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Okun Revisited: Who Benefits Most from a Strong Economy?

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

Conflict of Interest Disclosure: Stephanie Aaronson is the vice president and director of the Economic Studies program at the Brookings Institution; Mary Daly is the president and chief executive officer of the Federal Reserve Bank of San Francisco; William Wascher is deputy director of the Division of Research and Statistics of the Federal Reserve Board of Governors; and David Wilcox is the former director of the Division of Research and Statistics of the Federal Reserve Board of Governors. Beyond these affiliations, the authors did not receive financial support from any firm or person for this paper or from any firm or person with a financial or political interest in this paper. They are currently not officers, directors, or board members of any organization with an interest in this paper. No outside party had the right to review this paper before circulation. The views expressed in this paper are those of the authors, and do not necessarily reflect those of the Brookings Institution, the Federal Reserve Bank of San Francisco, or the Federal Reserve Board of Governors.

> 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, *Brookings Papers on Economic Activity*, 1973

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

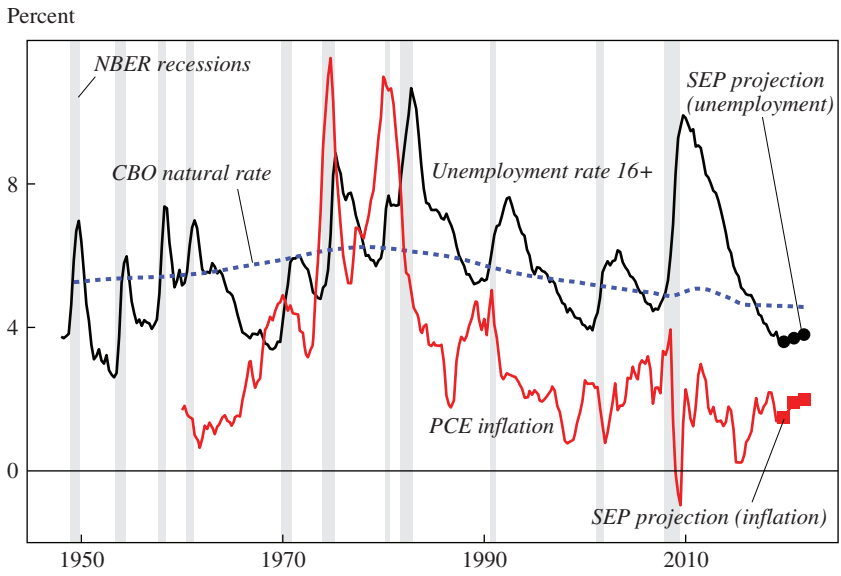
Nearly 50 years later, Okun's analysis remains relevant.[2] The current economic expansion has now become the longest in U.S. history and the labor market is tight by most standards. Moreover, inflation has been muted, running consistently below the 2 percent target of the Federal Open Market Committee (FOMC). As shown by the heavy solid line in figure 1, the unemployment rate, a standard measure of labor market strength, is currently about as low as it has been since 1969. Moreover, it is well below the estimate by the Congressional Budget Office (CBO) of its longer-run sustainable value (the dotted line).[3]

1. See Okun (1973, 240).

2. In the fall of 2016, the minutes of FOMC meetings and then–Federal Reserve chair Janet Yellen noted the emerging debate about the potential of running a "high-pressure economy." This discussion has continued in the media and publicly since that time and has been among the topics at the series of Fed Listens events held in 2019; see Federal Reserve Board of Governors (2019b).

3. The CBO's views are aligned with those of private sector forecasters (as measured by the Blue Chip consensus) and the FOMC's "Summary of Economic Projections" (SEP); as of March 2019, the CBO's estimate of the natural rate of unemployment was about 4½ percent, while the medians from private forecasters (Blue Chip) and the SEP were at 4¼ percent—all quite a bit higher than the actual unemployment rates that have prevailed

Figure 1. Unemployment and Inflation, 1950–2021[a]



Sources: Bureau of Labor Statistics; CBO; SEP, March 2019.

a. CBO = Congressional Budget Office; NBER = National Bureau of Economic Research; PCE = Personal Consumption Expenditures Price Index; SEP = Federal Open Market Committee's "Summary of Economic Projections."

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

over the past year. The labor market strength seen by economists and policymakers is also reflected in surveys of households and firms. In the Conference Board's Consumer Confidence Survey, for example, a much larger percentage of respondents stated that jobs are plentiful than said that jobs are hard to get, while in the National Federation of Independent Business's survey of small businesses, the percentage of companies reporting that jobs are hard to fill is at a historically high level.

4. See FOMC (2019).

document who benefits most from a strong economy. In particular, we are interested in the degree to which less advantaged groups of workers see disproportionate improvements in employment and income when the labor market is especially tight. We add to the existing literature by updating the analysis to include the current expansion, to focus specifically on whether the dynamics of key variables differ during hot labor markets, and to consider both the short- and longer-term impact of high-pressure periods on less advantaged groups. We also consider whether rural areas do better or worse than urban areas and whether the results hold in metropolitan-area-level, rather than national, data.

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

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

In contrast to the results for unemployment and participation, we find little evidence that gaps in hourly wages, annual own earnings, and household income vary over the labor market cycle; when they do change, they tend to widen. These results are consistent with previous research by Hilary Hoynes (2000); Jonathan Parker and Annette Vissing-Jorgensen (2010); Mary Daly, Bart Hobijn, and Joseph Pedtke (2019); and Cynthia Doniger (2019).

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

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

I. The Previous Literature

Following Okun (1973), many authors have investigated elements of the high-pressure hypothesis. A number of studies written in the wake of the strong economy of the late 1990s documented that disadvantaged workers, including blacks and low-skilled workers, experienced greater cyclical variation in their labor market outcomes. One example is the paper by Hoynes (2000), who examines how the employment, earnings, and income of less-skilled men vary over the business cycle. She finds that men with lower levels of education and nonwhites experience greater cyclical fluctuations in employment and earnings than high-skilled white men, but that earnings of other family members and government transfers mute the impact on family income.[6] Another prominent example is Lawrence Katz and Alan Krueger's (1999) exploration of whether the distributions of wages and incomes tighten systematically as the economy strengthens. They find that the wage growth of lower-wage individuals is more responsive to reductions in the unemployment rate than is the wage growth of higher-wage individuals, and that the tight labor market of the late 1990s produced more widespread benefits for the disadvantaged than did the tight market of the late 1980s, though this partly resulted from the expansion of the Earned Income Tax Credit during the later period.[7] Christina Romer and David Romer (1999) confirm that U.S. poverty rates decline during economic expansions, 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

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.

detrimental to the long-run well-being of the poor. More recently, Philip Jefferson (2008) has examined the behavior of employment-to-population ratios over the business cycle by level of educational attainment. He finds that the cyclical sensitivity of employment was greater from 1968 to 2005 for individuals with lower levels of educational attainment. Similarly, Tomaz Cajner and others (2017) find that both unemployment rates and patterns of labor force entry and exit for blacks and Hispanics are more cyclically sensitive than for whites.

Fewer studies have focused on the question we address here of whether the dynamics of key labor market variables differ when the economy is hot. One exception is Katherine Bradbury (2000), who, using data from the 1970s through 1990s, finds that the difference between black and white men's 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. She does not find a similar, separate effect on the unemployment rate gap between black and white women. Valerie Wilson (2015) compares the 1990s with several less-robust expansions and shows that with respect to both unemployment and earnings, African Americans particularly benefited from the high-pressure economy of the late 1990s. Julie Hotchkiss and Robert Moore (2018) analyze panel data from the National Longitudinal Surveys of Youth and find evidence that high-pressure economies lead to lower rates of unemployment and higher labor force attachment among disadvantaged groups, but that the effects are not particularly long-lived. Similarly, simulations conducted by Bruce Fallick and Pawel Krolikowski (2018) indicate that a hot labor market has modest but short-lived benefits for the labor market outcomes of less educated men.

In trying to understand these various findings, it is helpful to think about the specific channels through which a high-pressure economy could lead to improved labor market outcomes for more marginalized workers. As conceived by Okun in his seminal work, employers may upgrade workers into more productive jobs during a high-pressure economy, with the result that more marginal workers (women and teenagers, in Okun's analysis) increase their employment. A number of studies provide evidence of this phenomenon. Harry Holzer and others (2006) find 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 by Alicia Sasser Modestino and others (2016), who, using

job-posting data, find that in the immediate aftermath of the Great Recession, employers increased skill requirements listed in job postings, such as education and prior experience, and reduced them as the expansion gathered strength. Paul Devereux (2002) provides evidence that new hires tend to have lower educational attainment when the unemployment rate is low and that low-skilled workers experience the greatest occupational improvement in tight labor markets. This result is consistent with the model of vacancy chains developed by George Akerlof and others (1988), whereby as the unemployment rate falls, workers move into jobs that provide better matches. These studies all suggest that the benefits of a high-pressure economy are greater than those that would result simply from the fall in the unemployment rate.

II. Data and Measurement

Most of the data we use come from the Current Population Survey (CPS)—the survey of households used by the Bureau of Labor Statistics (BLS) to construct estimates of labor market outcomes. We focus our attention on 25- to 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 or blacks (we use the terms interchangeably); Hispanics or Latinos (again, we use the terms interchangeably); and non-Hispanic whites. We do not show results for Asian Americans, Native Americans, and others separately due to the statistical unreliability of results for smaller sample sizes. We define three levels of educational attainment: a high school degree or less; some college (which includes individuals with post–high school education who did not graduate from a four-year college, including those who earned an associate degree); and a four-year college degree or more. For annual household income, we take the demographic characteristics of the reference person or "householder" for each household in the Annual Social and Economic Supplements of the CPS.[8] All earnings and income series are deflated by the headline Personal Consumption Expenditures Price Index.[9]

8. We exclude "group quarters" households where the householder is not identified.

9. In all our statistical investigations, we use *gaps* in income between two different groups, constructed as 100 times the difference in log incomes. The choice of price index does not affect these gaps, but it does affect the levels shown in figures 4 and 5.

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

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

III. Results

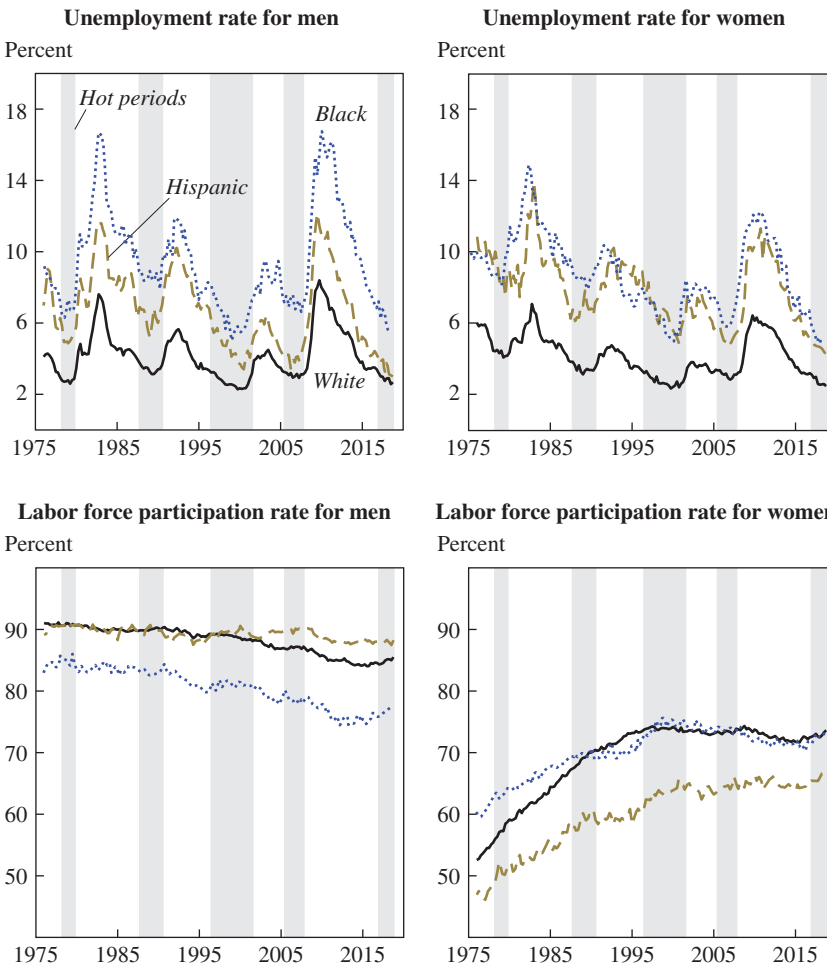
Among the myriad possible labor market outcomes, we focus on five measures: the unemployment rate; the labor force participation rate (LFPR); average hourly wages (which include the wages and salaries of employees, but not the self-employed); annual own earnings (including income from self-employment); and annual household income (from all sources).[10] We compare outcomes for black and Hispanic men and women with outcomes for white men and women; similarly, we compare outcomes for men and women with a high school degree or less and some college to outcomes for men and women with a college degree or more.

III.A. Evidence on the "High-Beta" Experience of Disadvantaged Groups

To set the stage for the results, it is useful to describe the trends in each of the key outcome variables. Figures 2 through 5 plot, in a 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.

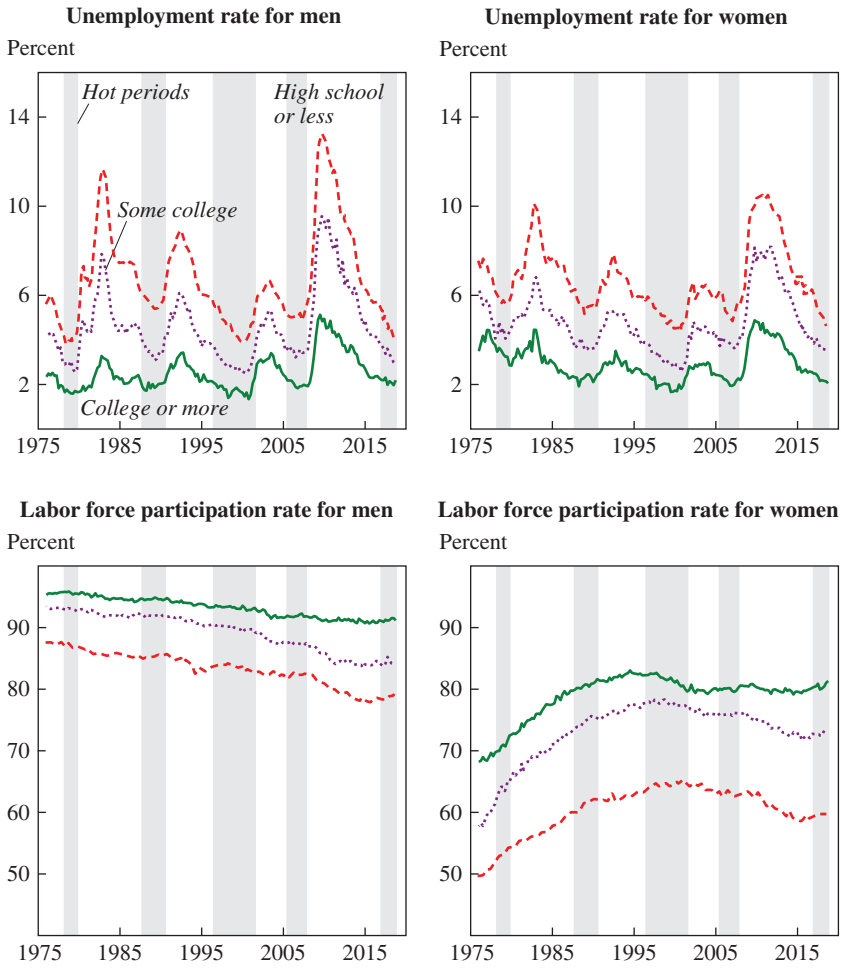
10. For completeness, we perform a similar analysis for the employment-to-population ratio. These results are available in the online appendix. The online appendixes for this and all other papers in this volume may be found at the Brookings Papers web page, ww.brookings.edu/bpea, under "Past BPEA Editions."

Figure 2. Labor Force Statistics by Race and Ethnicity, Age 25–64 Years, 1975–2018



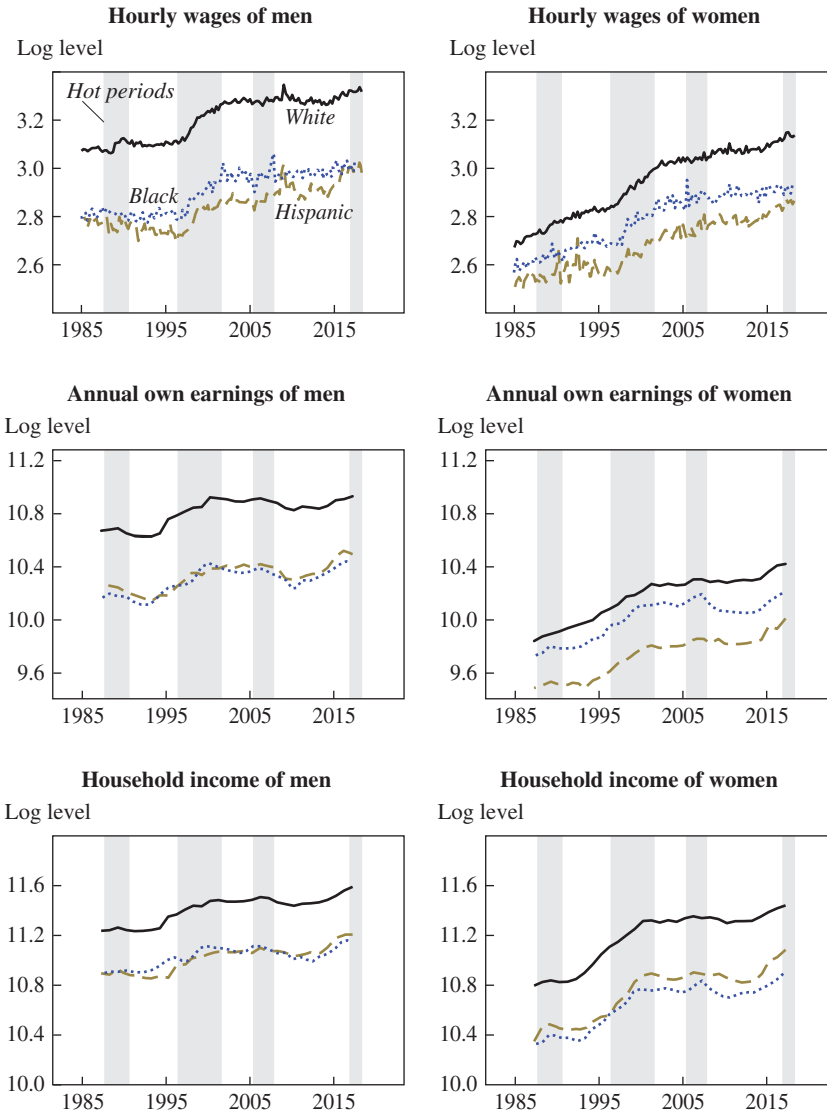
Sources: U.S. Census Bureau; Bureau of Labor Statistics (Current Population Survey).

Figure 3. Labor Force Statistics by Education Level, Age 25–64 Years, 1975–2018



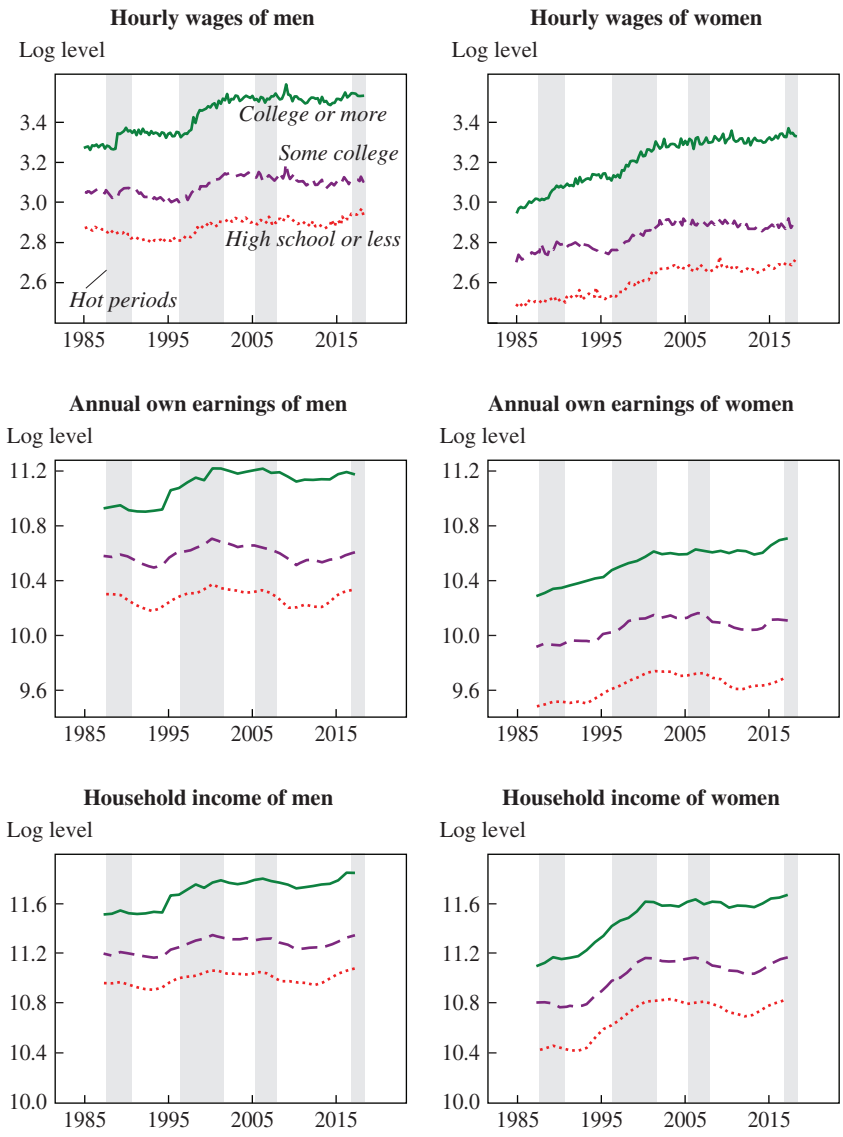
Sources: U.S. Census Bureau; Bureau of Labor Statistics (Current Population Survey).

Figure 4. Earnings and Income by Race and Ethnicity, Age 25–64 Years, 1985–2018



Sources: U.S. Census Bureau; Bureau of Labor Statistics (Current Population Survey).

Figure 5. Earnings and Income by Education, Age 25–64 Years, 1985–2018



Sources: U.S. Census Bureau; Bureau of Labor Statistics (Current Population Survey).

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

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

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

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

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

Table 1. Gaps by Race and Ethnicity and Gender, Full Sample, Age 25–64 Years[a]

		Men		*Women*	
Characteristic	*Ethnicity*	*Constant*	Ugap	*Constant*	Ugap
Unemployment rate	Black	4.446***	0.909***	4.214***	0.513***
		(0.119)	(0.078)	(0.156)	(0.116)
	Hispanic	2.234***	0.394***	3.427***	0.339***
		(0.180)	(0.086)	(0.183)	(0.091)
Nonparticipation rate	Black	7.609***	0.077	–1.026**	0.081
		(0.170)	(0.128)	(0.440)	(0.247)
	Hispanic	–0.936***	–0.152	9.362***	–0.250*
		(0.296)	(0.152)	(0.358)	(0.132)
Hourly wages	Black	29.559***	–0.057	14.780***	–0.045
		(0.407)	(0.220)	(0.721)	(0.424)
	Hispanic	35.812***	–0.566	24.691***	–0.402
		(0.876)	(0.477)	(0.976)	(0.657)
Annual own earnings	Black	54.391***	1.163***	16.005***	2.286***
		(0.735)	(0.342)	(1.008)	(0.431)
	Hispanic	51.205***	0.634	46.906***	0.802*
		(1.505)	(0.585)	(1.203)	(0.436)
Household income	Black	37.497***	1.048**	52.804***	1.481***
		(1.074)	(0.485)	(1.354)	(0.420)
	Hispanic	39.516***	–0.077	43.747***	0.637
		(1.052)	(0.360)	(1.522)	(0.570)

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

a. Robust standard errors are in parentheses; $*p < .10$, $**p < .05$, $***p < .01$. Sample period is 1976:Q1–2018:Q4 for the employment-to-population ratio, unemployement rate, and labor force participation rate; 1987–2017 for annual own earnings and household income; and 1979:Q1–2018:Q4, when available, for hourly wages. The unemployment rate and nonparticipation rate gap for each group are defined as the outcome for the group indicated minus the outcome for the reference group. The wage, earnings, and income gaps for each group are defined as the outcome for the reference group minus the outcome for the group indicated. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

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

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

In table 1, the left-hand-side variable in each equation (denoted y_{gt} in equation 1) is the difference between a labor market– or income-related variable for the race and ethnicity and gender group (g) that is named in the line and column of the table, and the same variable for whites of the same

Table 2. Gaps by Education Level and Gender, Full Sample, Age 25–64 Years[a]

Characteristic	*Education level*	*Men*		*Women*	
		Constant	Ugap	*Constant*	Ugap
Unemployment rate	High school or less	3.350***	0.969***	3.291***	0.560***
		(0.106)	(0.052)	(0.068)	(0.038)
	Some college	1.556***	0.583***	1.509***	0.365***
		(0.038)	(0.019)	(0.051)	(0.047)
Nonparticipation rate	High school or less	9.848***	0.114	18.469***	0.179
		(0.231)	(0.119)	(0.324)	(0.146)
	Some college	3.715***	0.258	5.588***	0.237*
		(0.278)	(0.168)	(0.304)	(0.139)
Hourly wages	High school or less	53.694***	–0.264	58.512***	–0.535
		(1.629)	(1.117)	(1.279)	(0.910)
	Some college	33.728***	–0.213	35.725***	–0.290
		(1.386)	(0.927)	(1.351)	(0.893)
Annual own earnings	High school or less	88.480***	2.782**	97.156***	2.517***
		(3.290)	(1.103)	(1.847)	(0.643)
	Some college	54.065***	2.327**	50.452***	2.268***
		(3.036)	(0.955)	(1.802)	(0.668)
Household income	High school or less	69.102***	1.597*	77.731***	1.817***
		(2.416)	(0.793)	(1.429)	(0.557)
	Some college	42.519***	1.229*	43.705***	2.029***
		(1.957)	(0.631)	(1.632)	(0.567)

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

a. Robust standard errors are in parentheses; *p <.10, **p < .05, ***p < .01. Sample period is 1976:Q1–2018:Q4 for the unemployment rate and labor force participation rate; 1987–2017 for annual own earnings and household income; and 1979:Q1–2018:Q4, when available, for hourly wages. The unemployment rate and nonparticipation rate gap for each group are defined as the outcome for the group indicated minus the outcome for the reference group. The wage, earnings, and income gaps for each group are defined as the outcome for the reference group minus the outcome for the group indicated. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

gender. Thus, for example, the upper left block of coefficients pertains to a regression in which the left-hand-side variable is the unemployment rate for black men minus the unemployment rate for white men. Similarly, in table 2, the left-hand-side variable in each equation is constructed as the difference between a labor market– or income-related variable for the education and gender group that is named in the line and column of the table, and the same variable for individuals of the same gender and with a college degree or more. The regressions are run over the period 1976:Q1–2018:Q4. Importantly, to simplify the task of keeping track of signs, we define the nonparticipation rate as 1 minus the participation rate; similarly, for the earnings/income variables, we redefine the left-hand-side

variable as 100 times the log of earnings/income for the reference group (for example, white women) minus the log of earnings/income for the comparison group (for example, black women). With this transformation, all the variables on the left-hand-side of regression equations are defined such that higher values represent worse outcomes, and a positive sign on the coefficient for *Ugap* indicates that the relatively disadvantaged group benefits more from each increment of labor market strengthening.

The coefficients of most interest to us in these tables are the ones that appear under the columns headed "*Ugap*." In the topmost 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 (that is, *Ugap* decreases), the unemployment rates for blacks and Hispanics decline by more than the unemployment rate for whites. Similarly, table 2 shows that the unemployment rates for individuals with a high school education or less and for individuals with some college education decline by more than the unemployment rate for individuals with a college degree or more. Moreover, in each of the tables, all eight of these slope coefficients are significantly different from zero at the 1 percent level.

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

The bottom three blocks of tables 1 and 2 report results for the three income-related measures that we examine (with the reminder that a positive slope coefficient is associated with the relatively disadvantaged group benefiting more from each increment of labor market strengthening). The gaps in average hourly earnings are not particularly cyclically sensitive; none of the four estimated slope coefficients shown in tables 1 and 2 is significantly different from zero, and all are negative. This result could

reflect the changing composition of employment as the economy improves and more marginal workers with lower pay become employed (Daly and Hobijn 2017). It could also be that more of the relative improvement in labor income for less advantaged groups comes in the form of hours worked rather than hourly pay (Doniger 2019). Consistent with the latter-hypothesis, 15 of the 16 coefficients in the bottom two blocks (annual own earnings and annual household income) of tables 1 and 2 are positive, and 13 of these are significant at the 10 percent level or better.

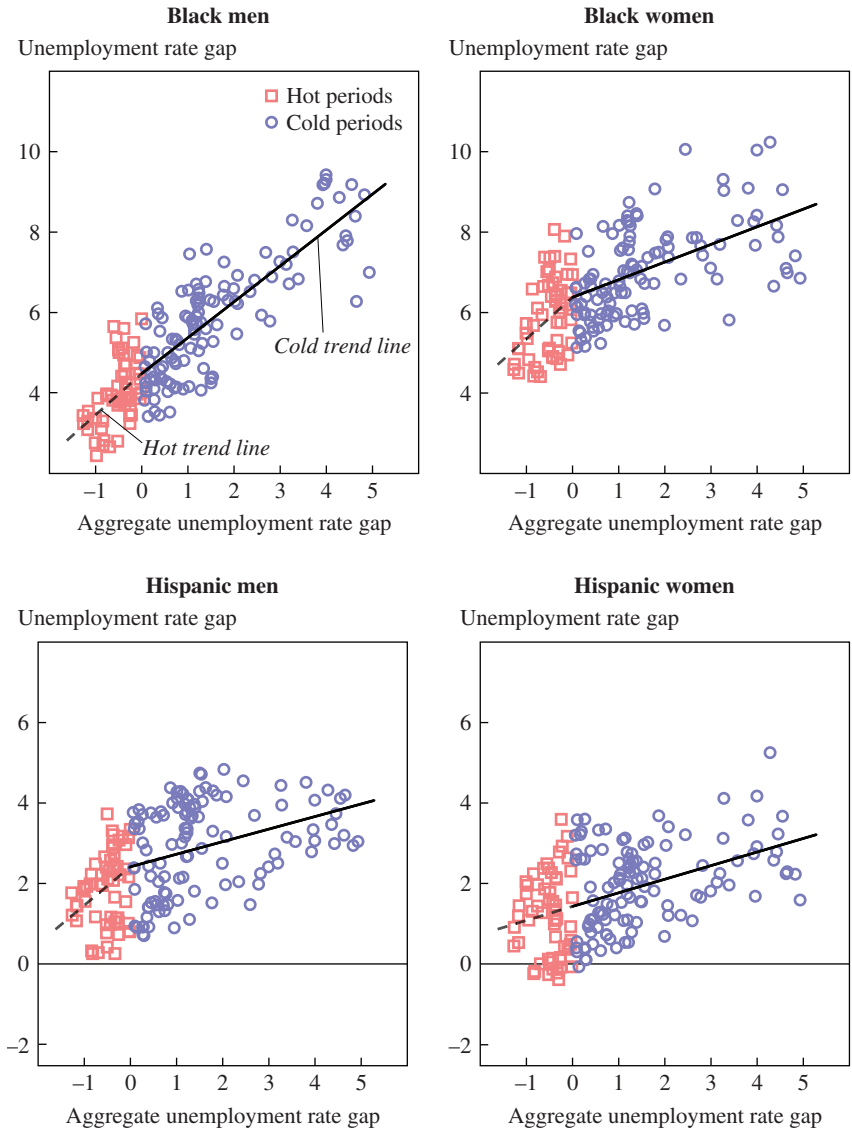
Overall, these results confirm those from previous studies, namely, that less advantaged groups experience a high-beta version of the cyclical sensitivity of labor market outcomes of more advantaged groups. Next, we consider whether that sensitivity differs significantly when the labor market is tight.

III.B. Are Hot Periods Different from Cold Periods?

To begin our examination of whether the average experience documented in tables 1 and 2 differs between hot and cold periods, figures 6 and 7 display scatter plots showing the differential unemployment experiences of our eight comparison groups relative to their white or more highly educated counterparts. In these figures, the variable plotted against the vertical axis is the difference between the unemployment rate for the comparison group relative to the unemployment rate for either whites or individuals with at least a college education; each differential variable is constructed separately for men and for women. The variable plotted against the horizontal axis is the aggregate unemployment rate gap; thus, observations further to the right in the figure come from periods when the labor market was looser (more slack) and observations further to the left come from periods when the labor market was tighter (less slack). To show average tendencies, we draw trend lines through the data points, noting that a flat line would indicate that the unemployment rate gap between the two groups is not sensitive to the tightness of the labor market. To ascertain whether the relative unemployment experience is different when the economy is operating in high-pressure mode, we allow each trend line to have a kink where the unemployment rate gap equals zero. If the responsiveness is the same in both hot and cold periods, the trend lines will be linear with no observable kink.

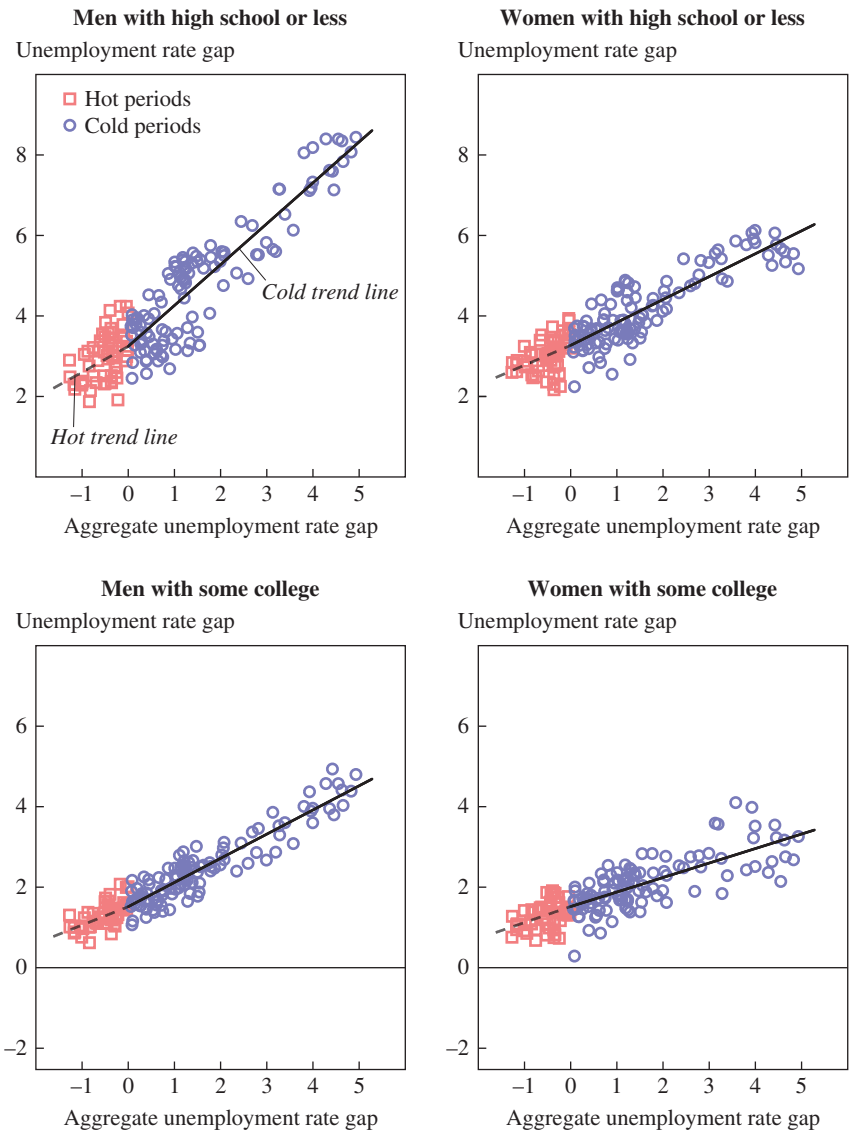
Figure 6 shows results for the unemployment rate by race and ethnicity. Pooling the roughly four decades in our sample, the lines are kinked downward for black women (the upper right panel) and Hispanic men (the bottom left panel), indicating that as the labor market moves into

Figure 6. Unemployment Rate Gap by Race and Ethnicity and by Gender, Age 25–64 Years



Sources: Authors' calculations, using data from U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

Figure 7. Unemployment Rate Gap by Education Level and Gender, Age 25–64 Years



Sources: Authors' calculations, using data from U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

high-pressure mode, not only do the unemployment rates of black women and Hispanic men continue to decline by more than the unemployment rate of their white counterparts, but the multiplier increases. In the econometric specification used to construct these panels, the process goes into reverse once the unemployment rate gap has reached its nadir. (Due to the limited number of data points, we did not test whether there was asymmetry depending on whether the economy was expanding or contracting.) As the unemployment rate comes back up toward its natural rate, the unemployment experience of black women and Hispanic men deteriorates more sharply than it does for their white counterparts, and by a wider margin than is estimated to occur once the unemployment rate moves above its natural rate. There is no discernible difference between hot and cold periods in the high-beta behavior of the unemployment rate of black men compared with white men, or for Hispanic women compared with white women.

Figure 7 compares the unemployment experience of individuals either with a high school degree or less, or with some college education, to that of individuals with a college degree or more. In no case is there evidence that hot periods are better for those with less than a college degree. In fact, as the aggregate unemployment rate moves below its natural rate, the unemployment rates for men either with a high school degree or less, or with some college, decline by less than they did earlier in the labor market cycle (indicated by the fact that the line is less steep to the left of $Ugap = 0$ than it is to the right). For women with a high school degree or less or some college education, hot and cold periods appear to differ little.

A natural question to ask is whether the basic relationships displayed in figures 6 and 7 have been stable over time. To answer this question, we divided our sample period into four labor market cycles—with each cycle defined as beginning in the quarter when the unemployment rate first exceeds the natural rate and ending in the quarter when the unemployment rate last falls below or equals the natural rate. We then conducted simple *F* tests to determine whether the null hypothesis of equality across the four slope coefficients can be rejected.[11] In the overwhelming majority of cases, the null hypothesis is rejected at the 5 percent level or better.

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

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

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

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

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

Next, we turn to the question of whether that high-beta experience evolved once the labor market was tight. In a pattern that is 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 period of the late 1980s; this is reflected in the table by the fact that the estimated coefficients on the interaction term in these three cases are negative. However, in 10 of the other 12 cases (the exceptions being Hispanic men during the cycle of the early 2000s and Hispanic women during the current cycle), the coefficient on the interaction term is estimated to have been positive, meaning that the high-beta experience of the studied group intensified as the unemployment rate moved below its natural rate. In fact, in 6 of those 10 cases, the coefficient estimates suggest that the relative improvement when the labor market was tight was more than double the relative improvement when the labor market was slack. The coefficient on the interaction term is statistically significant and positive in 5 cases.

As shown in table 4, the results are somewhat weaker for the relative unemployment rates of groups stratified by educational attainment. The slope of the trend line in cold periods is estimated to have been positive in 15 of the 16 cycle-specific cases shown in the table. However, the increment to the slope during a hot labor market is of mixed sign, positive in 9 cycle-specific instances and negative the other 7 times. That said, the overall slope during high-pressure economies typically remained positive. Thus, though less educated individuals also undergo a high-beta version of the unemployment experience of those with at least a college education, there is little evidence that the beta has increased in hot labor markets, with

Table 3. Unemployment Rate Gaps by Race and Ethnicity, Gender, and Business Cycle, Age 25–64 Years[a]

	Men					
	Black			*Hispanic*		
Business cycle	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*
All business cycles	0.881***	0.252	1.133	0.324***	0.566	0.890
	(0.102)	(0.347)		(0.110)	(0.481)	
1980:Q1–1990:Q3	0.854***	–0.426	0.428	0.272***	0.635	0.906
	(0.052)	(0.485)		(0.058)	(0.604)	
1990:Q4–2001:Q3	0.862***	0.193	1.055	0.678***	0.782***	1.460
	(0.121)	(0.307)		(0.124)	(0.288)	
2001:Q4–2007:Q4	0.254	0.511	0.765	0.871***	–0.660	0.211
	(0.407)	(1.234)		(0.243)	(0.584)	
2008:Q1–2018:Q4	0.905***	0.899*	1.804	0.501***	0.314	0.815
	(0.126)	(0.474)		(0.053)	(0.340)	

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

a. Robust standard errors are in parentheses; *p <.10, **p < .05, ***p < .01. The unemployment rate gap for each group is defined as the outcome for the group indicated minus the outcome for the reference group. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

Table 4. Unemployment Rate Gaps by Education Level, Gender, and Business Cycle, Age 25–64 Years[a]

	Men					
	High school or less			*Some college*		
Business cycle	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*
All business cycles	0.985***	–0.206	0.779	0.591***	–0.087	0.504
	(0.063)	(0.251)		(0.025)	(0.105)	
1980:Q1–1990:Q3	1.003***	–0.358	0.645	0.534***	0.419	0.952
	(0.034)	(0.274)		(0.038)	(0.254)	
1990:Q4–2001:Q3	1.015***	0.031	1.046	0.594***	–0.151*	0.443
	(0.069)	(0.170)		(0.029)	(0.090)	
2001:Q4–2007:Q4	0.341**	–0.672*	–0.331	0.602***	–1.046**	–0.444
	(0.163)	(0.371)		(0.176)	(0.411)	
2008:Q1–2018:Q4	1.009***	0.053	1.062	0.569***	0.199	0.767
	(0.054)	(0.310)		(0.027)	(0.166)	

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

a. Robust standard errors are in parentheses; *p <.10, **p < .05, ***p < .01. The unemployment rate gap for each group is defined as the outcome for the group indicated minus the outcome for the reference group. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

Women					
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*
0.445***	0.668	1.114	0.382***	–0.127	0.255
(0.143)	(0.427)		(0.126)	(0.515)	
0.555***	–0.308	0.247	0.725***	–1.819***	–1.094
(0.095)	(0.504)		(0.091)	(0.669)	
0.658***	0.171	0.828	–0.095	1.548***	1.453
(0.171)	(0.431)		(0.204)	(0.424)	
0.335	1.752*	2.087	1.101***	0.410	1.511
(0.357)	(0.866)		(0.211)	(0.516)	
0.443***	1.029***	1.472	0.518***	–0.024	0.494
(0.098)	(0.378)		(0.063)	(0.232)	

Women					
High school 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*
0.538***	0.039	0.577	0.337***	0.123	0.460
(0.046)	(0.155)		(0.059)	(0.136)	
0.469***	0.668	1.137	0.143***	0.702*	0.845
(0.051)	(0.497)		(0.049)	(0.377)	
0.501***	–0.077	0.424	0.459***	–0.119	0.340
(0.082)	(0.168)		(0.063)	(0.126)	
–0.169	1.327***	1.157	0.107	–0.556	–0.449
(0.185)	(0.449)		(0.125)	(0.340)	
0.520***	0.600***	1.119	0.354***	0.118	0.472
(0.064)	(0.216)		(0.068)	(0.221)	

Table 5. Increments to β When the Unemployment Rate Is below the Natural Rate[a]

Category	*Unemployment rate*	*Nonparticipation rate*
Black men	*	@
Black women	**	*
Hispanic men	*	
Hispanic women		@
Men with high school or less		*
Women with high school or less	**	**
Men with some college		
Women with some college		**

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

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

the possible exception of women with a high school degree or less. We have estimated similar regressions for the nonparticipation rate, the results of which are available in the online appendix.

Table 5 provides a compact summary of the results from all these regressions. In the table, a single asterisk in a cell denotes that the estimated increment to β was positive in at least three of the four labor market cycles. A double asterisk adds the requirement that in at least two cases, positive increments were estimated to have been significantly different from zero at the 10 percent level of confidence or better. For completeness, we use an "@" sign to denote intermediate cases (four in number), in which two increments are estimated to have been positive and statistically significantly different from zero, but the other two increments were estimated to have been negative.

As can be seen in the first column of table 5, the results (as noted above) in the case of the unemployment rate are suggestive but not conclusive: Half of the cells in this column are blank, meaning that in those cases, either fewer than three of the estimated increments to β were positive or fewer than two were statistically significantly different from zero. In two of the eight cells, at least two increments were statistically significantly different from zero. In the nonparticipation column, six of the eight cells earn some form of marking—an interesting result, given that through most of the labor market cycle, the gaps in nonparticipation rates are noticeably less cyclical than are the gaps in unemployment rates. Nonetheless, our results suggest that once the labor market is operating in high-pressure mode, relatively

marginalized persons are drawn into the labor market proportionately more than are relatively advantaged persons. Although this is not shown in the summary tables, the late 1990s seem to have brought widespread relative gains in participation rates: the increment to the slope during the hot period of that labor market cycle is positive for all racial and ethnic groups that we study, and these coefficients are statistically significant.

More generally, it is clear that labor market dynamics vary significantly across cycles, making it difficult to tell a simple story about the role of high-pressure economies. With that caveat, however, we read the evidence reported in table 5 as indicating that as the labor market has strengthened, the employment experiences of midlife African Americans and Hispanics age 25 to 64, as well as that of those with less than a college degree, have improved relatively more compared with whites and college-educated individuals of the same gender. Moreover, this observation holds true regardless of whether the labor market is operating in "cold" or "hot" territory. The evidence with respect to whether the relative experiences of disadvantaged groups have differed materially between cold and hot episodes is less clear, but leans in the direction of suggesting that there is a difference that skews in favor of these groups, particularly blacks and women with some college education or less. The relative improvement enjoyed by disadvantaged groups appears to have been particularly strong during the high-pressure labor market of the 1990s.[12]

III.C. Estimates with MSA Data

To test the robustness of these results, we use MSA-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

12. Although our assumption that the kink in the slope occurs when the unemployment gap is zero is intuitively appealing, in principle the kink could occur above or below that point. To assess this possibility, we also experimented with threshold specifications that allow the data to choose the point at which the kink occurs. For most groups, this version of the model chose a kink point that was between 1 and 2 percentage points above the natural rate; the exception was the unemployment differential for black men, for which the chosen kink point was ½ percentage point below the natural rate. For the unemployment and nonparticipation rate gaps, the slope coefficients during cold periods were similar to those shown in tables 3 and 4, despite the differences in the kink points. These specifications also tended to show an intensification of the high-beta experience for blacks and Hispanics below the chosen kink point (9 out of 12 cases for unemployment gaps, and 7 out of 12 cases for nonparticipation; we were unable to run this model for the 2001–7 period). And, as was the case for the specifications assuming a kink at $Ugap = 0$, the threshold results were weaker for relative unemployment gaps and nonparticipation gaps by educational attainment.

Table 6. Gaps by Demographic Group, Metropolitan Areas, Age 25–64 Years[a]

Characteristic	*Demographic group*	*Slope,* Ugap > *0*	*Increment,* Ugap < *0*
Unemployment rate	Black	0.476***	0.816**
		(0.172)	(0.394)
	Hispanic	0.305*	–0.238
		(0.171)	(0.341)
	High school or less	0.880***	0.246
		(0.104)	(0.201)
	Some college	0.477***	0.267**
		(0.078)	(0.133)
Nonparticipation rate	Black	0.326	1.054
		(0.252)	(0.832)
	Hispanic	–0.141	–0.745
		(0.312)	(0.803)
	High school or less	–0.0778	–0.268
		(0.165)	(0.436)
	Some college	–0.0533	0.701*
		(0.169)	(0.388)

Sources: Authors' estimates, using data from the U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

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

enters a high-pressure period.[13] We define the natural rate in each metropolitan area as the average unemployment rate for that area for the period 2004:Q3–2008:Q4 and run the panel regression over the period 2009:Q1–2018:Q4, including year and metropolitan-area fixed effects.[14]

The results, shown in table 6, are consistent with the time-series analysis. The coefficients are of similar magnitude in absolute value and show some

13. This analysis is similar in spirit to those done by Kiley (2015), Leduc and Wilson (2019), Leduc and Wilson (2017), and Smith (2014)—all of whom use cross-metropolitan-area or cross-state variation to test the sensitivity of wage or price inflation to labor market slack.

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

Table 7. Increments to β When the Unemployment Rate Is below the Natural Rate[a]

Category	*Hourly wages*	*Annual own earnings*	*Household income*
Black men			
Black women		*	
Hispanic men			
Hispanic women		*	*
Men with high school or less			
Women with high school or less		*	
Men with some college			
Women with some college		*	

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

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

evidence that high-pressure economies are particularly beneficial for disadvantaged groups. For example, the unemployment rates of the disadvantaged groups are more cyclical, and this relationship is statistically significant. Moreover, during the high-pressure phase of the cycle, this relationship appears to intensify for all groups except Hispanics, and it is statistically significant for blacks and those with some college education. With regard to the nonparticipation rate, the results using the metropolitan-level data are weaker—the slope coefficient in cold periods is positive only for blacks, and even then it is not statistically significant. When the economy is in a high-pressure state, the evidence suggests that the participation rate gap closes by more for blacks and for those with some college education, but it is only statistically significant for the latter group.[15]

III.D. Earnings and Income

Table 7 provides a scoring of results for the three relative income variables that we inspect, based on average hourly wages, annual own earnings,

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

and annual household income. For average hourly wages, we use the same method that we used to construct the scoring reported in table 5. For the own earnings and household income variables, we use a simpler method because the underlying data are annual: We award one asterisk if the estimated coefficient (by construction, over the whole sample period) is positive, and two asterisks if it is significantly so.[16]

The contrast between tables 5 and 7 is plain: Whereas a slight majority of cells in table 5 showed some marking, the great majority of cells in table 7 are blank, signifying that when the labor market is tight, β generally does not shift in a manner that is favorable to the relatively marginalized group. Results shown in the online appendix go a step further and demonstrate that, in fact, relative income gaps actually widen in about half the 24 cases that we examine (8 demographic pairs and 3 relative income variables).

The results on earnings gaps are broadly consistent with previous research that finds lower wage cyclicality among less advantaged groups than among more advantaged groups. For less advantaged workers, institutional constraints such as the minimum wage are more likely to bind in cold periods (Hoynes 2000); and in hot periods, more advantaged workers with higher skills are more likely to see rapid wage increases (Daly and Hobijn 2017; Doniger 2019). In terms of household earnings and income, previous research has shown that families smooth through income variability, including variability induced by unemployment rate shocks, using the social safety net and changes to family labor supply (Dynarksi and Gruber 1997). This behavior puts a floor under families in cold periods. In hot periods, the relatively larger wage gains going to more advantaged workers are likely amplified by patterns of household formation that result in the presence of multiple advantaged workers in the same household (Eika, Mogstad, and Zafar 2018). To sum up, in a hot economy, less advantaged groups improve relative to more advantaged groups in their employment experiences; in contrast, more advantaged groups experience relatively larger gains in hourly wages and income. Future research linking these findings to broader implications for economic welfare is needed.

III.E. Results for Individuals between the Age of 16 and 24 Years

Okun's hypothesis particularly focused on the advantage of hot labor markets to young workers, and indeed, the labor market experience of

16. Recall that for the earnings and income variables, we define the gaps as the earnings or income level for whites or college graduates relative to that for the indicated group, so that a positive coefficient signifies a narrowing of the gap as the unemployment gap declines.

individuals at the lower end of the age spectrum may differ importantly from the labor market experience of people age 25 to 64. To ascertain whether differences across age groups are important, we briefly review results that are analogous to those we have already shown for those age 25 to 64, but in this case for people between the age of 16 and 24.

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

For young Hispanics, the results are a little more uneven. Young Hispanic men exhibit greater cyclicality in their unemployment rates in all four labor market cycles, while young Hispanic women exhibit greater cyclicality in unemployment rates in three of the four. The evidence 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 is mixed. Of the eight cycle-specific interaction coefficients for young Hispanic men and women, only five are positive (only two of which are statistically significant).

III.F. Urban versus Rural Differences

We examine one final divide of interest: the difference in economic performance between more and less urbanized areas, or what the CPS denotes metropolitan and nonmetropolitan areas.[17] Alison Weingarden (2017) has documented that labor force participation rates in nonmetropolitan areas have decreased relative to those in metropolitan areas, going

17. Metropolitan areas are those that contain a significant population nucleus, 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.

Table 8. Unemployment Rate Gaps by Race and Ethnicity, Gender, and Business Cycle, Age 16–24 Years[a]

	Men					
	Black			*Hispanic*		
Business cycle	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*
All business cycles	0.872**	1.046	1.918	0.500***	–0.102	0.398
	(0.355)	(1.179)		(0.164)	(0.653)	
1980:Q1–1990:Q3	1.470***	2.676	4.146	0.675***	–0.041	0.634
	(0.226)	(1.678)		(0.144)	(1.353)	
1990:Q4–2001:Q3	1.123*	0.446	1.569	0.184	1.412**	1.596
	(0.646)	(1.366)		(0.344)	(0.695)	
2001:Q4–2007:Q4	0.272	6.352***	6.624	1.065	0.147	1.212
	(0.814)	(2.034)		(0.705)	(2.097)	
2008:Q1–2018:Q4	1.160***	2.311***	3.471	0.533***	–0.414	0.119
	(0.172)	(0.779)		(0.087)	(0.516)	

Sources: Authors' estimates, using data from the U.S. Census Bureau, the Bureau of Labor Statistics (Current Population Survey), and the Congressional Budget Office (natural rate of unemployment).

a. Robust standard errors are in parentheses; *p <.10, **p < .05, ***p < .01. The unemployment rate gap for each group is defined as the outcome for the group indicated minus the outcome for the reference group. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

back at least a decade. More recently, the improvement in the unemployment rate has lagged in nonmetropolitan 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 nonmetro 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 8, the unemployment rates in metro and nonmetro areas are very similar, both in terms of their levels and cyclical amplitudes.[18] In fact, the data indicate that the unemployment rate in metro areas is a little more cyclically sensitive than the unemployment rate in nonmetro areas. In contrast, the participation rates are not particularly cyclical. When, as shown in table 9, we regress the difference in the unemployment rate or labor force participation rate (nonmetro minus metro) on the aggregate unemployment rate gap and a hot labor market interaction, all the coefficients are close to zero. Moreover, the coefficient on the unemployment rate gap, which is statistically significant, is the opposite of what one would

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

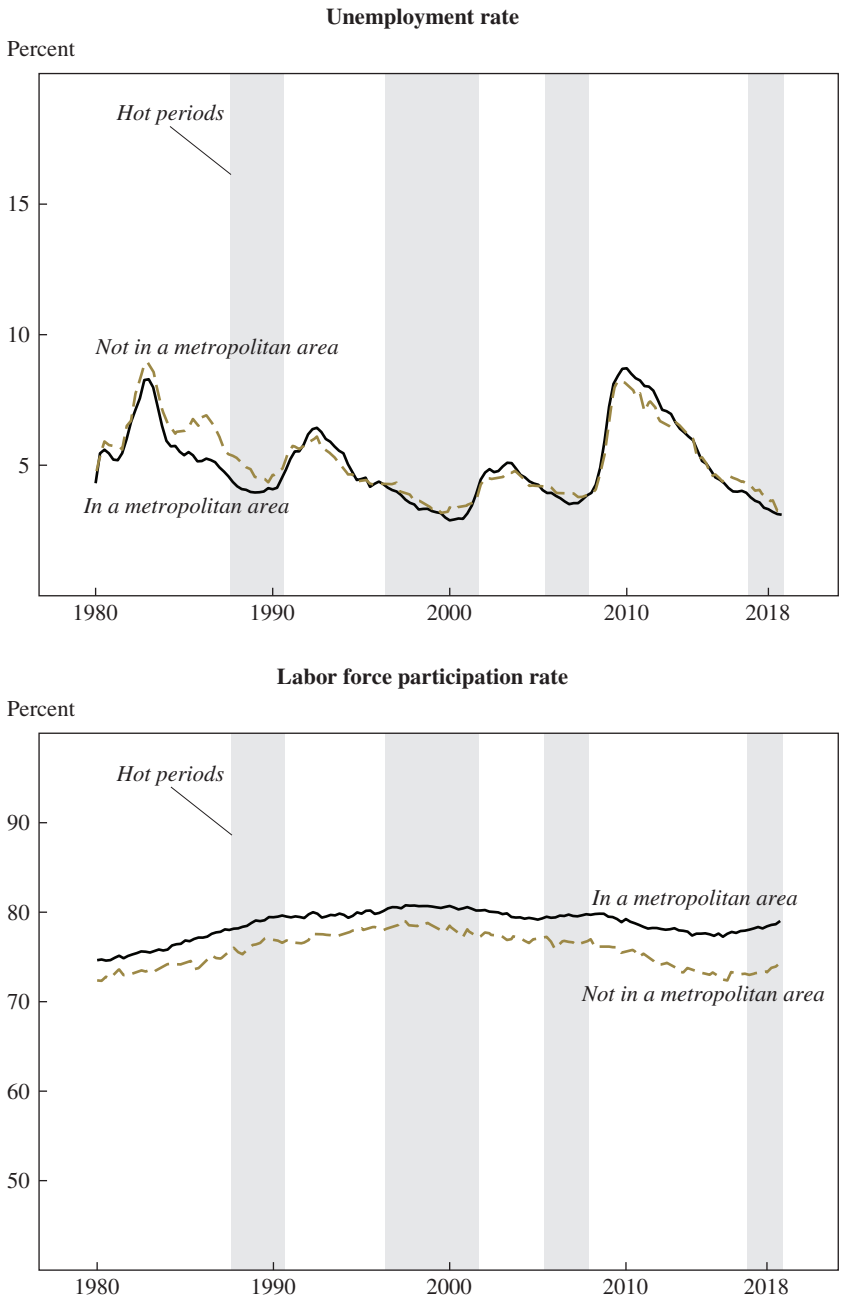
Women					
Black			*Hispanic*		
Slope when Ugap *>0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*	*Slope when* Ugap > *0*	*Increment when* Ugap ≤ *0*	*Slope when* Ugap ≤ *0*
0.871	3.280*	4.151	0.483**	–0.394	0.089
(0.573)	(1.783)		(0.186)	(0.922)	
1.401***	5.849***	7.250	0.749***	–2.664***	–1.915
(0.223)	(1.996)		(0.149)	(0.901)	
1.598***	1.923**	3.521	–0.635	2.873**	2.238
(0.383)	(0.722)		(0.810)	(1.304)	
1.567*	1.347	2.914	0.973	1.901	2.873
(0.870)	(2.313)		(0.659)	(1.254)	
1.256***	3.789***	5.045	0.734***	1.191	1.924
(0.194)	(1.029)		(0.107)	(0.748)	

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 metro areas (not shown). Hence, though the evidence is clear that rural and to a lesser extent small metro 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.

III.G. 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. Moreover, in Okun's original conception, high-pressure economies have an additional impact, because an individual who becomes employed may gain skills and networks that improve future employment prospects. To the extent that this dynamic exists, gains that start out as a result of the strong state of the business cycle could end up having beneficial longer-term effects on individual outcomes—what has been called positive

Figure 8. Labor Force Statistics by Metropolitan Area Status, Age 25–64 Years, 1980–2018



Sources: U.S. Census Bureau; Bureau of Labor Statistics (Current Population Survey).

Table 9. Nonmetropolitan/Metropolitan Gaps, 1980:Q1–2018:Q3, Age 25–64 Years[a]

Variable	*Slope,* Ugap > *0*	*Increment,* Ugap < *0*
Unemployment rate	–0.114*	0.106
	(0.062)	(0.204)
Nonparticipation rate	0.0534	–0.158
	(0.104)	(0.484)
Observations	156	

Sources: Authors' estimates, using data from the U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

a. Newey–West standard errors are in parentheses; *p <.10, **p < .05, *** p < .01. The unemployment rate and nonparticipation rate gap are defined as the outcome for nonmetropolitan areas minus the outcome for metropolitan areas. *Ugap* is defined as the aggregate unemployment rate minus the CBO's long-run natural rate of unemployment.

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 boost the economy's potential growth rate.

Our approach to this question follows the strand in the literature that has looked for evidence of hysteresis in the aggregate data. Olivier Blanchard and Lawrence Summers (1986) describe hysteresis as the dependence of the current rate of employment on past realizations, and they find evidence of it in Europe, but little in the United States. As noted by Magnus Gustavsson and Pär Österholm (2007), in the macroeconomics 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. Frank Song and Yangru Wu (1997) and Gustavsson and Österholm (2007) find little evidence of a unit root in unemployment in the United States. A few studies have also looked for evidence of a unit root in the employment-to-population ratio. Theoretically, this makes sense, because, as we have shown above, individuals adjust along the participation rate margin as well as the unemployment rate margin over the course of the business cycle. And indeed, the evidence for a unit root in the employment-to-population ratio seems a bit stronger (Gustavsson and Österholm 2007; Fallick and Krowlikowski 2018).

Here we repeat this time-series exploration of the question, updating past analysis to include data from the time of the Great Recession and through the current expansion. In addition, we examine unemployment and (non)participation rates by race and ethnicity and by level of education to explore the possibility that, even if aggregate statistics do not show clear evidence of hysteresis, it may be apparent in the labor market outcomes

Table 10. Univariate Unit-Root Tests, Age 25–54 Years[a]

Variable	*DF–GLS*	*Zivot–Andrews*	*Lags*
Unemployment rate	–3.164**	–5.051*	9, 3
Nonparticipation rate	–1.798	–3.548	10, 3

Sources: Authors' estimates, using data from the U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

a. For DF–GLS, the lag is determined by the Ng–Perron test with generalized least squares. For Zivot–Andrews, an endogenously determined break is allowed in the intercept and trend, the lag is determined by Akaike's Information Criterion, and the 5 percent critical value is –5.08; *p <.10, **p < .05, ***p < .01.

of specific groups. It is also important to note that the identification for this exercise comes from the entire sample, not just periods in which there are high-pressure economies, and so we do not distinguish the presence of positive versus negative hysteresis. As in our previous analysis, the tests are done using quarterly data from the CPS; however, because the aging of the population imparts a trend to the aggregate participation rate that could confound the results, we focus on the population age 25–54.

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

As can be seen in table 10, the tests indicate that the unemployment rate lacks a unit root, consistent with the previous literature on the topic. In contrast, the tests do not reject that the labor force participation rate has a unit root. Table 11 shows the results for variables broken out by race and gender. The existence of a unit root in the unemployment rate is clearly rejected for white and black men and for Hispanic women. In contrast, the tests fail to reject a unit root for white women, suggesting hysteresis. For

Table 11. Univariate Unit-Root Tests, Age 25–54 Years, by Race/Ethnicity and Gender[a]

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

Sources: Authors' estimates, using data from the U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

a. For DF–GLS, the lag is determined by the Ng–Perron test with generalized least squares. For Zivot–Andrews, an endogenously determined break is allowed in the intercept and trend, the lag is determined by Akaike's Information Criterion, and the 5 percent critical value is –5.08; *p <.10, **p < .05, ***p < .01.

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

Table 12 provides an assessment of the evidence of hysteresis for different education groups. The results clearly reject the presence of a unit root in the unemployment rate for men and women with a college education. For the remaining groups, the tests are less conclusive—with one of the tests rejecting the unit root. The tests almost unanimously fail to reject a unit root in the nonparticipation rate for men and women at all levels of education.[19]

These findings are consistent with there being positive spillovers from an expansion that could have lasting benefits for individuals and the economy, particularly along the participation rate margin, because the tests were consistent with hysteresis in the participation rate for nearly all groups. That said, one caveat to the analysis is that the microeconometric literature on hysteresis, which primarily focuses on the potentially lasting damage of recessions, suggests that employment gains are not expected to

19. We performed several robustness tests. Because 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 2007:Q4, 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.

Table 12. Univariate Unit-Root Tests, Age 25–54 Years, by Education Level and Gender[a]

Characteristic	*Education level*	*Gender*	*DF–GLS*	*Zivot–Andrews*	*Lags*
Unemployment rate	High school or less	Men	–2.793*	–5.352**	10, 2
		Women	–2.396	–5.397**	12, 3
	Some college	Men	–2.465	–5.769***	12, 3
		Women	–2.217	–4.890*	12, 3
	College or more	Men	–2.928**	–5.995***	13, 3
		Women	–2.694*	–4.879*	8, 0
Nonparticipation rate	High school or less	Men	–2.873*	–2.446	7, 2
		Women	–1.439	–3.330	10, 2
	Some college	Men	–1.553	–4.081	8, 1
		Women	–2.100	–4.244	11, 2
	College or more	Men	–1.638	–4.523	8, 3
		Women	–1.802	–4.289	13, 2

Sources: Authors' estimates, using data from the U.S. Census Bureau and the Bureau of Labor Statistics (Current Population Survey).

a. For DF–GLS, the lag is determined by the Ng–Perron test with generalized least squares. For Zivot–Andrews, an endogenously determined break is allowed in the intercept and trend, the lag is determined by Akaike's Information Criterion, and the 5 percent critical value is –5.08; *p <.10, **p < .05, ***p < .01.

be long-lived (Hotchkiss and Moore 2018; Kahn 2010; Kondo 2015; and Oreopolous and others 2012).[20]

IV. The Potential Costs of a High-Pressure Economy

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

Perhaps the most obvious risk associated with tight labor markets is the possibility of an unwelcome rise in inflation. Such a concern may seem unwarranted at present, given the apparent flattening of the Phillips curve in recent years, along with the observations that inflation has consistently run below the Federal Reserve's target for many of the past six 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 Personal Consumption Expenditures Price Index) moved up from less than 2 percent in 1965 to nearly 5 percent by 1970. In particular, policymakers at the time

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

judged that an unemployment rate of about 4 percent was sustainable in the longer run (Orphanides and Williams 2013). In retrospect, however, the CBO now estimates the natural rate of unemployment to have been between 5½ and 6 percent in the second half of the 1960s. Moreover, a flatter Phillips curve may not be an unalloyed benefit: If inflation were somehow to become anchored at some level well above the FOMC's preferred level and the Phillips curve were to remain flat, the cost of bringing inflation down might be very high in terms of lost employment and output.

A second risk of a high-pressure economy, also macroeconomic in nature, has to do with the possibility of excessive risk-taking in financial markets and a resulting destabilization of the financial system. Again, current circumstances do not suggest that this is an imminent risk. For example, although the Federal Reserve's (2019a) latest *Financial Stability Report* characterizes valuation pressures as somewhat elevated, the report also notes that large banks are strongly capitalized and concludes that funding risks in the financial system are low relative to the period leading up to the financial crisis. That said, the most recent two recessions were precipitated by financial imbalances that were difficult to identify in real time. Also, some other observers are less sanguine. Of particular note, the Bank for International Settlements' (2018) *Annual Economic Report* expresses the concern that the accommodative stance of monetary policy that has helped to sustain the expansion and contributed to record-low unemployment has also resulted in building financial vulnerabilities—including a sustained rise in global debt-GDP ratios—that have increased the fragility of the economy.

Third, a hot economy has the potential to distort incentives, leading to decisions that emphasize short-run economic gains at the cost of longer-run sustainable economic progress. One example is the decision by younger individuals as to whether they should work or enroll in school. From a theoretical standpoint, schooling decisions may be influenced by the opportunity cost of attending school and by the direct financial costs of attendance, both of which may vary over the business cycle (though in opposite directions).[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

21. See, for example, Dellas and Sakellaris (2003).

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 forgone 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]

V. Conclusions

So where do we stand? A few observations seem clear. First, as previous researchers have shown, when the economy weakens, everyone suffers; and when the economy strengthens, everyone benefits. This is seen most clearly in unemployment rates: Over our entire sample, the unemployment rates of each group we study move in tandem with the aggregate unemployment rate. Second, like others, we also find that the fluctuations of less advantaged groups—including blacks, Hispanics, and those with less than a college education—are more pronounced. When the labor market weakens, these groups tend to suffer disproportionately; when it recovers, their experience improves disproportionately. Third, inspired by Arthur Okun, we have also searched for evidence that high-pressure economies are qualitatively different, and we have found suggestive evidence that this is the case. A high-pressure economy does afford greater improvement for some less advantaged groups—most notably blacks and women with less than a college degree—in some key labor market variables, although the evidence is complicated by the heterogeneity observed across the various cycles. Finally, we also find suggestive evidence that these benefits persist

22. For evidence on four-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 good overviews of both mechanisms.

at least for a while, particularly along the dimension of the labor force participation rate. All in all, the evidence presented here supports the idea that high-pressure economies are different than normal expansions—but just how different remains a topic for further study.

ACKNOWLEDGMENTS We are grateful to Francisca Alba, Neil Gerstein, Bo Yeon Jang, and Morgan Smith for excellent research assistance and to Tomaz Cajner and Chris Nekarda for providing already-constructed data sets and data dictionaries for some of the CPS data used in our analyses.

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Comments and Discussion

COMMENT BY

JULIE L. HOTCHKISS Worse labor market outcomes among racial and ethnic minorities, the less educated, and to a certain extent, females, seem to have become an unalterable fact of the U.S. labor market. For decades, these "disadvantaged" workers have been getting the short end of the stick with respect to unemployment rates, labor force participation, wages, and hours of work. Economists have long sought explanations and solutions for the significant gaps in labor market outcomes between the disadvantaged and advantaged—or, rather, whites, the educated, and males. The identification of large unemployment disparities as a social issue has a long history, dating back at least to George Perry's (1970) identification of structural factors playing a role in the relationship between what level of unemployment can be attained at a given level of inflation, and Robert Hall's (1970) consideration of whether the notion of "normal" unemployment differs by race and gender. This paper by Stephanie Aaronson, Mary Daly, William Wascher, and David Wilcox follows in this tradition with a very specific goal: is there any evidence that periods of particularly strong labor markets can put a dent in these persistent gaps?

For the authors, all of whom have or have had policymaking or advising positions within the Federal Reserve, this question is not merely academic. With full employment being a legislated goal of the Federal Reserve, critics have argued that monetary policymakers should consider a more inclusive definition of full employment that places significant weight on the labor market outcomes of the disadvantaged. One way to do this is to adopt policies that encourage and prolong a "hot" or "high-pressure" economy. A hot economy, defined as one in which the unemployment rate falls below the Congressional Budget Office's (CBO) estimated sustainable unemployment rate, runs the risk (among other things, as identified by the authors) of

increasing inflation. So the question is not only whether there is evidence that a hot economy can help to close the gap in labor market outcomes, but also whether the degree of success expected is worth the risks it entails. The prevailing consensus on this point, consistent with results presented by Aaronson and her colleagues, is that though there is some evidence that a hot economy disproportionately improves the contemporaneous labor market outcomes of disadvantaged workers, the benefit neither sticks nor is it able to undo the disproportionate harm disadvantaged workers suffer during a "cold" economy (for example, see Hotchkiss and Moore 2018; and Fallick and Krolikowski 2018).

The authors provide evidence that is consistent with the literature they cite. In these remarks, I first take their results one step further to illustrate why a hot economy, alone, has not been effective in closing labor market gaps between advantaged and disadvantaged workers. Then—using their methodology, but with a different data set that allows observing individuals over many years and multiple business cycles—I offer additional evidence that the positive impact of hot economies does not reach very far into the future. And finally, I return to Okun's own words to interpret today's empirical evidence for policy considerations.

A LACK OF PROGRESS ACROSS BUSINESS CYCLES In drawing conclusions from the results presented by Aaronson and her colleagues, one needs to keep in mind that cold economic periods typically last longer and are more intense than hot periods. This can easily be seen in figure 1 of their paper. Even if the marginal impact of a negative unemployment gap (a hot economic period) exceeds the marginal impact of a positive unemployment gap for a particular disadvantaged group, the net total impact over the business cycle is not likely to benefit the disadvantaged group. As a concrete example of this, I use the estimation results from the authors' table 3. Their table 3 presents the average differential impact on the unemployment rate for black males and females, relative to white males and females, from an increase of 1 percentage point in the unemployment rate gap during four business cycle episodes that include both cold and hot periods. Their estimation also allows for a differential impact of a gap during hot periods. My table 1 summarizes each business cycle's cold and hot periods and the average and total differential impacts for blacks, relative to whites, from exposure to these hot and cold periods. Note that the business cycle starting in 2008 is extended through 2022 as projected by the authors in their figure 1.

The first thing to notice in my table 1 is that in each business cycle, the number of cold quarters exceeds the number of hot quarters, although the 1990–2001 business cycle came close to being an exception, with 23 cold

Table 1. Summary of Cold and Hot Periods by Business Cycle and the Differential Impact on the Unemployment Rate for Black Males and Females, Relative to White Males and Females, from a Rising Unemployment Rate Gap[a]

Business cycle	*Business cycle details*	*Differential impact on unemployment rate, blacks versus whites*	
		Males	*Females*
1980:Q1–1990:Q3			
Number of cold quarters	32		
Number of hot quarters	11		
Average gap—cold period	1.668		
Average gap—hot period	–0.409		
Average differential—cold		1.425	0.926
Average differential—hot		–0.175	0.029
Total differential—cold		45.588	29.631
Total differential—hot		–1.927	0.320
1990:Q4–2001:Q3			
Number of cold quarters	23		
Number of hot quarters	21		
Average gap—cold period	0.974		
Average gap—hot period	–0.768		
Average differential—cold		0.840	0.641
Average differential—hot		–0.810	–0.643
Total differential—cold		19.315	14.744
Total differential—hot		–17.015	–13.499
2001:Q4–2007:Q4			
Number of cold quarters	16		
Number of hot quarters	9		
Average gap—cold period	0.552		
Average gap—hot period	–0.315		
Average differential—cold		0.140	0.185
Average differential—hot		–0.241	–0.866
Total differential—cold		2.242	2.957
Total differential—hot		–2.168	–7.794
2008:Q1–2022:Q4			
Number of cold quarters	37		
Number of hot quarters	23		
Average gap—cold period	2.568		
Average gap—hot period	–0.676		
Average differential—cold		2.324	1.138
Average differential—hot		–1.220	–1.066
Total differential—cold		86.000	42.097
Total differential—hot		–28.055	–24.509

Sources: Bureau of Labor Statistics; Congressional Budget Office; author's calculations.

a. Average difference for blacks during hot and cold periods within each business cycle is calculated as follows: $\overline{Diff\,(gap)}_{Cold} = \frac{1}{N_C}\sum_{t=1}^{N_C}[\widehat{\alpha_1} * gap_t]$ and $\overline{Diff\,(gap)}_{Hot} = \frac{1}{N_H}\sum_{t=1}^{N_H}[\widehat{\alpha_1} * gap_t + \widehat{\alpha_2} * gap_t]$, where $\widehat{\alpha_1}$ and $\widehat{\alpha_2}$ are taken from table 3 in the paper by Aaronson and her colleagues, N_C is the number of "cold" quarters in the business cycle, N_H is the number of "hot" quarters in the business cycle, and gap_t is calculated using the difference between the aggregate unemployment rate from the BLS and the natural rate of unemployment from the Congressional Budget Office (obtained from https://fred.stlouisfed.org/series/NROU) in quarter t. Estimates through 2022 use estimated parameters from the fourth business cycle. The total impact of each business cycle's cold (or hot) period is calculated simply as the average difference during the cold (or hot) period times the number of cold (or hot) quarters.

quarters and 21 hot quarters. The second thing to notice is that, for all four business cycles, the average unemployment rate gap during cold quarters is greater than the absolute value of the average gap during hot quarters. For example, during the extended 2008 business cycle, the average cold period gap is 2.57 percentage points and the average hot period gap is -0.68 percentage point. In other words, cold periods are more intense labor market environments, on average, than hot periods.

Moving to the estimated differential effects for blacks versus whites, the third thing to notice in my table 1 is that, even though blacks tend to have a "higher-beta" experience for these outcomes during hot periods than during cold periods (as noted by Aaronson and her colleagues), the greater intensity of cold periods produces an average differential impact of the gap that is greater during cold periods than during hot periods. It is the combined influence of their longer length and greater average differential impact on the labor market experiences of blacks relative to whites that results in cold periods having larger total differential effects on blacks than hot periods.[1] This is shown in the last two rows for each business cycle in my table 1.

Purely as a thought experiment, we can use the information in my table 1 to estimate how many additional quarters a hot period would have to last (at the same average hot period differential impact) or what additional hot period differential impact it would take (at the same number of hot period quarters) for the total hot and cold differential effects for blacks versus whites to be equal across the business cycle (this would mean just breaking even for blacks). Using the unemployment rate for males in the current business cycle as an example, this exercise indicates that even if the current hot period extends through 2022, it would need to continue for another 48 quarters (12 years) beyond that, or the average differential hot period impact would need to have been an additional 2.5 percentage points lower unemployment rate for blacks, relative to whites, during the hot period through 2022 in order to wipe out the negative impact of the business cycle's cold period.[2] A less volatile business cycle, such as 2001–7, would have only required less than one-quarter of additional high-pressure

1. The exception to this in my table 1 is for women across the 2001 business cycle, where the absolute value of the total differential impact on the unemployment rate during the hot period (–7.79) exceeds the differential impact during the cold period (2.96).

2. To equalize the experience for black and white females over this extended business cycle, the hot period would have to last about four years beyond 2022 or the average differential hot period impact for black females would have to be 0.75 percentage point lower unemployment rate.

exposure or an additional 0.01 percentage point differential impact of the gap on the unemployment rate for black males.[3]

The implication of Aaronson and her colleagues' results across the full business cycle is that disadvantaged workers cannot seem to get a leg up. Stronger gains during hot economic periods are typically wiped out by even stronger setbacks during cold periods. This is consistent with my own research, using different data and methodology.

A QUESTION OF PERSISTENCE In light of the net negative impact of business cycles for disadvantaged groups, it would be hard to believe that hot economic environments have a cumulative, positive long-term impact on reducing labor market outcome gaps. In an effort to determine whether there is longer-term improvement in unemployment rates and nonparticipation among disadvantaged demographic groups, the authors present evidence (through tests for a unit root) for a trend in nonparticipation for all groups, but only in a few cases in the unemployment rate. As they point out, however, nothing in their analysis ties the presence of a unit root to exposure to a hot economic environment. In their excellent review of the literature, the authors point to various analyses using panel data to find evidence of negative hysteresis, or persistence, from cold economic events, such as entering the labor force for the first time during a recession.

In my own research, I have found little evidence of lasting positive effects from exposure to a hot economy. Complementing that earlier research, I loosely apply the authors' methodology to investigate this question of persistence using panel data, which tracks individuals over many years and multiple economic environments.[4] The analysis here also differs from that of Aaronson and her colleagues, in that it uses state-specific, long-term unemployment rates to calculate the unemployment gap—that is, the deviation of the state's unemployment rate from its long-term unemployment

3. Extra hot period number of quarters for a given business cycle needed to overcome the total impact of the cold period is calculated as follows: $N_H^{extra} = \frac{-\sum_{t=1}^{N_C} Diff_t^C}{\overline{Diff}_H} - N_H$, where $Diff_t^C$ is the estimated differential unemployment rate predicted for blacks from the unemployment gap in quarter t, $\overline{Diff}_H$ is the average differential unemployment rate experienced by blacks relative to whites during the hot period of the business cycle, and N_H is the actual number of quarters the hot period of the business cycle lasted. The formula for calculating the extra differential impact needed is given by $\overline{Diff}_H^{extra} = \frac{-\sum_{t=1}^{N_C} Diff_t^C}{N_H} - \overline{Diff}_H$.

4. The 1979 and 1997 cohorts of the National Longitudinal Surveys of Youth, covering the years 1982–2014, are used. The analysis is restricted to age 25–57 years (the maximum age in the sample).

rate, based the CBO's national long-term unemployment rate and deviations of the state's long-run average from the national long-run average; details can be found in my 2018 paper with Robert Moore.[5] As in the paper by Aaronson and her colleagues, the gap can either be positive (indicating a cold economy) or negative (indicating a hot economy), and the impact of the gap is allowed to differ across cold and hot environments.

Here, I consider two labor market outcomes: unemployment and real hourly wages. Each labor market outcome, $LMoutcome_{i,s,t}$, of person i in state s in year t is expressed as a function of the person's individual demographics (age, race, education, and gender, which all enter as group dummies) and the current and lagged values of the unemployment gap ($GAP_{i,s,t-j}$). The unemployment gap enters separately, interacts with each demographic characteristic, and is allowed to affect outcomes differently during hot economic environments through $HotDum_{t-j}$:

$$
\begin{aligned}
(1)\quad & LMoutcome_{i,s,t} \\
&= \alpha + \sum_{k=2}^{4}\left\{AGE_i^k\left(\delta_{1k} + \sum_{j=0,2,4} GAP_{i,s,t-j}\left[\delta_{2k,j} + \delta_{3k,j} HotDum_{t-j}\right]\right)\right\} \\
&\quad + \sum_{k=2}^{3}\left\{RACE_i^k\left(\beta_{1k} + \sum_{j=0,2,4} GAP_{i,s,t-j}\left[\beta_{2k,j} + \beta_{3k,j} HotDum_{t-j}\right]\right)\right\} \\
&\quad + \sum_{k=2}^{3}\left\{EDUC_i^k\left(\varphi_{1k} + \sum_{j=0,2,4} GAP_{i,s,t-j}\left[\varphi_{2k,j} + \varphi_{3k,j} HotDum_{t-j}\right]\right)\right\} \\
&\quad + MALE_i\left\{\theta_1 + \sum_{j=0,2,4} GAP_{i,s,t-j}\left[\theta_{2j} + \theta_{3j} HotDum_{t-j}\right]\right\} \\
&\quad + \sum_{j=0,2,4} GAP_{i,s,t-j}\left[\rho_{1j} + \rho_{2j} HotDum_{t-j}\right] + \tau_t + \sigma_s + \pi_i + \varepsilon_{i,s,t}.^{6}
\end{aligned}
$$

Marginal effects for the impact of a change in the gap (contemporaneous and lagged) on the two labor market outcomes are reported in my table 2, for the full sample and by race.[7] First, note that the "higher-beta" experience for blacks is most evident with the lagged gaps. For example,

5. The pattern of results using a comparison of state unemployment rates to the national long-term unemployment rate is similar to those presented here.

6. Although this estimation includes individual fixed effects, robustness checks indicate that this does not make much difference to the point estimates. State and year dummies are included, and errors are clustered at the state level. Analysis is restricted to individuals with minimal labor market attachment. Lags of two years are considered because later National Longitudinal Surveys of Youth surveys are done every two years.

7. Weekly hours and labor force participation were also explored as additional labor market outcomes and produce a similar pattern, but less precise estimates. The pattern of results in my table 2 are also generally consistent across advantaged and disadvantaged age and education groups.

Table 2. Marginal Effects for the Impact of Gap Changes on Unemployment and the Log of Real Hourly Wages[a]

	Current gap		*Gap lagged 2 years*		*Gap lagged 4 years*	
Outcome/demographic group	*Positive gap (cold economy)*	*Negative gap (hot economy)*	*Positive gap (cold economy)*	*Negative gap (hot economy)*	*Positive gap (cold economy)*	*Negative gap (hot economy)*
Impact on unemployment						
Full sample	0.0023**	0.0004	0.0072***	0.0044***	0.0031**	0.0007
	[0.0008]	[0.0022]	[0.0008]	[0.0009]	[0.0010]	[0.0016]
White, non-Hispanic	0.0016	0.0033	0.0068***	0.0041**	0.0020*	–0.0003
	[0.0009]	[0.0021]	[0.0010]	[0.0013]	[0.0009]	[0.0018]
Hispanic	0.0024	–0.0011	0.0055***	0.0035	0.0034*	0.0055
	[0.0013]	[0.0040]	[0.0013]	[0.0023]	[0.0017]	[0.0042]
Black, non-Hispanic	0.0035***	–0.0042	0.0090***	0.0054*	0.0050***	–0.0003
	[0.0010]	[0.0033]	[0.0011]	[0.0021]	[0.0015]	[0.0020]
Impact on log of real hourly earnings						
Full sample	0.0041	–0.0073	–0.0035	–0.0154***	–0.0111***	–0.0012
	[0.0029]	[0.0052]	[0.0027]	[0.0031]	[0.0020]	[0.0051]
White, non-Hispanic	0.0055	–0.0039	–0.0034	–0.0103*	–0.0104***	–0.0031
	[0.0030]	[0.0069]	[0.0028]	[0.0042]	[0.0019]	[0.0054]
Hispanic	0.0048	–0.0219***	–0.001	–0.0190*	–0.0109***	–0.011
	[0.0037]	[0.0061]	[0.0034]	[0.0079]	[0.0027]	[0.0064]
Black, non-Hispanic	0.0011	–0.0038	–0.0053	–0.0226***	–0.0125***	0.009
	[0.0028]	[0.0054]	[0.0030]	[0.0039]	[0.0029]	[0.0075]

Sources: National Longitudinal Survey of Youth; author's calculations.

a. Data are the 1979 and 1997 cohorts of the National Longitudinal Surveys of Youth covering the years 1982–2014. Unemployment is measured as the share of time during the year in the labor market spent unemployed. Real hourly pay is in 2014 dollars.

a decrease of 1 percentage point in the gap during a hot economy two years earlier decreases the share of time in the labor force during the year that blacks spend being unemployed, on average, by 0.5 percentage point, whereas the average time spent being unemployed decreases by 0.4 percentage point for whites. There is also a larger impact on average hourly earnings for blacks.

A larger contemporaneous gap increases unemployment (during a cold economy) but does not significantly affect hourly earnings. A larger gap two years earlier increases current unemployment experience (in both a hot and cold economy) and decreases current real hourly earnings (only in a hot economy). In other words, a hotter economy (meaning a more negative gap) two years earlier will have a positive impact on current hourly wages. Higher unemployment gaps four years earlier increase the current unemployment experience and decrease current real hourly earnings, in both cases only in a cold economy. Gaps longer than four years earlier were generally not found to be statistically significant. The conclusion is that exposure to a hot economic environment does not appear to have a particularly long-lasting impact on individual labor market outcomes.

IMPLICATIONS FOR POLICYMAKING Arthur Okun's preoccupation with the relationship between the labor market and output is predicated on his assumption "that idle labor is a satisfactory measure of all idle resources" (Okun 1962, 6). The channel through which a hot labor market translates into higher economic output is through increased individual productivity—what Okun (1973) referred to as "cyclical upgrading." This upgrading of productivity can take place, according to Okun, in three ways. First, employment in more productive industries is more volatile across the business cycle; during a hot economy, workers shift from less productive to more productive industries because that is where the greater demand for labor is concentrated. Second, workers experience upward movement by climbing productivity ladders within firms. And third, geographic mobility will allow workers to move from lower-income to higher-income regions during periods of high demand. Okun (1973, 227) only provides empirical evidence for the first of these three potential channels, but he speculates that "the skills accumulated during years of employment in [higher-productivity jobs made possible during hot economies] may make workers much more adaptable for good jobs elsewhere." The implication is that a hot economy provides an opportunity (with emphasis on "opportunity") for the effects of cyclical upgrading to be long-lasting.

Aaronson and her colleagues provide and cite significant evidence that hot economies have a disproportionately positive, contemporaneous

impact on labor market outcomes among disadvantaged workers. However, the overwhelming evidence in the literature so far is that exposure to a hot economy does not have a lasting positive impact on individual labor market outcomes—including unemployment, labor force participation, hours of work, and, Okun's favorite, wages. The general comments offered on Okun's (1973) paper were by and large quite skeptical about the permanence of the cyclical upgrading laid out by Okun. The general discussion notes that Okun responded that "he was claiming not that all the upgrading effects he uncovered were permanent, but only that they lasted long enough to be *important*" (quoted by Okun 1973, 259; emphasis added). This point is crucial for policy considerations.

It is clear that in his paper, Okun did not suggest that a "high-pressure policy" will, by itself, permanently reduce labor market gaps between advantaged and disadvantaged workers. Just creating more good jobs is not enough. He calls for "manpower programs" (that is, policymakers) to take advantage of hot economic environments to "incorporate a major effort to instill training and the basis for upgrading [skills], rather than merely create more [good] jobs" (Okun 1973, 245). He goes on to say, "Barriers to entry into good jobs may be swept away most easily when market forces are making racial and sexual discrimination costly to employers" (Okun 1973, 245).

Given that the results presented by Aaronson and her colleagues indicate that there is also no relative improvement in labor market outcomes (even from contemporaneous exposure) across the business cycle for disadvantaged workers (see my table 1), policymakers are clearly not taking advantage of hot economic environments to break down barriers to "good jobs." In fact, the contemporaneous hot economy bonus accruing to disadvantaged workers, which will quickly disappear during the next economic downturn, indicates that the bonus is more a suspension of prejudice and discriminatory behavior than an upgrading of individual productivity. The implication for monetary policy is that without a coordinated effort from makers of social policy to capitalize on employers' desperate need for labor to break down forces of discrimination and prejudice, accommodation of a high-pressure economy for the purposes of long-term improvement in labor market gaps will be ineffective.

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COMMENT BY

JUSTIN WOLFERS This paper by Stephanie Aaronson, Mary Daly, William Wascher, and David Wilcox explores how the business cycle shapes the labor market outcomes of different demographic groups. It updates and expands upon an existing literature, which has typically found that recessions do more harm to the labor market prospects of disadvantaged groups than to those of others, and that economic expansions also do more to boost their labor market prospects. That is, the labor market outcomes of disadvantaged groups tend to be especially procyclical. A finance economist would say that these are "high-beta" groups.

This new paper makes two contributions to this literature, and my comment responds to each. First, Aaronson and her colleagues update and confirm earlier findings that the labor market prospects of certain disadvantaged groups are especially sensitive to business cycle conditions. The first part of my comment explores these findings further, showing that they reveal a particularly interesting structure. Second, the authors look for evidence of an asymmetry, asking whether the boost these groups get from a "hot" labor market is larger than the harm done by an equally "cold" labor market. Although the authors strike a mildly optimistic tone, arguing that they uncovered some suggestive evidence in favor of their hypothesis, I am less optimistic. That is because the second part of my comment expands the authors' analysis beyond the United States, finding

no systematic evidence in favor of their hypothesis. An additional strength of this paper is that it expands the array of labor market measures that are typically analyzed, evaluating the cyclicality of not just unemployment but also participation rates, average hourly earnings, own earnings, and household earnings. For the sake of brevity, I focus my comment only on the unemployment rate.

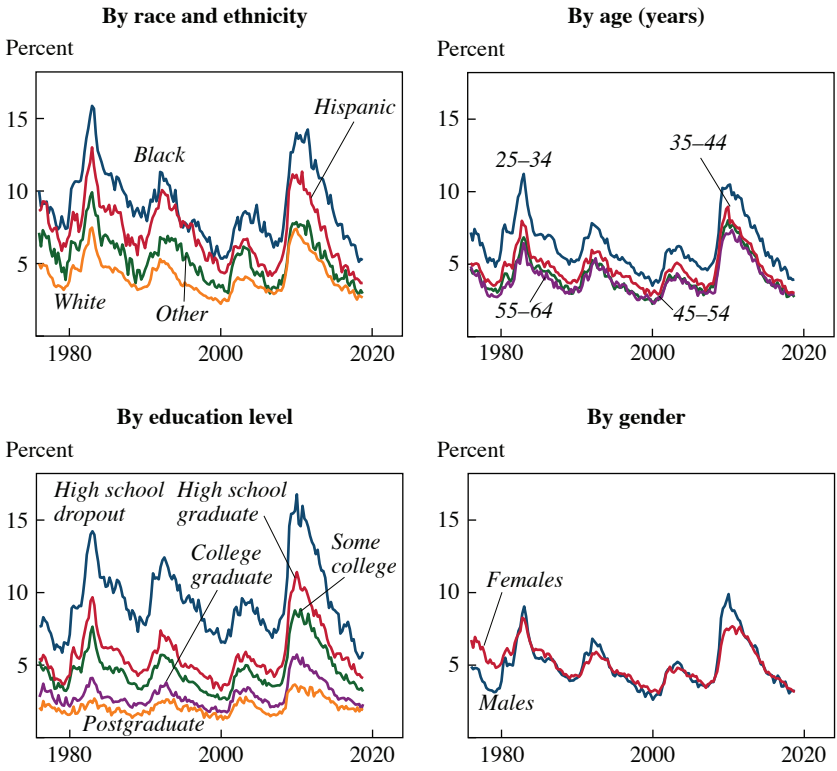
BENEFITS OF A HIGH-PRESSURE LABOR MARKET My figure 1 illustrates the key ideas in the paper by Aaronson and her colleagues, graphing the unemployment rate by race and ethnicity, by gender, by education, and by age. The data I used to construct these plots—and throughout this comment—are largely the same as those used by the authors. Following their approach, I start with micro data on labor market outcomes from the Current Population Survey (CPS), focusing on those age 25–64 years over the period 1976–2018.[1] I also expand a little on their analysis. Though the authors only show results for three race/ethnicity groups (non-Hispanic blacks, non-Hispanic whites, and Hispanics), I also include the "other" category. And though they show only a coarse categorization of education into three groups, I separate out high school graduates from high school dropouts, and I also separate out those with only a college degree from those who have studied for postgraduate degrees. In addition, though the authors only analyze differences by gender, race/ethnicity, and education, I also separate out four age groups, analyzing those age 25–34, 45–44, 45–54, and 55–64 years.

The top left panel of my figure 1 shows that the unemployment rate for blacks is clearly both higher and more cyclically sensitive than it is for whites. Between these lies the unemployment rate for Hispanics, which is both lower and less cyclical than that of blacks, and higher and more cyclical than that of whites. (The CPS also contains a residual "other" group, whose unemployment rate is a bit lower and less cyclical than that of Hispanics but, again, higher and more cyclical than that of whites.)

The next panel of my figure 1 shows differences by age, a dimension that Aaronson and her colleagues do not analyze in much detail. The unemployment rates for those age 45–54 and 55–64 are virtually identical. The unemployment rate for those age 35–44 is slightly higher, and slightly more cyclical. The more notable difference arises with the youngest age

1. I drew these micro data from the cleaned and harmonized data file maintained by the Federal Reserve Bank of Kansas City, and I then aggregated them into a quarterly series, which I seasonally adjusted using a simple ratio–to–moving average filter.

Figure 1. Unemployment Rates by Demographic Group, 1976–2017



Source: Author's calculations, using the Current Population Survey.

group—those age 25–34—whose unemployment rate is both substantially higher and substantially more cyclical than that of any other age group.

The starkest differences are across education levels, which are shown in the figure's lower left panel. The unemployment rate for high school dropouts is both higher and more cyclical than that of high school graduates, which in turn is higher and more cyclical than that of those with some college, which in turn is higher and more cyclical than that of college graduates. Indeed, it is quite striking just how low and steady the unemployment rate of those with postgraduate degrees is, given that throughout this entire period, it rose or fell within a range that was only 1½ percentage points above or below its mean level.

The common theme here is that disadvantaged groups—racial and ethnic minorities, young people, and those with less education—all appear to have both higher and more cyclically sensitive unemployment

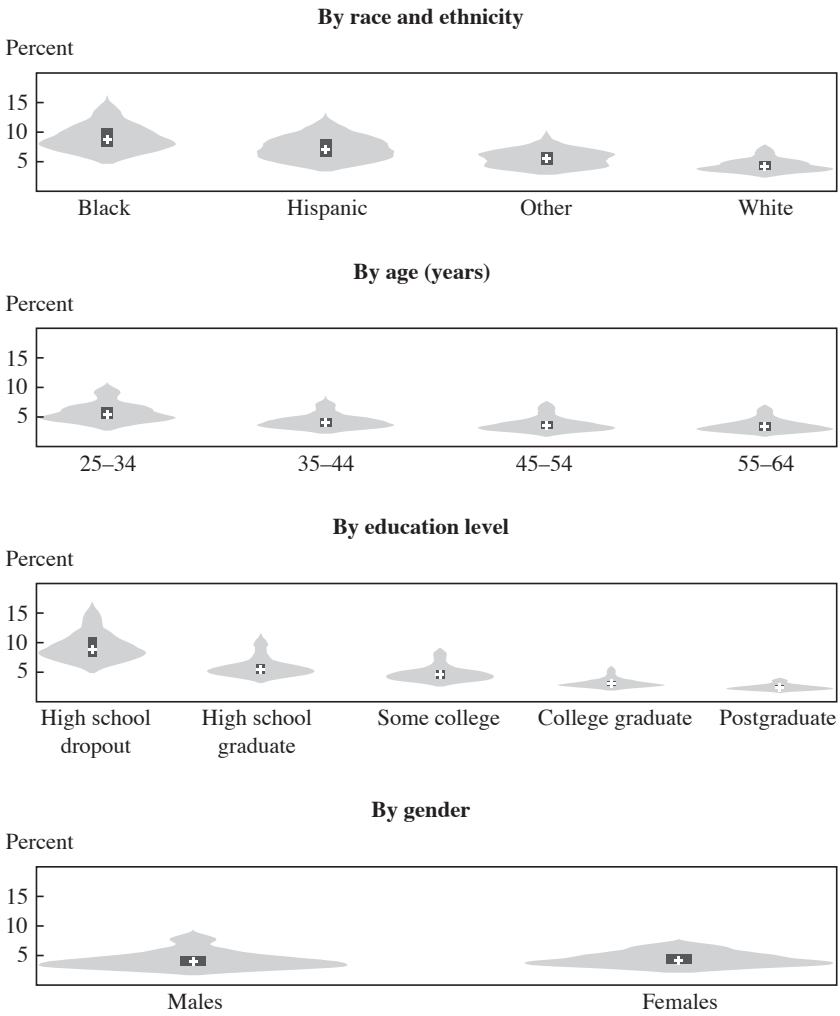
rates. Gender differences in both the level and cyclicality of unemployment rates are much smaller.

My figure 2 shows a closely related idea, in a different format, presenting violin plots for each demographic group. As a reminder, the light gray bell curves (the violins) show kernel density estimates of the probability density function of the unemployment rate; the black bar in the middle illustrates the interquartile range of unemployment for that group; and the white cross illustrates the median unemployment rate for that group. In each panel, the plots shown on the left summarize the distribution of unemployment rates for disadvantaged groups—blacks and Hispanics, younger people, and those with less education. In each case, these groups have both higher unemployment rates on average and also more variable unemployment rates, reflecting the greater amplitude of their cyclical variation. As you look across to the right within each panel, the plots for more advantaged groups—whites, older people, and those with college degrees—reveal unemployment rates that are both lower on average and much less variable.

Taken together, this evidence suggests that there is a demographic dividend from running a high-pressure labor market—not only do all groups benefit, but those who have historically been disadvantaged benefit the most. In this sense, the findings confirm Arthur Okun's (1973, 246) argument that "the greater diffusion of opportunity and of upward mobility in a full-utilization economy is a vital social benefit; and that benefit helps explain why the pursuit of full employment is an integral part of a liberal's creed."

LINKING THE LEVEL AND CYCLICALITY OF UNEMPLOYMENT Implicit in Okun's idea is the notion that somehow the factors that make some people more susceptible to unemployment, on average, also make them more susceptible to cyclical fluctuations. But the evidence the literature has accumulated on this point so far is largely informal and qualitative, essentially just pairing the observation that those groups with more cyclical unemployment rates—blacks, Hispanics, younger workers, and those with less education—have also tended to have higher unemployment rates. What has not previously been tested is the more precise quantitative prediction: If disadvantage explains both the susceptibility of a person or group to unemployment, and their susceptibility to cyclical fluctuations, then from a statistical perspective, a single index can explain both phenomena. This single index property suggests that the cyclicality of a demographic group's unemployment should rise in proportion with its unemployment rate. In what follows, I extend the research of Aaronson and her colleagues to examine whether it is consistent with this additional quantitative prediction.

Figure 2. The Distribution of Unemployment Rates, 1976–2017[a]



Source: Author's calculations, using the Current Population Survey.

a. The probability density function is shown in light gray; the 25th–75th percentiles are highlighted in black; and the median is shown as a white cross.

A micro data perspective. I compiled the CPS micro data for the United States for the period and sample of the authors' study, and ran this regression:

$$U_{i,t} = \left(\begin{array}{l} \sum_r \alpha_r I(race_i = r) + \sum_a \alpha_a I(age_i = a) \\ + \sum_e \alpha_e I(educ_i = e) + \sum_s \alpha_s I(sex_i = s) \end{array} \right) + \left[\begin{array}{l} \sum_r \beta_r I(race_i = r) + \sum_a \beta_a I(age_i = a) \\ + \sum_e \beta_e I(educ_i = e) + \sum_s \beta_s I(sex_i = s) \end{array} \right] \times \underbrace{(U_t - U_t^*)}_{\substack{Aggregate \\ unemployment\ gap}},$$

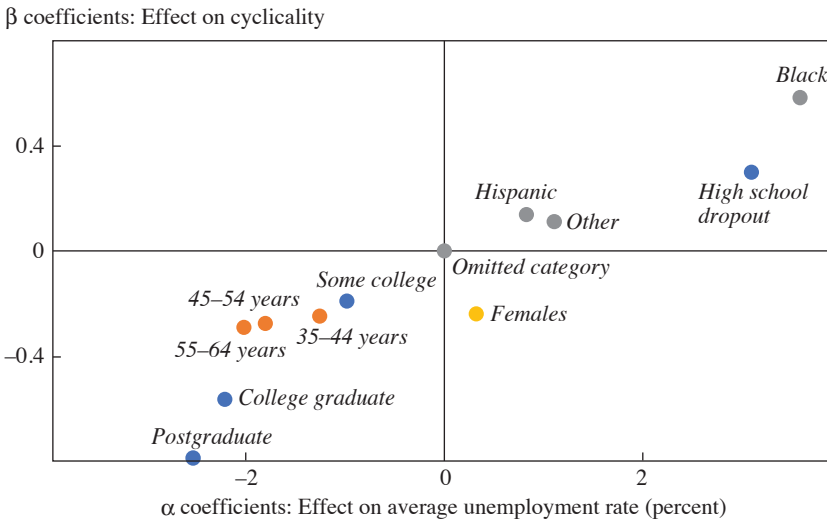
where the dependent variable, $U_{i,t}$, is a binary variable set to 1 if individual i is unemployed at time t, and 0 if he or she is employed (those who are not in the labor force are excluded from the sample). The α coefficients effectively describe how the average risk of unemployment varies, depending on each person's demographic characteristics. In particular, it describes differences in the unemployment rate that might occur when the aggregate unemployment rate is equal to the equilibrium rate. By contrast, the βs describe how sensitive the unemployment risk of people with different demographic characteristics is to the state of the business cycle, which, following Aaronson and her colleagues, I measure as the gap between the national unemployment rate, U_t, and the equilibrium unemployment rate calculated by the Congressional Budget Office, U_t^*.

The point is that the αs describe how demographic characteristics shape the average level of unemployment, while the βs describe its cyclicality. Importantly, the idea that both are determined by a common factor called "disadvantage" suggests that any characteristic c (which might refer to race, age, education, or gender) that leads to a higher α_c will also lead to a commensurately higher β_c. And so, rather than presenting these regression results in a standard table, my figure 3 graphs them, showing the β_c for each characteristic against the corresponding α_c.

The findings clearly are consistent with the idea that demographic characteristics that lead to higher unemployment also lead to more cyclical unemployment. This pattern can be seen both within each demographic characteristic, and also between them. Indeed, across these characteristics, the correlation between the estimates of α_c and β_c is 0.93 (and with a t statistic of 7.9, this meets standard metrics for statistical significance).

A macro data perspective. An alternative approach to the same question considers the unemployment rates of quite specific demographic groups.

Figure 3. Regression Results Showing How Demographic Characteristics Shape the Average Level and Cyclicality of Unemployment



Source: Author's calculations, using the Current Population Survey.

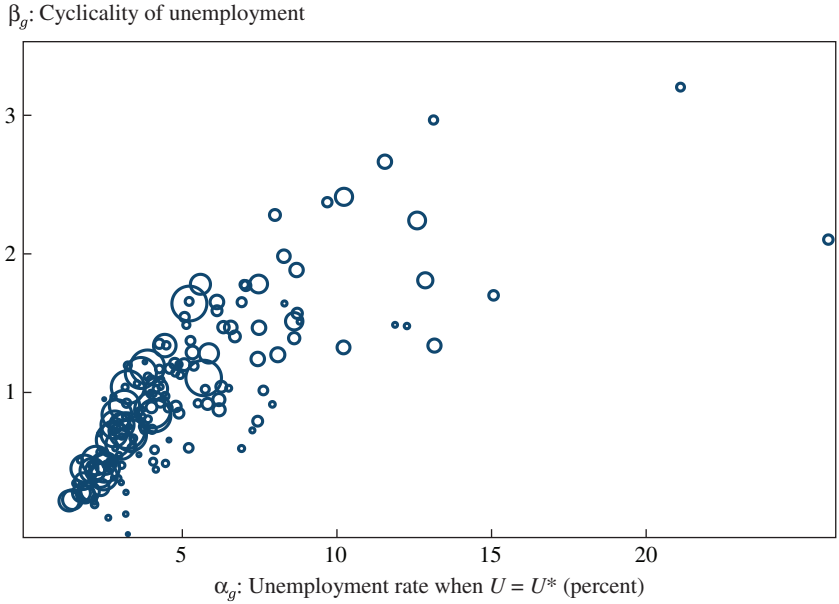
For this, I used the same CPS micro data to construct seasonally adjusted estimates of the quarterly unemployment rate for quite fine partitions of the workforce by race and ethnicity, gender, education, and age. This led to a total of 160 separate unemployment rates (4 race/ethnicity groups × 2 genders × 5 education groups × 4 age groups). The advantage of this approach is that it accounts for all possible interactions between these demographic characteristics.

For each of these narrowly defined demographic groups, g, I ran a simple regression of the form

$$U_{g,t} = \alpha_g + \beta_g \times (U_t - U_t^*),$$

where the dependent variable is the unemployment rate of demographic group g (such as 25- to 34-year-old Hispanic women with some college), and the independent variable is the same economy-wide unemployment gap used above to measure business cycle conditions. The interpretation of this regression is similar: The variable α_g describes the average unemployment rate for a demographic group when the economy-wide unemployment rate is equal to the equilibrium rate, and β_g measures the cyclicality of the unemployment rate for that group.

Figure 4. Groups with Higher Unemployment Have More Cyclical Unemployment[a]



Source: Author's calculations, using the Current Population Survey.

a. Each point describes the results for a sex × age × education × race group, g; $U_{g,t} = \alpha_g + \beta_g \times (U_t - U_t^*)$.

I present the estimates from all 160 regressions in my figure 4, where each point shows the estimate of α_g and β_g for a specific demographic group. Because some of the cell sizes are quite small, the size of each point is proportional to the number of observations for that group in the underlying micro data.

Again, the finding is quite clear: Those narrowly defined demographic groups that tend to have higher unemployment rates (that is, higher αs) also tend to have more cyclical unemployment (higher βs). The data are clustered along a line of best fit that appears roughly linear, or perhaps slightly concave.

To my knowledge, this is a new finding in the literature, and it presents a stylized fact that I hope will be useful in guiding theoretical models of why different groups fare differently over the business cycle. It is consistent with the notion that a single index determines both an individual's average unemployment risk and the cyclicality of his or her unemployment rates. This could arise if demographic characteristics directly lead to both higher and more cyclical unemployment (an idea that Okun implicitly

endorsed when he wrote that a high-pressure labor market might especially help particular groups, because that is "when market forces are making racial and sexual discrimination costly to employers"). It could also arise if these demographic characteristics are statistical proxies for some deeper notion of disadvantage or some other index relevant to labor market outcomes.

INTERNATIONAL EVIDENCE Aaronson and her colleagues are not just interested in whether disadvantaged groups have more cyclical unemployment. They see their unique contribution as testing the hypothesis that a high-pressure labor market may be different—perhaps even more effective—at improving the labor market outcomes of disadvantaged relative to advantaged groups. Effectively, they want to know whether the relative gains to disadvantaged groups from a "hot" labor market are even larger than might be expected from a linear relationship with the state of the aggregate economy. To study this, they examine how unemployment differentials—such as the difference between the unemployment rates of blacks and whites, or the difference between the unemployment rate of less educated workers and that of more educated workers—vary with the state of the business cycle. Previous research had shown that these differentials narrow when the national unemployment rate declines. They hypothesize that there might be an asymmetry to this cyclicality, so that the relationship between unemployment differentials and the state of the economy becomes stronger in hot economies.

The challenge is that by looking only at the United States, their sample includes just five episodes of "hot" labor markets (the late 1970s just before the Volcker disinflation; the late 1980s just before the 1990 recession; the middle to late 1990s, in the late stages of the Clinton-era boom; the middle to late 2000s, when unemployment barely dipped below the natural rate; and, finally, after 10 years of the recovery, following the Great Recession). Perhaps, then, it is unsurprising that their estimates of the extent (if any) of this asymmetry—shown in their tables 3 and 4—are extremely imprecisely estimated. Their estimates are sufficiently imprecise that they are left unable to reject the null hypothesis that this relationship is the same in both hot and cold labor markets, just as they are typically unable to reject the null that hot labor markets make unemployment differentials either 50 percent more or less sensitive to the state of the business cycle. My own conclusion is that their sample contains too few "experiments" of hot labor markets to be very informative about this issue. (The authors' subsequent attempt to parse the results by individual business cycle yields even lower power.)

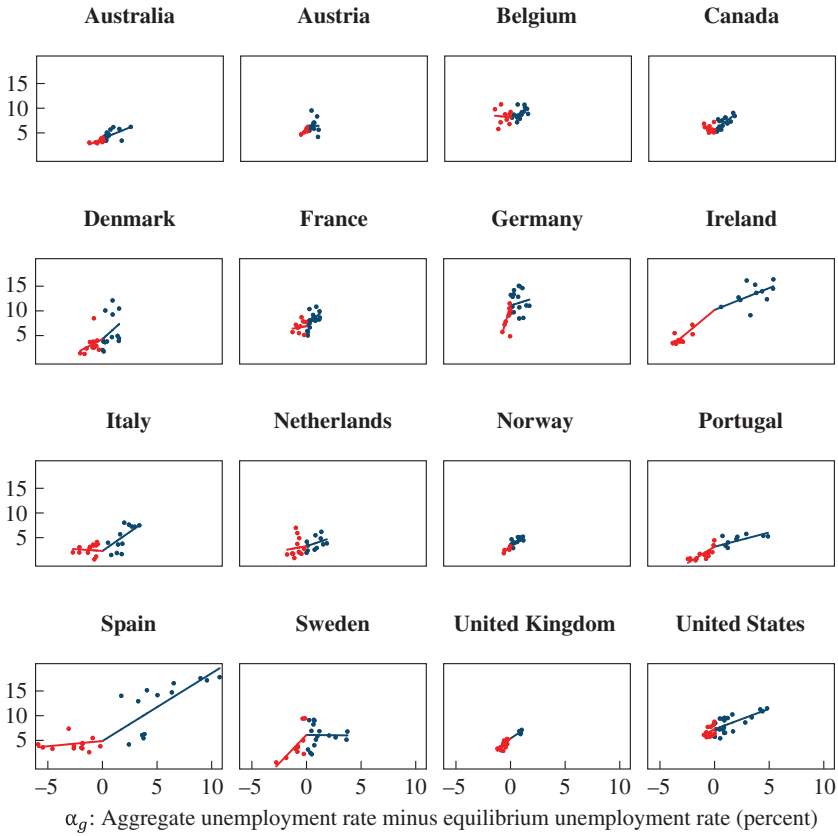
One natural response to underpowered results coming from a single-country study is to expand the sample to include the experiences of other countries. To this end, I collected unemployment data on those age 25–64 by educational attainment for nations that belong to the Organization for Economic Cooperation and Development (OECD). I drew these data from the *OECD Education Statistics* database and use them to construct unemployment differentials by education, focusing on the difference between the unemployment rate of those with less than an upper-secondary education ("high school dropouts") and those with a tertiary education ("college graduates"). I compare the evolution of each of this differential with the state of the national business cycle, as measured by the gap between a country's aggregate unemployment rate and the OECD's measure of that country's equilibrium unemployment rate, drawn from the May 2019 edition of its *Economic Outlook* database. This yields annual data covering up to 32 countries over the sample period 1981–2017 (albeit with some missing data).

My figure 5 illustrates how the educational unemployment differential—the unemployment rate of high school dropouts minus the (lower) unemployment rate of college graduates—varies with aggregate business cycle conditions. Though my full sample includes up to 32 countries, in order to keep the plots manageable, I show results only for 16 of the larger and more interesting OECD economies. In order to draw attention to hot labor markets, outcomes where the national unemployment rate is below that country's equilibrium unemployment rate are shown on the left of each panel in a lighter shade.

Two key facts are evident. First, there is a positive correlation between this unemployment differential and the state of the labor market. That is, the lower the national unemployment rate, the smaller are these education unemployment differentials. This finding is consistent with the earlier United States–centric literature that had found that the unemployment rate of disadvantaged groups is more sensitive to cyclical fluctuations. Indeed, across the 32 countries for which I have usable data, the "unemployment gap" is a statistically significant explanator of this unemployment differential at the 1 percent level for 20 countries, and at the 10 percent level for 28 countries. (The 4 countries where it is not significant all had fairly short samples.)

Second, there is not much evidence to support the hypothesis of Aaronson and her colleagues that this relationship steepens in a hot labor market. My figure 5 shows a regression line where I allow this relationship to change in a hot labor market (defined as one where the national unemployment rate is below the equilibrium unemployment rate). Across these

Figure 5. Unemployment Differentials by Education Level, Selected Countries



Source: Author's calculations, using *OECD Education Statistics and OECD Economic Outlook.*

countries, this relationship does not appear to systematically steepen (or flatten) in hot labor markets. Following their approach, I estimated regressions of the following form for each country:

$$U_{c,t}^{HS\ dropout} - U_{c,t}^{College} = \alpha_c + \beta_c\left(U_{c,t} - U_{c,t}^{*}\right) + \gamma_c\left(U_{c,t} - U_{c,t}^{*}\right) \times I\left(U_{c,t} < U_{c,t}^{*}\right).$$

In this case, γ_c measures how much this relationship steepens (or flattens) when the national unemployment rate falls below the equilibrium unemployment rate. Aaronson and her colleagues had hypothesized that γ_c would be positive. My point estimate was positive for 16 countries, and

negative for 16 countries. Judged against a 10 percent significance level, it was significantly positive in 5 countries, significantly negative in 6, and insignificant in the remaining 21 countries. (And, in the absence of corrections for autocorrelation, this probably overstates significance.)

Finally, in order to allow the data to speak as clearly as possible, I pooled all the data into a country-year panel, to estimate one $\overline{\gamma}$ (rather than allowing it to vary by country)—while controlling for country fixed effects and allowing β_c to vary by country. This yielded a statistically significant negative coefficient, which is precise enough to reject the authors' hypothesis that it would be positive.

CONCLUSION My conclusion is that there is robust evidence across countries that a strong national labor market narrows unemployment differentials, but there is no support for the hypothesis of Aaronson and her colleagues that this relationship intensifies in a "hot" labor market.

From a policy perspective, I am not convinced that the authors' hypothesis is central to Okun's argument about the social benefit of pursuing full employment. Previous research has found—and this paper and my comment have confirmed—that hot labor markets help disadvantaged groups more than advantaged groups. As such, full employment reduces unemployment differentials between groups. The failure to identify an asymmetry does not undermine the broader point that full employment is valuable not only from an efficiency perspective but also because it yields an "equality dividend," in which labor market opportunity becomes more equally shared across demographic groups.

Finally, a personal note. The exploration of this question is one to which the late Alan Krueger contributed (see, for instance, the 1999 paper by Lawrence Katz and Krueger), and I know that he would have found this paper interesting. Alan was always deeply engaged by questions at the intersection of labor and macroeconomics, and he was a frequent and vigorous contributor to the Brookings Panel (and, indeed, in any setting where the issues of the day were debated). Our discussion of this work—as with our discussion of so many policy-relevant topics—was impoverished by his recent death. Alan, you are missed, not just by your colleagues who valued your insights but also by the less fortunate whose lives your work illuminated, and improved.

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Katz, Lawrence F., and Alan B. Krueger. 1999. "The High-Pressure U.S. Labor Market of the 1990s." *Brookings Papers on Economic Activity*, no. 1: 1–81. https://www.brookings.edu/wp-content/uploads/1999/01/1999a_bpea_katz.pdf.

Okun, Arthur M. 1973. "Upward Mobility in a High-Pressure Economy." *Brookings Papers on Economic Activity*, no. 1: 207–52. https://www.brookings.edu/wp-content/uploads/1973/01/1973a_bpea_okun_fellner_greenspan.pdf.

GENERAL DISCUSSION Katharine Abraham noted the importance of this paper by Stephanie Aaronson and her colleagues, especially the section examining whether there is evidence of positive hysteresis from running a tight labor market. Abraham observed that evidence of positive hysteresis would affect the trade-offs that policymakers face. On this note, she questioned the authors' decision to limit their analysis to people age 25–64 years, given that indications of negative hysteresis have been particularly apparent among those entering the labor market during a bad economic period. As such, investigating the subsequent effects of entering the labor market during a hot period might be especially useful.

Abraham commented that analyzing the effects of a hot labor market on the flows across labor market states, in contrast to the effects on stocks such as the unemployment rate and employment-to-population-ratio, would be especially interesting. She wondered whether running a hot labor market increases the likelihood of a person either finding a job or changing jobs. She imagined that labor market flow patterns are likely to differ by age.

Steven Davis reflected on a paper by Sherwin Rosen that highlights the dynamic complementarity between specific human capital investment and future utilization rates of that human capital.[1] Davis remarked that a person can invest in market-relevant and/or non-market-relevant skills As a person acquires market-relevant skills, for example, the reward to working in the market rises. There is also an effect in the other direction, whereby someone who anticipates future market work activity perceives a high return to acquiring market-relevant skills. In this sense, anticipated market work and the acquisition of market-relevant skills are mutually reinforcing. The same logic applies to nonmarket activities and the acquisition of skills that pay off in nonmarket activities. Davis commented that this phenomenon is highly relevant for thinking about potential mechanisms of a hot labor market because the causality is two-way and intertemporal. This two-way causality implies that isolating the effects of a hot labor market is empirically challenging.

1. Sherwin Rosen, "Specialization and Human Capital," *Journal of Labor Economics* 1, no. 1 (1983): 43–49.

Davis referred to a paper by David Neumark and Olena Nizalova that examines the connection between the employment rate of younger, less-educated people and whether the minimum wage in their local labor market was binding 10 years earlier.[2] Neumar and Nizalova find that younger, less-educated people who were affected by a binding minimum wage 10 years earlier will currently have lower employment rates. Davis remarked that this finding suggests that there are persistent effects of a person's ability to find work earlier in life on his or her likelihood of employment later in life. Thus, in considering the benefits of a tight labor market, the best place to look may not be the unemployment rate. Indeed, looking at other outcomes, such as employment and wages down the road, is likely to be especially enlightening. Davis noted that Rosen's logic also suggests important omitted variables—for example, the expected persistence of labor market tightness.

Davis noted that labor market tightness differs greatly across localities at a point in time. Spatial differences in tightness are potentially quite useful for estimating their effects on future labor market outcomes, despite the endogeneity of worker mobility across spatial labor markets.

Davis also argued that there is abundant evidence pointing to persistent positive effects of drawing less skilled people into the labor market, especially a hot one. For example, he described the research finding that tight labor markets facilitate job-to-job mobility. In addition, he noted research that links job-to-job mobility for younger workers with the ability to find a good-quality job match and get a larger share of the rents in the match. All in all, he asserted that economists have good reasons to believe that match quality improves the likelihood of higher wages, especially for less educated workers operating in a high-pressure environment. In this regard, he mentioned an empirical paper by Robert Topel and Michael Ward and a forthcoming theoretical paper by Gregor Jarosch that both study match quality effects and their connection to wages.[3]

Adele Morris wondered whether it would be possible to exploit variation across different sectors of the economy, given that some job sectors are more cyclical than others. This tendency for some sectors to be more

2. David Neumark and Olena Nizalova, "Minimum Wage Effects in the Longer Run," *Journal of Human Resources* 42, no. 2 (2007): 435–52.

3. Robert H. Topel and Michael P. Ward, "Job Mobility and the Careers of Young Men," *Quarterly Journal of Economics* 107, no. 2 (1992): 439–79; Gregor Jarosch, "Searching for Job Security and the Consequences of Job Loss," forthcoming, https://www.dropbox.com/s/whwpxtwskjzfq22/JobSecurity_121115_Full.pdf?dl=0.

cyclical than others implies that when the economy is hot, workers are disproportionately brought into the most cyclical sectors. As such, when the economy cools off, these same people are the most likely to experience unemployment. Thus, differentiating between workers—such as construction workers or schoolteachers—might give the authors additional insights.

Harry Holzer noted that the United States has experienced a large secular decline in the labor force participation rate among less educated males, which accelerated during the most recent economic downturn. He observed that examining the extent to which these males are returning to work and disaggregating some of the reasons they left work would be interesting. Moreover, he proposed that using a different data set, which includes people with criminal records or disability status, would likely be informative.

Holzer commented that research shows that supply-oriented interventions—like job training—are more effective when the economy is hot, especially job training centering on the tighter sectors. Importantly, this research also shows that sector-based training is more effective than other kinds of job training. Given this, Holzer pronounced the present moment to be a logical time to ramp up these investments and specifically target them toward workers who have permanently left the job market.

Jonathan Pingle emphasized Adele Morris's point about using industry data, noting that the excess cyclicality in the male unemployment rate in the last business cycle was likely due, in part, to the acute downturn in construction. Pingle also observed that structural sectoral shifts—such as the long-term decline in manufacturing jobs—could dampen or mask some of the cyclicality across some disadvantaged groups.

Susanto Basu linked the paper's discussion of employment and earning outcomes to the theme of persistence. Basu noted the concept of the "user cost of labor," introduced by Marianna Kudlyak, which is the difference between the present discounted wage and a point in time wage.[4] Cynthia Doniger disaggregated this concept of the user cost by education group, and finds that user costs are very procyclical.[5] Specifically, user costs are procyclical for the college educated, and are fairly procyclical for people

4. Marianna Kudlyak, "The Cyclicality of the User Cost of Labor," *Journal of Monetary Economics* 68 (2014): 53–67.

5. Cynthia L. Doniger, "Do Greasy Wheels Curb Inequality?" Finance and Economics Discussion Series 2019-021 (Washington: Federal Reserve Board of Governors, 2019), https://www.federalreserve.gov/econres/feds/files/2019021pap.pdf.

with some college education, but are not at all cyclical for those without a high school degree. Basu observed that the fact that the paper by Aaronson and her colleagues shows that less educated groups are the most likely ones to have a positive beta over the cycle for employment exactly because these same groups do not experience a positive beta for their wages, at least in the present value sense. Basu closed by noting that this phenomenon of positive gains in employment but not wages among the less educated also suggests that what is gained on the swings is lost on the roundabouts.

Ayşegül Şahin commented that it seems natural that employment gaps decrease when the economy is doing well. Agreeing with Abraham, Şahin observed that labor force attachment is important, and notes that she believes it is a positive development that attachment is rising faster for black males than white males. However, she pondered whether this progress was related to a hot economy or something else. For example, she noted that decreasing incarceration rates are also likely to be reducing labor market exits. Similar to the trend in the female labor force participation rate and the disappearance of the gender gap, the decreasing incarceration rate is increasing labor force attachment and reducing the unemployment rate. She concluded that examining the variation in socioeconomic factors could also shed light on whether these observed positive developments are actually related to the hot economy.

John Haltiwanger discussed the job-to-job flows (known as J2J) database, a new Census Bureau data product constructed using administrative data. J2J is an employer-employee matched database that tracks all businesses and all workers in the United States. In addition, J2J tracks characteristics about businesses and workers—such as age, race, ethnicity, and education—and is available at the level of metropolitan statistical areas (MSAs). These J2J data show—consistent with earlier evidence from the Current Population Survey—that the job ladder collapsed during the Great Recession. Furthermore, this collapse disproportionately affected the less educated, the young, and the disadvantaged. Haltiwanger noted that the slow recovery includes a slower recovery on the job ladder, especially among these groups. He concluded that he does not believe that $U - U^*$ (the unemployment rate minus the natural rate of unemployment) is the correct way to measure a hot labor market. Instead, he believes that a more general measure of labor market tightness would be useful, such as V (vacancies) over U.

David Romer cautioned about drawing policy implications about these issues without a macroeconomic model. In the extreme, effects at the macro level may undo or reverse the conclusions one might be tempted to draw

based on intuition. If aggregate demand policy cannot affect the average unemployment rate and if aggregate welfare is linear in the unemployment rate, then the discovery that recessions are worse than perceived and booms are better than perceived has no implications for the welfare effects of stabilization policy. The reason is simply that under these assumptions, it is impossible to affect average welfare through stabilization policy. And if there are nonlinearities in the Phillips curve in the most plausible direction, with below-normal unemployment raising inflation more than above-normal inflation lowers it, then introducing volatility in the economy—by pushing unemployment below the natural rate, with a later period of unemployment above the natural rate to avoid a permanent increase in inflation—raises average unemployment over the cycle. In that case, a finding that unemployment is costlier than previously thought implies that such a policy reduces average welfare over the cycle, and that the welfare cost is higher than previously believed. In contrast, the opposite holds true if there are nonlinearities in the Phillips curve in the other direction. Similarly, nonlinearities in aggregate welfare as a function of the unemployment rate would also affect these calculations, and we have little evidence about such nonlinearities. In sum, Romer emphasized that it is the nonlinearities that drive any policy implications, rather than the first-order terms.

Robert Hall stated that his take on Kudlyak's work was different than Basu's. Kudlyak finds that there is an advantage to taking a job in a hot market relative to either what existing workers have or to the starting wage in a normal market. Moreover, this advantage is persistent over about six years. Hall noted that this finding does not directly relate to the question of a differential effect for disadvantaged people, but rather suggests that the effects are persistent. Hall affirmed that using a panel data set is important. In terms of wage rates, Hall referred to a large body of research that shows that though employment effects are not very persistent, wage effects are. To Hall, these findings indicate that looking at wage rates is the best way to explore the idea of persistence.

Robert Gordon reflected on the Okun coefficient, which up through the mid-1980s shows that unemployment moves about half as much as the gap between actual and potential output. This coefficient suggests that when unemployment goes down, output increases by 1 percent. This 1 percent bonus in a high-pressure economy comes from a combination of higher labor force participation, higher hours of work per employee, and higher productivity. Recent data, however, suggest a shift in Okun's law in the direction of a larger labor force response and a smaller productivity

response. Indeed, Gordon indicated that recent data show very little procyclicality in productivity. Currently, the response of unemployment to a change in the output gap is more like 0.7 or 0.5, suggesting that the additional bonus of a hot labor market is not as large as it used to be. However, Gordon cautioned that, when thinking about the issue of the procyclicality of productivity, much of the change in the Okun coefficient is conditional on the jump of about 2.2 percent in productivity during the worst period of the Great Recession. To Gordon, this suggests that the increase in the sensitivity of unemployment to output change is partly an artifact of unusual behavior during the Great Recession, and that the issue of whether the economy got an additional bonus from higher productivity is still on the table.

Gilbert Metcalf considered a paper by Gordon Hanson, Chen Liu, and Craig McIntosh on changes in low-skilled immigration.[6] Metcalf wondered what the changes in low-skilled immigration mean for the findings of the paper by Aaronson and her colleagues. Metcalf also contemplated whether examining underemployment and its effects on income serves as a better measure for analyzing a hot labor market.

Stephanie Aaronson thanked both commenters, Julie Hotchkiss and Justin Wolfers, for bringing additional perspective to their work, and she also thanked all who participated in the general discussion. In response to the comments on exploiting regional variation, Aaronson noted that their paper does include an MSA analysis. This MSA analysis largely confirms the results in the rest of the paper: that there is weak evidence of a kink when the labor market gets hot, especially for African Americans. Similarly, Aaronson noted that the paper also includes an analytical comparison of metropolitan with nonmetropolitan areas. This analysis shows that the gap in labor market outcomes between metropolitan and nonmetropolitan areas is not sensitive to the aggregate unemployment rate, implying that what is going on in nonmetropolitan areas is recent, is structural, and does not seem to be affected by the business cycle.

Aaronson appreciated Abraham's question regarding younger workers, especially because this age group was an original focus of Okun. Aaronson remarked that although their paper does not show results for younger workers, earlier versions of the paper did include those age 16–65 and

6. Gordon H. Hanson, Chen Liu, and Craig McIntosh, "The Rise and Fall of U.S. Low-Skilled Immigration," *Brookings Papers on Economic Activity*, Spring 2017, 83–151, https://www.brookings.edu/bpea-articles/along-the-watchtower-the-rise-and-fall-of-u-s-low-skilled-immigration/.

that these results showed more evidence of hysteresis. She mentioned that exploring whether there is evidence of positive hysteresis among younger workers would be easy to do, and the authors hope to present these new results in the final version of the paper.

In response to Davis, Aaronson agreed that using panel data is valuable. Aaronson noted a study by Julie Hotchkiss and Robert Moore that explores the concept of positive hysteresis using panel data from the National Longitudinal Survey of Youth.[7] Aaronson agreed that employment effects are likely to be short-lived, whereas wage effects may last longer for some groups of workers.

Aaronson expressed concern about using industry-level data, noting the difficulty of attaching people to an industry over time, but she agreed that some workers are brought into more cyclical industries. On this note, she mentioned that there is also evidence that finds no indication of hysteresis for precisely this reason: workers who are brought into highly cyclical industries are the same workers who become unemployed again when the economy turns cold.

Aaronson thanked David Romer for his comments, and she reflected on a paper that he and Christina Romer wrote for the 1998 Economic Policy Symposium at Jackson Hole that discussed the trade-offs of running a hot economy.[8] Aaronson remarked that running a hot economy can be a powerful tool to help disadvantaged workers; however, it remains unclear whether a hot economy can be run for long enough to provide a substantial benefit to these same workers. Aaronson explained that neither her and her colleagues' paper nor historical experience provides an indication of a long-term benefit. She cautioned that policymakers should be careful about using policy levers—such as running a hot economy—to solve structural problems. Such problems, she advised, are likely to require more than monetary policy to solve.

William Wascher commented on Haltiwanger's warning that using $U - U^*$ might not be the best measure of the tightness of the labor market.

7. Julie L. Hotchkiss and Robert E. Moore, "Some Like It Hot: Assessing Longer-Term Labor Market Benefits from a High-Pressure Economy," Working Paper 2018-1 (Atlanta: Federal Reserve Bank of Atlanta, 2018), https://www.frbatlanta.org/-/media/documents/research/publications/wp/2018/01-assessing-longer-term-labor-market-benefits-from-a-high-pressure-economy-2018-01-30.pdf.

8. Christina D. Romer and David H. Romer, "Monetary Policy and the Well-Being of the Poor," paper presented at Economic Policy Symposium on Income Inequality Issues and Policy Options, sponsored by Federal Reserve Bank of Kansas City, Jackson Hole, Wyo., August 27–29, 1998, https://www.kansascityfed.org/publicat/sympos/1998/S98romer.pdf.

Wascher noted that previous iterations of his and his colleagues' paper had included a model that picked the unemployment rate where the kink might occur. This model chose an unemployment rate that was often higher than U^*. As such, thinking more broadly about how to carefully measure labor market tightness would be useful. Wascher agreed with Metcalf's comment that underemployment is likely to be an issue. Wascher noted that the paper attempts to get at this underemployment question through their analysis of wages, but he agreed that this problem requires more attention.