the unemployment rate has lagged in non-metropolitan areas, with the result that employment rates in these areas have fallen further behind those of metropolitan areas.

That said, the difference in labor market outcomes across metro and non-metro areas seems to be mostly structural and does not appear to be particularly sensitive to the business cycle. For instance, as can be seen in the top panel of figure 19, the unemployment rates in metro and non-metro areas are very similar, both in terms of their levels and cyclical

[19] Metropolitan areas are those that contain a significant population nucleus, apparently of at least 50,000 people, and adjacent communities that have a high degree of integration with that nucleus. Nonmetropolitan areas are the complement. Strictly speaking they are not synonymous with rural areas.

amplitudes.[20] In fact, the data indicate that the unemployment rate in metropolitan areas is a little more cyclically sensitive than the unemployment rate in non-metro areas. In contrast, the participation rates are not particularly cyclical. When, as shown in table 17, we regress the difference in the unemployment rate or labor force participation rate (nonmetropolitan minus metropolitan) on the aggregate unemployment rate gap and a hot labor market interaction, all of the coefficients are close to zero. Moreover, the coefficient on the unemployment rate gap, which is statistically significant, is the opposite of what one would expect if economic expansions were bringing rural area outcomes closer to those in metro areas. Furthermore, there is no evidence that the relationship changes when the unemployment rate falls below its natural rate. These results do not change if we distinguish between small and large metropolitan areas (not shown). Hence, while the evidence is clear that rural and to a lesser extent small metropolitan area labor markets are falling behind those in larger metropolitan areas, the causes seem to be structural and are not ameliorated by a strong national labor market.

(f) Hysteresis

Overall, it is clear that, as the aggregate labor market strengthens, disadvantaged workers benefit disproportionately, and there is suggestive evidence that this high-beta experience intensifies when the labor market is especially strong. However, in Okun's original conception high-pressure economies have an additional impact, because an individual who becomes employed may gain skills and networks that improve future employment prospects. To the extent that this dynamic exists, gains that start out as a result of the strong state of the business cycle could end up having beneficial longer-term effects on individual outcomes--what has been called positive hysteresis. Moreover, if these individual outcomes result in improvements in the

[20] An exception to the typically tight co-movement was the period of the 1980s, when rural areas were devastated by a farm crisis (cf, Barnett, 2000).

economy overall—for instance, a lower unemployment rate on average or higher trend labor force participation—this would also boost to the economy's potential growth rate.

Our approach to this question follows the strand in the literature that has looked for evidence of hysteresis in the aggregate data. Blanchard and Summers (1986) describe hysteresis as the dependence of the current rate of employment on past realizations, and they find evidence of it in Europe, but little in the United States. As noted in Gustavsson and Osterholm (2007), in the macroeconomic literature, hysteresis has generally been interpreted as being reflected in the existence of a unit root in the unemployment rate. The evidence on this has, however, been mixed. Song and Wu (1997) and Gustavsson and Osterholm (2007) find little evidence of a unit root in unemployment in the United States. A few studies have also looked for evidence of a unit root in the employment-to-population ratio. Theoretically, this makes sense because, as we have shown above, individuals adjust along the participation rate margin as well as the unemployment rate margin over the course of the business cycle. And indeed the evidence for a unit root in the employment-to-population ratio seems a bit stronger.[21].

Here we repeat this time series exploration of the question, updating past analysis to include data from the time of the Great Recession and through the current expansion. In addition, we examine unemployment and (non)participation rates by race and ethnicity and by level of education to explore the possibility that, even if aggregate statistics don't show clear evidence of hysteresis, it may be apparent in the labor market outcomes of specific groups. It is also important to note that the identification for this exercise comes from the entire sample, not

[21] See, for example, Gustavsson and Osterholm (2007), who do not reject a unit root in the employment-to-population ratio across a number of countries, including the United States; and Fallick and Krowlikowski (2018), who use state-level data and find evidence of hysteresis in the employment-to-population ratio of low-skilled men that fades roughly 3 years after the shock.

just periods in which there are high-pressure economies, and so we do not distinguish the presence of positive versus negative hysteresis. As in our previous analysis, the tests are done using quarterly data from the CPS; however, because the aging of the population imparts a trend to the aggregate participation rate that could confound the results, we focus on the population aged 25 to 54.

One of the problems with identification of a unit root is that if the data follow a trend or have a break, this can result in a spurious failure to reject a unit root. Indeed, a further inspection of figure 1 shows the unemployment rate drifting down between the 1980s and early 2000s, a time when some evidence suggests that the natural rate was falling, at least in part due to the aging of the baby boomers (cf. Barnichon and Mester, 2018; Staiger, Stock and Watson, 2001). The labor force participation rate more clearly has an uptrend, driven largely by the rapid increase in female labor force participation, but there appears to be a break in that uptrend starting in the mid-1990s. For this reason, we select for our analysis tests that allow us to control for these trends and that include lags to eliminate serial correlation in the errors: the augmented Dickey-Fuller test with generalized least squares detrending and the Zivot-Andrews test, which allows for the possibility of breaks in the intercept and trend, with the break points determined endogenously. Both these tests have the null hypothesis that the series has a unit root.

As can be seen in table 18, the tests indicate that the unemployment rate lacks a unit root, consistent with the previous literature on the topic. In contrast, the tests do not reject that the labor force participation rate has a unit root. Table 19 shows the results for variables broken out by race and gender. The existence of a unit root in the unemployment rate is clearly rejected for white and black men and for Hispanic women. In contrast the tests fail to reject a unit root for white women, suggesting hysteresis. For black women and Hispanic men, the results are

inconclusive. With respect to the nonparticipation rate, the tests indicate the presence of a unit root for each of the groups defined by race, ethnicity and gender.

Table 20 provides an assessment of the evidence of hysteresis for different education groups. The results clearly reject the presence of a unit root in the unemployment rate for men and women with a college education. For the remaining groups, the tests are less conclusive—with one of the tests rejecting the unit root. The tests almost unanimously fail to reject a unit root in the non-participation rate for men and women at all levels of education.[22]

These findings are consistent with there being positive spillovers from an expansion that could have lasting benefits for individuals and the economy, particularly along the participation rate margin, because the tests were consistent with hysteresis in the participation rate for nearly all groups. That said, one caveat to the analysis is that the microeconometric literature on hysteresis, which primarily focuses on the potentially lasting damage of recessions, suggests that employment gains are not expected to be long-lived (cf. Hotchkiss and Moore (2018), Kahn (2010), Kondo (2015), Oreopolous et al, (2012)).[23]

5. Potential costs of a high-pressure economy

We have thus far focused on potential benefits of a high-pressure economy. However, running a hot economy also brings with it potential costs that policymakers should take into account.

[22] We performed several robustness tests. Since a number of studies have suggested that the severity of the Great Recession may have led to an unusual degree of negative hysteresis (Yagan, forthcoming), we reran the tests on a sample ending in 2007Q4, but the results were similar. Using the log odds ratio instead of the rate in order to avoid the problem that the rates are bounded between 0 and 1 also did not materially change the results.

[23] In contrast, these studies find the impact of macroeconomic conditions on wages tends to last longer (see also Hagedorn and Manovskii (2013)).

Perhaps the most obvious risk associated with tight labor markets is the possibility of an unwelcome rise in inflation. Such a concern may seem unwarranted at present, given the apparent flattening of the Phillips curve in recent years along with the observations that inflation has consistently run below the Federal Reserve's target for many of the past 6 years and that inflation expectations appear to be well anchored (see Figure 1). However, it is worth remembering that the last time the unemployment rate was this low—in the late 1960s—inflation (as measured by the PCE price index) moved up from less than 2 percent in 1965 to nearly 5 percent by 1970. In particular, policymakers at the time judged that an unemployment rate of about 4 percent was sustainable in the longer run (Orphanides and Williams, 2013). In retrospect, however, the CBO now estimates the natural rate of unemployment to have been between 5½ and 6 percent in the second half of the 1960s. Moreover, a flatter Phillips curve may not be an unalloyed benefit: If inflation were somehow to become anchored at some level well above the FOMC's preferred level and the Phillips curve were to remain flat, the cost of bringing inflation down might be very high in terms of lost employment and output.

A second risk of a high-pressure economy, also macroeconomic in nature, has to do with the possibility of excessive risk taking in financial markets and a resulting destabilization of the financial system. Again, current circumstances do not suggest that this is an imminent risk. For example, although the Federal Reserve's (2019) Financial Stability Report characterizes valuation pressures as somewhat elevated, the report also notes that large banks are strongly capitalized and concludes that funding risks in the financial system are low relative to the period leading up to the financial crisis. That said, the most recent two recessions were precipitated by financial imbalances that were difficult to identify in real time. Also, some other observers are less sanguine. Of particular note, the Bank for International Settlements' (2018) *Annual Report*

expresses the concern that the accommodative stance of monetary policy that has helped to sustain the expansion and contributed to record-low unemployment has also resulted in building financial vulnerabilities—including a sustained rise in global debt-GDP ratios—that have increased the fragility of the economy.

Third, a hot economy has the potential to distort incentives, leading to decisions that emphasize short-run economic gains at the cost of longer-run sustainable economic progress. One example is the decision by younger individuals as to whether they should work or enroll in school. From a theoretical standpoint, schooling decisions may be influenced by the opportunity cost of attending school and by the direct financial costs of attendance, both of which may vary over the business cycle (though in opposite directions).[24] However, the empirical evidence indicates that enrollment rates tend to be countercyclical, suggesting that the short-term benefits of a high-pressure economy may hinder the building of sustainable career opportunities by incentivizing young people to drop out of school at a critical point in their academic career or to take an unstable job that may disappear with the next recession, rather than invest in training opportunities.[25]

Similarly, a high-pressure economy may encourage firms to focus on short-term economic profits at the expense of decisions aimed at enhancing their longer-run viability. For example, the owners of a firm may decide to defer maintenance of machinery, reorganizations, or research and development activities in a strong economy because the cost of potential forgone sales is viewed as too high. If so, the firm's future productivity may suffer as a result. More

[24] See, for example, Dellas and Sakellaris (2003).
[25] For evidence on 4-year college enrollment, see Dellas and Sakellaris (2003). For evidence on enrollment at community colleges, see Betts and McFarland (1995). For evidence on high-school enrollment, see Dellas and Koubi (2003).

broadly, a high-pressure economy can potentially hinder the reallocation of resources from more-productive to less-productive activities by reducing the pressures on less-productive firms to close down.[26]

Generally speaking, the evidence for both of these mechanisms is mixed. With regard to the first mechanism, some researchers find evidence that firm-level productivity tends to be countercyclical (e.g., Gali and Hammour, 1992). However, others find that spending by firms on types of activity hypothesized to be deferred because of opportunity costs tend to be procyclical (Barlevy, 2007; Francois and Lloyd-Ellis, 2009). With regard to the second mechanism, the evidence largely supports the idea that reallocative effects are procyclical, due largely to the responsiveness of job destruction to business fluctuations.[27] More recently, however, Foster et al. (2016) find support for the positive productivity effects of reallocation in past recessions but found that this mechanism was severely diminished in the Great Recession. Of course, whether any of these results pertain to a high-pressure economy has not been studied directly and thus is still open to question.

6. Conclusions

So where do we stand? A few observations seem clear. First, as previous researchers have shown, when the economy weakens everyone suffers and when the economy strengthens, everyone benefits. This is seen most clearly in unemployment rates: Over our entire sample, the unemployment rates of each group we study move in tandem with the aggregate unemployment

[26] Research on this issue focuses mostly on the behavior of firms in recessions rather than in strong economies. See, for example, Hall (1991), Caballero and Hammour (1994), and Aghion and Howitt (1992). Aghion and Saint-Paul (1998) and Legrand and Hagemann (2017) provide a good overview of both mechanisms.
[27] See, for example, Davis and Haltiwanger (1990) and Davis, Faberman, and Haltiwanger (2006, 2012).

rate. Second, like others, we also find that the fluctuations of less advantaged groups including blacks, Hispanics, and those with less than a college education are more pronounced. When the labor market weakens, these groups tend to suffer disproportionately; when it recovers, their experience improves disproportionately. Third, inspired by Arthur Okun, we have also searched for evidence that high-pressure economies are qualitatively different, and we have found suggestive evidence that this is the case. A high-pressure economy does afford greater improvement for some less advantaged groups—most notably blacks and women with less than a college degree—in some key labor market variables, although the evidence is complicated by the heterogeneity observed across the various cycles. Finally, we also find suggestive evidence that these benefits persist at least for a while, particularly for labor force attachment. All in all, the evidence presented here supports the idea that high-pressure economies are different than normal expansions, but just how different remains a topic for further study.

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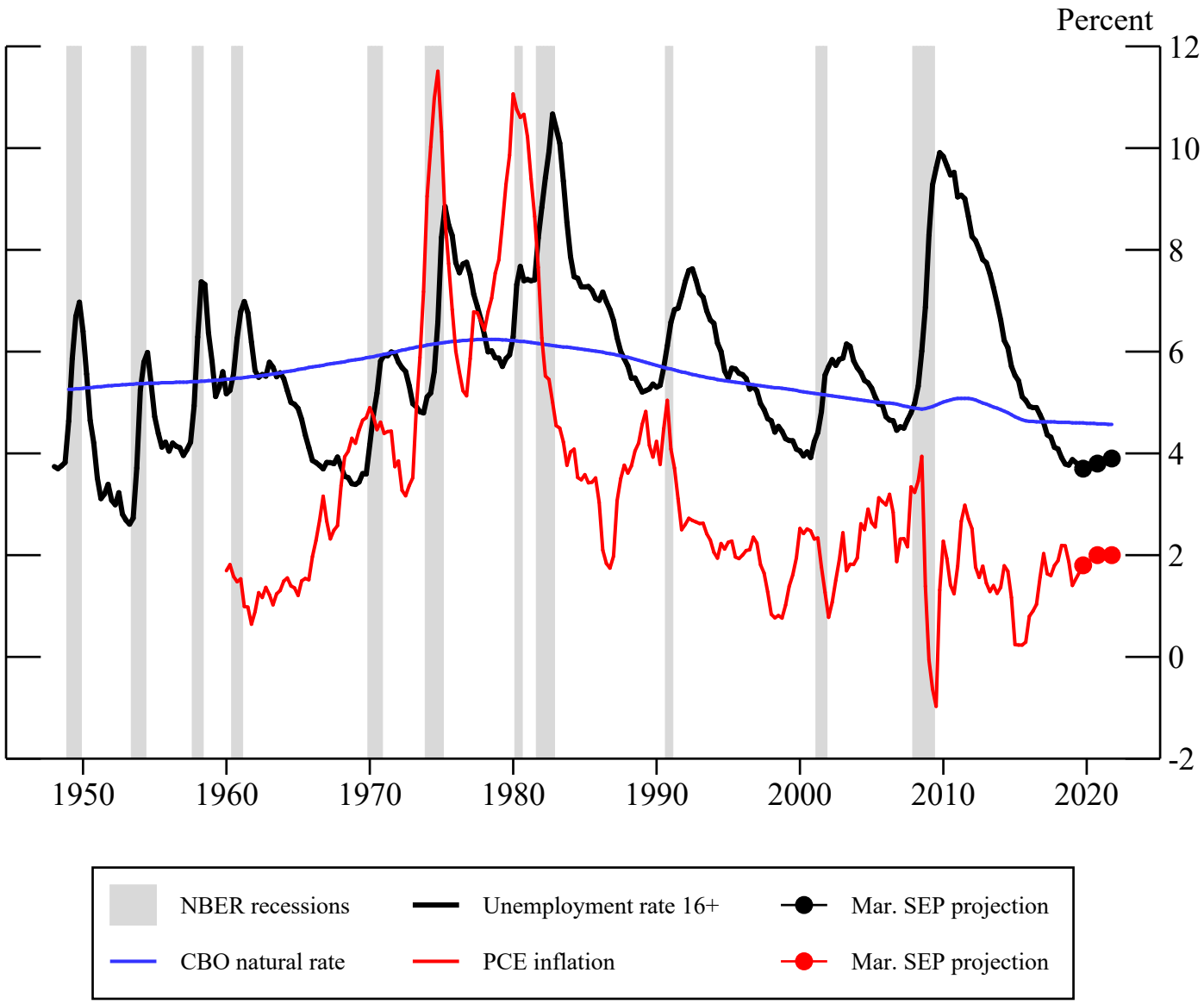
Figure 1:
Unemployment and Inflation



Source: BLS, CBO and Summary of Economic Projections, Federal Reserve: March 2019

Figure 2:
Labor Force Statistics by Race/Ethnicity, (Ages 25-64)

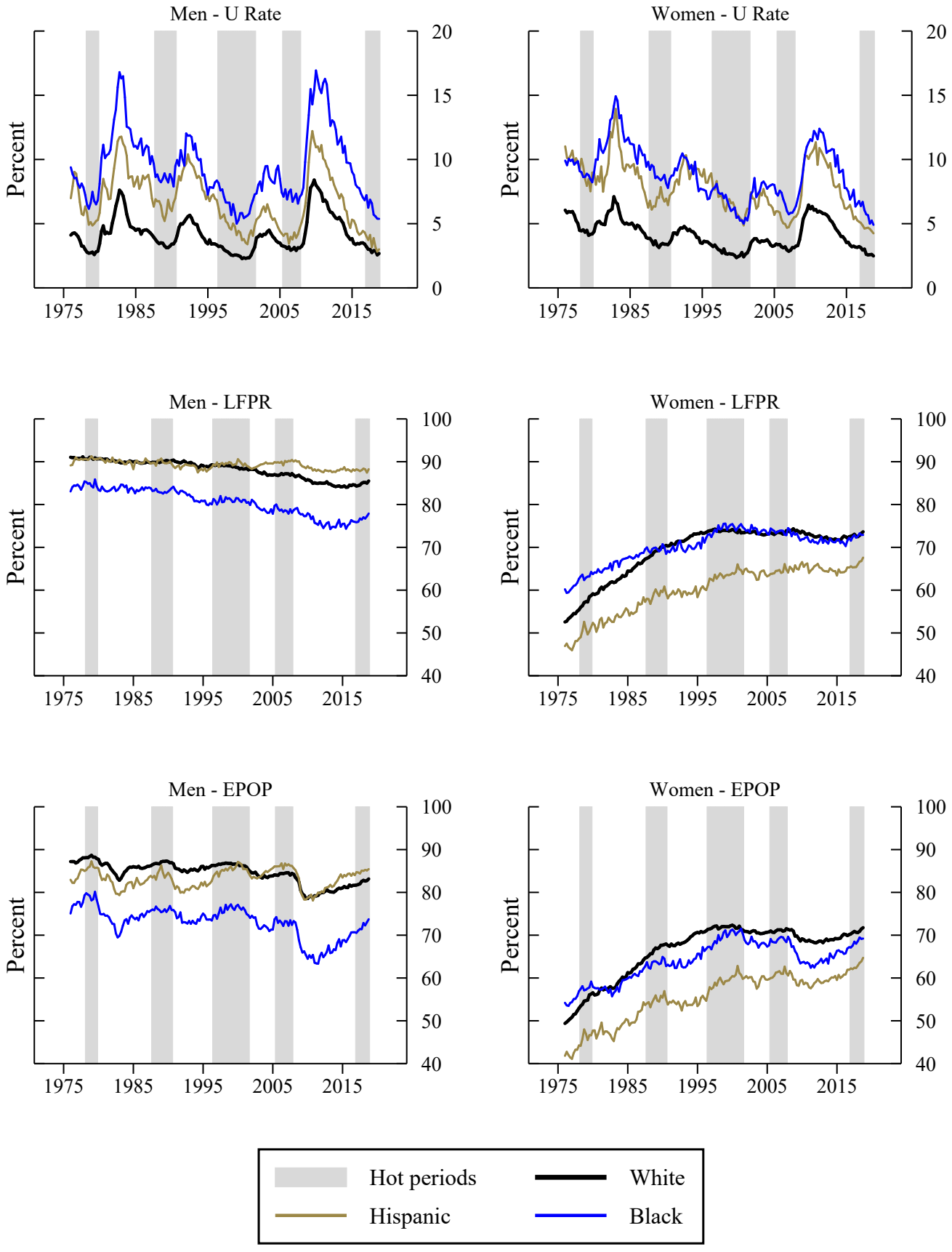


Figure 3:
Labor Force Statistics by Education, (Ages 25-64)

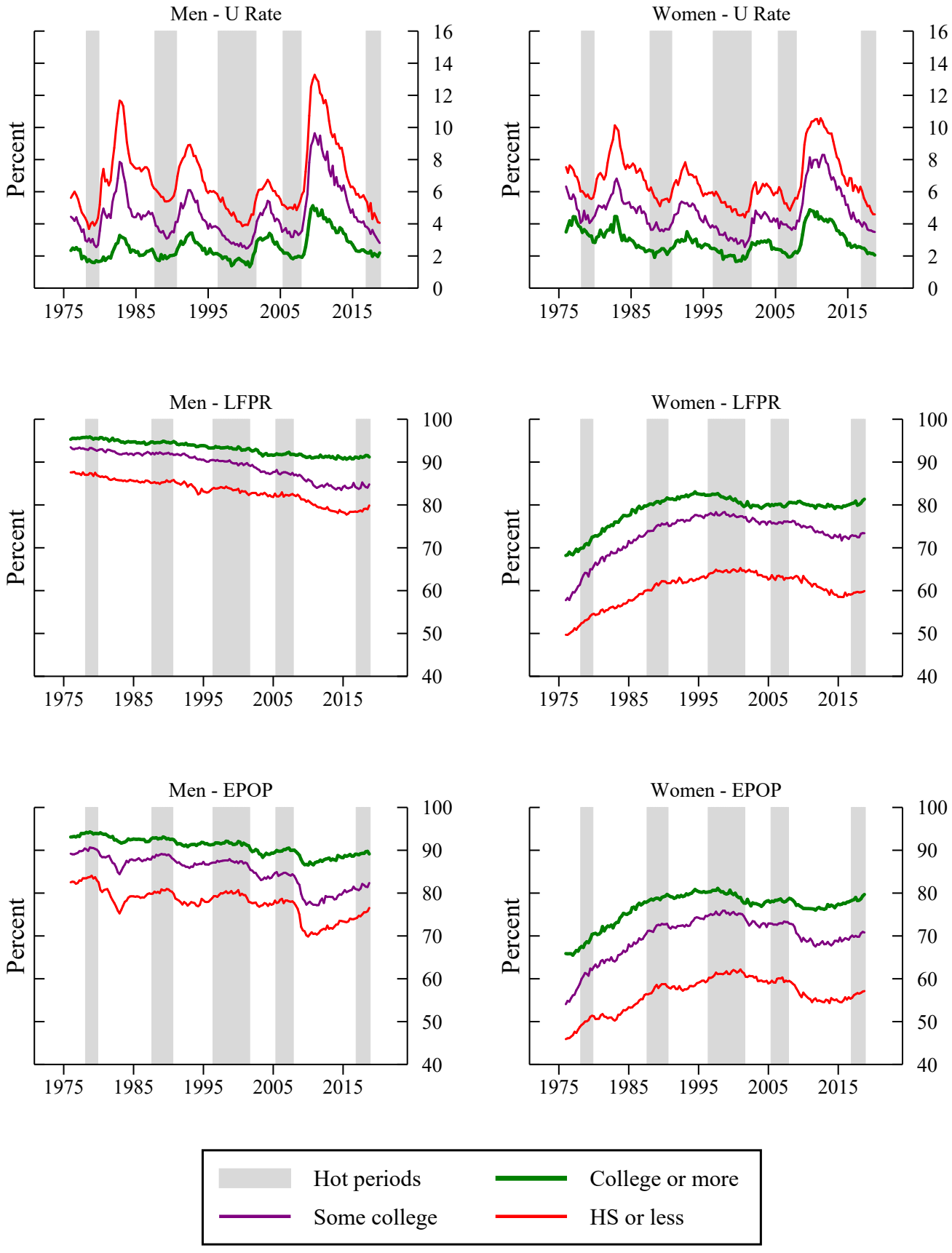


Figure 4:
Earnings and Income by Race/Ethnicity, (Ages 25-64)

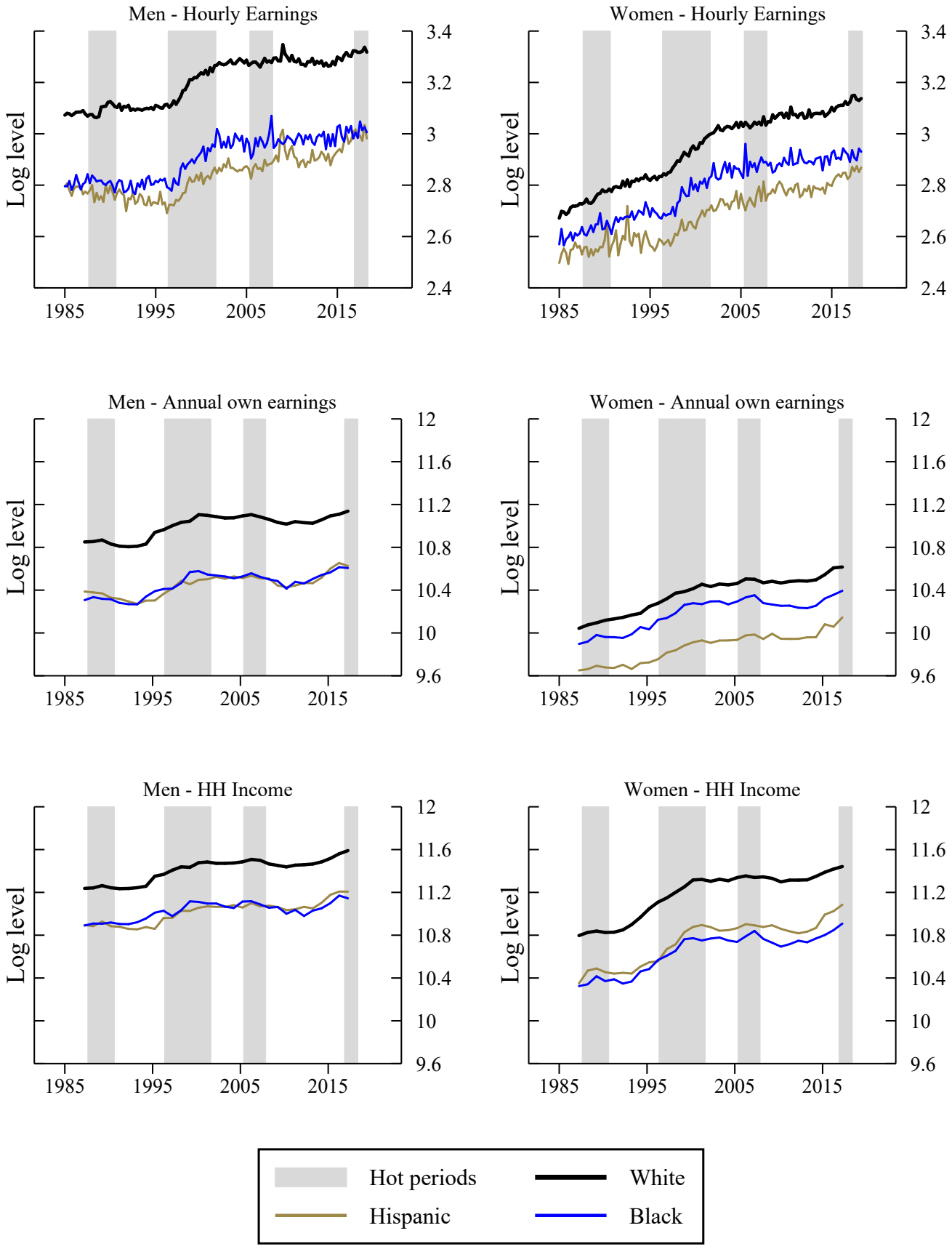


Figure 5:
Earnings and Income by Education, (Ages 25-64)

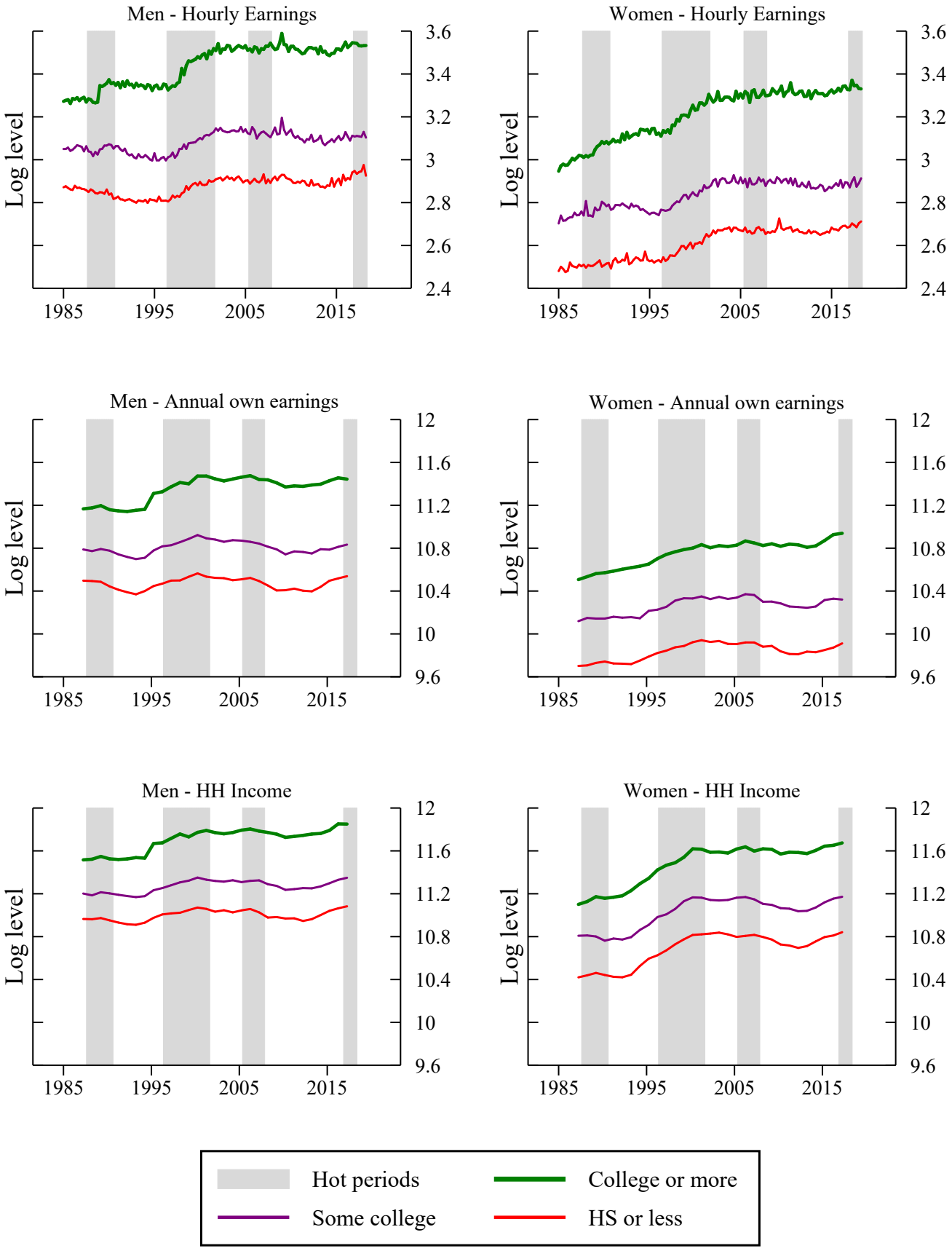


Table 1:
Gaps by Race/Ethnicity and Sex - Full Sample, Ages 25-64

		Men		Women	
		Const.	Ugap	Const.	Ugap
U rate	Black	4.446***	0.909***	4.214***	0.513***
		(0.119)	(0.078)	(0.156)	(0.116)
	Hispanic	2.234***	0.394***	3.427***	0.339***
		(0.180)	(0.086)	(0.183)	(0.091)
Non-participation	Black	7.609***	0.077	-1.026**	0.081
		(0.170)	(0.128)	(0.440)	(0.247)
	Hispanic	-0.936***	-0.152	9.362***	-0.250*
		(0.296)	(0.152)	(0.358)	(0.132)
Non-employment	Black	10.960***	0.708***	1.982***	0.418**
		(0.136)	(0.094)	(0.427)	(0.202)
	Hispanic	1.092**	0.217	11.066***	-0.098
		(0.440)	(0.220)	(0.420)	(0.151)
Hourly earnings	Black	29.559***	-0.057	14.780***	-0.045
		(0.407)	(0.220)	(0.721)	(0.424)
	Hispanic	35.812***	-0.566	24.691***	-0.402
		(0.876)	(0.477)	(0.976)	(0.657)
Annual own earnings	Black	54.391***	1.163***	16.005***	2.286***
		(0.735)	(0.342)	(1.008)	(0.431)
	Hispanic	51.205***	0.634	46.906***	0.802*
		(1.505)	(0.585)	(1.203)	(0.436)
HH income	Black	37.497***	1.048**	52.804***	1.481***
		(1.074)	(0.485)	(1.354)	(0.420)
	Hispanic	39.516***	-0.077	43.747***	0.637
		(1.052)	(0.360)	(1.522)	(0.570)

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1976Q1-2018Q4 for EPOP, U rate, and LFPR. 1987-2017 for Annual own earnings and HH income. 1979Q1-2018Q4 when available for Hourly earnings.

Table 2:
Gaps by Education and Sex - Full Sample, Ages 25-64

		Men		Women	
		Const.	Ugap	Const.	Ugap
U rate	HS or less	3.350***	0.969***	3.291***	0.560***
		(0.106)	(0.052)	(0.068)	(0.038)
	Some college	1.556***	0.583***	1.509***	0.365***
		(0.038)	(0.019)	(0.051)	(0.047)
Non-participation	HS or less	9.848***	0.114	18.469***	0.179
		(0.231)	(0.119)	(0.324)	(0.146)
	Some college	3.715***	0.258	5.588***	0.237*
		(0.278)	(0.168)	(0.304)	(0.139)
Non-employment	HS or less	12.446***	0.851***	19.998***	0.414***
		(0.214)	(0.082)	(0.325)	(0.139)
	Some college	5.036***	0.733***	6.551***	0.467***
		(0.261)	(0.145)	(0.287)	(0.132)
Hourly earnings	HS or less	53.694***	-0.264	58.512***	-0.535
		(1.629)	(1.117)	(1.279)	(0.910)
	Some college	33.728***	-0.213	35.725***	-0.290
		(1.386)	(0.927)	(1.351)	(0.893)
Annual own earnings	HS or less	88.480***	2.782*	97.156***	2.517***
		(3.290)	(1.103)	(1.847)	(0.643)
	Some college	54.065***	2.327*	50.452***	2.268***
		(3.036)	(0.955)	(1.802)	(0.668)
HH income	HS or less	69.102***	1.597*	77.731***	1.817***
		(2.416)	(0.793)	(1.429)	(0.557)
	Some college	42.519***	1.229*	43.705***	2.029***
		(1.957)	(0.631)	(1.632)	(0.567)

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1976Q1-2018Q4 for EPOP, U rate, and LFPR. 1987-2017 for Annual own earnings and HH income. 1979Q1-2018Q4 when available for Hourly earnings.

Figure 6:
U Rate Gap by Race/Ethnicity and Sex (Ages 25-64)

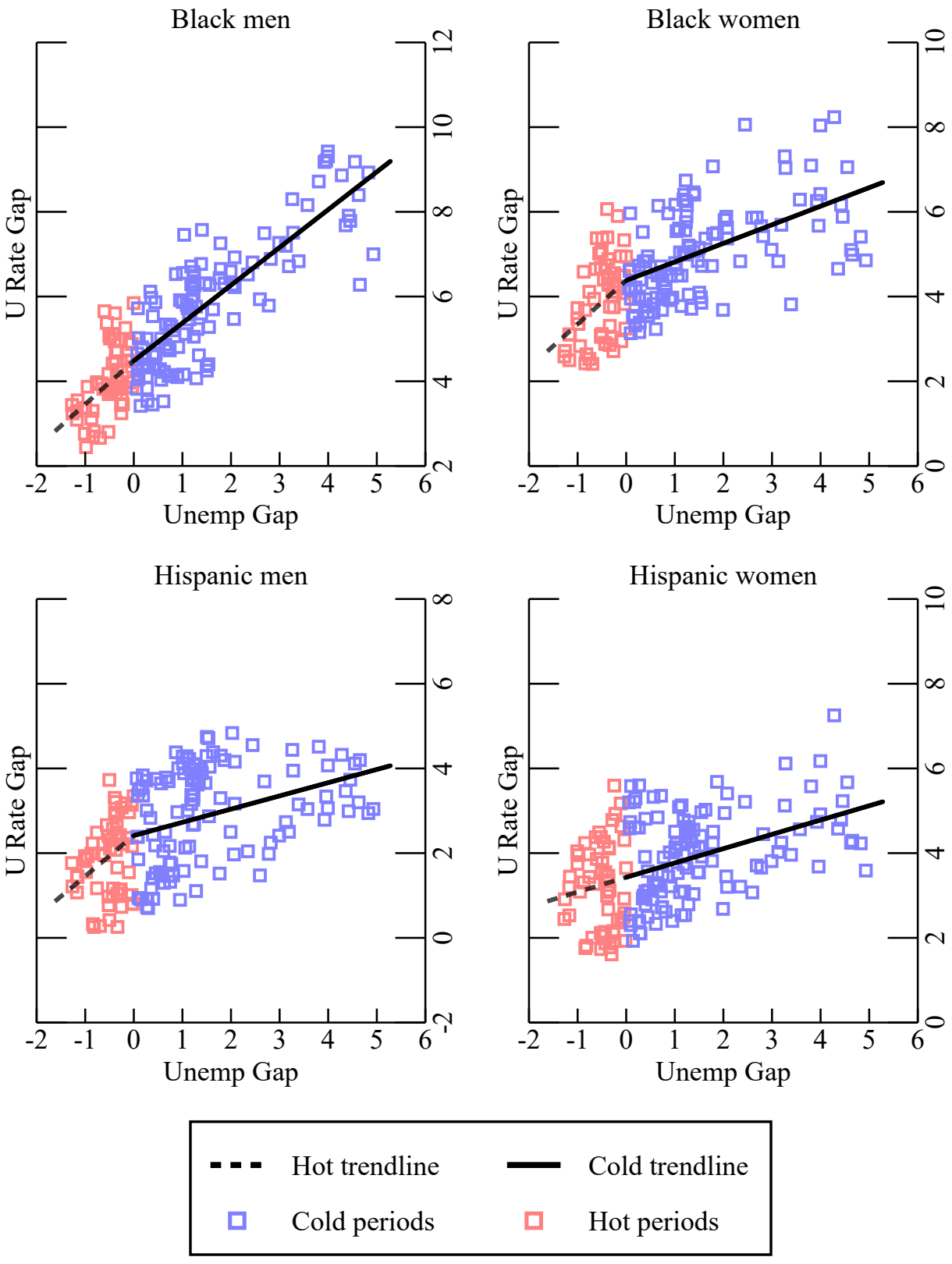


Figure 7:
U Rate Gap by Education and Sex (Ages 25-64)

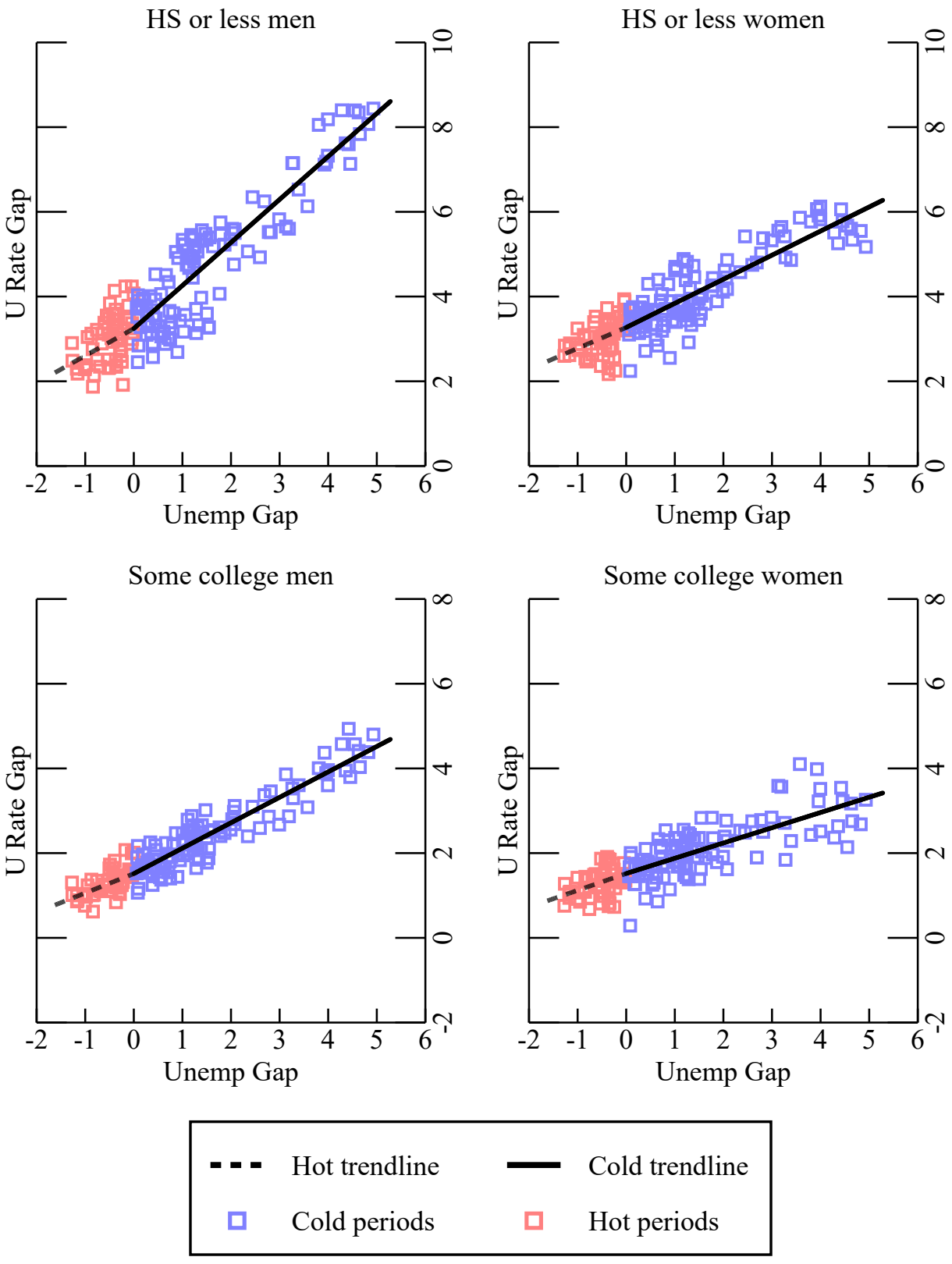


Figure 8:
U Rate Gap for Hispanic and White Men, Ages 25-64

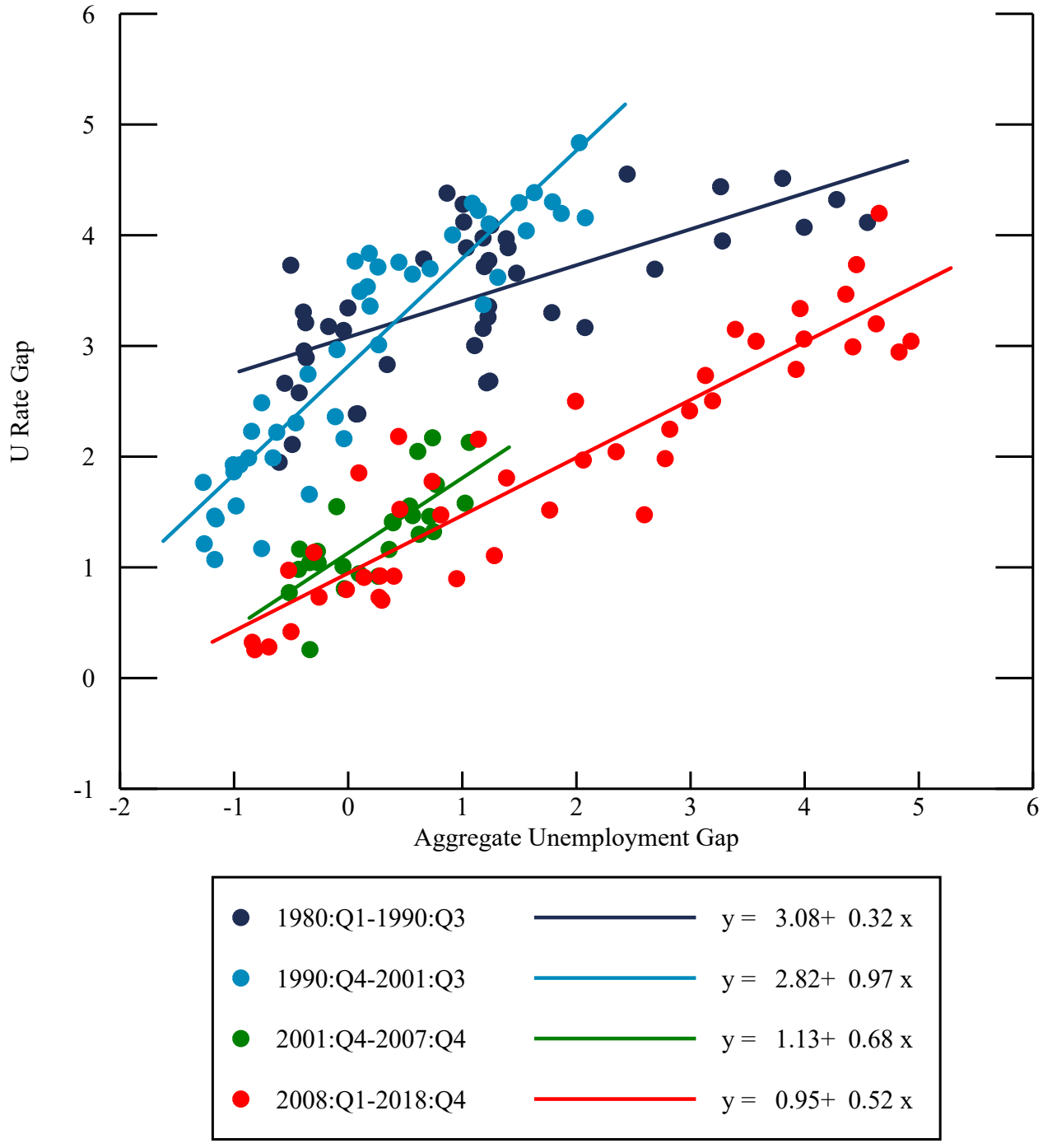


Table 3:
U Rate Gaps by Race/Ethnicity, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.881***	0.252	1.133	0.324***	0.566	0.890	0.445***	0.668	1.114	0.382***	-0.127	0.255
	(0.102)	(0.347)		(0.110)	(0.481)		(0.143)	(0.427)		(0.126)	(0.515)	
1980:Q1-1990:Q3	0.854***	-0.426	0.428	0.272***	0.635	0.906	0.555***	-0.308	0.247	0.725***	-1.819***	-1.094
	(0.052)	(0.485)		(0.058)	(0.604)		(0.095)	(0.504)		(0.091)	(0.669)	
1990:Q4-2001:Q3	0.862***	0.193	1.055	0.678***	0.782***	1.460	0.658***	0.171	0.828	-0.095	1.548***	1.453
	(0.121)	(0.307)		(0.124)	(0.288)		(0.171)	(0.431)		(0.204)	(0.424)	
2001:Q4-2007:Q4	0.254	0.511	0.765	0.871***	-0.660	0.211	0.335	1.752*	2.087	1.101***	0.410	1.511
	(0.407)	(1.234)		(0.243)	(0.584)		(0.357)	(0.866)		(0.211)	(0.516)	
2008:Q1-2018:Q4	0.905***	0.899*	1.804	0.501***	0.314	0.815	0.443***	1.029***	1.472	0.518***	-0.024	0.494
	(0.126)	(0.474)		(0.053)	(0.340)		(0.098)	(0.378)		(0.063)	(0.232)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table 4:
U Rate Gaps by Education, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	HS or less			Some college			HS or less			Some college		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.985***	-0.206	0.779	0.591***	-0.087	0.504	0.538***	0.039	0.577	0.337***	0.123	0.460
	(0.063)	(0.251)		(0.025)	(0.105)		(0.046)	(0.155)		(0.059)	(0.136)	
1980:Q1-1990:Q3	1.003***	-0.358	0.645	0.534***	0.419	0.952	0.469***	0.668	1.137	0.143***	0.702*	0.845
	(0.034)	(0.274)		(0.038)	(0.254)		(0.051)	(0.497)		(0.049)	(0.377)	
1990:Q4-2001:Q3	1.015***	0.031	1.046	0.594***	-0.151*	0.443	0.501***	-0.077	0.424	0.459***	-0.119	0.340
	(0.069)	(0.170)		(0.029)	(0.090)		(0.082)	(0.168)		(0.063)	(0.126)	
2001:Q4-2007:Q4	0.341**	-0.672*	-0.331	0.602***	-1.046**	-0.444	-0.169	1.327***	1.157	0.107	-0.556	-0.449
	(0.163)	(0.371)		(0.176)	(0.411)		(0.185)	(0.449)		(0.125)	(0.340)	
2008:Q1-2018:Q4	1.009***	0.053	1.062	0.569***	0.199	0.767	0.520***	0.600***	1.119	0.354***	0.118	0.472
	(0.054)	(0.310)		(0.027)	(0.166)		(0.064)	(0.216)		(0.068)	(0.221)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Figure 9:
Non-participation Gap by Race/Ethnicity and Sex (Ages 25-64)

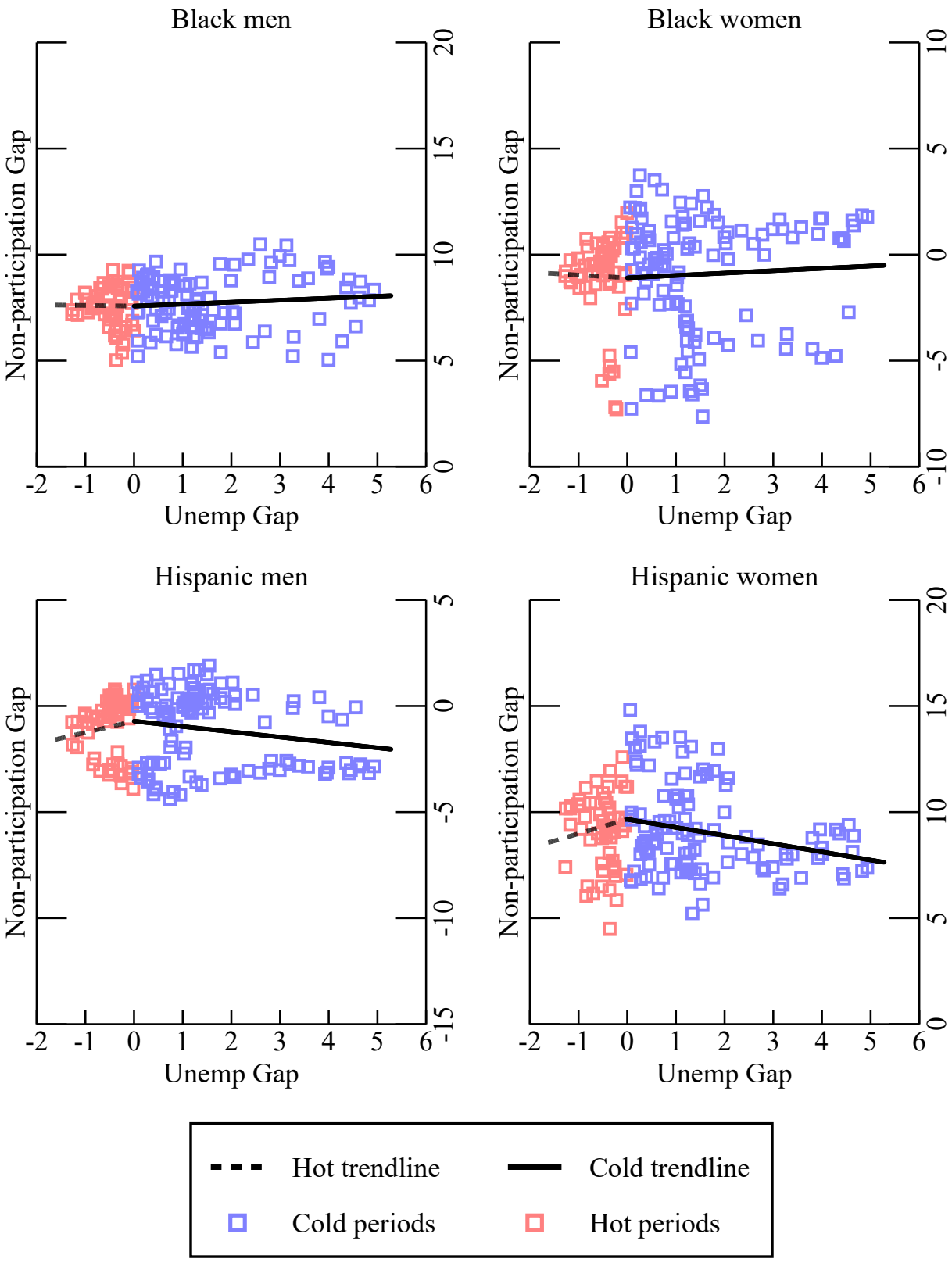


Table 5:
Non-participation Gaps by Race/Ethnicity, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.032	0.040	0.073	-0.213	0.597	0.384	-0.093	0.556	0.463	-0.491***	1.426	0.935
	(0.163)	(0.428)		(0.203)	(0.780)		(0.301)	(0.876)		(0.169)	(0.966)	
1980:Q1-1990:Q3	-0.140	-0.701	-0.841	-0.093*	0.486	0.393	-0.502**	-4.058**	-4.560	-0.194	-1.497	-1.692
	(0.117)	(0.680)		(0.054)	(0.569)		(0.228)	(1.574)		(0.156)	(1.309)	
1990:Q4-2001:Q3	-0.719***	1.520***	0.801	0.148	1.339***	1.486	-0.134	2.923***	2.789	-0.422	3.348***	2.926
	(0.152)	(0.338)		(0.159)	(0.347)		(0.330)	(0.735)		(0.265)	(0.680)	
2001:Q4-2007:Q4	0.630	-2.659*	-2.029	1.472*	-1.051	0.421	-0.610	0.863	0.253	0.879	-0.576	0.302
	(0.501)	(1.355)		(0.730)	(1.580)		(0.493)	(1.240)		(0.726)	(1.803)	
2008:Q1-2018:Q4	0.053	1.073**	1.125	0.213***	-1.490***	-1.277	0.191**	0.141	0.332	-0.028	1.976***	1.947
	(0.106)	(0.480)		(0.044)	(0.270)		(0.077)	(0.544)		(0.089)	(0.543)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Figure 10:
Non-participation Gap by Education and Sex (Ages 25-64)

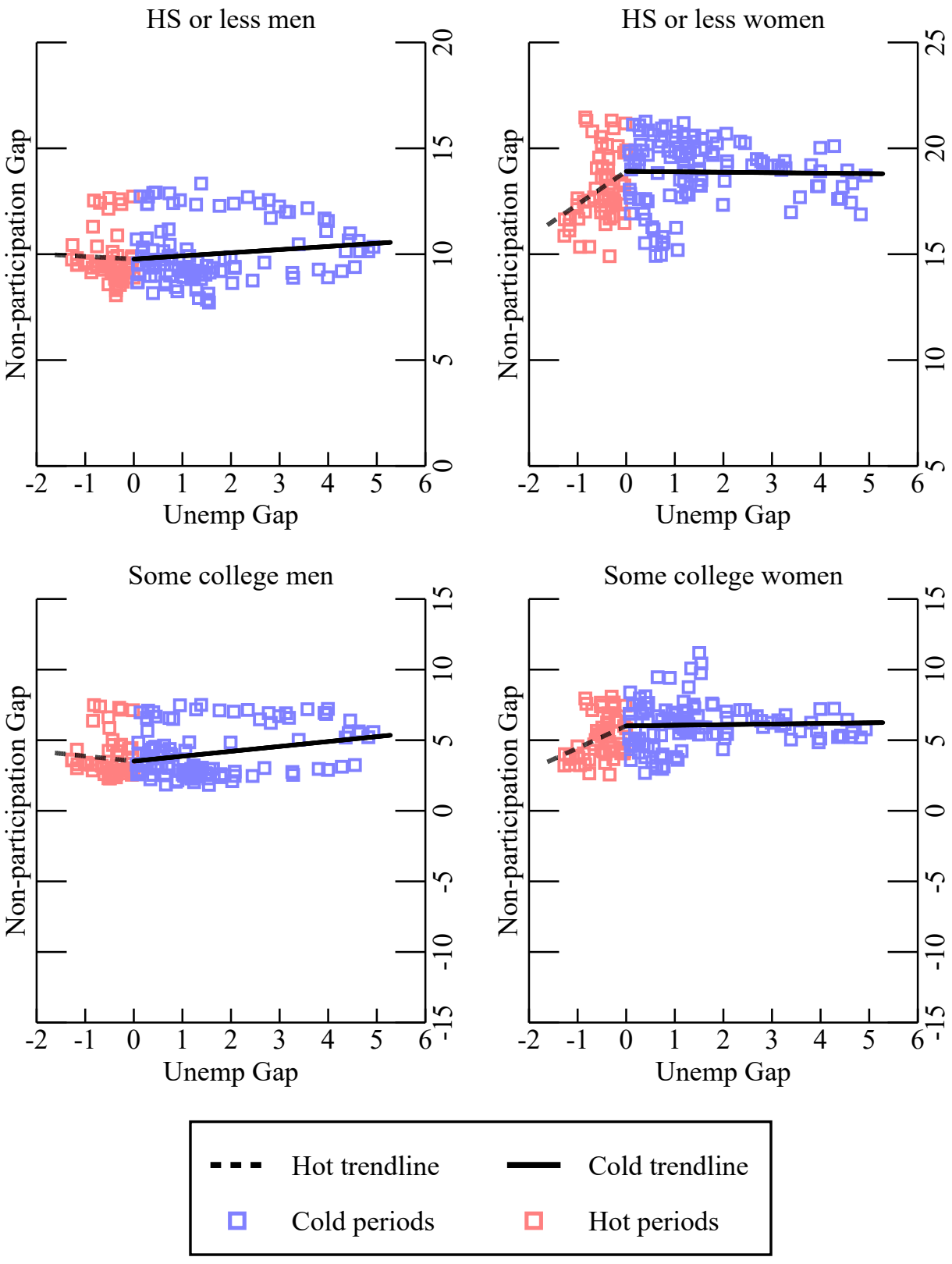


Table 6:
Non-participation Gaps by Education, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	HS or less			Some college			HS or less			Some college		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.098	-0.060	0.038	0.309	-0.532	-0.223	-0.055	1.690*	1.635	0.114	1.115	1.229
	(0.149)	(0.591)		(0.206)	(0.772)		(0.161)	(0.866)		(0.135)	(0.696)	
1980:Q1-1990:Q3	0.048	-0.861***	-0.813	0.117***	-0.371	-0.254	-0.047	1.221	1.175	0.059	1.999***	2.057
	(0.037)	(0.251)		(0.029)	(0.266)		(0.104)	(0.967)		(0.053)	(0.439)	
1990:Q4-2001:Q3	-0.431**	0.913*	0.482	-0.347***	0.140	-0.207	0.398	2.021***	2.420	0.449**	0.763**	1.212
	(0.177)	(0.462)		(0.098)	(0.214)		(0.276)	(0.544)		(0.180)	(0.340)	
2001:Q4-2007:Q4	-0.089	0.234	0.144	-0.110	-0.921	-1.031	-1.750***	2.117*	0.366	-0.619*	0.492	-0.127
	(0.397)	(0.887)		(0.169)	(0.640)		(0.440)	(1.081)		(0.302)	(0.821)	
2008:Q1-2018:Q4	-0.307*	0.545	0.238	-0.106	-0.334	-0.440	-0.567***	-0.167	-0.734	-0.357***	-0.626	-0.983
	(0.155)	(1.058)		(0.126)	(0.740)		(0.143)	(1.052)		(0.126)	(0.915)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Figure 11:
Non-employment Gap by Race/Ethnicity and Sex (Ages 25-64)

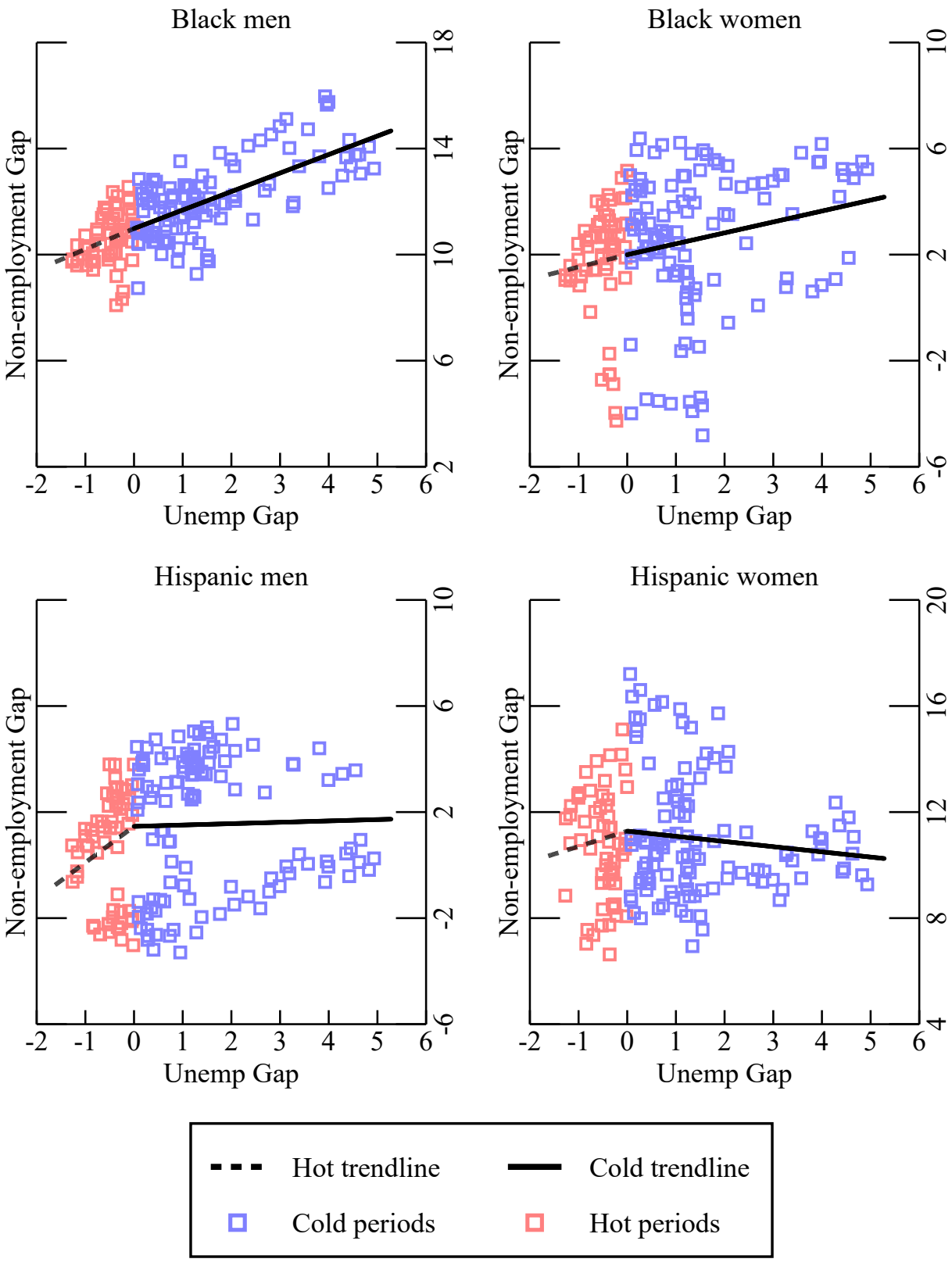


Table 7:
Non-employment Gaps by Race/Ethnicity, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.637***	0.310	0.947	0.101	1.054	1.155	0.209	0.906	1.114	-0.291	1.119	0.828
	(0.114)	(0.312)		(0.289)	(1.160)		(0.229)	(0.716)		(0.208)	(1.193)	
1980:Q1-1990:Q3	0.538***	-1.037	-0.498	0.153**	1.120	1.273	-0.120	-4.330**	-4.450	0.121	-2.763*	-2.643
	(0.087)	(0.675)		(0.075)	(0.908)		(0.226)	(1.670)		(0.165)	(1.377)	
1990:Q4-2001:Q3	-0.004	1.547***	1.543	0.755***	1.953***	2.708	0.272	2.916***	3.188	-0.596*	4.122***	3.526
	(0.199)	(0.400)		(0.241)	(0.550)		(0.282)	(0.543)		(0.309)	(0.791)	
2001:Q4-2007:Q4	0.667	-1.856	-1.188	2.172**	-1.570	0.602	-0.324	2.108*	1.784	1.481*	-0.277	1.204
	(0.613)	(1.822)		(0.817)	(1.784)		(0.382)	(1.069)		(0.751)	(1.722)	
2008:Q1-2018:Q4	0.672***	1.667**	2.339	0.676***	-1.194***	-0.518	0.497***	0.800	1.297	0.264***	1.838***	2.102
	(0.164)	(0.640)		(0.067)	(0.429)		(0.092)	(0.527)		(0.089)	(0.541)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Figure 12:
Non-employment Gap by Education and Sex (Ages 25-64)

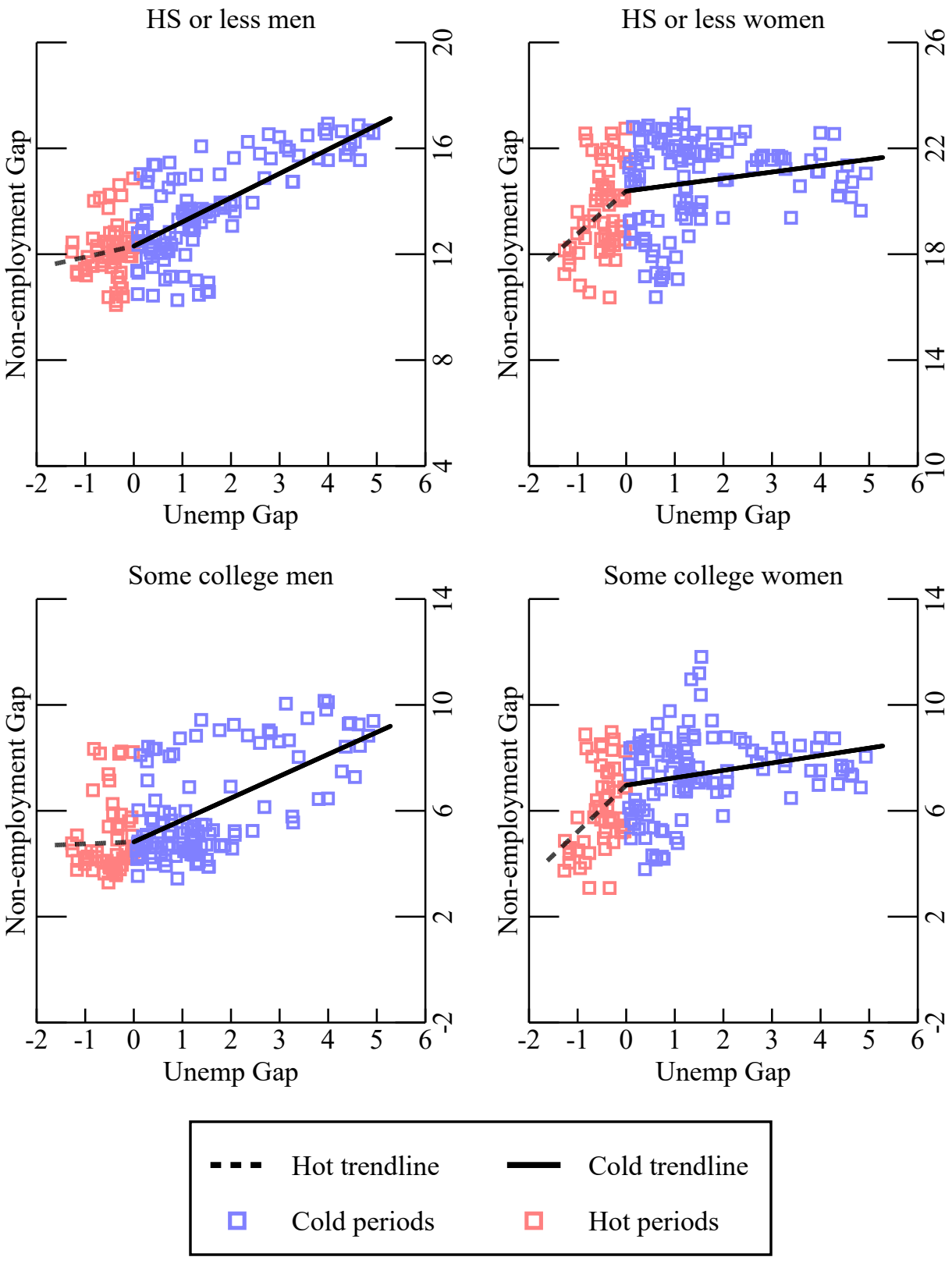


Table 8:
Non-employment Gaps by Education, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	HS or less			Some college			HS or less			Some college		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.843***	-0.175	0.669	0.784***	-0.545	0.239	0.174	1.605*	1.779	0.326**	1.170*	1.497
	(0.099)	(0.489)		(0.174)	(0.697)		(0.157)	(0.837)		(0.126)	(0.700)	
1980:Q1-1990:Q3	0.887***	-1.071**	-0.184	0.603***	0.025	0.627	0.115	1.461	1.577	0.120	2.393***	2.513
	(0.058)	(0.414)		(0.056)	(0.295)		(0.139)	(1.293)		(0.079)	(0.663)	
1990:Q4-2001:Q3	0.412**	0.887*	1.299	0.204**	-0.022	0.181	0.615**	1.877***	2.492	0.765***	0.654*	1.418
	(0.166)	(0.444)		(0.091)	(0.203)		(0.242)	(0.473)		(0.198)	(0.379)	
2001:Q4-2007:Q4	0.056	-0.200	-0.144	0.309	-1.611**	-1.302	-1.890***	2.884**	0.994	-0.573*	0.149	-0.424
	(0.404)	(0.811)		(0.252)	(0.776)		(0.441)	(1.025)		(0.313)	(0.939)	
2008:Q1-2018:Q4	0.462***	0.509	0.971	0.352***	-0.200	0.152	-0.295**	0.100	-0.195	-0.101	-0.574	-0.675
	(0.116)	(0.831)		(0.108)	(0.672)		(0.141)	(1.010)		(0.119)	(0.865)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table 9

Increments to β when the unemployment rate is below the natural rate

	Unemployment rate	Non-participation rate	Non-employment rate
Black men	*	@	@
Black women	**	*	**
Hispanic men	*		
Hispanic women		@	@
HS or less men		*	
HS or less women	**	**	**
Some college men			
Some college women		**	**

* At least three cycle-specific increments to β estimated to have been positive, of which no more than one is statistically significantly different from zero at the 10 percent level or better.

** At least two of the positive increments to β estimated to have been statistically significantly different from zero at the 10 percent level or better.

@ Two cycle-specific increments to β estimated to have been positive and statistically significantly different from zero at the 10 percent level or better, but the other two increments estimated to have been negative.

Table 10:
Gaps by Demographic Group - Metropolitan Areas, Ages 25-64

		Slope Ugap>0	Increment Ugap<0
U rate	Black	0.476***	0.816**
		(0.172)	(0.394)
	Hispanic	0.305*	-0.238
		(0.171)	(0.341)
	HS or less	0.880***	0.246
		(0.104)	(0.201)
	Some college	0.477***	0.267**
		(0.078)	(0.133)
NLFPR	Black	0.326	1.054
		(0.252)	(0.832)
	Hispanic	-0.141	-0.745
		(0.312)	(0.803)
	HS or less	-0.0778	-0.268
		(0.165)	(0.436)
	Some college	-0.0533	0.701*
		(0.169)	(0.388)

Note: Robust standard errors, clustered by metropolitan area, are in parentheses. All regressions include year and metropolitan area fixed effects. Yearly data from 2004Q3 – 2008Q4 is used to calculate the natural rate of unemployment. Regressions then include 2009Q1 - 2018Q4. Regressions are weighted by population size. Metropolitan areas included have an average of 75 observations per demographic category and an average population of over 500,000 over the 15-year period. Regressions on the black gap include 520 observations, on the Hispanic gap include 513 observations, on the HS or less gap include 530 observations, and on the some college gap include 540 observations. * p<.10, ** p<.05, *** p<.01

Figure 13:
Earnings Gap by Race/Ethnicity and Sex (Ages 25-64)

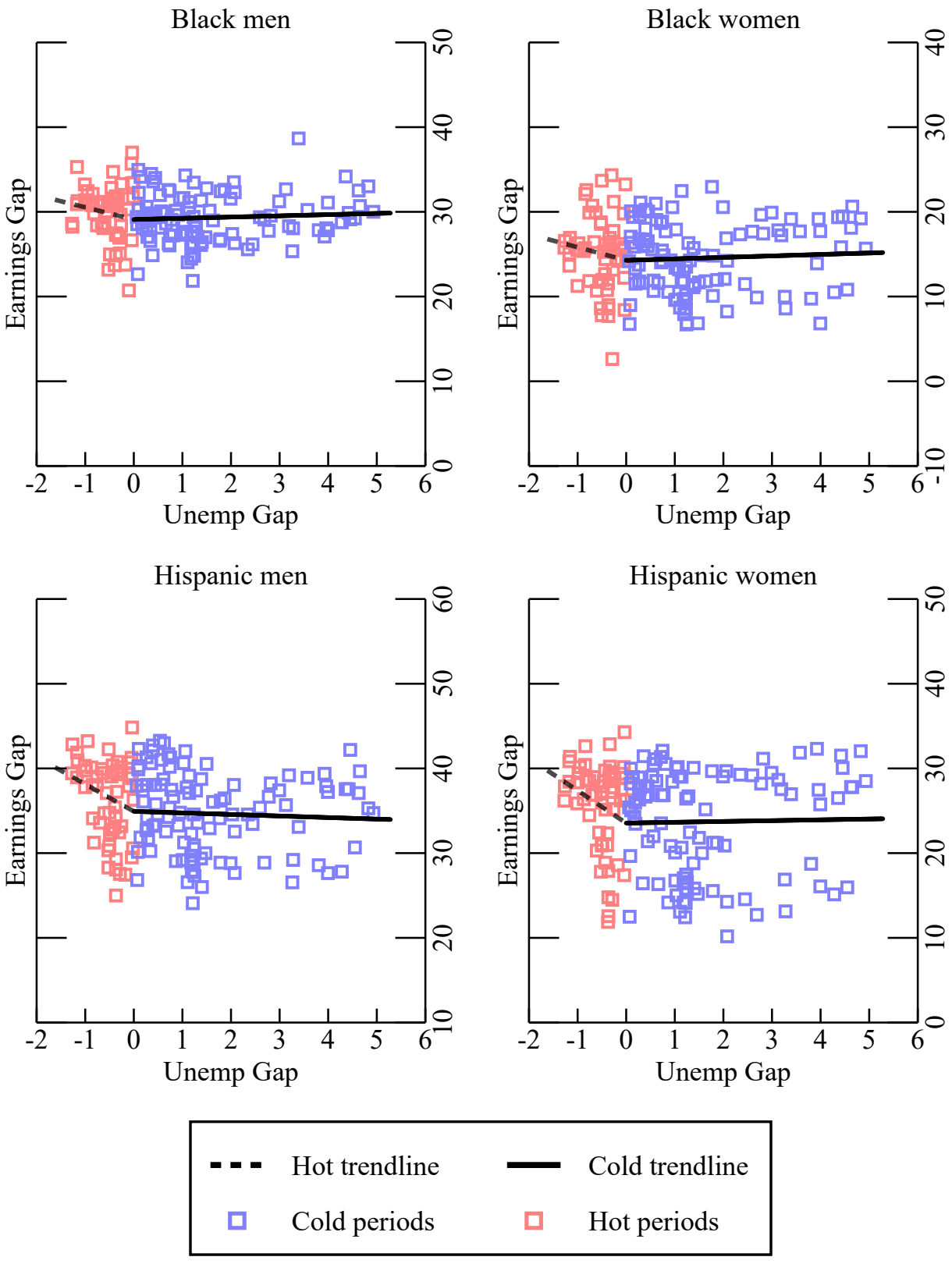


Table 11:
Hourly Earnings Gaps by Race/Ethnicity, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.099	-1.687*	-1.588	-0.291	-3.190	-3.482	0.073	-1.821	-1.748	-0.030	-4.085*	-4.115
	(0.268)	(0.883)		(0.582)	(2.086)		(0.507)	(1.747)		(0.796)	(2.300)	
1980:Q1-1990:Q3	0.280	-4.253	-3.973	-0.258	-7.919***	-8.177	-0.354	-1.754	-2.108	-0.435	-6.250*	-6.686
	(0.353)	(2.877)		(0.309)	(1.850)		(0.274)	(2.068)		(0.407)	(3.474)	
1990:Q4-2001:Q3	0.246	-1.439	-1.193	-1.662***	-0.796	-2.458	-1.209**	0.408	-0.801	-3.671***	1.672	-2.000
	(0.555)	(1.246)		(0.503)	(1.206)		(0.503)	(1.255)		(0.630)	(1.179)	
2001:Q4-2007:Q4	1.014	-2.762	-1.748	-0.741	3.689	2.948	0.250	1.596	1.846	-0.948	5.861	4.914
	(4.086)	(11.081)		(1.095)	(3.007)		(1.958)	(5.327)		(1.527)	(4.052)	
2008:Q1-2018:Q4	0.042	-0.220	-0.178	0.762**	1.693	2.455	-0.332*	-3.530***	-3.862	0.305*	-1.553	-1.248
	(0.277)	(1.429)		(0.338)	(1.933)		(0.195)	(1.049)		(0.154)	(1.544)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1980:Q1-1990:Q3 cycle missing some quarters. All other cycles contain all quarters.

Figure 14:
Earnings Gap by Education and Sex (Ages 25-64)

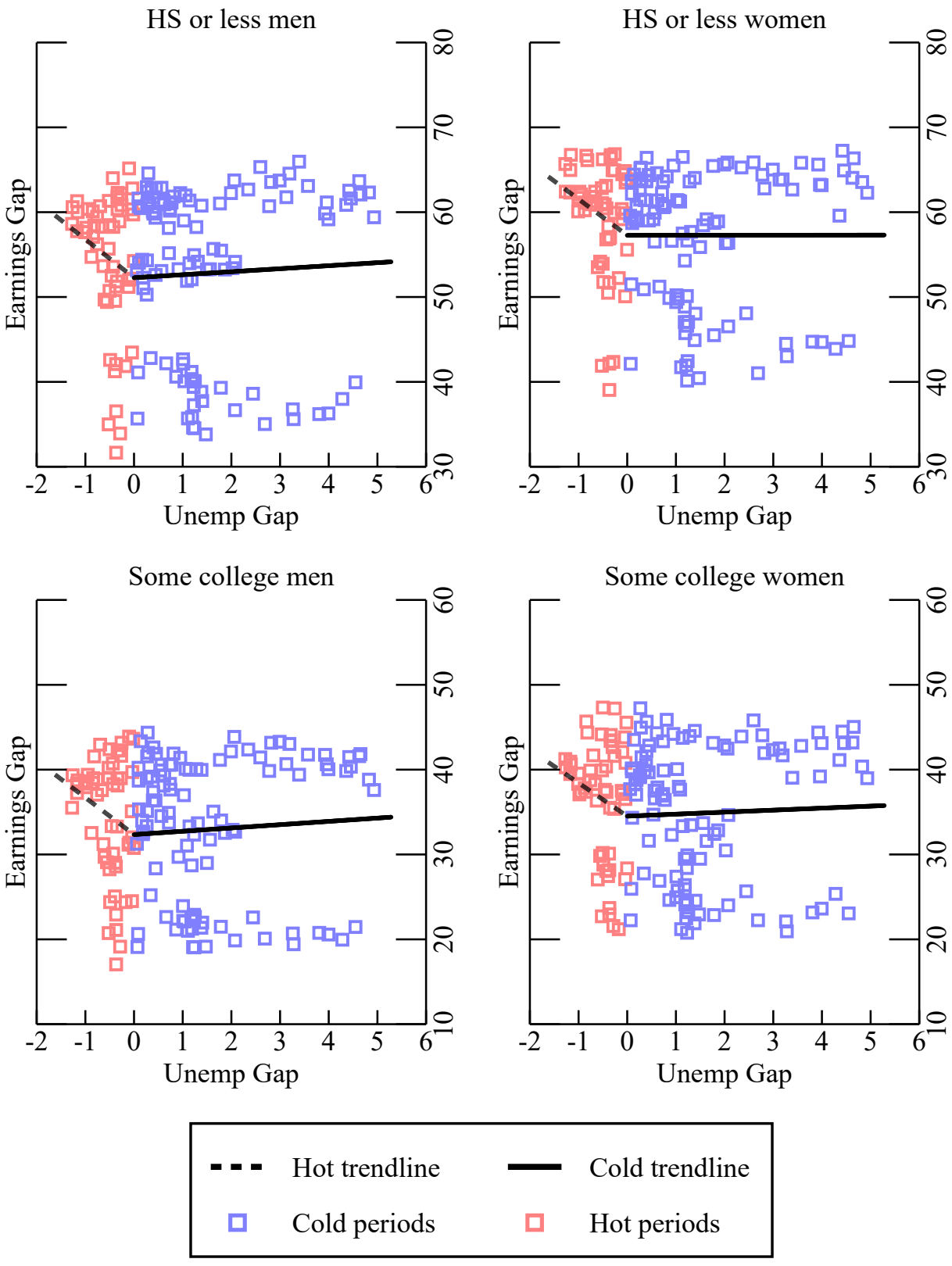


Table 12:
Hourly Earnings Gaps by Education, Sex, and Business Cycle, Ages 25-64

	Men						Women					
	HS or less			Some college			HS or less			Some college		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.115	-5.255	-5.140	0.212	-5.009	-4.798	-0.205	-4.617	-4.822	0.076	-4.406	-4.330
	(1.376)	(3.773)		(1.144)	(3.245)		(1.102)	(2.955)		(1.099)	(3.167)	
1980:Q1-1990:Q3	-1.267*	-13.473***	-14.740	-0.712**	-9.443***	-10.155	-1.437**	-9.864**	-11.301	-0.598*	-6.197***	-6.795
	(0.660)	(4.975)		(0.338)	(2.499)		(0.548)	(4.455)		(0.308)	(2.085)	
1990:Q4-2001:Q3	0.870*	-6.815***	-5.945	-0.127	-4.759***	-4.886	-1.388***	-1.425	-2.813	-3.086***	1.310	-1.776
	(0.480)	(0.887)		(0.509)	(1.084)		(0.457)	(0.972)		(0.691)	(1.446)	
2001:Q4-2007:Q4	-2.229*	4.718	2.489	-0.833	-1.273	-2.106	-3.468***	5.802*	2.334	-3.689***	6.015*	2.326
	(1.086)	(2.801)		(1.781)	(4.482)		(0.801)	(2.899)		(1.249)	(3.462)	
2008:Q1-2018:Q4	0.205	4.359***	4.564	-0.304	1.287	0.983	-0.166	-0.051	-0.217	-0.441**	-0.310	-0.752
	(0.153)	(0.922)		(0.208)	(1.399)		(0.129)	(1.047)		(0.194)	(1.355)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1980:Q1-1990:Q3 cycle missing some quarters. All other cycles contain all quarters.

Figure 15:
Annual Own **Earnings** Gap by Race/Ethnicity and Sex (Ages 25-64)

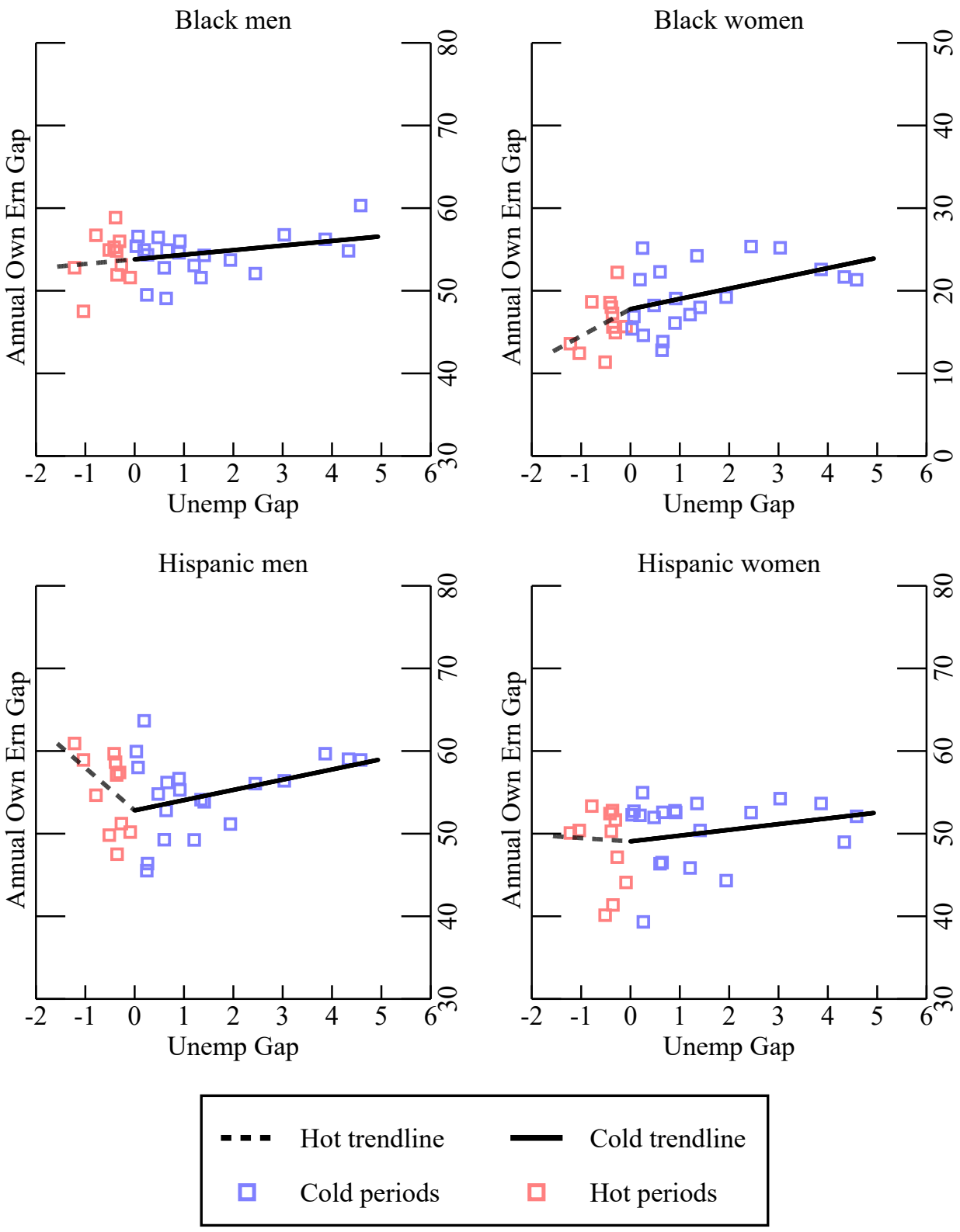


Figure 16:
Annual Own **Earnings** Gap by Education and Sex (Ages 25-64)

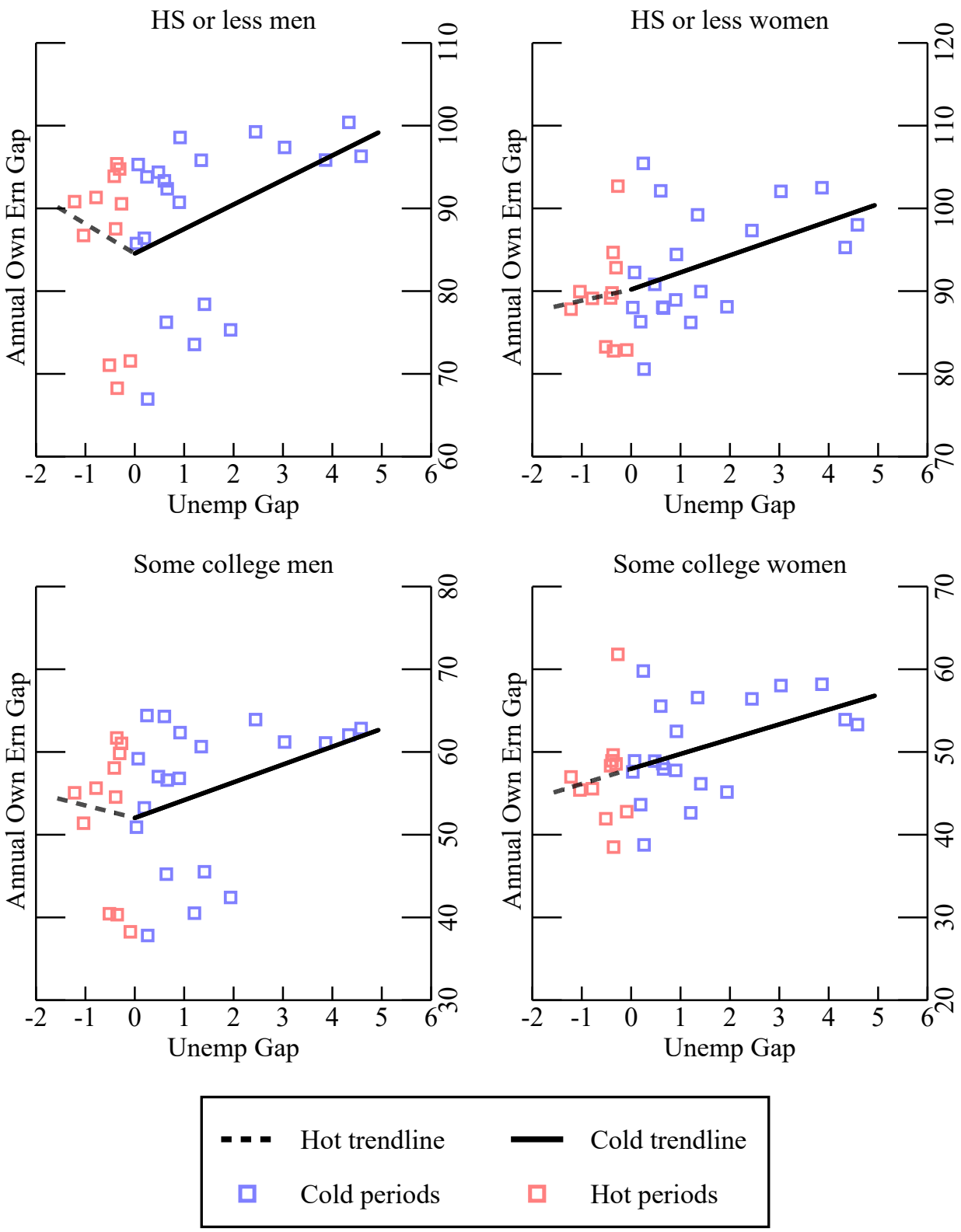


Figure 17:
HH Income Gap by Race/Ethnicity and Sex (Ages 25-64)

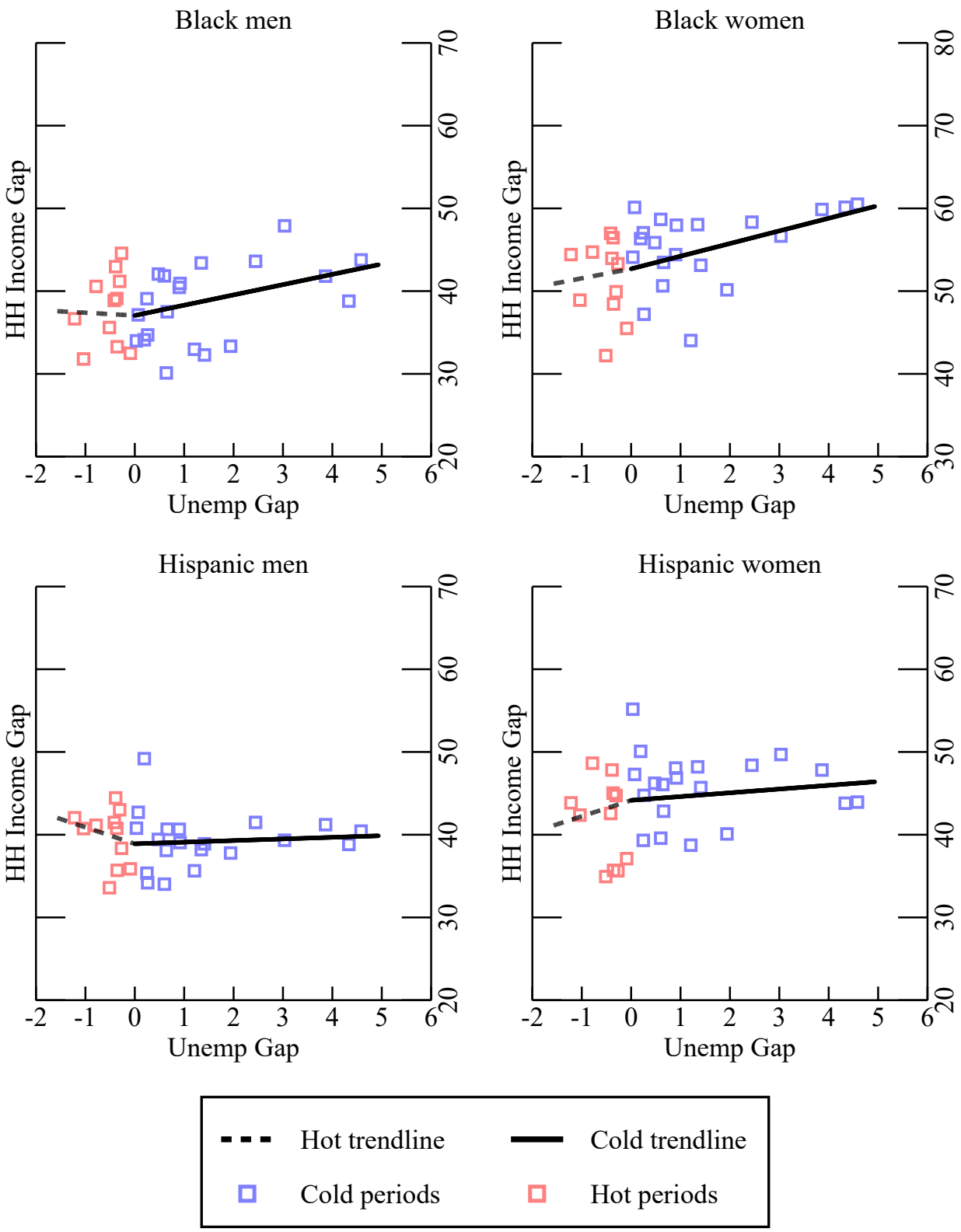


Figure 18:
HH Income Gap by Education and Sex (Ages 25-64)

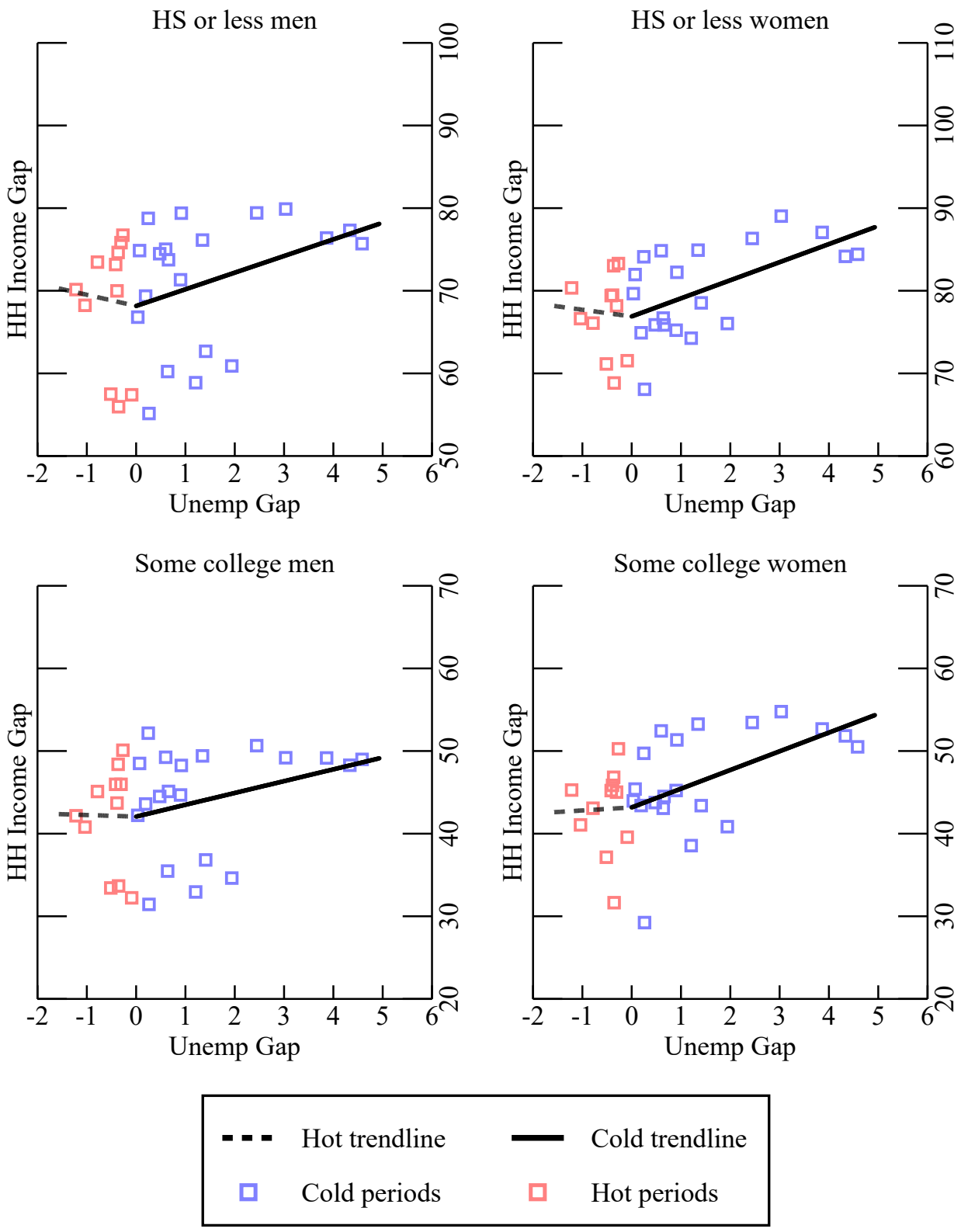


Table 13:
Annual Own Earnings and HH Income Gaps by Race/Ethnicity and Sex, Ages 25-64 - All Business Cycles

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
Annual Own Earnings	0.555	0.008	0.564	1.238*	-6.397**	-5.159	1.240**	2.023	3.263	0.696	-1.102	-0.405
	(0.384)	(1.927)		(0.669)	(2.967)		(0.461)	(1.921)		(0.602)	(2.128)	
HH Income	1.244**	-1.576	-0.333	0.196	-2.192	-1.996	1.528***	-0.379	1.149	0.453	1.486	1.939
	(0.596)	(2.791)		(0.477)	(1.939)		(0.497)	(2.363)		(0.755)	(3.100)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table 14:
Annual Own Earnings and HH Income Gaps by Education and Sex, Ages 25-64 - All Business Cycles

	Men						Women					
	HS or less			Some college			HS or less			Some college		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
Annual Own Earnings	2.963**	-6.555	-3.592	2.153**	-3.661	-1.508	2.065**	-0.721	1.344	1.789**	0.040	1.829
	(1.162)	(4.458)		(1.039)	(4.172)		(0.959)	(3.721)		(0.815)	(2.938)	
HH Income	2.015**	-3.370	-1.354	1.430*	-1.624	-0.194	2.189***	-3.000	-0.811	2.265***	-1.899	0.365
	(0.955)	(3.659)		(0.790)	(3.130)		(0.705)	(2.506)		(0.749)	(2.769)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table 15:
Increments to β when the Unemployment Rate is Below the Natural Rate

	Hourly earnings	Annual own earnings	HH income
Black men			
Black women		*	
Hispanic men			
Hispanic women		*	*
HS or less men			
HS or less women		*	
Some college men			
Some college women		*	

* For hourly earnings, at least three cycle-specific increments to β estimated to have been positive, of which no more than one is statistically significantly different from zero at the 10 percent level or better. For annual own earnings and household income, estimated increment to β is positive but not significantly different from zero. ** For hourly earnings, at least two of the positive increments to β estimated to have been statistically significantly different from zero at the 10 percent level or better. For annual own earnings and household income, estimated increment to β is positive and significantly different from zero at the 10 percent level or better. @ For hourly earnings, two cycle-specific increments to β estimated to have been positive and statistically significantly different from zero at the 10 percent level or better, but the other two increments estimated to have been negative. Not relevant for annual own earnings or household income.

Table 16:
U Rate Gaps by Race/Ethnicity, Sex, and Business Cycle, Ages 16-24

	Men						Women					
	Black			Hispanic			Black			Hispanic		
	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0	Slope when Ugap>0	Increment when Ugap≤0	Slope when Ugap≤0
All business cycles	0.872**	1.046	1.918	0.500***	-0.102	0.398	0.871	3.280*	4.151	0.483**	-0.394	0.089
	(0.355)	(1.179)		(0.164)	(0.653)		(0.573)	(1.783)		(0.186)	(0.922)	
1980:Q1-1990:Q3	1.470***	2.676	4.146	0.675***	-0.041	0.634	1.401***	5.849***	7.250	0.749***	-2.664***	-1.915
	(0.226)	(1.678)		(0.144)	(1.353)		(0.223)	(1.996)		(0.149)	(0.901)	
1990:Q4-2001:Q3	1.123*	0.446	1.569	0.184	1.412**	1.596	1.598***	1.923**	3.521	-0.635	2.873**	2.238
	(0.646)	(1.366)		(0.344)	(0.695)		(0.383)	(0.722)		(0.810)	(1.304)	
2001:Q4-2007:Q4	0.272	6.352***	6.624	1.065	0.147	1.212	1.567*	1.347	2.914	0.973	1.901	2.873
	(0.814)	(2.034)		(0.705)	(2.097)		(0.870)	(2.313)		(0.659)	(1.254)	
2008:Q1-2018:Q4	1.160***	2.311***	3.471	0.533***	-0.414	0.119	1.256***	3.789***	5.045	0.734***	1.191	1.924
	(0.172)	(0.779)		(0.087)	(0.516)		(0.194)	(1.029)		(0.107)	(0.748)	

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Figure 19:
Labor Force Statistics by Metro Status, (Ages 25-64)

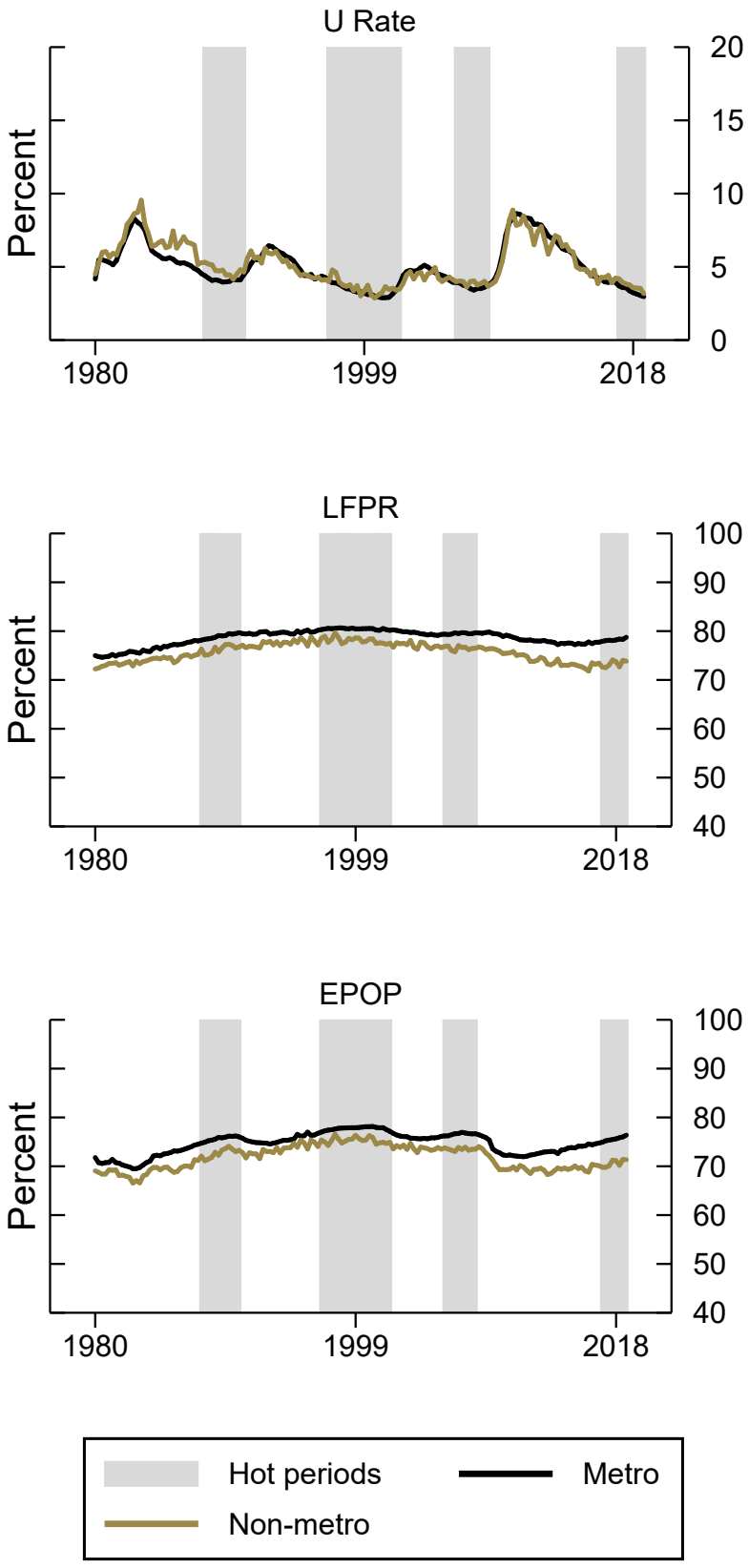


Table 17:
Nonmetro-Metro Gaps - 1980:Q1-2018:Q3, Ages 25-64

	Slope Ugap>0	Increment Ugap<0
U rate	-0.114*	0.106
	(0.062)	(0.204)
NLFPR	0.0534	-0.158
	(0.104)	(0.484)
Observations	156	

Newey-West Standard errors in parentheses.
* p<.10, ** p<.05, *** p<.01

Table 18:
Univariate Unit-Root Tests: Ages 25-54

	DF-GLS	Zivot-Andrews	Lags
U rate	-3.164**	-5.051*	9, 3
NLFPR	-1.798	-3.548	10, 3

For DF-GLS, lag is determined by Ng-Perron test.
For Zivot-Andrews, an endogenously determined break is allowed in the intercept and trend, lag is determined by AIC, and the 5 percent critical value is -5.08.
*p <.10, **p < .05, ***p < .01.

Table 19:
Univariate Unit-Root Tests: Ages 25-54
By Race/Ethnicity and Sex

			DF-GLS	Zivot-Andrews	Lags
U rate	White	Men	-2.985**	-5.616***	13, 2
		Women	-2.466	-4.800	13, 2
	Black	Men	-3.358***	-5.024*	10, 3
		Women	-3.009**	-4.194	6, 3
	Hispanic	Men	-2.735*	-4.466	12, 3
		Women	-3.464**	-5.069*	13, 3
NLFPR	White	Men	-1.827	-3.164	13, 0
		Women	-2.268	-4.897*	13, 2
	Black	Men	-1.975	-3.719	7, 2
		Women	-1.258	-3.778	12, 3
	Hispanic	Men	-1.867	-4.399	12, 2
		Women	-0.973	-3.790	10, 3

For DF-GLS, lag is determined by Ng-Perron test.
For Zivot-Andrews, an endogenously determined break is allowed in
the intercept and trend, lag is determined by AIC, and the 5 percent critical value is -5.08.
*p <.10, **p < .05, ***p < .01.

Table 20:
Univariate Unit-Root Tests: Ages 25-54
By Education and Sex

			DF-GLS	Zivot-Andrews	Lags
U rate	HS or less	Men	-2.793*	-5.352**	10, 2
		Women	-2.396	-5.397**	12, 3
	Some college	Men	-2.465	-5.769***	12, 3
		Women	-2.217	-4.890*	12, 3
	College or more	Men	-2.928**	-5.995***	13, 3
		Women	-2.694*	-4.879*	8, 0
NLFPR	HS or less	Men	-2.873*	-2.446	7, 2
		Women	-1.439	-3.330	10, 2
	Some college	Men	-1.553	-4.081	8, 1
		Women	-2.100	-4.244	11, 2
	College or more	Men	-1.638	-4.523	8, 3
		Women	-1.802	-4.289	13, 2

For DF-GLS, lag is determined by Ng-Perron test.
For Zivot-Andrews, an endogenously determined break is allowed in the intercept and trend, lag is determined by AIC, and the 5 percent critical value is -5.08. *p <.10, **p < .05, ***p < .01.