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Okun Revisited:
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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 some *extra* benefit to some disadvantaged groups, relative to earlier in the labor-market cycle. In addition, we provide some evidence suggesting that these gains are persistent, at least for a while, for some groups, particularly blacks and women.

PRELIMINARY AND INCOMPLETE

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> "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 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 jobs, build their skills, and climb the job and income ladder. He concluded that these benefits were indeed a feature of a strong U.S. economy. He found that during high-pressure periods, men moved up the job ladder, which in turn created room for women and teenagers to move into the labor market. Based on these findings, Okun argued that while not sufficient to guarantee attainment of the goal of upward mobility, a high-pressure economy complemented other policies working to achieve these objectives.

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, 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 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 is the topic of an upcoming Federal Reserve Conference on "The Costs and Benefits of a Hot Economy," September 2019.

standards, and inflation is close to the FOMC's 2 percent target. 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 2000, and before that since the turn of the year from 1969 to 1970. Moreover, it is well below the Congressional Budget Office's (CBO) estimate of its longer-run sustainable value (blue line). The CBO's views are well aligned with private sector forecasters and the FOMC Summary of Economic Projections (SEP); all put the natural rate of unemployment in the vicinity of 4.5 percent, quite a bit higher than the rates that have prevailed over the past year.[3]

Looking ahead, based on the median of the FOMC's December 2018 Summary of Economic Projections (SEP), indicated by the dot symbols 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 to ¾ percentage point 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 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 or more-marginalized groups of workers see disproportionate improvements in employment and income

[3] Notably, the labor market strength seen by economists and policymakers is 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] https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20181219.pdf.

when the labor market is especially tight. We add to the existing literature by updating the analysis to include the current expansion, to include women as a group, to focus specifically on whether the dynamics of hot labor markets differ from other phases of the labor market, 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 using metropolitan, rather than national, data or alternative measures of slack.

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. We reaffirm the earlier finding 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 and hot periods. Moreover, we find suggestive evidence that certain disadvantaged workers especially benefit from further strengthening when the labor market is already strong. In other words, the last increments of strengthening appear to reduce labor market disparities by a little more than earlier increments of strengthening had done. Moreover, for women and blacks these gains appear to be at least somewhat persistent.[5] The bulk of our enquiry focuses on individuals age 25 to 64; however, we also briefly examine data for younger persons, age 16 to 24, and find that young black workers experience more cyclical sensitivity than whites and mid-life blacks. Gaps in hourly wages appear not to be very

[5] Reifschneider, Wascher, and Wilcox (2015) show that the presence of hysteresis can affect the rules used by monetary policy makers.

cyclically sensitive; on the other hand, gaps in broader measures of income that take into account fluctuations in hours worked show that, in contrast to the unemployment, LFPR, and EPOP, more advantaged groups benefit more than less advantaged groups. 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) several 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 Hoynes (2000), who examined how employment, earnings, and income vary over the business cycle for less-skilled men. She finds that men with lower levels of education and nonwhites experience greater cyclical fluctuations in employment and earnings than high-skilled white men; the effects were more muted for 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 report evidence suggesting that the wage growth of lower-wage individuals is more responsive to reductions in the 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 1980s, though this partly resulted from the expansion of the Earned Income Tax Credit over the later period.[7] Romer and Romer (1999) confirmed that U.S. poverty rates decline during economic expansions,

[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.

[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.

but they argue, 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) examines 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.

Fewer studies have focused on the question we address here of whether the dynamics 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. By contrast, she finds that hot labor markets do not appear to affect the unemployment rate gap between black and white women or differentials in labor force participation rates more generally. Wilson (2015) compares the 1990s to several less robust expansions and shows that with respect to both unemployment and earnings, African Americans particularly benefited from the high-pressure of the economy of the 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 the effects are not particularly long-lived. Similarly, simulations in Fallick and Krolikowski (2018) indicate that a hot labor market has only modest and short-lived benefits on the labor market outcomes of less-educated men.

In trying to understand these various dynamics, 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), which, using job posting data, found that in the immediate aftermath of the Great Recession employers increased skill requirements listed in job postings, such as education and prior experience, and have been reducing them as the expansion has gathered strength. Devereux (2002) provides evidence that new hires have lower educational attainment when the unemployment rate is low and that low-skilled workers experience the greatest occupational improvement. This result is consistent with the Akerlof et al. (1988) model of vacancy chains, 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 what would result simply from the fall in the unemployment rate.

3. Data and Measurement

We use data from the Outgoing Rotation Group (ORG) and March Annual Demographic Files (ADF) from the Current Population Survey (CPS). The CPS is a survey of households used by the Bureau of Labor Statistics (BLS) to construct national estimates of unemployment and employment rates. Importantly, because it describes the employment circumstances of the non-institutional population, the CPS takes no account of those who are currently incarcerated or otherwise institutionalized. From the CPS ORG we use employment last week, unemployment

last week, and earnings and hours last week to construct the unemployment rate, labor force participation rate, and employment-to-population ratio for the period 1976:Q1 to 2018:Q2, and hourly earnings for the period 1979:Q1 to 2018:Q2, pooling the monthly observations to the quarterly frequency.[8] We augment these data with annual data from the ADF (or March CPS), which includes a full range of demographic, labor market, and income indicators. We use two variables: annual own income (sum of all earnings and all other income) and annual household income (sum of all income across all household members). All measures from the ADF are annual and refer to the years 1988 to 2017, corresponding to the calendar year preceding the survey year.

In line with previous research 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. 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/blacks (we will use the terms interchangeably); Hispanics or Latinos (again, we will use the terms interchangeably); and 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 educational attainment by three groups: high school degree or less; some college (which includes individuals with post-high school education who did not graduate from a four-year college, as well as those who did not attend a four-year college but earned an associate degree); and college degree or more. The very few individuals missing labor force status were excluded from the sample. For

[8] Outgoing rotation weights are used whenever possible; in the earlier months of the sample when they were not available, the final weights are used. The resulting series are seasonally adjusted.

annual household income, we take the demographic characteristics of the reference person or "householder" for each household in the ADF. We exclude "group quarters" households where the householder is not identified. All earnings and income series are deflated by the headline PCE price index.

Finally, we define cold and hot periods as periods 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. The predominant method we use to explore differences in the labor market experiences of different groups is graphical, complemented by only the simplest modeling and hypothesis testing. We do not attempt to delve into the causal mechanisms that might explain why different groups respond differently to business cycle conditions.

4. Results

Among the myriad possible labor market outcomes across groups, we focus on six measures: unemployment rates; labor force participation rates (LFPR); employment-to-population ratios (EPOP); hourly earnings; own annual earnings; and annual household income. We compare outcomes for black and Hispanic men and women to 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) Cyclical sensitivity--or evidence of "high-beta" behavior

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 tier of panels). However, these rates are uniformly higher than the rates for white men and women and 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 to the unemployment rate, the labor force participation rate (middle tier of panels) is considerably less cyclically sensitive. A much greater fraction of the variation in the gaps in labor force participation rates across different races and ethnicities appears to reflect secular trends. Overall, black men have lower labor force participation rates than white or Hispanic men. Among women, Hispanic women participate at a lower rate than either black or white women.

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.[9] In terms of levels, black men and Hispanic women have lower EPOPs than their counterparts, reflecting both their lower rates of labor force participation and higher unemployment rates.

[9] 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.

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 points the unemployment rates for those without a college degree are higher than the rates for those with a college degree.

Labor force participation rates and EPOPs (the middle and lower panels) are lower for those with less education. Similar to the results by race and ethnicity, labor force participation exhibits very little observable cyclical sensitivity. EPOPS are slightly more cyclical. The gaps in both LFPRs and EPOPs by educational attainment are large and persistent.

In his original paper, Okun noted that a high-pressure economy not only helps workers get jobs but also affects the types of jobs they obtain, translating into better wages, earnings, and household incomes. Figures 4 and 5 present analogous information with respect to real hourly earnings, own annual earnings (which accounts for both hourly wage and hours of work), and 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 more carefully 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 of the relative outcomes for each group

as a linear function of the unemployment rate gap. Each line of the table reports estimated coefficients from an equation of the following form:

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

In Table 1, the left-hand-side variable in each equation (denoted y_{gt} in equation (1)) is constructed as 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, relative to the same variable for whites of the same gender.[10] 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.[11] 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, relative to 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 2018Q2.

The coefficients of greater interest to us in these tables are the slope coefficients (α_1 in the above equation (1)); these coefficients appear under the columns marked "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

[10] The relative wage and income variables are constructed as log differences multiplied by 100.
[11] The full-sample coefficients reported here mask considerable variability from decade to decade. We investigate these differences across business cycles later in the paper.

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 significant at the 1 percent level.

In the blocks reporting results for the labor-force participation rate, a negative 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. Perhaps unsurprisingly given the only moderate cyclicality of the participation rate (cf. Aaronson et al, 2014), in this case the slope coefficients are of mixed sign and statistical significance. For blacks, the coefficients are negative but not statistically significant, while the two coefficients for Hispanics are positive and significant. By educational attainment, all of the coefficients are negative and statistically significant at the 1 percent level. In the EPOP block, the strong cyclicality of the unemployment rate dominates, so six of the eight coefficients have the negative 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. In these three blocks, a negative coefficient on Ugap once again implies that the relatively marginalized group benefits by more, at the margin, as the labor-market strengthens. The gaps in hourly earnings are not particularly cyclically sensitive; only two of the four estimated slope coefficients shown in Table 1 are significantly different from zero—and one of those is positive. 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 improvement, at the

margin, in relative circumstances comes in the form of hours worked rather than hourly pay. Consistent with that hypothesis, 15 of the 16 coefficients in the bottom two blocks (annual income and household income) of Tables 1 and 2 are negative, and 11 of those are significant at the 5 percent level or better.

Overall, the results from the time-series plots and the table are consistent with the findings in the literature that the labor-market experiences of less-advantaged groups are more cyclically sensitive. In other words, the results in Tables 1 and 2 reaffirm the high-beta experience that earlier authors have described. Next we consider whether that sensitivity varies significantly over the business cycle.

(b) Are hot periods different from cold periods?

To begin our examination of whether the average experience documented in Table 1 differs between hot and cold periods, Figures 6-12 display scatter plots showing the differential experiences of our eight groups relative to their white or more-highly-educated counterparts. In all cases the variable plotted against the vertical axis is the difference between the variable of interest (e.g. the unemployment rate) for the studied group relative to 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 (the solid lines) come from periods when unemployment gap was positive and larger, in other words when the labor market was less tight or had more slack. Conversely points further to the left (the dashed portion of the lines) come from periods when the unemployment gap was negative, or when the labor market was tighter or had less slack. If the cyclical sensitivity of the labor-market experiences of our comparison groups is the same as those of their white or more-highly-educated counterparts, the plotted trend

lines will be flat, meaning the average gap between the groups is constant across the labor-market cycle. To ascertain whether the relative employment experience is different when the economy is operating in high-pressure mode versus a cold 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). With the unemployment rate as the variable of study, a downward kink indicates that as the actual unemployment rate falls below its natural rate, the high-beta experience of black women and Hispanic men intensifies. In other words, not only does the unemployment rate of black women and Hispanic men continue to decline by more than the unemployment rate of their white counterparts, but the multiplier increases. At the level of detail shown in this graph, the process goes into reverse once the unemployment rate gap has reached its nadir. 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 high-school educated men and women to that of individuals with a college degree or more, as well as the relative unemployment experience of those with some college but not a college degree. For both men and women with a high-school degree or less, the trend line rotates slightly in a clockwise

direction once the unemployment rate descends below its estimated natural rate. Thus, as the aggregate unemployment rate moves further below its natural rate, the unemployment rate for individuals with a high-school diploma or less continues to decline by more than the unemployment rate for those with at least a college degree (indicated by the fact that the slope of the trend line remains positive), but the multiplier is smaller than it had been earlier in the labor-market cycle (indicated by the fact that the line is less steep to the left of Ugap than it is to the right). A similar pattern is evident for men with some college but without a degree, while for women with some college, the trend line is kinked downward slightly.

A natural question to ask is whether the basic relationships displayed in Figures 6 and 7 have been stable over time.[12] To ascertain the answer to that question, we divided our sample period into four labor-market cycles. We define a "labor-market cycle" 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 a simple F-test to determine whether the null hypothesis of equality across the four slope coefficients can be rejected.[13] In the overwhelming

[12] We were initially led to ask this question as a result of noting that nearly every quarterly unemployment differential shown in Figure 6 is positive. We wondered whether there had been any convergence over time in the average unemployment experience of blacks and Hispanics as compared to whites, and similarly by educational attainment.

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

majority of cases, the null hypothesis is rejected at the 5 percent level or better. Indeed, in the case shown in Figure 8, the null is rejected at better than the 1 percent level.

The next few tables accordingly dig a little deeper in search of a meaningful change in behavior when the labor market moves into high-pressure territory, using a simple regression taking the following form:

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

As in equation 1, the left-hand-side variable in the regression is the difference between the labor market outcome for the comparison group, *g* (blacks, Hispanics, those with a high school education or less, and some college), and that of their more "advantaged" counterparts (whites or those with at least a college education). The variable *hot-dummy* takes a value of 1 when the unemployment rate is less than its natural rate and 0 otherwise.

The top row of Table 3 reports for the unemployment rate the average responsiveness in cold and hot periods over all the cycles---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 for the four race/ethnicity/gender pairs, in all 16 cases the trend line during cold periods (when Ugap>0) is estimated to have been positive, confirming that the basic high-beta experience for the unemployment rates of these groups relative to their white counterparts is a consistent feature of labor-market cycles.

We next turn to the question of whether that high-beta experience changes during high-pressure periods. 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 the high pressure economy in the late 1980s (the cycle from 1980:Q1 to 1990:Q3); this is

reflected in the table by the fact that the coefficients on the interaction term in those three cases have the wrong sign (negative), although they are not statistically significant in that cycle. However, in the remainder of the cycles (with the exception of Hispanic men during the cycle of the early 2000s), the high-beta experience of the studied group did intensify as the labor market continued to tighten. In fact, the magnitudes of the coefficient estimates suggest that the relative improvement in these other cases when the unemployment rate falls below its natural rate is nearly double the relative improvement when it is above it. That said, the shift coefficients are statistically significant only for black men and women in the most recent (incomplete) cycle and for black women in the early 2000s. It is possible there are just aren't enough data points in any individual cycle to identify with confidence whether the shift from cold to hot is statistically significant.

The results are somewhat weaker for the relative unemployment rates of groups stratified by educational attainment (Table 4). The slope of the trend line in cold periods is estimated to be positive in all four labor market cycles for the relative unemployment rates of both individuals with a high-school degree or less and for individuals with some college. However, the increment to the slope during a hot labor market is of mixed sign: for most groups it is positive only half the time and not statistically significant, the exception being for women with a high school degree or less, for whom it is positive (albeit not statistically significant) in 3 out of 4 cycles. That said, the overall slope during high-pressure economies typically remains positive. Thus, while the evidence indicates that 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 increases in hot labor markets, with the possible exception of women with a high school degree or less.

With regard to the labor-force participation rate, as shown in Figures 9 and 10 and in Tables 5 and 6, the evidence is less tidy. As a reminder, in this case a *negative* coefficient on Ugap would signify that the LFPR of the comparison group increased by more, on average, than the LFPR of the reference group when the labor market was tightening. As we noted previously, the participation rate is only modestly procyclical overall, and, as shown in Table 5, in the first two labor market cycles in our sample the gap between the white participation rate and that of blacks or Hispanics does not close as the economy is improving; in fact, the point estimate of the slope of the trend line during cold periods is positive. In contrast the coefficient is negative for black and Hispanic men during the most-recent two labor-market cycles (and statistically significant for Hispanic men), and for black and Hispanic women in one of the most recent cycles each.

With respect to the question of whether a high-pressure economy is more beneficial in this regard, as shown in the "increment" columns, 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 a high-pressure mode (with the coefficient statistically significant for all three groups). However, 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 negative 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 large in both periods (though not statistically significant), and of mixed sign for the other groups. On balance, we read this evidence as suggestive that, from the 1990s on, hot

periods have been somewhat better than cold periods with regard to drawing members of historically relatively marginalized groups defined by race and ethnicity into the labor force (or retaining them).

For relative LFPRs by educational attainment (Table 6), the point estimate of the trend line during cold periods is more likely to be positive than negative (11 out of 16 cases), indicating that in the four labor market cycles we consider, participation rates for less-educated individuals tend to rise by less than participation rates for those with a college degree in a tightening labor market. That said, the trend lines tend to become more negatively sloped in hot labor markets, especially for men with a high school degree or less and women with some college education. Moreover, in the labor market cycles of the 1980s and 1990s, these increments are almost all statistically significant, and the overall slope of the trend line for less-educated women is estimated to have been negative when the unemployment rate fell below the natural rate in both cycles, indicating that participation rates for these groups increased by more than their college-educated counterparts when the labor market was in high pressure mode. However, this pattern has tended to weaken over time, especially for women, and is not evident in the current labor market cycle. The fact that these low-skilled women show relatively less improvement in participation in the recent cycles, a time in which the trend in female participation rate flattened out and seems to have turned down for less skilled women (Figure 3, middle right panel) raises the question of whether the results for the recent cycles are contaminated by structural change.

Figures 11 and 12 and Tables 7 and 8 bring together the unemployment rate and the LFPR by displaying results for the employment-to-population ratio. Again, as a point of reference, in this case a negative coefficient on Ugap signifies that the EPOP of the comparison

group increased by more, on average, than the EPOP of the reference group when the labor market was tightening. By and large, as noted before, the EPOP inherits its cyclical characteristics from the unemployment rate. As shown in Table 7, the trend line was negatively sloped for most of the groups in most time periods (13 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 10 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 positively 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 negative 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 negatively 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.

In considering these results, 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 overall evidence reported in Tables 7 and 8 as indicating that the employment experience of mid-life African Americans and Hispanics, as well as that of those with less than a college degree, has improved relatively more compared to whites of the same gender as the labor market has strengthened; moreover, that observation holds true regardless of whether the labor market is operating in "cold" or "hot" territory. The evidence with respect to whether the relative experience of different groups has differed materially between cold and hot episodes is less one-sided, but nonetheless leans in the direction of suggesting that there is a difference, and one that skews in favor of groups that historically have been relatively marginalized in the labor market, particularly blacks and women with some college education or less. Moreover, the impact appears to have been particularly strong for nearly all disadvantaged groups during the high-pressure labor market of the 1990s.

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. 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 wages or inflation to labor market slack. For this analysis, we use the outgoing rotation group files of the CPS beginning in 2004, when the Census switched to designating geographic areas using the core-based statistical

area (CBSA) classification system, and ending in 2018. To ensure 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 limit our sample to areas with at least 500,000 individuals and at least 75 observations for each group being analyzed. Because Hispanics and blacks are concentrated in different parts of the country, and because there are greater numbers of individuals in cells defined by education, we allow the CBSAs included in the analysis to differ according to the unit of observation. We define the natural rate in the CBSA as the average unemployment rate in the period from 2004 to 2008 and run the panel regression over the period from 2009 to 2018, including year and metropolitan-area fixed effects.[14]

The results, shown in Table 9, 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, though it is only large and statistically significant for blacks. With regard to the participation rate (where a negative coefficient on the aggregate unemployment rate gap indicates that the disadvantaged group improves its relative participation rate as the economy expands), the results using the CBSA-level data are weaker, with the slope coefficient in cold periods negative and statistically significant only for blacks. There is more evidence that when the economy is in a high-pressure state the participation rate gap closes in the

[14] Ideally, we would use a longer-length lag or some other filtering to compute the natural rate, but the time series of CBSA-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.

sense that three of the four "increment" coefficients are negative, but the relationship is only statistically significant for those with some college education. Finally, the cyclicality of the relative employment-to-population ratios appears mainly to reflect the unemployment margin. The slope coefficient during cold periods is negative 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).

Overall, these results confirm the basic findings from our time-series exploration. In both the time series and cross-sectional results, blacks benefit from a high-pressure economy, particularly along the unemployment rate margin. In these results, workers with some college education also see greater improvement in their relative participation rates and employment-to-population ratios in a high-pressure economy, but this does not appear to be the case for those with a high school degree or less.[15]

One potential complication associated with both the time series and the cross-sectional analysis is that the labor force variables are constructed with the same data that we use to construct our measure of the unemployment rate gap, leading to the possibility that some common measurement error or shock is producing the correlation. More generally, the unemployment rate gap is only one possible measure of the cyclical position of the economy. To test the robustness of our results we replicated the exercises using a measure of the output gap constructed based on the CBO's measure of potential output. We identified hot labor markets as

[15] We would note to 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 cycle of our time-series analysis.

those when actual GDP was above the CBO measure of potential output. For this analysis, we restricted the sample to the period from 1990:Q4 to 2007:Q4 because the first and last cycle had almost no quarters with hot labor markets according to the output-based measure. The results using this alternative measure of labor market tightness also provide mixed evidence that high-pressure economies particularly benefit marginal workers, especially on the participation rate margin for blacks and those with a high school degree or less.

Figures 13 and 14, together with Tables 10 and 11, present the evidence with regard to hourly earnings. In Figures 13 and 14, a negatively sloped trend line would indicate that, on average, as the labor market strengthened (that is, moving from right to left in the figure), the earnings gap between the comparison group and the reference group narrowed. Pooling the data from all four labor-market cycles, Figure 13 and the first row of Table 10 provide 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 earnings gap between the comparison groups and the reference groups. However, in all four cases shown in Figure 13, when the unemployment gap turns negative, the trend line is estimated to have rotated in a counterclockwise direction, and sufficiently so in all four cases as to indicate some gap *widening* as the unemployment rate continued to descend further below the estimated natural rate. Inspection of the individual labor-market cycle experiences by race/ethnicity (rows 2 through 5 in Table 10) 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 Figure 14, the trend lines for the earnings gaps by educational attainment all rotate noticeably in the counterclockwise direction, indicating wage gap *widening* as the unemployment rate moves further below its natural rate. As shown in Table 11, the estimated increments to the slope of the trend line are about evenly

distributed between positives and negatives and only 5 of the 16 hot-period trend lines are negatively sloped.

Figures 15 through 18 report results based on own annual income (15 and 16) and household annual income (17 and 18). As noted earlier, these series are computed at the annual rather than quarterly frequency using data covering the years 1987 through 2017; accordingly, in the associated Tables 12 and 13 we do not break out results for individual labor-market cycles. Looking across the four figures, two main findings stand out. First, all of the trend lines are negatively sloped when the unemployment rate is above its natural rate, indicating that as the unemployment rate comes down toward its natural rate, these income gaps narrow on average, again reaffirming the basic high-beta experience of these groups (both by race/ethnicity and by educational attainment). Moreover, three-quarters of the estimated cold-period negative slopes are significantly different from zero. Second, and perhaps counterintuitively, hot labor markets were not particularly favorable to most of these groups. In 14 out of the 16 cases shown in Figures 15 through 18, the trend line either did not rotate when the unemployment rate moved below its natural rate, or it rotated in a counterclockwise direction. In half of the 16 cases, the counterclockwise rotation was big enough to leave the trend line positively sloped—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 income gap between the comparison group and the reference group.

These results with regard to income gaps are puzzling and worth investigating further, especially in light of the generally contradictory results from the complex of variables examined earlier (U, LFPR, and EPOP). 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), but it is difficult to think of reasons why such effects would operate with greater strength during hot labor markets than during cold ones. Another possibility is that hot labor markets are good for everyone, but the relative advantages vary across measures. In a hot economy, less advantaged groups improve relative to more advantaged groups in their employment experiences (U, LFPR, and EPOP); in contrast, more advantaged groups experience relatively larger gains in earnings and income. Future research linking these findings to broader implications for economic welfare is needed.

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

The labor-market experience of individuals at the lower end of the age spectrum may differ importantly from the labor-market experience of mid-life people. To ascertain whether differences across age groups are important, we briefly review results that are analogous to those we have already shown for mid-life people, but in this case for people between the ages of 16 and 24.

Table 14 presents the relative cyclical sensitivities of the employment ratios of young adults for each of the four demographic pairs in our focus, in the same format as was used in Table 7. Thus, in this table, the point estimates in the second column for each group show the increment to the relative cyclical sensitivity of the employment rate for the mentioned group relative to the employment rate of the reference group, once the labor market is in high-pressure territory. Again, a negative coefficient indicates that the employment rate of the comparison group increased by more, on average, than the employment rate of the reference group when the labor market was tightening.

For African Americans, these results are reasonably straightforward to characterize. In nearly all episodes, the employment rates of young African Americans were more cyclically

sensitive than the employment 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 7 of the 8 point estimates reported in the first column for each sex are negative and all 8 point estimates in the second column for each sex are negative.) Looking across age groups, the fact that the point estimates are generally larger, in absolute value, than the point estimates in Table 7 shows that young blacks also experience more relative cyclical variation in their employment rates (relative, that is, to their white counterparts) than do mid-life blacks.

For young Hispanics, the results are more uneven. The coefficients are of mixed sign, with young Hispanic men exhibiting greater cyclicality in their employment rates in two of the four labor market cycles, and young Hispanic women exhibiting greater cyclicality in employment rates in just one of the four (the current cycle). Regarding the question of 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, the evidence is again mixed, with 5 of the 8 coefficients negative and three positive (and only two that are statistically significant). As for the mid-life group, however, the late 1990s stands out as a period when young blacks and Hispanic experienced especially large benefits from a high-pressure labor market.

(d) Urban vs. rural differences

Before we leave off examining whether the relative labor market outcomes of disadvantaged workers improve during high-pressure labor markets, we focus on one other divide of interest: the difference in economic performance between more and less urbanized areas, or what the Current Population Survey denotes metropolitan and nonmetropolitan areas.[16]

[16] 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.

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 amplitudes.[17] 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 15, we regress the gap 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 and the coefficient on the unemployment rate, 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.

[17] 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).

(e) 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, as an individual who becomes employed may gain skills and networks that improve future employment prospects. Workers also have the opportunity to move up in the occupational distribution and experience wage gains. 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 economy overall—for instance, a lower unemployment rate on average or higher trend labor force participation—this would also provide a boost to the potential growth rate of the economy. On the flip side, negative hysteresis could occur. This would reflect spells of unemployment that originate from weak aggregate demand and cause individuals to lose skills or networks or to be stigmatized, resulting in long-term dislocation from the labor market, with potentially detrimental implications for potential output growth.

One strand of the literature has used panel data to look for evidence of hysteresis by following the labor market experiences of individuals over time. Whereas Hotchkiss and Moore (2018), mentioned previously, examined high-pressure economies, a number of earlier studies have focused instead on the long-term impact of recessions. These studies typically find that graduating from college into a weak economy has a long-lasting impact on wages, although not on employment outcomes (e.g. Kahn (2010), Kondo (2015), Oreopolous et al, (2012)). In these studies, the persistence of the wage effect is dependent on the mobility of the workers—for

instance Kondo hypothesizes that the apparently low degree of hysteresis experienced by women can be explained by their higher likelihood of transitioning out of the labor market, while Oreopolous et al. find that the impact of graduating during a recession has shorter-lived impact on workers with higher levels of education since they transition more quickly into higher occupation matches. Hagedorn and Manovskii (2013) also identify persistence in wages, which they attribute to match quality.

Another strand of the literature has looked for evidence of hysteresis in aggregate data. Blanchard and Summers (1986) described hysteresis as a dependence of the current rate of employment on past realizations, and found evidence of such in Europe, although little evidence for this in the United States. As noted in Gustavsson and Osterholm (2007), in the macro 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 since, 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 (cf. 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, with persistence lasting for several years, although by 3 years after the shock the effect is negligible).

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 the unemployment 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. As in our previous analysis, the tests are done using quarterly data from the Current Population Survey for the population aged 25-64, although the results are qualitatively similar for the population aged 16 and older.

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, 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, 2017; Staiger, Stock and Watson, 2002). The employment-to-population ratio 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. The tests also include lags to eliminate serial correlation in the errors. Two of the tests have the null hypothesis that the series has a unit root: the augmented Dickey-Fuller test with GLS detrending and the Zivot-Andrews test, which allows for the possibility of breaks in the intercept and trend, with the break points determined endogenously. In contrast, the KPSS test's null hypothesis is that the series is trend stationary against the alternative of a unit root.

As can be seen in table 16, with respect to the unemployment rate, 2 out of 3 tests indicate that the aggregate unemployment rate lacks a unit root. Table 17 shows the results for variables broken out by race and gender. The Hispanic unemployment rate also appears to lack a

unit root. In contrast, the tests tend to suggest that the black unemployment rate does have a unit root, and this is the case with the unemployment rates for both men and women. (For blacks 16 and older, all three tests are consistent with a unit root). Two of the three tests also suggest that the unemployment rate for white women has a unit root. With respect to the employment-to-population ratio, all of the tests indicate the presence of a unit root in the aggregate and for each of the groups defined by race, ethnicity and gender.

Table 18 explores whether different education groups experience different amounts of hysteresis. The results show little evidence of a unit root in the unemployment rate for men at most every level of education, but fairly consistent evidence of a unit root in the unemployment rate for women with at least a high school degree, with nearly all the tests pointing toward a unit root. And while the tests on balance indicate that the employment-to-population ratios for men of various levels of education exhibit a unit root, the result is more definitive for women.

Altogether, the tests suggest a unit root in the unemployment rate for blacks and for women with at least a high school degree. The employment-to-population ratio also exhibits a unit root, and this result is widespread across different racial and ethnic groups as well as across workers with different levels of education.

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.

These findings are consistent with there being positive spillovers from an expansion that could have lasting benefits to individuals and the economy. That said, there are two caveats to the analysis: first, the literature reviewed above suggests that, at least with respect to employment gains, any benefits are not expected to be long-lived (whereas wage effects appear to persist longer). In addition, the spillovers are not specifically identified with high-pressure economies, and may be equally relevant in times of slack labor markets.

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 some potential costs that policymakers should take into account when making their policy decisions.

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 much 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.[18] 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

[18] Orphanides and Williams (2005).

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 latest Financial Stability Report characterizes valuation pressures as generally elevated, the report also notes that large banks are well capitalized and concludes that funding risks in the financial system are low relative to the period leading up to the financial crisis.[19] That said, the most recent two recessions were precipitated by financial imbalances that were difficult to identify in real time. And, some other observers are less sanguine. Of particular note, the BIS 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.[20]

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

[19] Board of Governors of the Federal Reserve System, **Financial Stability Report – November 2018**, https://www.federalreserve.gov/publications/2018-november-financial-stability-report-purpose.htm
[20] Bank for International Settlements, **Annual Economic Report 2018**, https://www.bis.org/publ/arpdf/ar2018e.htm

over the business cycle (though in opposite directions).[21] 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.[22]

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 foregone sales is viewed as too high. If so, the firm's future productivity may suffer as a result. More 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.[23]

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

[21] See, for example, Dellas and Sakellaris (2003).
[22] 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).
[23] 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.

evidence largely supports the idea that reallocative effects are procyclical, due largely to the responsiveness of job destruction to business fluctuations.[24] 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 gets weak everyone suffers and when the economy gets stronger, everyone benefits. This is seen most clearly in unemployment rates: Over our entire sample, the unemployment rates of each group we study moves in tandem with the aggregate unemployment 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 found suggestive evidence that this is the case. A high-pressure economy does afford greater improvement for some less-advantaged groups 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. 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 of further study.

[24] See, for example, Davis and Haltiwanger (1990) and Davis, Faberman, and Haltiwanger (2006, 2012).

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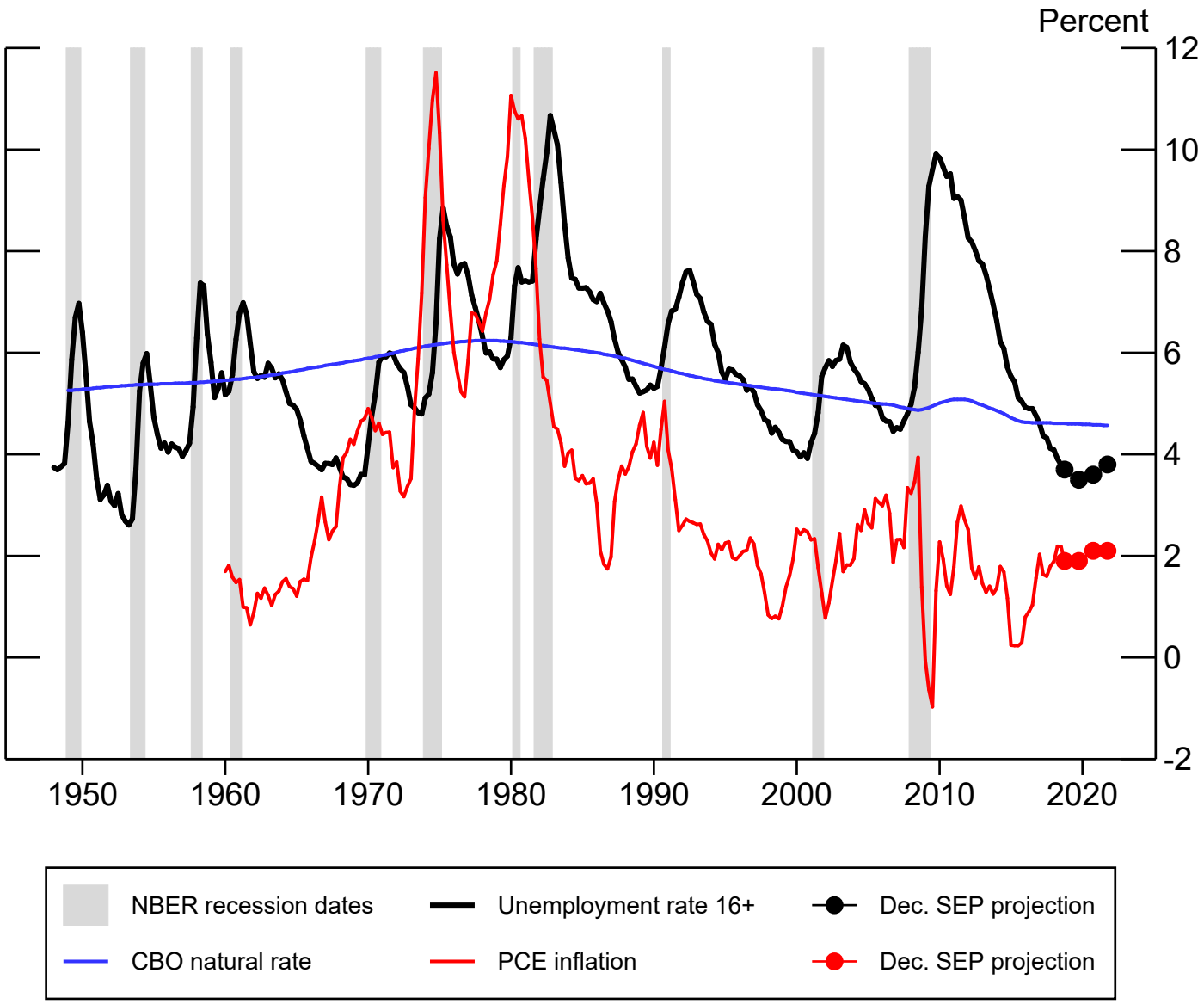
Figure 1:
Unemployment and Inflation



Source: BLS, CBO and Summary of Economic Projections, Federal Reserve: December 2018

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

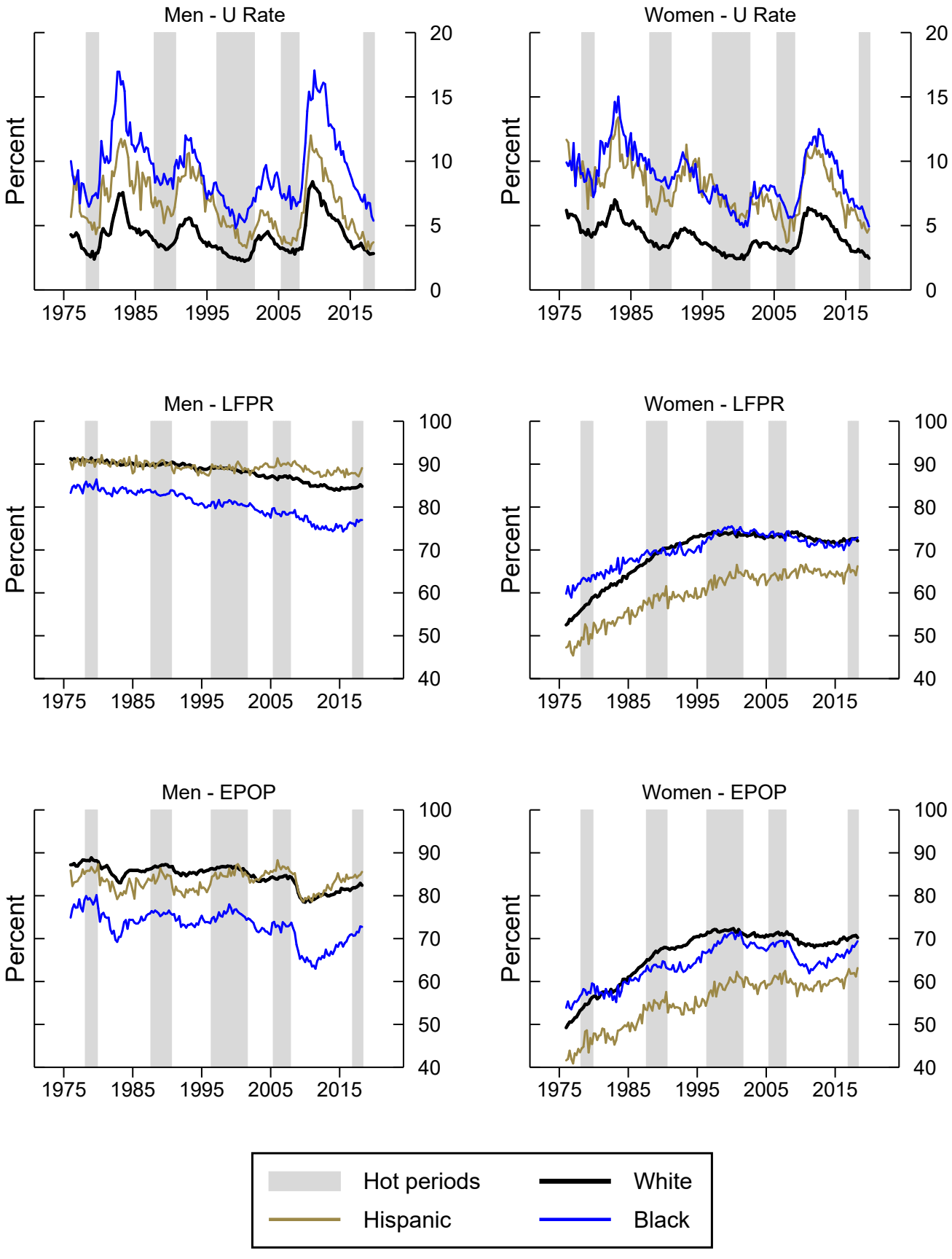


Figure 3:
Labor Force Statistics by Education, (Ages 25-64)

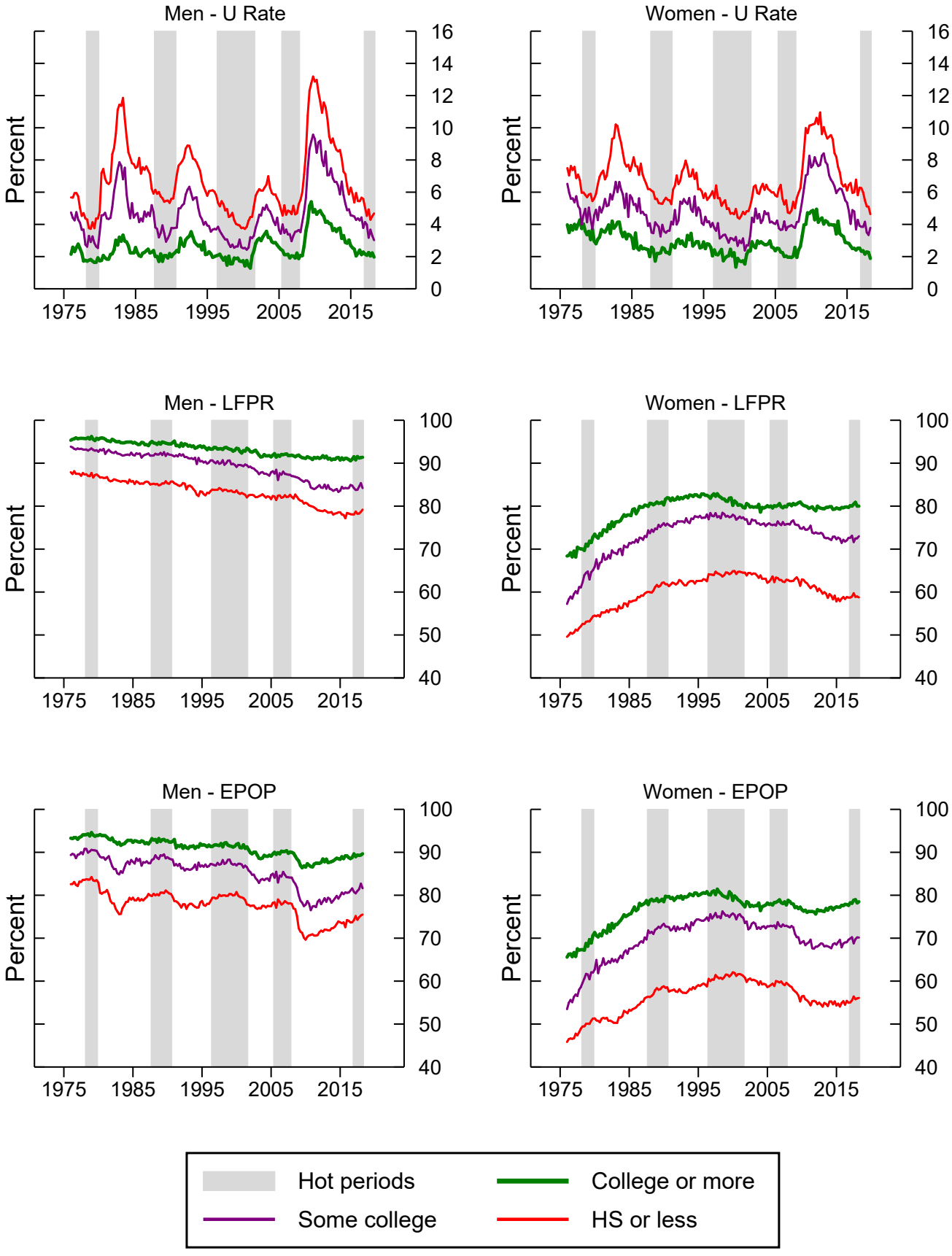


Figure 4:
Earnings and Income by Race/ethnicity, (Ages 25-64)

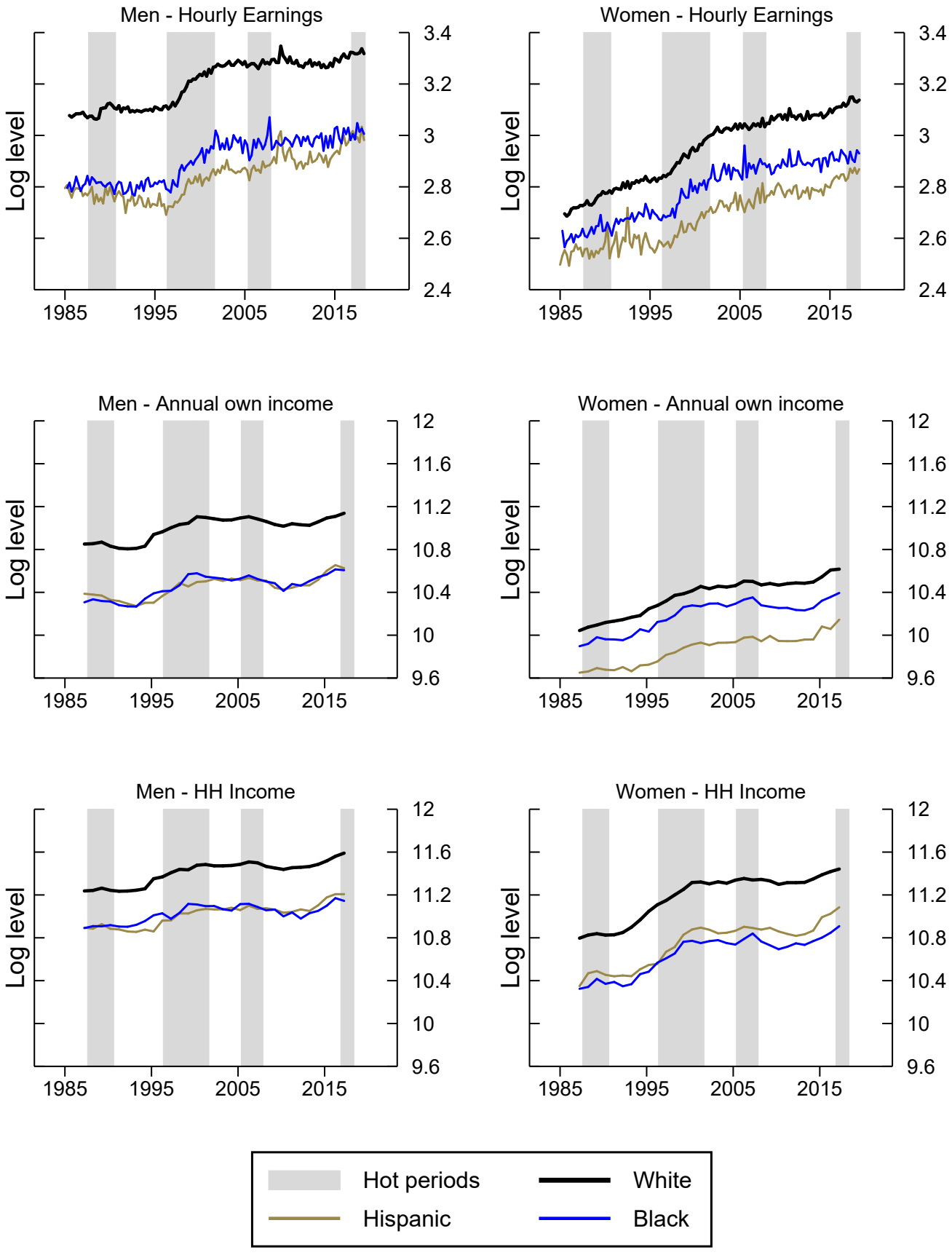


Figure 5:
Earnings and Income by Education, (Ages 25-64)

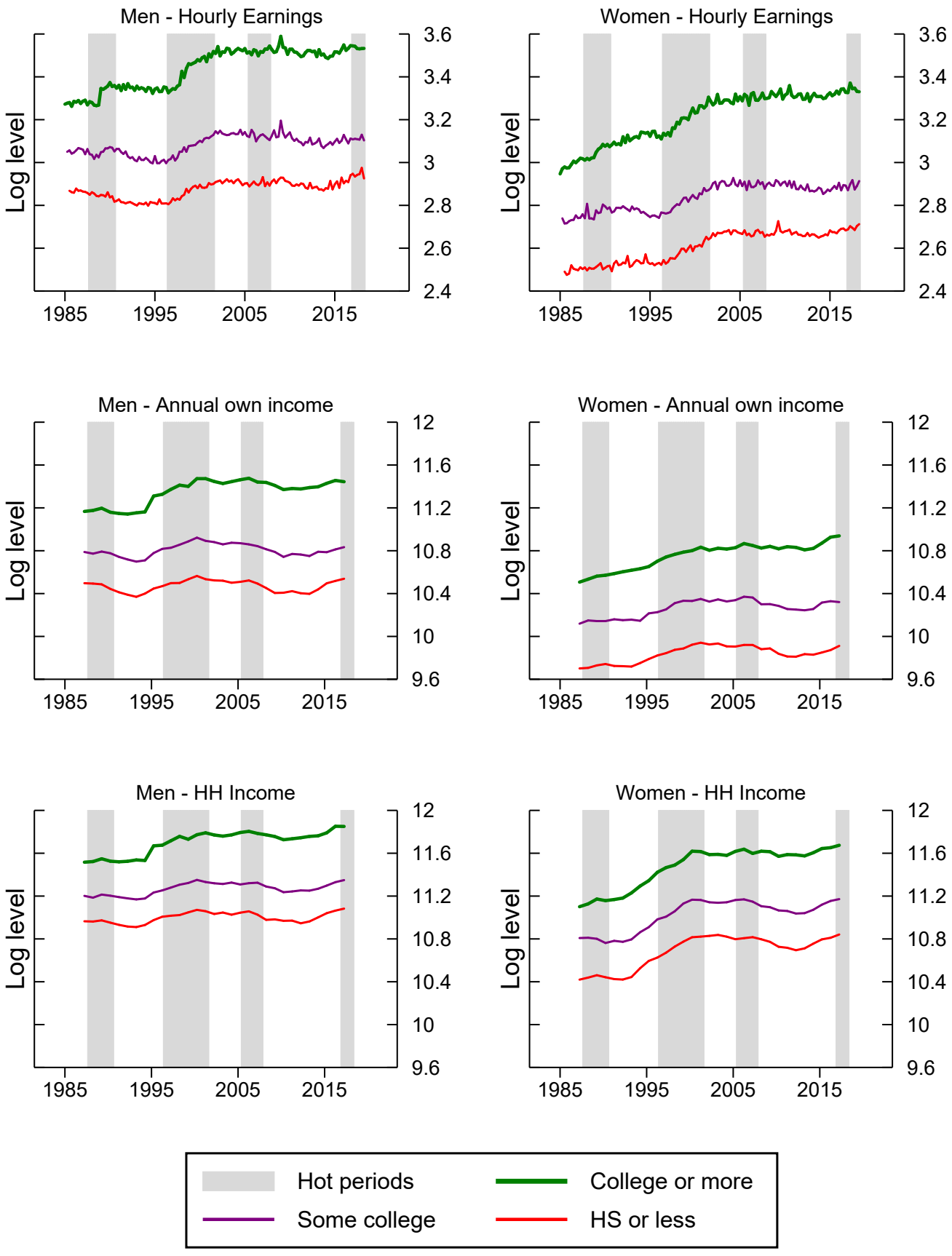


Table 1:
Gaps by Race/ethnicity and Sex - Full Sample, Ages 25-64

		Men		Women	
		Const.	Ugap	Const.	Ugap
U rate	Black	4.462***	0.904***	4.159***	0.480***
		(0.070)	(0.053)	(0.085)	(0.060)
	Hispanic	2.191***	0.337***	3.506***	0.285***
		(0.095)	(0.049)	(0.099)	(0.052)
LFPR	Black	-7.597***	-0.107	1.006***	-0.112
		(0.096)	(0.066)	(0.211)	(0.114)
	Hispanic	0.874***	0.231***	-9.616***	0.312***
		(0.151)	(0.077)	(0.188)	(0.080)
EPOP	Black	-10.967***	-0.730***	-1.959***	-0.426***
		(0.084)	(0.055)	(0.208)	(0.099)
	Hispanic	-1.114***	-0.093	-11.353***	0.190**
		(0.214)	(0.109)	(0.211)	(0.087)
Hourly earnings	Black	-29.739***	0.034	-15.258***	-0.360**
		(0.285)	(0.160)	(0.369)	(0.176)
	Hispanic	-36.432***	0.457**	-25.484***	-0.110
		(0.412)	(0.226)	(0.456)	(0.260)
Annual own income	Black	-53.807***	-0.556	-17.222***	-1.491***
		(0.574)	(0.336)	(0.669)	(0.326)
	Hispanic	-54.603***	-0.444	-49.377***	-0.560
		(1.033)	(0.436)	(0.921)	(0.382)
HH income	Black	-37.497***	-1.048**	-52.804***	-1.481***
		(0.833)	(0.439)	(0.945)	(0.346)
	Hispanic	-39.516***	0.077	-43.747***	-0.637
		(0.742)	(0.262)	(1.039)	(0.444)

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1976Q1-2018Q2 for EPOP, U rate, and LFPR. 1987-2017 for Annual own income and HH income.
1979q1-2018Q2 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	3.260***	0.970***	3.261***	0.563***
		(0.058)	(0.034)	(0.046)	(0.027)
	Some college	1.540***	0.576***	1.521***	0.369***
		(0.034)	(0.024)	(0.044)	(0.032)
LFPR	HS or less	-9.920***	-0.126**	-18.651***	-0.184**
		(0.114)	(0.061)	(0.160)	(0.080)
	Some college	-3.664***	-0.295***	-5.610***	-0.238***
		(0.129)	(0.082)	(0.158)	(0.075)
EPOP	HS or less	-12.439***	-0.861***	-20.150***	-0.420***
		(0.111)	(0.047)	(0.162)	(0.077)
	Some college	-4.971***	-0.763***	-6.580***	-0.471***
		(0.127)	(0.069)	(0.154)	(0.073)
Hourly earnings	HS or less	-54.931***	-0.431	-59.908***	-0.296
		(0.707)	(0.443)	(0.495)	(0.284)
	Some college	-34.207***	-0.036	-36.098***	-0.269
		(0.642)	(0.417)	(0.636)	(0.377)
Annual own income	HS or less	-86.377***	-2.149***	-90.398***	-1.975***
		(1.995)	(0.778)	(1.227)	(0.506)
	Some college	-53.054***	-1.698**	-47.962***	-1.794***
		(1.705)	(0.625)	(1.125)	(0.470)
HH income	HS or less	-69.102***	-1.597**	-77.731***	-1.817***
		(1.534)	(0.580)	(0.976)	(0.426)
	Some college	-42.519***	-1.229**	-43.705***	-2.029***
		(1.250)	(0.456)	(1.100)	(0.437)

Robust standard errors in parentheses. * p<.10, ** p<.05, *** p<.01
1976Q1-2018Q2 for EPOP, U rate, and LFPR. 1987-2017 for Annual own income and HH income.
1979q1-2018Q2 when available for Hourly earnings.

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

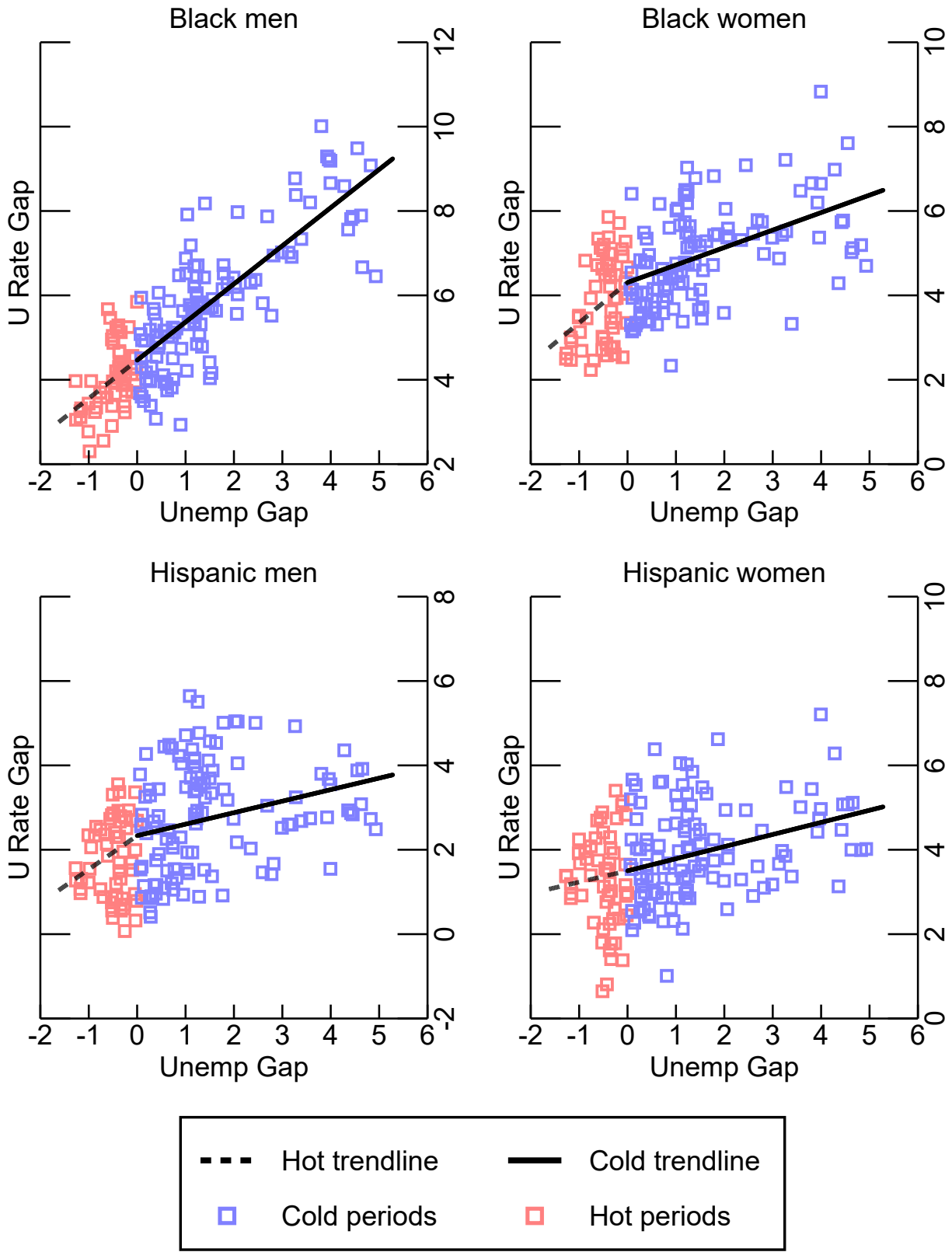


Figure 7:
U Rate Gap by Education and Sex (Ages 25-64)

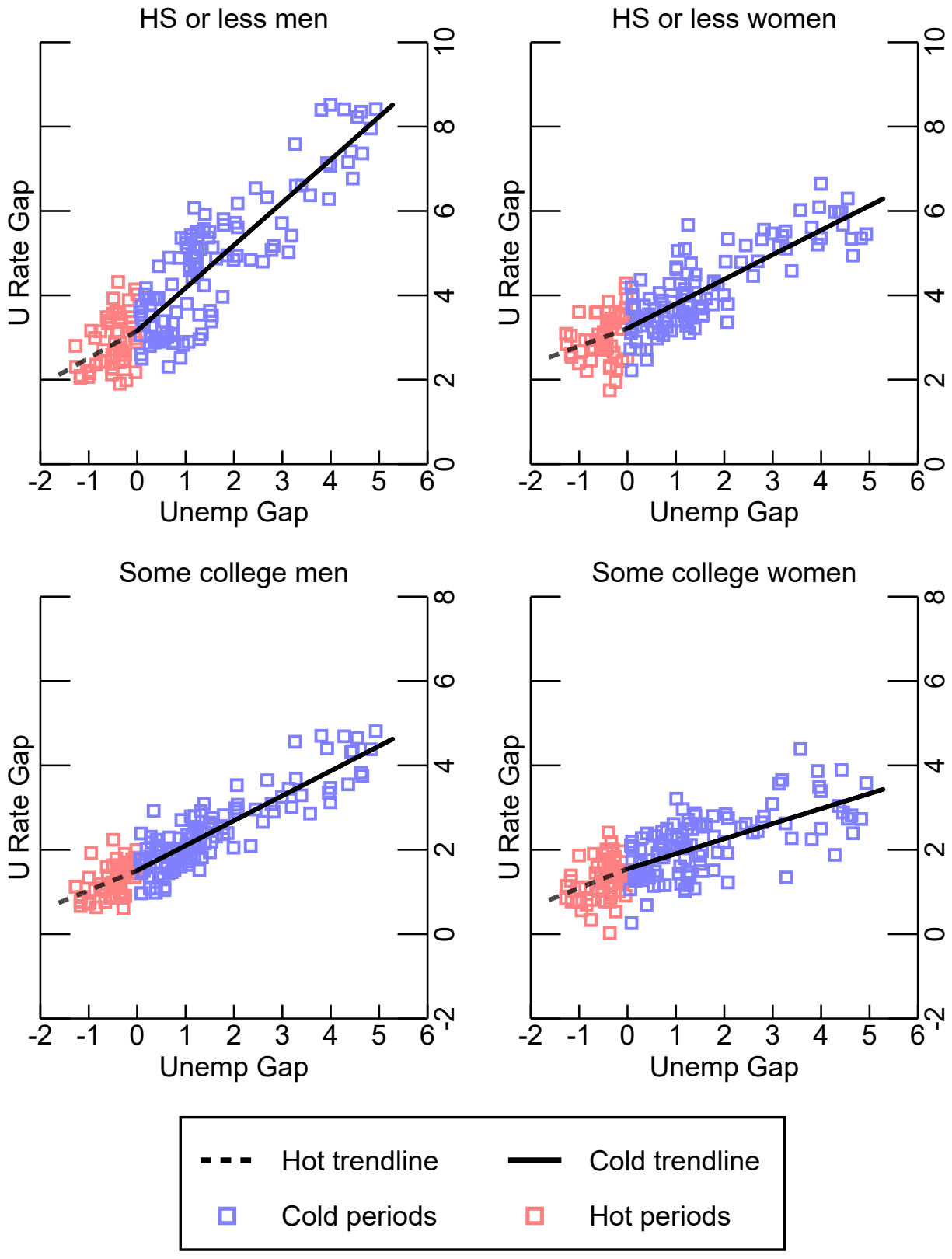


Figure 8:
U Rate Gap for Hispanic and White Men, Ages 25-64

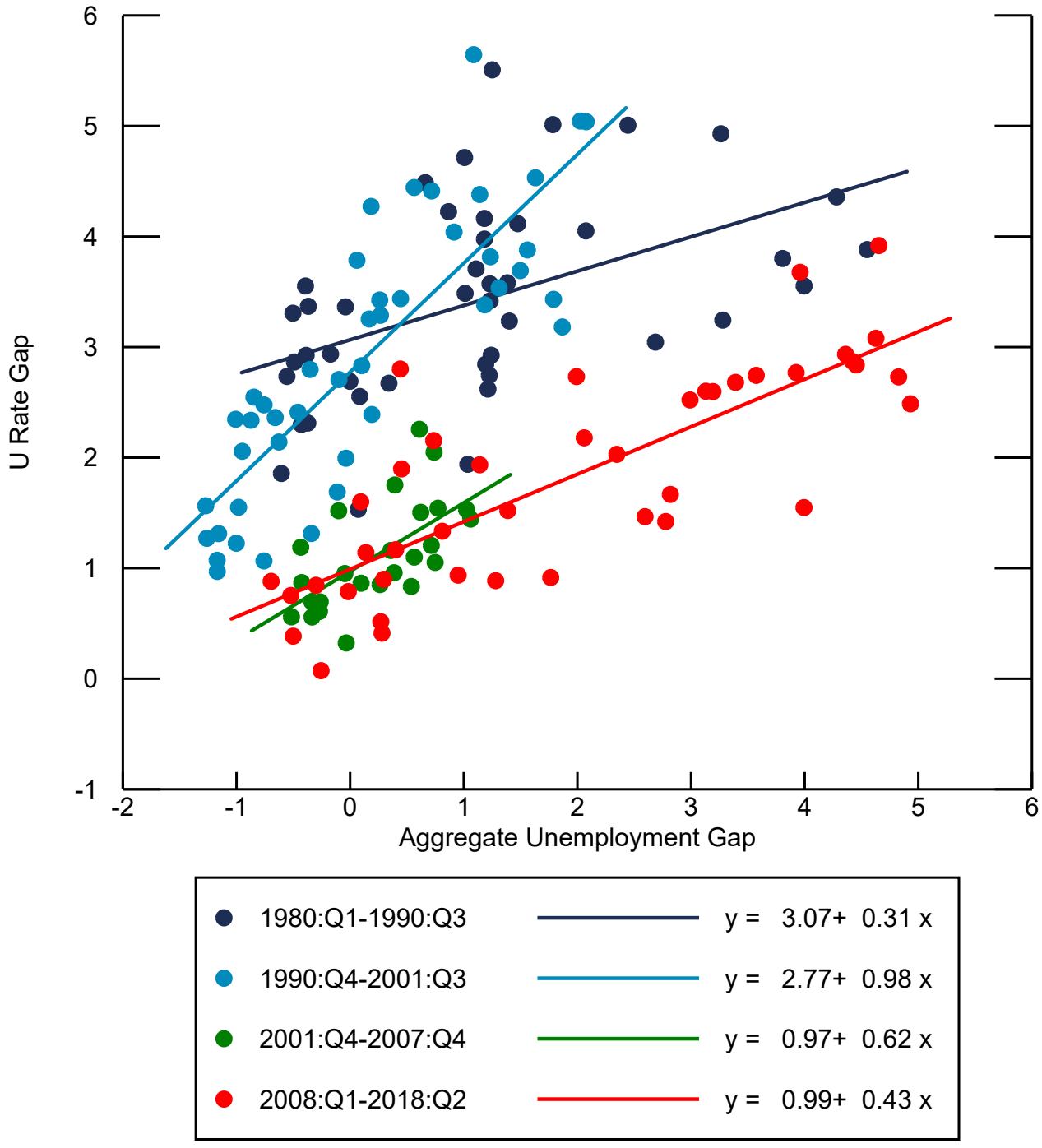


Table 3:
U Rate Gaps by Race/ethnicity, Sex, and Business Cycle, Ages 25-64

	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	0.903***	0.115	1.018	0.279***	0.493*	0.773	0.418***	0.617**	1.035	0.308***	-0.083	0.225
	(0.072)	(0.242)		(0.064)	(0.268)		(0.076)	(0.259)		(0.068)	(0.273)	
1980:Q1-1990:Q3	0.916***	-0.436	0.481	0.252**	0.692	0.944	0.523***	-0.626	-0.103	0.507***	-0.651	-0.144
	(0.085)	(0.558)		(0.100)	(0.737)		(0.126)	(0.699)		(0.139)	(0.906)	
1990:Q4-2001:Q3	0.894***	0.042	0.936	0.735***	0.657	1.392	0.680***	0.179	0.859	0.060	1.087**	1.147
	(0.124)	(0.300)		(0.201)	(0.398)		(0.147)	(0.351)		(0.244)	(0.478)	
2001:Q4-2007:Q4	0.279	0.295	0.573	0.756**	-0.466	0.290	0.172	2.415**	2.587	0.641	2.536	3.177
	(0.423)	(1.243)		(0.275)	(0.734)		(0.372)	(1.004)		(0.582)	(1.717)	
2008:Q1-2018:Q2	0.879***	1.105*	1.983	0.414***	0.360	0.774	0.431***	1.133***	1.563	0.438***	0.147	0.584
	(0.095)	(0.584)		(0.061)	(0.508)		(0.067)	(0.341)		(0.063)	(0.463)	

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	0.986***	-0.218	0.768	0.579***	-0.070	0.510	0.549***	-0.061	0.488	0.333***	0.168	0.501
	(0.043)	(0.167)		(0.031)	(0.119)		(0.034)	(0.139)		(0.039)	(0.138)	
1980:Q1-1990:Q3	1.061***	-0.427	0.635	0.621***	0.028	0.649	0.540***	0.141	0.681	0.135**	0.605	0.740
	(0.062)	(0.379)		(0.065)	(0.432)		(0.057)	(0.460)		(0.065)	(0.444)	
1990:Q4-2001:Q3	1.021***	0.124	1.145	0.693***	-0.246	0.447	0.631***	-0.244	0.387	0.521***	-0.141	0.380
	(0.086)	(0.207)		(0.068)	(0.164)		(0.138)	(0.289)		(0.112)	(0.220)	
2001:Q4-2007:Q4	0.519	-0.668	-0.148	0.282	-0.373	-0.091	0.011	0.911	0.922	0.437*	-1.672***	-1.235
	(0.328)	(0.807)		(0.197)	(0.691)		(0.346)	(0.919)		(0.237)	(0.498)	
2008:Q1-2018:Q2	0.997***	-0.364	0.633	0.498***	0.308	0.806	0.517***	0.261	0.778	0.334***	0.293	0.627
	(0.048)	(0.406)		(0.038)	(0.298)		(0.052)	(0.321)		(0.054)	(0.510)	

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

Figure 9:
LFPR Gap by Race/ethnicity and Sex (Ages 25-64)

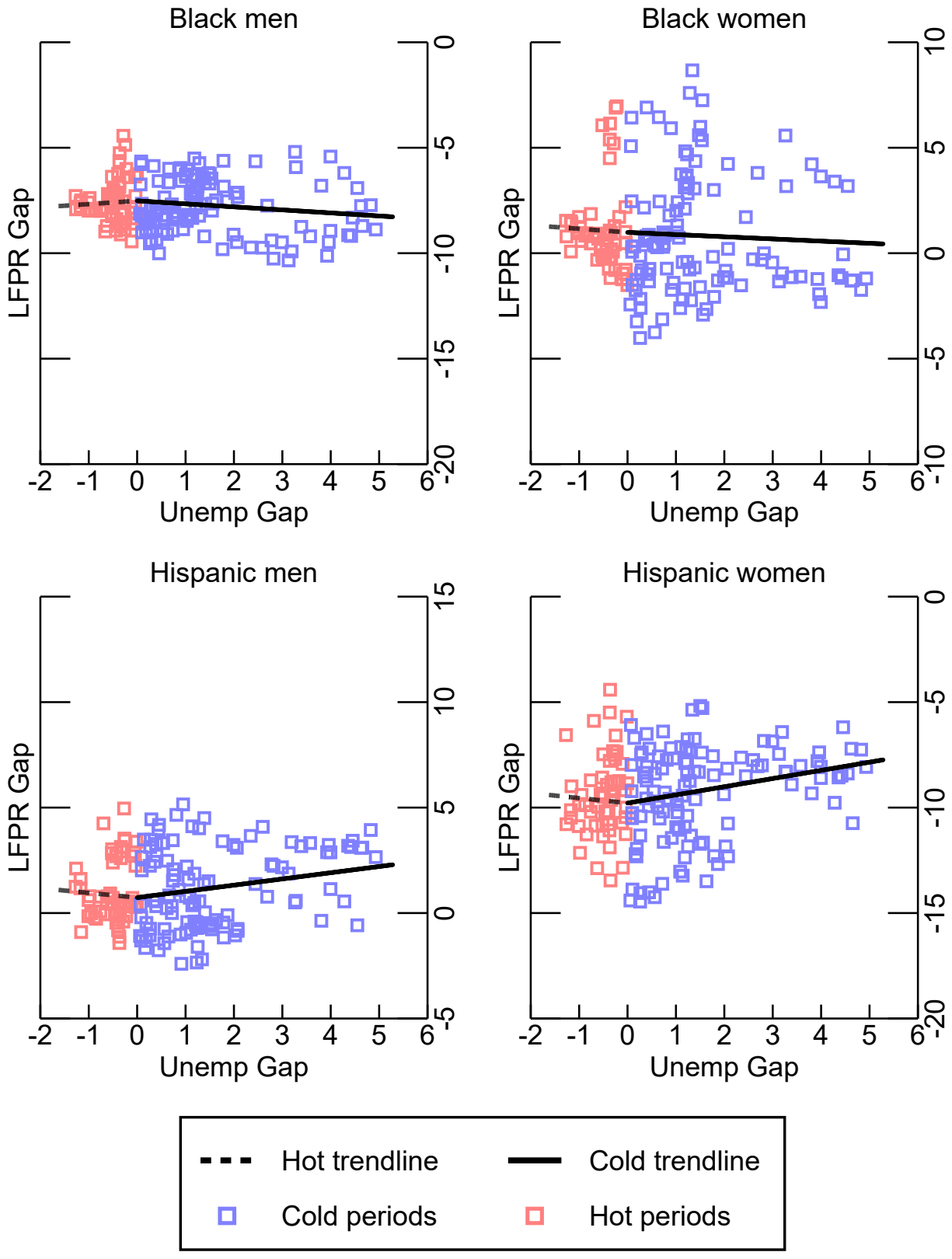


Table 5:
LFPR Gaps by Race/ethnicity, Sex, and Business Cycle, Ages 25-64

	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	-0.080	0.156	0.076	0.244**	-0.292	-0.047	0.097	-0.832*	-0.735	0.481***	-0.955	-0.475
	(0.084)	(0.247)		(0.102)	(0.453)		(0.140)	(0.449)		(0.107)	(0.582)	
1980:Q1-1990:Q3	0.022	1.240***	1.262	0.073	-0.599	-0.526	0.392**	4.236***	4.629	0.055	2.879**	2.935
	(0.090)	(0.441)		(0.096)	(0.727)		(0.193)	(1.288)		(0.140)	(1.214)	
1990:Q4-2001:Q3	0.745***	-1.427***	-0.682	0.026	-1.315***	-1.289	0.156	-3.176***	-3.020	0.404	-3.340***	-2.937
	(0.131)	(0.299)		(0.165)	(0.461)		(0.285)	(0.590)		(0.293)	(0.788)	
2001:Q4-2007:Q4	-0.161	1.102	0.941	-1.190**	-0.588	-1.778	0.711	-1.030	-0.319	-1.181	2.359	1.178
	(0.391)	(1.260)		(0.488)	(1.186)		(0.454)	(1.203)		(0.783)	(2.311)	
2008:Q1-2018:Q2	-0.088	-1.229**	-1.316	-0.152**	1.045	0.893	-0.147*	-1.097	-1.244	0.023	-1.412	-1.389
	(0.079)	(0.510)		(0.060)	(1.013)		(0.075)	(0.656)		(0.141)	(1.361)	

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

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

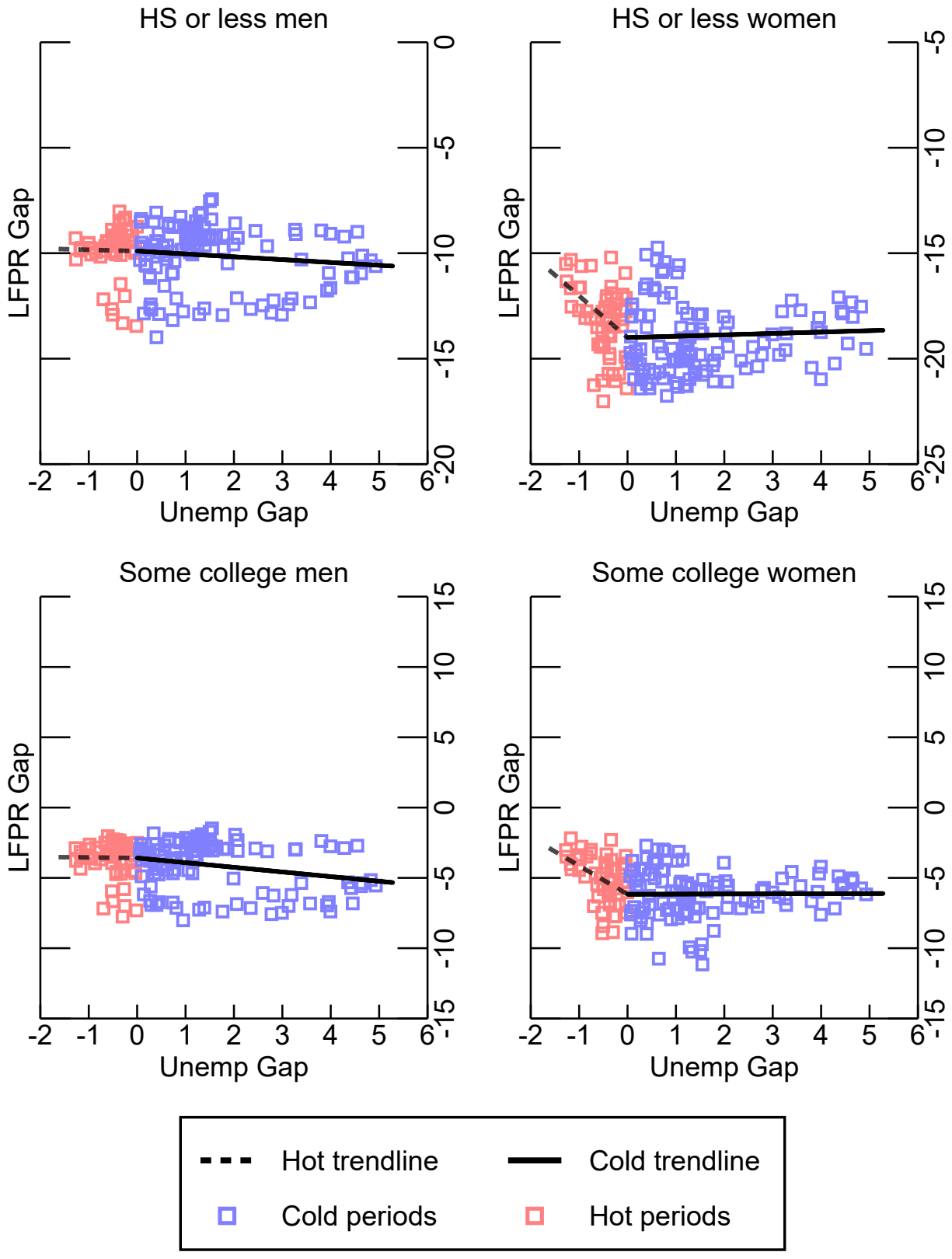


Table 6:
LFPR Gaps by Education, Sex, and Business Cycle, Ages 25-64

	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	-0.079	-0.165	-0.244	-0.292***	0.106	-0.186	0.097	-2.175***	-2.078	-0.069	-1.622***	-1.691
	(0.080)	(0.301)		(0.105)	(0.371)		(0.092)	(0.453)		(0.075)	(0.370)	
1980:Q1-1990:Q3	-0.008	0.841**	0.834	-0.033	-0.245	-0.279	0.051	-1.423*	-1.371	0.006	-2.672***	-2.666
	(0.047)	(0.363)		(0.045)	(0.424)		(0.101)	(0.720)		(0.091)	(0.772)	
1990:Q4-2001:Q3	0.501***	-1.062***	-0.561	0.380***	-0.320	0.060	-0.323	-2.328***	-2.651	-0.463**	-0.851*	-1.315
	(0.172)	(0.367)		(0.133)	(0.287)		(0.244)	(0.534)		(0.182)	(0.429)	
2001:Q4-2007:Q4	0.029	-0.339	-0.311	-0.007	1.139	1.132	1.335***	-0.481	0.854	0.591*	-0.255	0.336
	(0.412)	(0.902)		(0.477)	(1.349)		(0.473)	(1.357)		(0.308)	(0.986)	
2008:Q1-2018:Q2	0.308***	-0.168	0.141	0.099	0.304	0.403	0.618***	0.403	1.022	0.389***	0.919	1.309
	(0.108)	(0.934)		(0.089)	(0.796)		(0.117)	(0.951)		(0.101)	(1.100)	

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

Figure 11:
EPOP Gap by Race/ethnicity and Sex (Ages 25-64)

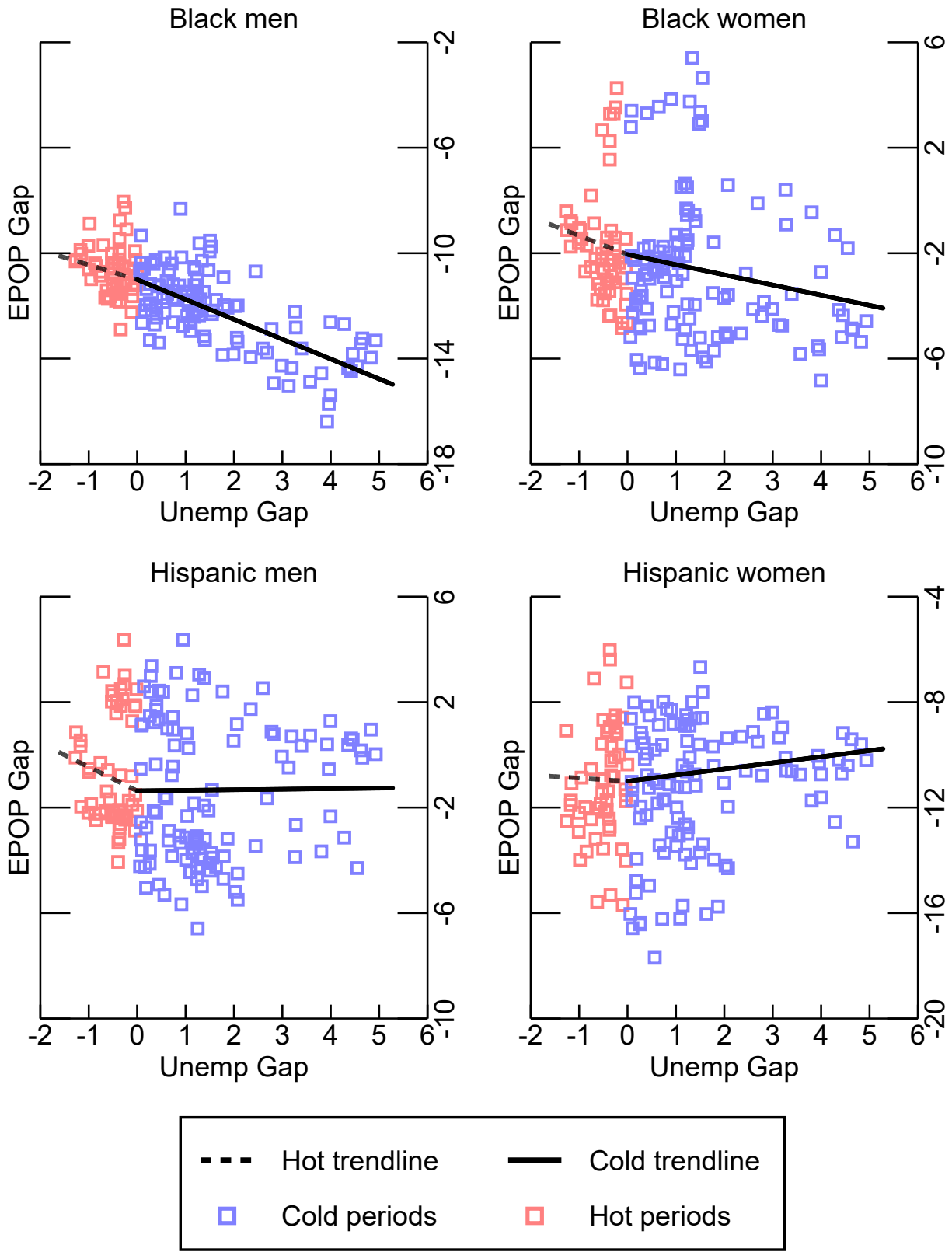


Table 7:
EPOP Gaps by Race/ethnicity, Sex, and Business Cycle, Ages 25-64

	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	-0.697***	-0.010	-0.708	-0.036	-0.687	-0.723	-0.185	-1.147***	-1.332	0.329***	-0.703	-0.374
	(0.068)	(0.229)		(0.143)	(0.615)		(0.113)	(0.404)		(0.118)	(0.615)	
1980:Q1-1990:Q3	-0.694***	1.511**	0.817	-0.168	-1.235	-1.403	0.044	4.672***	4.717	-0.118	3.366***	3.248
	(0.111)	(0.609)		(0.131)	(1.051)		(0.217)	(1.407)		(0.157)	(1.195)	
1990:Q4-2001:Q3	-0.001	-1.323***	-1.324	-0.631**	-1.846***	-2.477	-0.261	-3.178***	-3.439	0.477	-3.805***	-3.327
	(0.161)	(0.337)		(0.279)	(0.674)		(0.264)	(0.519)		(0.310)	(0.727)	
2001:Q4-2007:Q4	-0.200	0.448	0.248	-1.800***	-0.233	-2.034	0.507	-2.657**	-2.150	-1.424	0.456	-0.969
	(0.522)	(1.804)		(0.550)	(1.252)		(0.300)	(0.982)		(0.870)	(2.431)	
2008:Q1-2018:Q2	-0.683***	-1.984***	-2.667	-0.545***	0.813	0.268	-0.445***	-1.907**	-2.352	-0.214	-1.469	-1.684
	(0.110)	(0.670)		(0.072)	(0.760)		(0.084)	(0.764)		(0.138)	(1.272)	

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

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

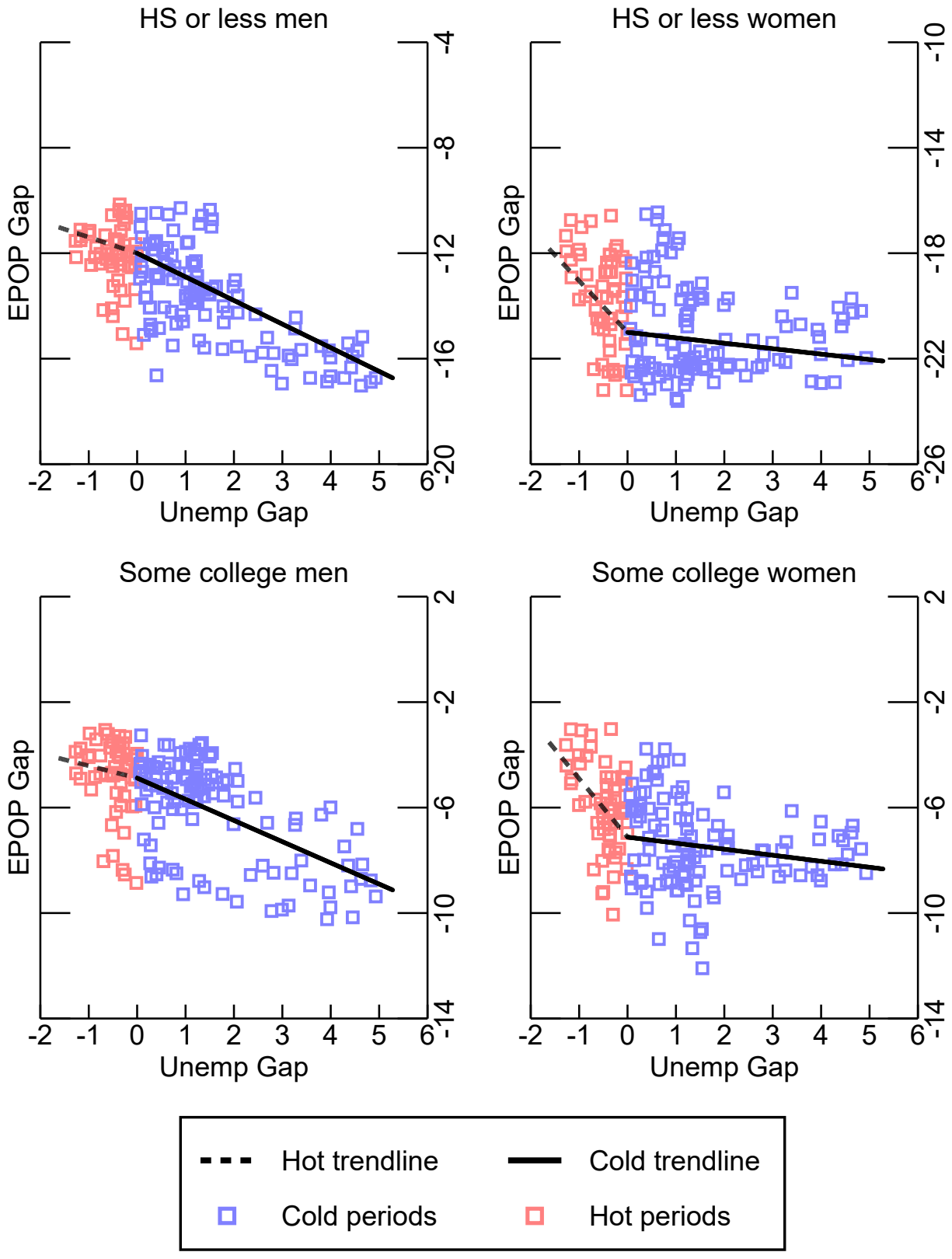


Table 8:
EPOP Gaps by Education, Sex, and Business Cycle, Ages 25-64

	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	-0.821***	-0.049	-0.870	-0.758***	0.121	-0.637	-0.141	-1.989***	-2.131	-0.282***	-1.671***	-1.953
	(0.060)	(0.275)		(0.088)	(0.358)		(0.090)	(0.451)		(0.073)	(0.397)	
1980:Q1-1990:Q3	-0.894***	1.074*	0.180	-0.600***	-0.265	-0.866	-0.154	-1.263	-1.418	-0.054	-2.945***	-2.999
	(0.086)	(0.603)		(0.069)	(0.507)		(0.116)	(0.896)		(0.099)	(0.863)	
1990:Q4-2001:Q3	-0.348**	-1.124***	-1.472	-0.255*	-0.084	-0.338	-0.653***	-2.007***	-2.660	-0.838***	-0.689	-1.527
	(0.169)	(0.366)		(0.138)	(0.299)		(0.216)	(0.490)		(0.187)	(0.432)	
2001:Q4-2007:Q4	-0.155	-0.173	-0.328	-0.201	1.406	1.205	1.340***	-0.941	0.399	0.217	1.150	1.367
	(0.381)	(0.940)		(0.550)	(1.721)		(0.437)	(1.222)		(0.434)	(1.029)	
2008:Q1-2018:Q2	-0.447***	0.169	-0.278	-0.297***	0.071	-0.226	0.348***	0.301	0.648	0.148	0.778	0.926
	(0.100)	(0.781)		(0.088)	(0.849)		(0.108)	(0.882)		(0.100)	(0.962)	

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

Table 9:
Gaps by Demographic Group - Metropolitan Areas, Ages 25-64

		Slope Ugap>0	Increment Ugap<0
U rate	Black	0.765***	0.774**
		(0.183)	(0.347)
	Hispanic	0.424***	0.144
		(0.135)	(0.298)
	HS or less	0.839***	0.0299
		(0.0877)	(0.188)
	Some college	0.353***	0.261
		(0.0892)	(0.181)
LFPR	Black	-0.299*	-0.188
		(0.176)	(0.516)
	Hispanic	0.0819	-0.339
		(0.222)	(0.602)
	HS or less	0.182	0.125
		(0.115)	(0.323)
	Some college	0.143	-0.795**
		(0.118)	(0.352)
EPOP	Black	-0.794***	-0.699
		(0.193)	(0.525)
	Hispanic	-0.260	-0.416
		(0.229)	(0.594)
	HS or less	-0.346***	0.131
		(0.126)	(0.349)
	Some college	-0.112	-0.951**
		(0.137)	(0.392)

Note: Robust standard errors 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 418 observations, on the Hispanic gap include 336 observations, and include 540 observations on both the HS or less gap and the Some college gap. * p<.10, ** p<.05, *** p<.01

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

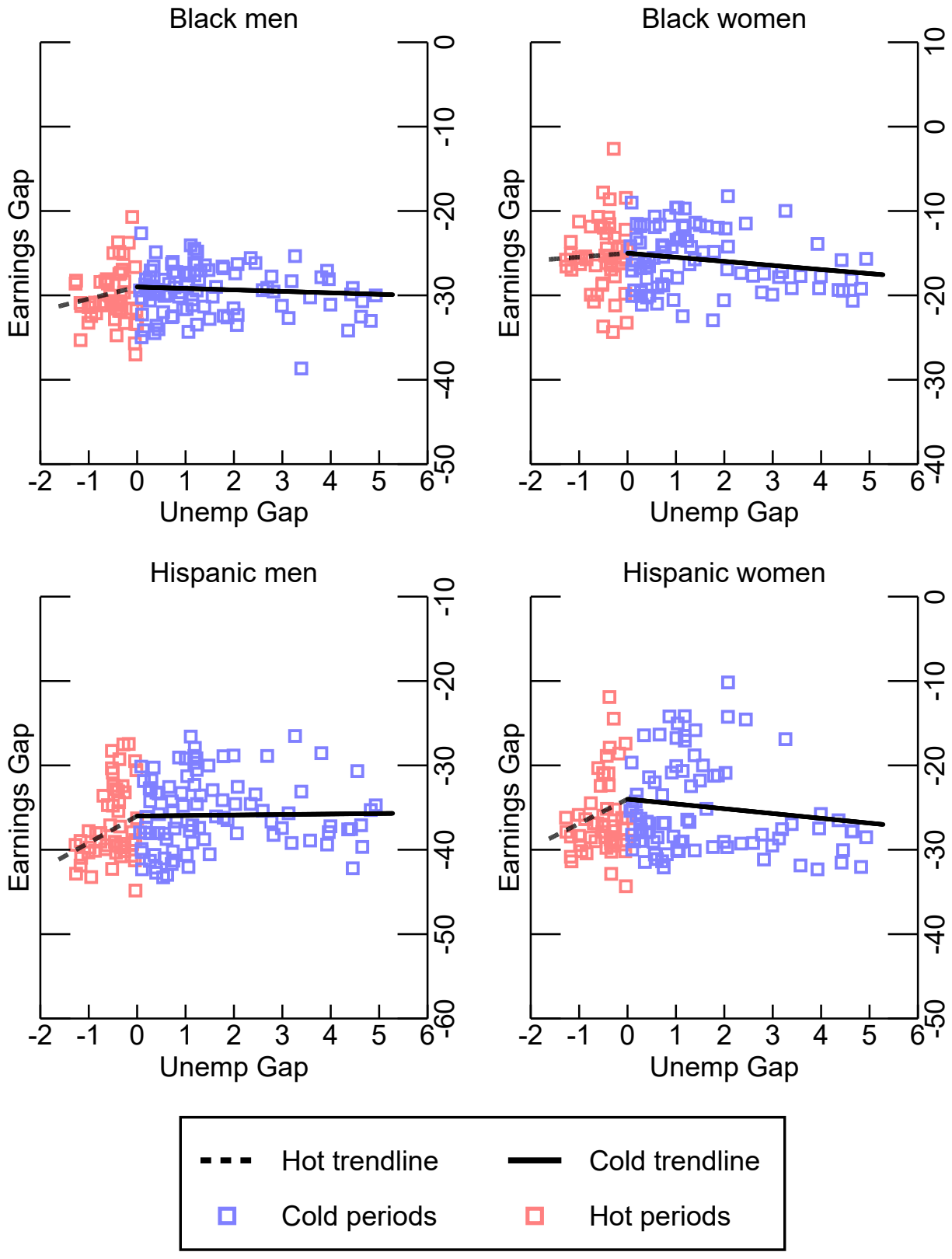


Table 10:
Hourly Earnings Gaps by Race/ethnicity, Sex, and Business Cycle, Ages 25-64

	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	-0.146	1.580*	1.433	0.114	3.243***	3.357	-0.430**	0.881	0.451	-0.522*	3.420***	2.898
	(0.211)	(0.863)		(0.277)	(1.065)		(0.211)	(0.902)		(0.293)	(1.098)	
1980:Q1-1990:Q3	0.036	3.054	3.090	0.310	6.321**	6.631	0.860*	-2.335	-1.475	1.344	1.664	3.009
	(0.576)	(3.452)		(0.442)	(2.730)		(0.473)	(2.504)		(0.934)	(4.291)	
1990:Q4-2001:Q3	-0.245	1.437	1.193	1.662***	0.794	2.456	1.210***	-0.408	0.801	3.674***	-1.676	1.998
	(0.592)	(1.282)		(0.585)	(1.278)		(0.429)	(0.986)		(1.000)	(1.645)	
2001:Q4-2007:Q4	-1.019	2.791	1.772	0.741	-3.690	-2.950	-0.245	-1.615	-1.860	0.955	-5.875	-4.920
	(3.568)	(9.571)		(1.366)	(3.895)		(3.057)	(8.627)		(1.602)	(4.699)	
2008:Q1-2018:Q2	-0.050	0.710	0.660	-0.751***	-2.267	-3.018	0.326	3.896	4.222	-0.255	-1.238	-1.493
	(0.266)	(1.968)		(0.265)	(2.473)		(0.217)	(2.546)		(0.174)	(1.132)	

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)

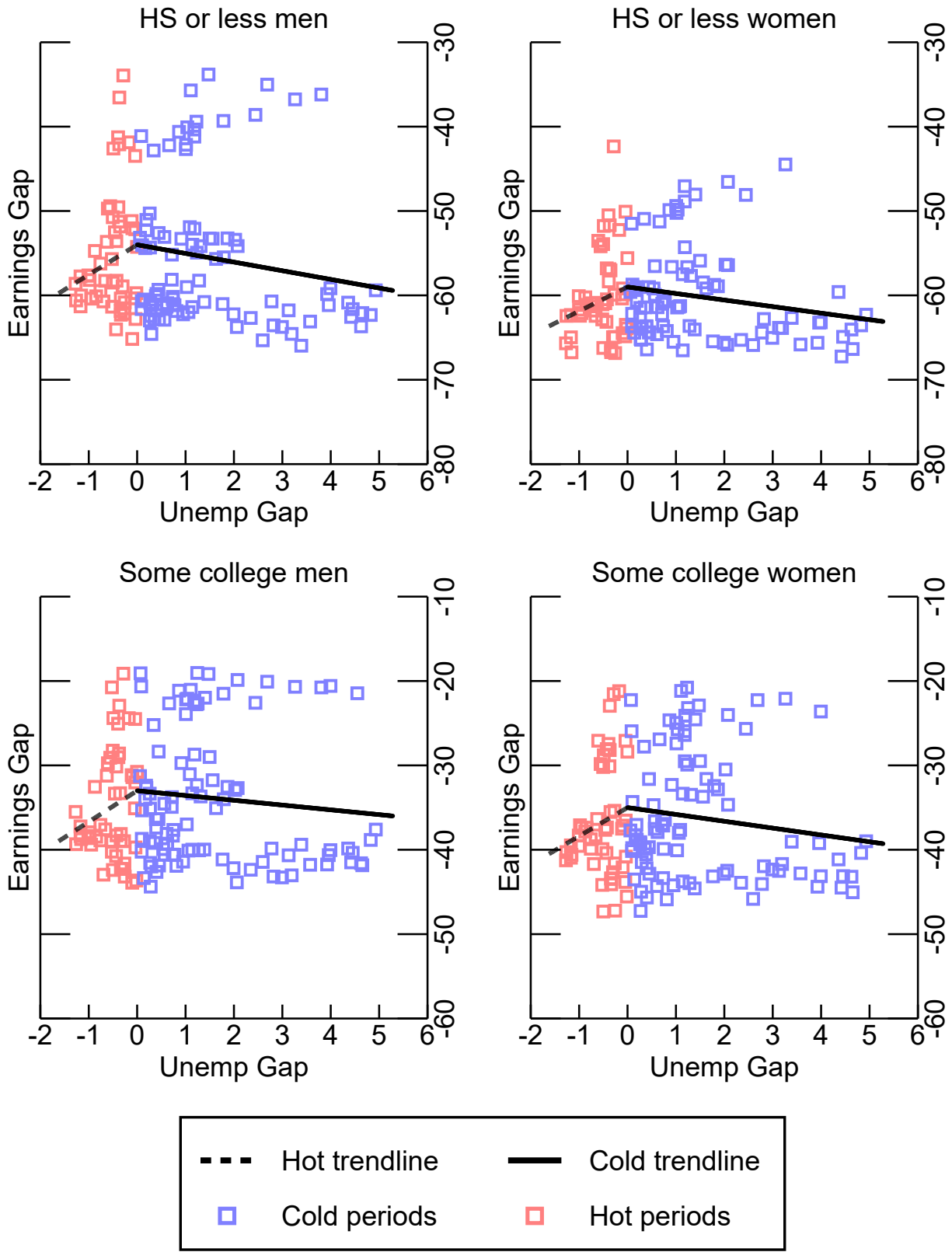


Table 11:
Hourly Earnings Gaps by Education, Sex, and Business Cycle, Ages 25-64

	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	-0.876	4.548***	3.672	-0.480	4.459***	3.978	-0.702**	3.562***	2.860	-0.707	4.190***	3.482
	(0.532)	(1.656)		(0.521)	(1.645)		(0.322)	(1.150)		(0.458)	(1.515)	
1980:Q1-1990:Q3	2.542***	6.671	9.214	0.693*	9.200***	9.893	2.419***	1.568	3.987	0.795**	5.270**	6.065
	(0.808)	(4.975)		(0.386)	(2.827)		(0.445)	(2.372)		(0.388)	(2.173)	
1990:Q4-2001:Q3	-0.869*	6.811***	5.942	0.128	4.754***	4.882	1.389***	1.423	2.812	3.085***	-1.313	1.773
	(0.460)	(1.013)		(0.489)	(1.108)		(0.441)	(1.045)		(0.601)	(1.187)	
2001:Q4-2007:Q4	2.230*	-4.723	-2.493	0.835	1.267	2.102	3.459***	-5.785*	-2.326	3.691**	-6.017	-2.326
	(1.293)	(3.928)		(1.832)	(4.700)		(0.874)	(3.169)		(1.421)	(3.721)	
2008:Q1-2018:Q2	-0.199	-4.719*	-4.918	0.277	0.228	0.504	0.205	-2.187	-1.981	0.451*	-0.211	0.241
	(0.168)	(2.615)		(0.175)	(1.595)		(0.165)	(1.861)		(0.226)	(2.701)	

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 Inc Gap by Race/ethnicity and Sex (Ages 25-64)

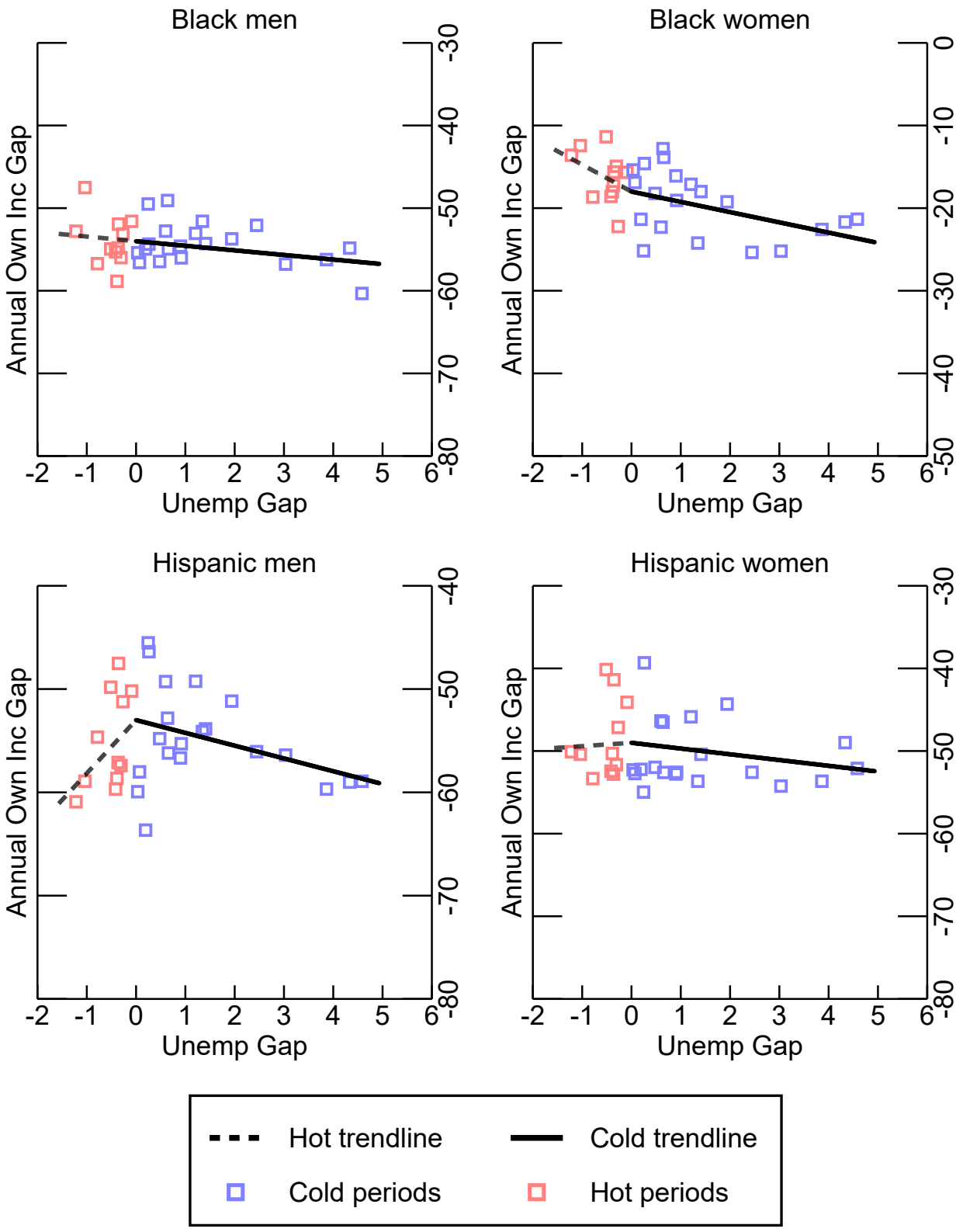


Figure 16:
Annual Own Inc Gap by Education and Sex (Ages 25-64)

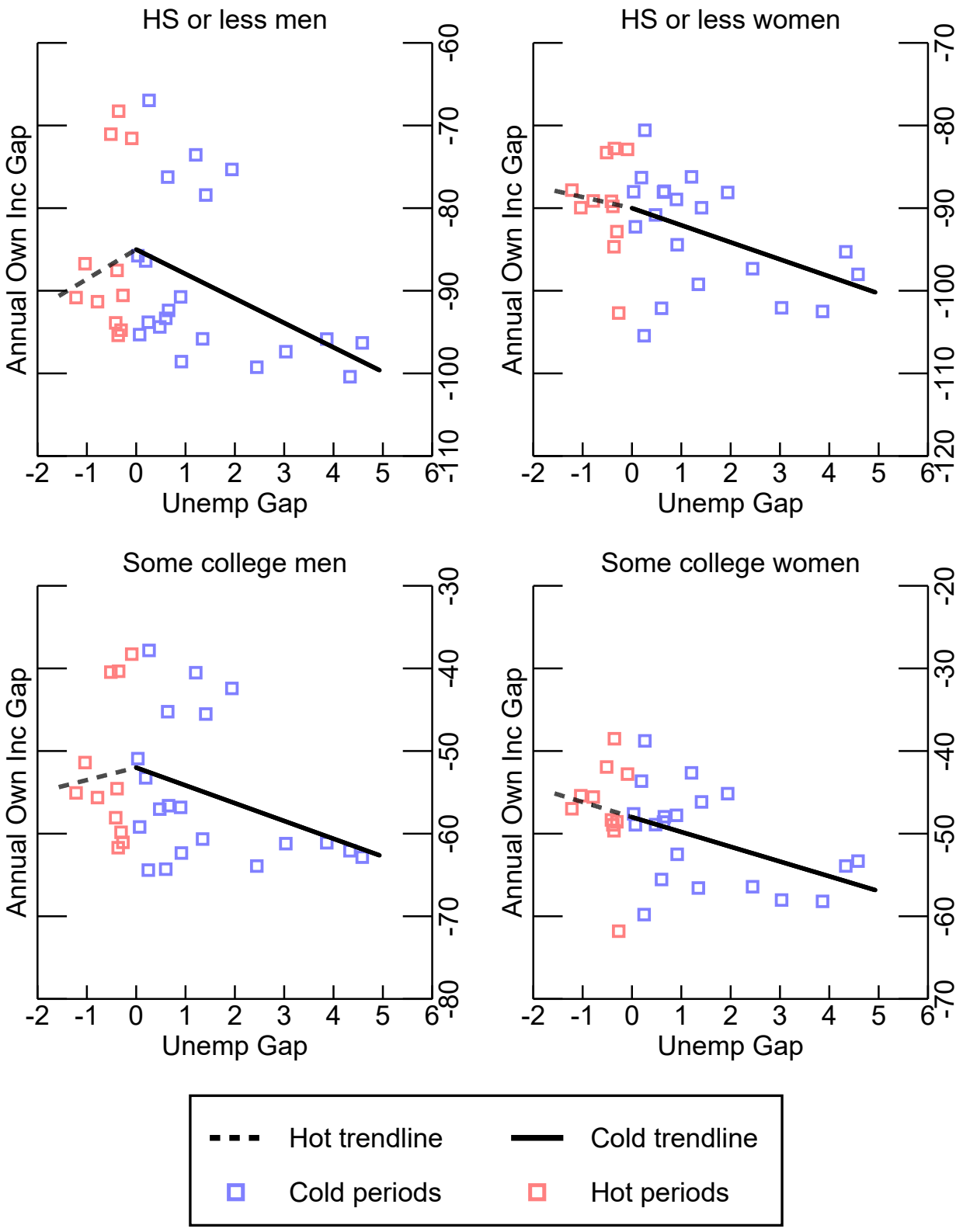


Figure 17:
HH Income Gap by Race/ethnicity and Sex (Ages 25-64)

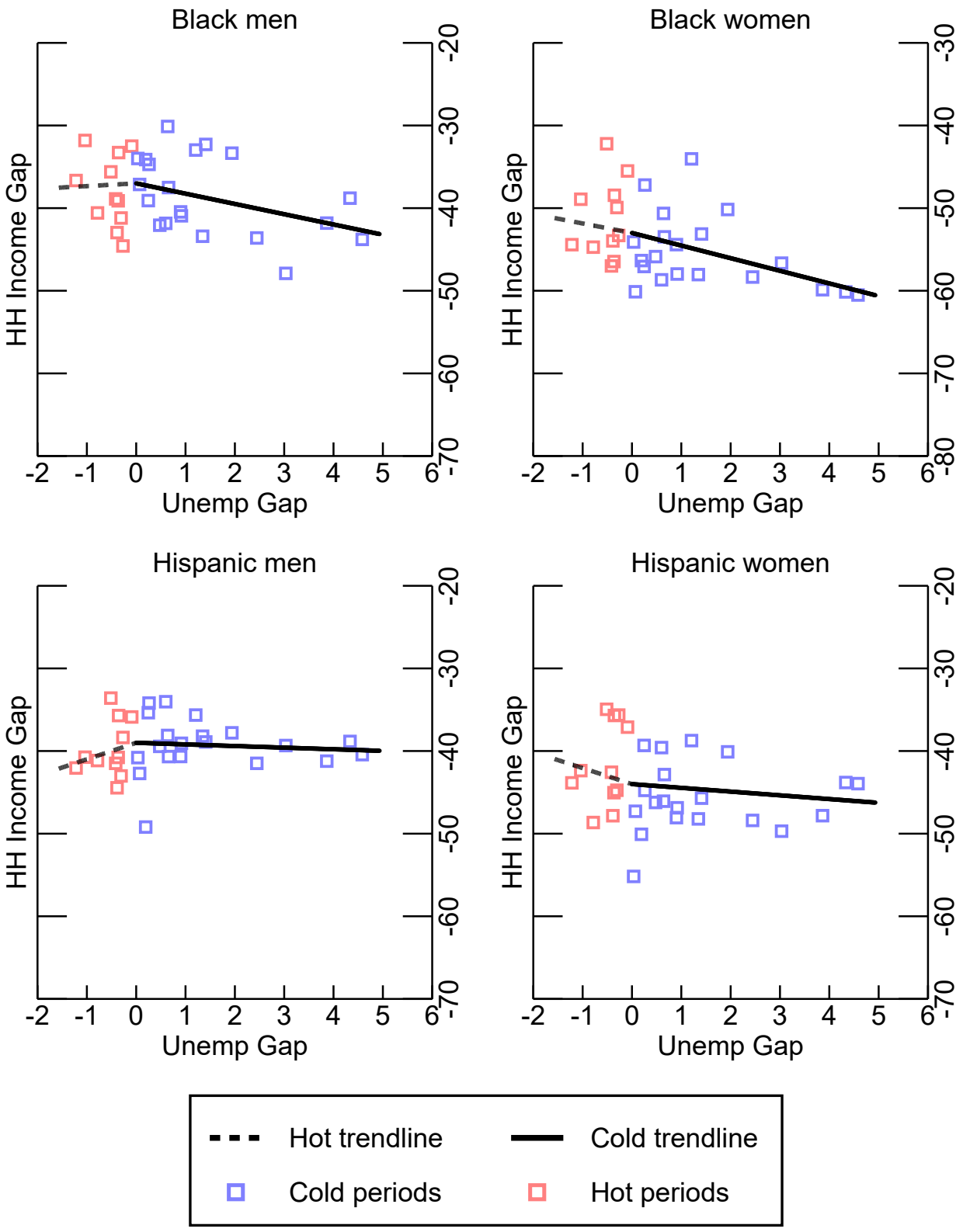


Figure 18:
HH Income Gap by Education and Sex (Ages 25-64)

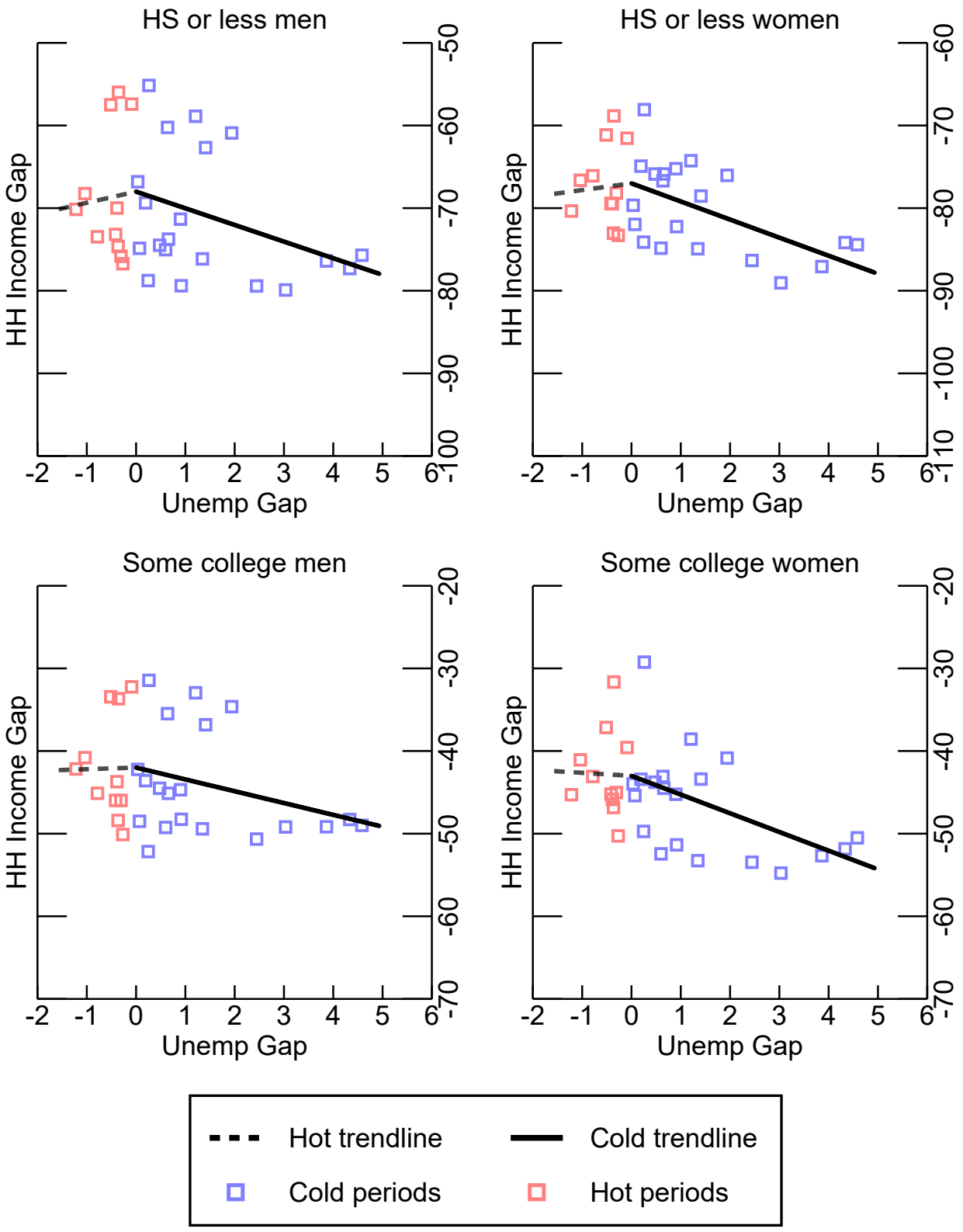


Table 12:
Annual Own Income and HH Income Gaps by Race/ethnicity and Sex, Ages 25-64 - All Business Cycles

	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 Income	-0.555	-0.008	-0.564	-1.238**	6.397**	5.159	-1.240***	-2.023	-3.263	-0.696	1.102	0.405
	(0.397)	(2.294)		(0.501)	(2.598)		(0.394)	(1.872)		(0.488)	(2.291)	
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
	(0.523)	(2.537)		(0.382)	(1.910)		(0.412)	(2.662)		(0.583)	(2.786)	

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

Table 13:
Annual Own Income 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 Income	-2.963***	6.555	3.592	-2.153**	3.661	1.508	-2.065**	0.721	-1.344	-1.789***	-0.040	-1.829
	(0.914)	(4.417)		(0.792)	(3.885)		(0.751)	(3.041)		(0.647)	(2.495)	
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
	(0.735)	(3.482)		(0.604)	(2.926)		(0.566)	(2.443)		(0.592)	(2.737)	

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

Table 14:
EPOP 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	-0.027	0.571	0.544	-0.607***	-0.382	-0.989	-0.231	-3.096**	-3.326	0.069	-0.689	-0.620
	(0.232)	(1.001)		(0.221)	(0.782)		(0.327)	(1.187)		(0.254)	(1.123)	
1980:Q1-1990:Q3	-0.567**	-4.501**	-5.069	-1.570***	-2.520	-4.090	-0.692**	-2.694	-3.386	-0.138	0.750	0.612
	(0.260)	(1.744)		(0.399)	(1.884)		(0.272)	(1.603)		(0.371)	(2.139)	
1990:Q4-2001:Q3	0.330	-1.158	-0.827	1.035**	-3.976***	-2.941	-2.417***	-1.901*	-4.318	0.022	-4.419***	-4.397
	(0.349)	(0.981)		(0.471)	(0.952)		(0.411)	(1.005)		(0.720)	(1.425)	
2001:Q4-2007:Q4	-1.361*	-1.779	-3.140	-2.390*	3.922	1.532	-1.504***	-1.578	-3.082	0.186	-4.956	-4.770
	(0.768)	(2.044)		(1.349)	(4.097)		(0.532)	(2.015)		(1.467)	(4.334)	
2008:Q1-2018:Q2	-0.939***	-2.642	-3.581	-0.076	3.521**	3.446	-1.474***	-1.959	-3.434	-1.166***	1.818	0.652
	(0.196)	(1.729)		(0.177)	(1.377)		(0.265)	(2.233)		(0.223)	(1.813)	

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

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

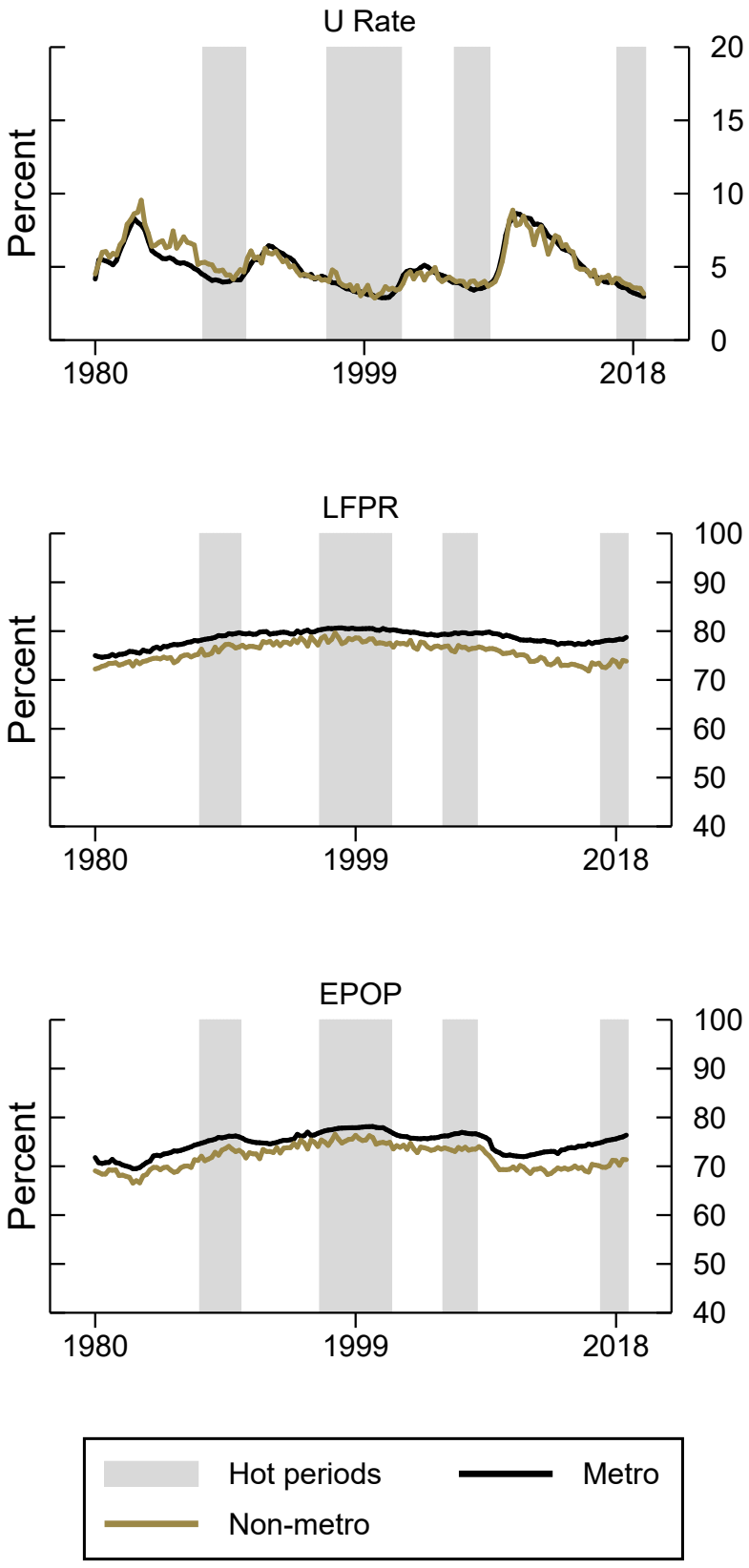


Table 15:
Metro Status Gaps - 1980:Q1-2018:Q3, Ages 25-64

	Slope Ugap>0	Increment Ugap<0
U rate	-0.00081**	0.00005
	(0.00041)	(0.00138)
LFPR	-0.00053	0.00034
	(0.00056)	(0.00269)
EPOP	0.00043	0.00020
	(0.00052)	(0.00287)
Observations	155	

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

Table 16:
Univariate Unit-Root Tests on
Unemployment and the Employment-to-Population Ratio

	DF-GLS	Zivot-Andrews	KPSS	Lags
U rate	-3.152**	-5.535**	0.185**	5, 2, 4
EPOP	-1.302	-3.645	0.729***	9, 3, 4

For ADF-GSL, lag is determined by Ng-Perron test.
For KPSS, lag is determined by Shwert criteria, 5% critical value with 4 lags is .146.
For Zivot-Andrew, an endogenously determined break is allowed in the intercept and trend, lag is determined by AIC, 5 percent critical value is -5.08.

Table 17:
Univariate Unit-Root Tests on
Unemployment and the Employment-to-Population Ratio
By Race/ethnicity and Sex

			DF-GLS	Zivot-Andrews	KPSS	Lags
U rate	White	Men	-3.536**	-5.905***	0.154**	9, 2, 4
		Women	-2.391	-5.299**	0.327***	8, 3, 4
	Black	Men	-3.003**	-4.837	0.194**	3, 3, 4
		Women	-3.386**	-4.201	0.246***	7, 3, 4
	Hispanic	Men	-2.955**	-4.451	0.133	6, 0, 4
		Women	-3.162**	-4.871	0.127	7, 1, 4
EPOP	White	Men	2.446	-4.718	0.328***	9, 3, 4
		Women	-0.888	-3.751	0.851***	9, 1, 4
	Black	Men	-2.711	-4.448	0.236***	8, 3, 4
		Women	-1.404	-3.018	0.66***	5, 1, 4
	Hispanic	Men	-2.966**	-4.276	0.131	6, 1, 4
		Women	-1.058	-3.439	0.639***	8, 3, 4

For ADF-GSL, lag is determined by Ng-Perron test.
For KPSS, lag is determined by Shwert criteria, 5% critical value with 4 lags is .146.
For Zivot-Andrew, an endogenously determined break is allowed in the intercept and trend, lag is determined by AIC, 5 percent critical value is -5.08.

Table 18:
Univariate Unit-Root Tests on
Unemployment and the Employment-to-Population Ratio
By Education and Sex

			DF-GLS	Zivot-Andrews	KPSS	Lags
U rate	Less than HS	Men	-3.069**	-4.298	0.126	9, 3, 4
		Women	-3.403***	-5.184**	0.119	7, 3, 4
	High school	Men	-3.112**	-5.424**	0.156**	9, 2, 3
		Women	-2.88	-4.406	0.256***	8, 3, 4
	Some college	Men	-3.201**	-5.177**	0.168**	8, 3, 4
		Women	-2.664	-4.711	0.297***	3, 3, 4
	College or more	Men	-3.858***	-6.312***	0.117	7, 3, 4
		Women	-2.828	-5.091**	0.361***	7, 3, 4
EPOP	Less than HS	Men	-2.663	-3.179	0.239**	7, 1, 4
		Women	-2.527	-3.392	0.425***	7, 2, 4
	High school	Men	-2.706	-5.185**	0.238***	8, 3, 4
		Women	-0.758	-3.268	0.846***	7, 3, 4
	Some college	Men	-2.547	-4.253	0.344***	8, 3, 4
		Women	-0.732	-3.219	0.819***	7, 2, 4
	College or more	Men	-3.011**	-4.939**	0.141	8, 1, 4
		Women	-0.965	-4.007	0.756***	7, 2, 4

For ADF-GSL, lag is determined by Ng-Perron test.
For KPSS, lag is determined by Shwert criteria, 5% critical value with 4 lags is .146.
For Zivot-Andrew, an endogenously determined break is allowed in the intercept and trend, lag is determined by AIC, 5 percent critical value is -5.08.