Minority Unemployment, Inflation, and Monetary Policy*

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Preliminary, comments welcome.

Abstract

Persistent income inequality between Black and white households has generated a vigorous debate on what policy instruments may be effective to reduce such disparities. One such instrument to be evaluated is monetary policy. In this paper, we study precisely how monetary policy affects the real income volatility of Black and white households, in a framework where the monetary authority faces a trade-off between unemployment and inflation. Our assessment is informed by four empirical regularities: (i) the unemployment rate for Black individuals is about twice as high than the unemployment rate for white individuals, *at all times*; (ii) though the levels differ, the unemployment rates for Black and white individuals move closely *over the business cycle*; (iii) labor income represents a larger portion of overall income for Black than for white households; (iv) Black households experience *higher* price volatility with respect to white households. We argue that (i) and (ii) imply that proposals postulating that monetary policy targets Black unemployment are equivalent to a policy accepting larger inflation fluctuations. At the same time, (iii) and (iv) imply that the real income volatility of Black households is more directly affected by inflation changes. In our quantitative evaluation, we find that Black households gain disproportionately more from accommodative monetary policy so long as inflation expectations remain anchored. With unanchored expectations, on the other hand, the benefit from reducing unemployment become smaller and the erosion of real income from higher inflation dominates.

*We thank John B. Jones, Alexander Wolman, and Chen Yeh for helpful comments, and Brandon Fuller and Rachel Moore for excellent research assistance. Throughout the text, we choose to capitalize "Black" and not capitalize "white". To this respect, we echo The New York Times' editorial board: "We don't treat the [Times'] stylebook as an instrument of activism, but want the stylebook to reflect common usage. The Times looked at whether to capitalize white in reference to race, but it will remain lowercase. White does not represent a shared culture and history in the way Black does, and also has long been capitalized by hate groups." The views expressed in this article are those of the authors and do not necessarily reflect the positions of the Federal Reserve Bank of Richmond nor the Federal Reserve System.

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1 Can monetary policy address racial inequality?

Racial disparities in labor market outcomes are sizeable and persistent; in particular, the rate of joblessness for Black workers has been well above the unemployment rate for white workers since the Bureau of Labor Statistics started collecting such information. These large and sustained differences in unemployment rates, together with several other disparities affecting the lives of Black citizens, give raise to persistent income differences and vulnerabilities, and have prompted a vigorous debate on what policy instruments may successfully reduce the gaps we observe in the data. One such candidate, come to the fore in recent policy debate, is monetary policy.

In this paper we investigate whether monetary policy is an effective mean of reducing racial disparities in real income volatility and what relevant trade-offs are at play. Our assessment is based on a framework where the monetary authority cannot simultaneously lower both unemployment and inflation. In our quantitative evaluation, we find that Black households gain disproportionately more from accommodative monetary policy so long as inflation expectations remain anchored (and inflation volatility itself is contained). With unanchored expectations, on the other hand, inflation expectations increase following a period of higher-than-expected inflation. Then, the benefit from reducing unemployment becomes smaller and the erosion of real income from higher inflation dominates.[1]

We discipline our quantitative analysis by four empirical regularities: (i) the unemployment rate for Black individuals is about twice as high than the unemployment rate for white individuals, *at all times*; (ii) though the levels differ, the unemployment rates for Black and white individuals move closely *over the business cycle*; (iii) labor income represents a larger portion of overall income for Black than for white households; (iv) Black households experience *higher* price volatility with respect to white households.

The difference in Black and white unemployment rates' levels bring about a higher labor income volatility for Black households than for white ones. However, the close co-movement

[1] We use the terminology "anchored" and "unanchored" following Bernanke [2007]: "Long-run inflation expectations do vary over time. That is, they are not perfectly anchored in real economies; moreover, the extent to which they are anchored can change, depending on economic developments and (most important) the current and past conduct of monetary policy. In this context, I use the term "anchored" to mean relatively insensitive to incoming data. So, for example, if the public experiences a spell of inflation higher than their long-run expectation, but their long-run expectation of inflation changes little as a result, then inflation expectations are well-anchored. If, on the other hand, the public reacts to a short period of higher-than-expected inflation by marking up their long-run expectation considerably, then expectations are poorly anchored."

between the two unemployment rates over the business cycle imply that targeting Black unemployment — a common policy proposal to reduce income volatility disparities (see section 1) — is effectively equivalent to accepting larger inflation fluctuations. Therefore, we focus our quantitative analysis on accommodative monetary policy and allow the monetary policy rule to react to the aggregate unemployment rate (rather than the Black unemployment rate). At the same time, we observe that labor income represents a larger portion of overall income for Black than for white households, because of significantly lower home ownership rates. Furthermore, our own analysis of expenditure data emphasizes that Black households experience *higher* price volatility with respect to white households, by about 20%. These two facts imply that the real income of Black households is more directly affected by inflation volatility than the income of white households.

To sum up, on the one hand Black households are likely to gain disproportionately more from unemployment stabilization because this brings about a reduction in income variability that is relatively larger than for white households. On the other, Black households' real income is also more directly affected by inflation, so that as the latter changes so does the former (and more so than for white households). The overall net effect of a more accommodative monetary policy stance on the relative real income volatility of Black households is, therefore, *ex ante* ambiguous.

In our quantitative evaluation, we find that two policy parameters play an important role in resolving this ambiguity and determining the net real income gain for Black households. The slope of the Phillips curve, or the strength of the inflation-unemployment trade-off, is a first key parameter to evaluate whether monetary policy is an effective policy instrument to combat income inequality. The flatter the Phillips curve, the larger the reduction in unemployment associated with a one percentage point increase in inflation. Because unemployment risk faced by Black households is about twice as large as that faced by white households, the more effective monetary policy is at reducing overall unemployment, the higher are the gains for Black households from accommodative policy (relative to white households).

A second crucial parameter to evaluate the net effect of monetary policy is the degree of credibility enjoyed by the monetary authority. We show that, as long as inflation expectations remain anchored and inflation volatility itself is contained, the net gain to Black households is positive because the costs of inflation are small with respect to the benefits from reduced unemployment. With unanchored expectations, however, the benefit from reducing unemployment become smaller and the erosion of real income from higher inflation

dominates — especially for Black households, whom we showed are more subject to price volatility to begin with. We conclude that using monetary policy as an instrument for income redistribution is not straightforward and requires careful, on-going evaluation of the economic environment.

Contribution to the literature Our paper primarily contributes to an emerging literature assessing how concerns for inequality may inform monetary policy decisions, including Walsh [2017], Acharya, Challe, and Dogra [2020], Bilbiie and Monacelli [2020], Hansen, Lin, and Mano [2020], Feiveson, Gornemann, Hotchkiss, Mertens, and Sim [2020], and Bergman, Matsa, and Weber [2020] among others. In this strand of the literature, our paper is mostly closely related to Bartscher, Kuhn, Schularick, and Wachtel [2021]. While they provide an insightful analysis of how monetary policy affects wealth accumulation for Black and white households, our focus is instead on the unemployment-inflation trade-off — for which we provide novel evidence about heterogeneity in the price volatility faced by Black and white households (in the spirit of Cravino, Lan, and Levchenko [2020] and Argente and Lee [2021]).

This paper also relates to the vast empirical literature on racial disparities in the labor market, especially in relationship to the cyclicality of unemployment and labor market flows for different racial groups (see, for example, Cajner, Radler, Ratner, and Vidangos [2017] and Zavodny and Zha [2000] for excellent overviews, and the many references therein). We complement this evidence by providing novel facts about inflation rates by race and using both sets of facts to evaluate the net income effect of monetary policy.

Finally, for our quantitative exercise, we build upon the literature estimating the slope of the Phillips curve, that is the strength of the unemployment-inflation trade-off (for example, Hazell, Herreno, Nakamura, and Steinsson [2020] and Coibion, Gorodnichenko, and Kamdar [2018]).

A survey of policy proposals for redistributive monetary policy Can monetary policy reduce unemployment disparities between Black and white citizens? How so? Conversely, does monetary policy exacerbate such differences when it does *not* take them explicitly into account? This paper aims to address precisely these questions. To begin with, however, it is helpful to think of them in the context of the specific policy mandate Congress has conferred upon the Fed, and the proposed amendments to this mandate.

The Federal Reserve Act (as amended in 1977), directs the Board of Governors of the Federal

Reserve System and the Federal Open Market Committee to "maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates." The combination of "maximum employment" with "stable prices" is commonly referred to as the Federal Reserve's dual mandate — and the interpretation of the wording "maximum employment" is what has given rise to the debate on monetary policy's role in reducing racial inequality.[2] This is because the "maximum employment" goal has arguably be interpreted, over the years, as a "low unemployment" one. As such, a somewhat simplistic way to understand monetary policy is a trade-off between unemployment and price stability.

However, an increasing number of policy and decision makers argue that aggregate unemployment is *not* the appropriate empirical object to adjudicate such trade-off. As Abigail Wozniak, the director of the Opportunity and Inclusive Growth Institute at the Federal Reserve Bank of Minneapolis, puts it, "It's true that distributional issues have not generally been a forefront issue for the Federal Reserve. [...] In the past several decades, [however] there has been much more disparity in how people are faring both geographically and across demographic groups in the United States.[...] Are we truly meeting the full employment part of our mandate when we see such disparate outcomes?" (FRB of Minneapolis, Spring 2020)

There is little agreement on whether monetary policy is a plausible instrument to reduce racial disparities. In a congressional testimony in 2016 then-Fed chairwoman Janet Yellen pointed out that "it's important to recognize that our [the Fed's] powers, which involve setting interest rates, affecting financial conditions, are not targeted and can't be targeted at the experience of particular groups." The economic distress brought about by the Covid-19 pandemic, however, has renewed interest in the role of the Fed in combating racial inequality. In August 2020, the Federal Reserve's own "Statement on Longer-Run Goals and Monetary Policy Strategy" appears to reflect some of these concerns by maintaining that: *The maximum level of employment is a* broad-based *and* inclusive *goal that is not directly measurable and changes over time owing largely to non-monetary factors that affect the structure and dynamics of the labor market.* [Emphasis added by the authors]. Many decision makers, within and outside of the Federal Reserve System, have opined on the means to achieve such "inclusive" and "broad-based" goal. Raphael Bostic, the President and CEO of the FRB of

[2]It bears noting that, though various proposals have been made, Congress would need to *change* the Federal Reserve Act to justify alternative policies, such as the Fed responding to the Black unemployment rate.

Atlanta, in June 2020 declared: "I believe the Federal Reserve can play an important role in helping to reduce racial inequities and bring about a more inclusive economy. We can do this, first, by fulfilling the mission given to us, which is to promote the health of the U.S. economy and the stability of the U.S. financial system." Jared Bernstein, a member of the Council of Economic Advisers for President Biden, went even further and called for "the Fed [to] take on another task: delivering more racial equity into the labor market. The Fed should consider targeting not the overall unemployment rate, but the Black rate." Ursula Burns, former CEO of Xerox and the first Black woman to head a Fortune 500 company, explicitly addressed the monetary authority in a round table hosted by the Federal Reserve System in October 2020: "I want [the Fed] to use the tools at its hand to actually build and develop a more inclusive society".

Can the Fed's tool be used to "build and develop a more inclusive society"? Should they? What trade-offs are at play? In this paper, we make progress on these questions while maintaining the trade-off between inflation and unemployment volatility. Though the decision to alter the monetary authority's mandate belongs to Congress and Congress alone, our goal is to contribute to the debate by offering (i) a concise but wide-ranging view of the pertinent empirical disparities between Black and white households, (ii) an appraisal of the policy trade-offs between price stability and unemployment in view of such disparities, through a stylized model of monetary policy. In view of these objectives, the next section documents a series of stylized facts for the evolution of unemployment for Black and white individuals, and provides novel evidence that Black and white households face different inflation rates (Black households experience higher price volatility on average).

Structure of the paper The rest of the paper is organized as follows. Section 2 presents our empirical evidence, that we will use to carefully discipline the model in section 3. Section 4 uses to the calibrated model to assess the sign and magnitude of the net gains from accommodative monetary policy for Black and white households. Section 5 concludes.

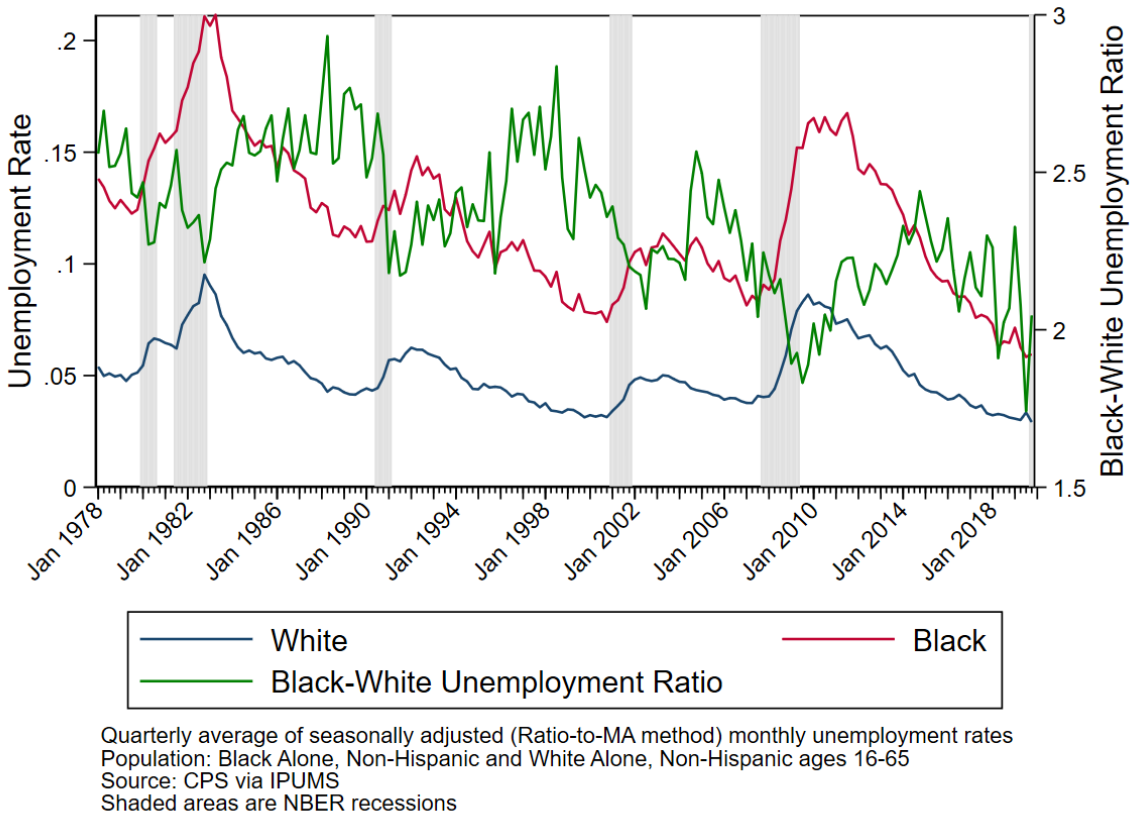

Figure 1: The unemployment rate for Black individuals is persistently and significantly larger than for white individuals, but fluctuations over the business cycle are similar.

2 Disparities in unemployment and inflation rates between Black and white households

2.1 The level of unemployment is always higher for Black than white citizens, but fluctuations over the cycle are similar

To begin our analysis, we provide detailed evidence of the differences in the cyclical behavior for Black unemployment and white unemployment.[3] Figure 1 depicts the unemployment rate for Black and white workers, and the ratio between the two, for the period 1978-2019 from the Current Population Survey. From the figure, it is apparent that Black unemployment is higher in level than white unemployment throughout the period. Furthermore, although

[3]We define as "Black", all CPS respondents who identify as "African-American or Black, alone" and as "white" all CPS respondent who identify as "white alone". Inclusion of respondent who identify as multi-racial does not change our results, but we restrict our definition to single-race individuals to be consistent with the literature (see, for example, Cajner *et al.* 2017).

recessions induce higher percentage points increases in the unemployment rate for Black people, when we consider percent changes we find that Black and white unemployment exhibit a remarkable level of co-movement over the business cycle. The ratio between Black and white unemployment remains large through the business cycle's peaks and troughs, and exhibits a rather modest pro-cyclicality and negative trend. For example, during the Great Recession of 2007-2009 Black unemployment increased from 8.5% to 14.8%, an increase of 6.3 percentage points, while white unemployment increased from 4.1% to 8.7%, a smaller increase of 4.6 percentage points. Though the increase in the unemployment rate for Black people is substantially larger than for whites, the ratio of the two barely changed. Specifically, the ratio of Black to white unemployment rates went from approximately 2 at the beginning of the 2007-09 recession to about 1.8 at its end. We observe a similar pattern for other recessionary periods: though cyclical percentage points changes in the unemployment rate are substantially larger for Black than white workers, percent deviations from the respective means are not.

These facts are well-known in the literature, but we view the distinction as worth emphasizing for two reasons. On the one hand, it underlines the persistence of the Black-white unemployment gap; on the other, it disciplines our quantitative analysis of the relationship between monetary policy and the cyclical fluctuations in Black unemployment. In particular, because the fluctuations over the business cycle suggest strong co-movement between the two series, we will be able to postulate an interest rate rule that takes into account deviations in a single unemployment rate rather than two separate ones (for the purpose of monetary policy and stabilization). From this observation, it also follows that a monetary policy rule that reacts to *Black* unemployment is isomorphic to a monetary policy rule that is more accommodative with respect to deviations of *aggregate* unemployment from its equilibrium value. We will discuss these aspects in more detail in section 3.

2.2 Black households experience higher price volatility than white households

In this section, we move on to the second "argument" of a typical monetary rule: inflation. We document that the prices of the goods consumed by Black households are more volatile than those of the goods consumed by white households.[4] This difference will be a key ingre-

[4]This finding is consistent to Cravino, Lan, and Levchenko [2020]. They find that the prices of the goods consumed by high-income households are stickier and less volatile than those of the goods consumed by middle-income households. Part of our finding, therefore, reflects overall income differences between Black and white households, as well as race-specific consumption differences.

dient to quantify the trade-off that the monetary authority faces when tasked with reducing racial inequality in income volatility. It is true that Black household experience higher unemployment risk (section 2.1), therefore the benefits of a more accommodative stance accrue disproportionately to them. However, as we show next, so do the costs — because Black households are more exposed to inflation volatility. Which effect prevails is a quantitative question we address in section 3.

Table 1 presents the duration of prices, the frequency of price changes, and standard deviation of inflation for Black and white households. To construct it, we combine three sources of data. The first is the US Consumer Expenditure Survey (CES), from which we obtain expenditure shares across detailed product categories for Black and white households. We use the consumption basket of Black and white households in 2015, which is neither in recession or boom. The second data source is the measures of price stickiness constructed by Nakamura and Steinsson [2008], who report the frequency of price adjustment for detailed product category in the US Consumer Price Index (CPI) for 1998-2005. The third source is the item-level consumer price data from the US Bureau of Labor Statistics (BLS) from January 1998 to December 2020. Those are the most finely disaggregated consumer prices publicly available. Combining the first and the second data sources, 472 Universal Classification Code (UCC) categories in the CES are matched to 254 Entry Level Items (ELIs) in Nakamura and Steinsson [2008]. Combining the first and the second data sources, 352 UCC categories in the CES are matched to 138 Item Strata in the BLS data.[5]

The first two rows of Table 1 report the mean duration of prices weighted by consumption shares on each category. Rows labeled "All prices" include sales, while those labeled "regular prices changes" exclude sales. The mean duration is 8.31 months for Black households and 8.88 months for white households, which means that the prices of the goods consumed by Black households are more volatile. Duration of prices in a product category can be converted to frequency of price changes.[6] The mean frequency of all price changes is 31.43 (31.43% of prices change in a month) for Black households and 28.77 (28.77% of prices change in a month) for white households, as shown in the third row of Table 1. Excluding sales, the results are qualitatively similar. The last row of Table 1 shows standard deviation of CPI for Black and white households calculated from January 1998 to December 2020. The standard deviation is 0.67 for Black households and 0.58 for white households. We conclude that Black

[5] We use the most recent concordance from the BLS. See https://www.bls.gov/cpi/additional-resources/ce-cpi-concordance.htm

[6] A constant hazard of λ of price change implies a monthly probability of a price change equal to $f = 1-e^{-\lambda}$. This implies $\lambda = -\ln(1-f)$ and $d = 1/\lambda = -1/\ln(1-f)$.

households' consumption bundles is such that the price volatility faced by Black households is higher than the one faced by white ones.

Table 1: Duration of Prices, Frequency of Price Changes, and CPI Volatility

	Black	white
Duration of all prices (in months)	8.31	8.88
Duration of regular prices (in months)	11.87	12.61
Frequency of all price changes (in %)	31.43	28.77
Frequency of regular price changes (in %)	26.75	24.21
Standard deviation of CPI	0.67	0.58

Notes: This table reports weighted mean duration of prices, weighted mean frequency of price changes, and the standard deviation of the 12-month log change in CPI for Black and white households.

What consumption patterns are responsible for these differences in price volatility? Table 2 reports the 10 consumption items with the largest differences in the expenditure shares between Black and white households. The top categories in which Black households show highest expenditure shares relative to white households are mainly necessity goods such as Electricity, Gasoline, and Cable and Satellite TV. The items with the largest expenditure shares of white households relative to Black households are mostly luxury goods or services, such as New Vehicles, Full Service Meals and Snacks, College Tuition and Fees, and Physicians' Services. The difference in mean frequency of price changes in both cases is pronounced. On average, top 10 categories in which Black households exhibit highest expenditure shares have a frequency of 38.51 (38.51% of prices change in a month), while top 10 categories in which white households exhibit highest expenditure shares have a frequency of 12.20 (12.20% of prices change in month). Therefore, major part of our results comes from the fact that Black households consume more on goods than services, or more on necessity than luxury goods, and prices of goods (especially necessity) are more volatile.

Table 2: Expenditure Share Differences and Frequency of Price Adjustment

Category	Black	white	Difference	Price Change	Regular Price Change
Top 10, larger expenditure shares by Black households					
Rent of Primary Residence	0.188	0.091	-0.097	N/A	N/A
Electricity	0.031	0.021	-0.009	38.14	38.14
Gasoline	0.062	0.053	-0.009	87.74	87.71
Cable and Satellite Television Service	0.029	0.020	-0.009	12.83	12.35
Motor Vehicle Insurance	0.036	0.030	-0.006	8.16	8.16
Wireless Phone Service	0.020	0.015	-0.005	13.00	13.00
Utility (Piped) Gas Service	0.010	0.006	-0.004	72.44	72.44
Intracity Transit	0.006	0.003	-0.004	3.04	3.04
Motor Vehicle Maintenance and Servicing	0.012	0.008	-0.004	11.28	10.72
Used Cars and Trucks	0.039	0.036	-0.003	100.00	100.00
Mean				38.51	38.40
Median				13.00	13.00
Top 10, larger expenditure shares by white households					
Owners' equivalent rent of primary residence	0.127	0.169	0.042	N/A	N/A
New vehicles	0.025	0.042	0.018	47.54	47.51
Unsampled owners' equivalent rent of secondary residence	0.003	0.010	0.007	N/A	N/A
Full Service Meals and Snacks	0.013	0.020	0.007	5.08	4.99
College Tuition and Fees	0.010	0.016	0.006	5.77	5.77
Pets and pet products	0.002	0.007	0.005	10.10	4.70
Physicians' Services	0.013	0.018	0.005	3.37	3.37
Pet services including veterinary	0.002	0.006	0.005	7.26	7.26
Hospital Services	0.015	0.019	0.004	6.26	6.26
Prescription Drugs	0.012	0.016	0.004	N/A	N/A
Mean				12.20	11.41
Median				6.26	5.77

Notes: This table reports the categories with the largest differences in expenditure shares between Black and white households and the frequency of price changes. N/A represents the categories that are not matched with Nakamura and Steinsson [2008].

3 A stylized framework to evaluate policy amendments to the dual mandate

In this section we introduce a framework that will allow us to highlight, and then quantify, the potential trade-offs that are present when the monetary authority is tasked with addressing racial inequality. Our model is predicated on four empirical regularities: (i) the unemployment rate for Black individuals is about twice as high than the unemployment rate for white individuals,at all times; (ii) though the levels differ, the unemployment rates for Black and white individuals move remarkably closely over the business cycle; (iii) labor income represents a larger portion of overall income for Black than for white households; (iv) Black households experience higher price volatility with respect to white households. We argue that, within the framework we provide, (i) and (ii) imply that targeting Black unemployment is equivalent to accepting larger inflation fluctuations at in order to have smoother unemployment rates for all. At the same time, (iii) and (iv) imply that the real income of Black households is more directly affected by inflation volatility. The model also allows us to assess which effect prevails under different assumptions about households' inflation expectations and the credibility of monetary policy.

3.1 Model

The economy is composed by a large number of households, belonging to one of either group B, W. We will use this classification to capture salient statistical differences between the income and consumption of Black and white households. Each household derives utility from the consumption of a bundle of (i) goods and services C, and (ii) shelter H:

$$U^k(C,H) = \left(\frac{C}{\alpha^k}\right)^{\alpha^k} \left(\frac{H}{1-\alpha^k}\right)^{1-\alpha^k}$$

where $k \in \{B, W\}$. The relative share of consumption that is accounted for by goods and services and shelter may differ between B and W households, reflecting empirical differences in the share of expenditures that accrues to goods and services or shelter (housing) for different households. Let P denote the price of goods and services and R denote rents. We can write a cost minimizing price index Q as $Q = P^{\alpha} R^{1-\alpha}$.

Throughout the paper, our focus will be on real pre-tax income ("real income") as a measure of the household well-being. We recognize that it is an imperfect measure. However, it is easy to interpret and characterize, and unlikely to be model-dependent (unlike, say, welfare). We

also take comfort in the notion that, as in any model with less than perfect insurance, in our framework real income is strongly related to welfare and captures an important component of the differential impact of policy on households' overall well-being.

In the stylized economy sketched here, nominal pre-tax income is:

$$W^k(1-u^k) + R\bar{H}^k \tag{1}$$

where W are nominal wages, u is unemployment, and $\bar{H}^k$ are housing assets owned by a household of type k.[7]

To understand how unemployment risk and price volatility affect real income, we divide (1) and take a log-linear approximation. In any period, deviation of log real income from its equilibrium value can be approximated by

$$\begin{aligned}\widehat{Y}_t^k \simeq & \frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k}\left(\widehat{W}_t - \widehat{P}_t\right) \\ & + \left[\frac{R\bar{H}^k}{W^k(1-u^k)+R^k\bar{H}^k} - (1-\alpha)\right]\left(\widehat{R}_t - \widehat{P}_t\right) \\ & - \frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k}\frac{u^k}{1-u^k}\widehat{u}_t^k\end{aligned} \tag{2}$$

where $Y^k \equiv \frac{W_t^k(1-u_t^k)+R_t\bar{H}^k}{P_t^\alpha R_t^{1-\alpha}}$ is real income, and hatted variables denote log-deviations from initial conditions capturing average long-run relationships.

The expression highlights how the component of an inflation-unemployment trade-off affect real income for a household of type k. On the one hand, lower unemployment is favorable to income, the more so the higher the baseline unemployment rate u^k (last term in (2)). On the other hand, higher inflation is detrimental to income to the extent that prices are less sticky than wages, and the more so the larger is the fraction of labor income in total income (first term in (2)). Finally, to the extent that nominal rents are more sensitive to inflation than other prices, inflation is detrimental to real income for households whose net real estate income is negative (second term in (2)).

[7] Following national accounting convention, we take imputed rents from owner-occupied housing to be part of household income, reflecting the fact that home-ownership implies that households do not need to pay rent to someone else.

3.2 An interest rate rule responding to Black unemployment is a more accommodative one

Much of the commentary around racial inequality and monetary policy has centered around the proposal to take a low Black unemployment as the appropriate measure of "maximal employment". We know make progress in evaluating such a proposal. To do so, we start by postulating an interest rate rule and describe the economy's dynamics over time.

Consider a two-period environment, including "short-run" ($t = 0$) and "long-run" ($t = 1$). In the short run, the economy is affected by shocks and adapts to them with all necessary adjustments in nominal and real variables; on the other hand, we call "the long-run" the period in which all shocks have subsided and transitions have taken place.

The evidence shown in 2.1 points to strong co-movement between Black and white unemployment rates so that, by and large, $\widehat{u}^W \simeq \widehat{u}^B$ in (2). This near equality holds, of course, in log deviations from steady-state but not in levels, as Black unemployment is consistently about twice as large as white unemployment. Furthermore, the strong time-series correlation between fluctuations in the two unemployment rates suggests to postulate a New Keynesian Phillips Curve where inflation only depends on $\widehat{u}_t$, as opposed to each unemployment rate separately. Therefore, we write:

$$\pi_{Q,t} = -\varphi \widehat{u}_t + \beta E_t \pi_{Q,t+1} + \eta_t \tag{3}$$

where η_t is a cost-push shock as in Clarida, Gali, and Gertler [1999] and $\pi_{Q,t} = \widehat{P}_{Q,t} - \widehat{P}_{Q,t-1}$ is inflation in the consumption price index Q. Note that when $\widehat{u}_t = 0$ then unemployment is, by definition, equal to its "natural rate", which we here take to be constant and equal to the long-run value. The cost-push shock induces a trade-off between inflation stabilization and stabilization of unemployment at its natural rate.[8]

The slope of the Phillips curve in (3) at $t = 0$ depends on the "anchoring" of the long-run inflation expectations $\pi_{Q,1}$. Here, we follow Bernanke [2007] in conceptualizing "anchoring" in terms of how sensitive long-run inflation expectations are to incoming data. In particular, we assume

$$E_t \pi_{Q,t+1} = b \pi_{Q,t}$$

[8] In New Keynesian DSGE models cost-push shocks often appear as caused by shocks to markups.

so that if $b = 0$ expectations are "perfectly anchored" and if $b = 1$ agents expect inflation to follow a random-walk.

Finally, we close the model with a policy rule tying inflation to the unemployment rate:

$$e^{\pi_{Q,t}} = \psi(u_t - u) \tag{4}$$

where u_t is the average aggregate unemployment rate in the economy and u is its natural value. Following (4), policy-maker is willing to let inflation rise if unemployment is above this reference value according to the parameter ψ. The policy rule can be written in log-linear form as $\pi_{Q,t} \simeq \psi u \widehat{u}_t$. Combining this with (3) yields

$$\pi_{Q,t} = \Psi\eta \qquad \text{and} \qquad \widehat{u}_t = (1 - (1 - \beta b)\Psi)\frac{1}{\varphi}\eta \tag{5}$$

where $\Psi \equiv \frac{\psi u}{\varphi + \psi u(1-\beta b)}$ is the sensitivity of inflation to the cost-push shock under the chosen monetary policy rule.

The expressions in (5) are useful to see the disparate effects of the anchoring parameter b and the inflation-sensitivity parameter Ψ. Suppose that inflation expectations are "perfectly anchored" so that $b = 0$. If $\Psi = 1$, the cost-push shock is allowed to translate entirely into inflation, and unemployment does not fluctuate at all. This can be understood as a policy that perfectly stabilizes unemployment. On the other hand, lower values for Ψ correspond to less accommodative policies, which lead to a partial increase in inflation (less than η) accompanied by an increase in unemployment. Unanchoring, on the other hand hand, corresponds to higher values for b and implies that, for any policy rule, more of the cost-push shock translates into inflation (higher Ψ), but a smaller portion of the inflation increase translates into smoother unemployment.

Given this discussion and the fact that $\widehat{u}^B \simeq \widehat{u}^w \simeq \widehat{u}$, proposals to amend the monetary authority's dual mandate to "target the Black unemployment rate", in place of the aggregate one, can thus be framed as a policy rule in log-linear form given by:

$$\pi_{Q,t} \simeq \Psi u^B \widehat{u}_t$$

Given that $u^B \simeq 2u$, this is approximately equivalent to doubling Ψ. In practice, therefore, a monetary policy rule that reacts to the Black unemployment rate is simply one that leads the Central Bank to tolerate a higher rate of inflation in response to cost-push shocks η. In

this sense, amending the monetary policy rule to react to Black unemployment is isomorphic to postulating a more accommodating policy stance while still targeting the aggregate unemployment rate.

4 Accommodating monetary policies and the resulting trade-offs

We now use the Phillips Curve in (3) and policy rules in (5) to describe how accommodative policy can lead to more or less real income risk for Black and white households, depending on parameters.

Note that since all prices start from their steady-state values, we can write $\widehat{P}_0 = \pi_{P,0}, \widehat{W}_0 = \pi_{W,0}$ and $\widehat{R}_0 = \pi_{R,0}$, where $\pi_{i,0}$ with $i \in P, W, R$ is the inflation for prices of non-shelter goods, wages, and rents. These prices may change differently from overall inflation, given differential frequencies of price, wage, and rent adjustments.

We furthermore assume that in $t = 0$ only fractions λ^P, λ^W and λ^R of, respectively, goods prices, wages, and rents stay fixed. All prices, wages, and rents that are adjusted in $t = 0$ do so by the same amount.[9] These assumptions imply that

$$\frac{\pi_{P,0}}{1-\lambda^P} = \frac{\pi_{W,0}}{1-\lambda^P} = \frac{\pi_{R,0}}{1-\lambda^W} = \frac{\pi_{Q,0}}{1-\lambda^Q}$$

where λ^Q is the overall fraction of prices that remain unadjusted within period 0.[10]

As our baseline policy outcome, we focus on the sensitivity of real income for household k at time 0 (equation (2)) to the cost-push shock induced by the policy, that is $\partial \widehat{Y^k}_0 / \partial \eta$. The larger this sensitivity, the higher is the real income risk associated with the shocks. To the extent that optimal policy seeks to minimize fluctuations in real income, $\partial \widehat{Y^k}_0 / \partial \eta$ is a useful metric for policy evaluation.

Recall that, in the previous section, we concluded that the strong co-movement of Black

[9] Such an assumption is compatible with strategic neutrality, i.e., the assumption that price-setting takes place irrespective of the choices of other agents. Under strategic complementary one might expect price changes of agents who do change their prices to be smaller in sectors where the fraction of adjusters is smaller.

[10] Those relationships no longer hold in $t = 1$, since at that point all relative prices return to their reference levels by definition. Given overall 0 inflation in $t = 1$, this implies that prices that increase more in $t = 0$ have to decline more in $t = 1$ and vice versa.

and white unemployment over the business cycle, combined with the fact that $u^B \approx 2u$ at any date, implies that a monetary policy rule "targeting" Black unemployment is equivalent to a monetary policy rule that tolerates higher sensitivity of inflation to shocks (higher Ψ). Because of this, we now ask how such an accommodative monetary policy translates into real income sensitivity to shocks. To do so, we calculate:

$$\frac{\partial \widehat{Y}_0^k}{\partial \eta \partial \Psi} = \frac{\partial \widehat{Y}_0^k}{\partial \pi_0} + \left| \frac{\partial \widehat{Y}_0^k}{\partial u_0} \right| \frac{1-\beta b}{\varphi/u} \tag{6}$$

with

$$\frac{\partial \widehat{Y}_0^k}{\partial \pi_0} = \frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k} \frac{\lambda_P^k - \lambda_W}{1-\lambda_Q} + \left[\frac{R\bar{H}^k}{W^k(1-u^k)+R^k\bar{H}^k} - (1-\alpha^k) \right] \frac{\lambda_P^k - \lambda_R}{1-\lambda_Q}$$
$$\frac{\partial Y_0^k}{\partial u} = -\frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k} \frac{u^k}{1-u^k} \frac{1}{u}$$

Equation (6) can be understood as the *net* real income effect of a given increase in inflation rate allowed by the monetary authority. If that effect is positive, the income effects of fluctuations in cost-push shocks are dampened by monetary policy. If negative, the opposite is true.

As we calibrate (6), we find that $\frac{\widehat{Y}_0^k}{\partial \pi_0} < 0$, so that, for a given level of unemployment, real income falls with inflation. Also, inasmuch as at least some portion of a household's overall income derives from labor, it is unambiguously true that $\frac{\widehat{Y}_0^k}{\partial \widehat{u}_0} < 0$. The monetary authority then faces the following trade-off: by making inflation more sensitive to cost-push shocks, the larger the shocks the more negative is the impact of inflation on real income, but the less that is corroded by higher unemployment. The net effect is ambiguous and has to be assessed quantitatively.[11]

[11] The expressions above follow from substituting the expressions for π and $\widehat{u}_t$ as functions of η in the approximate expression for real income to get

$$\widehat{Y}_t \simeq \left[\frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k} \frac{\lambda_P - \lambda_W}{1-\lambda_Q} \frac{\psi u}{\varphi + (1-\beta b)\psi u} \right.$$
$$+ \left[\frac{R\bar{H}^k}{W^k(1-u^k)+R^k\bar{H}^k} - (1-\alpha) \right] \frac{\lambda_P - \lambda_R}{1-\lambda_Q} \frac{\psi u}{\varphi + \psi(1-\beta b)u}$$
$$\left. - \frac{W^k(1-u^k)}{W^k(1-u^k)+R\bar{H}^k} \frac{u^k}{1-u^k} \left(1 - \frac{\psi(1-\beta b)u}{\varphi + \psi(1-\beta b)u} \right) \varphi^{-1} \right] \eta$$

Also, we focus on the derivative of real income to unemployment u rather than its log-deviation from steady-state $\widehat{u}_t$.

Finally, equation (6) transparently states the trade-offs involved in any monetary policy in terms of (i) the frequency of price, wage, and rent adjustments (summarized by λ_p, λ_W and λ_R); (ii) the share of shelter in the consumption basked (α^k); (iii) the share of labor and rental income in overall income; and (iv) the Phillips curve slope φ. These four components can be empirically evaluated for both the average Black and white household, so that the trade-off implicit in (6) can be quantified.

4.1 Calibration

We now turn to some quantitative exercises. Consider again equation (6).

Labor and rental income To calibrate the wage share of income we rely on median real estate asset holdings by race, as reported by Bartscher *et al.* (2021) for 2019. In particular, they report that median holdings by Black households are zero, as more than half of Black households do not own any real estate. On the other hand, the median holdings by white households are $104,694. To get at rental income, we multiply real estate holdings by the ratio of the output from the housing services sector to the value of the stock of residential real estate, again fro 2019. The former is reported by the BEA and the latter we obtain from the Integrated Macroeconomic Accounts for the United States made available by the Federal Reserve Board.[12] This yields a rent-to-value ratio of 5.55%. We then compare the resulting rental incomes to median average wages by race, as reported by the BLS.[13]

Frequency of price changes The estimates for the frequency of price changes are based on our own calculations. In particular, we find that average duration of prices for non-shelter goods purchased by white households is 8.88 months, whereas for Black households it is 8.31 months. We set λ_P^k to the fraction of prices that have yet to be adjusted after one year, assuming that price adjustments arrive at a constant hazard rate. Thus, $\lambda_P^{Black} = e^{-12/8.88} = 23.6\%$ and $\lambda_P^{white} = e^{-12/8.31} = 25.9\%$. Grigsby, Hurst, and Yildirmaz [2021] report that wages for continuously employed individuals remain fixed on average for 18 months, so we set $\lambda_W = 51.3\%$. Finally, for λ_R we rely on Genesove [2003], who reports that 29% of rents remain unchanged after a year.

[12] One needs to collect separately residential real estate assets for households, non-corporate non-financial corporations and non-financial corporations. For the latter, only data on total real estate holdings is available, as well as the historical cost of residential and non-residential structures. We assume that the proportion of real estate value at market cost held by non-financial corporations that is residential is equal to the proportion of residential structures at historical cost in total structures. The total amount is relatively small.

[13] Those are, respectively, $735 per week for Black and $945 for white individuals.

The Phillips curve For φ, we use two different estimates. Before discussing them, it is worth remarking that Phillips curve estimates that take unemployment as a measure of slack typically use unemployment rates rather than log unemployment as the explanatory variable, so that estimated coefficients correspond to φ/u rather than just φ. A second, related point is that the estimated coefficients correspond to the effect of unemployment on inflation *within a given quarter*, for given inflation expectations *in the subsequent quarter*. Within the confines of our model, we interpret period 1 as a "long-run" period at which point unemployment is equal to the natural rate. This implies that φ should include the effect of persistent unemployment over the whole transition to this long-run period.[14] Hazell, Herreno, Nakamura, and Steinsson [2020] face this same issue when performing counterfactual exercises. They estimate that one should multiply the Phillips curve coefficient by 6.16 in order to account for the slow transition of unemployment back to its natural level. We follow the same approach.

Our baseline estimate of φ is by Coibion, Gorodnichenko, and Kamdar [2018], who use the Michigan Survey of Consumer Expectations as a measure of inflation expectations, and find $\varphi/u = 0.23$ ($\times 6.16 = 1.42$). An alternative estimate is by Hazell, Herreno, Nakamura, and Steinsson [2020]. They estimate the slope of the Phillips Curve for non-tradeable goods, using cross-state variation in the US to control for long-run inflation expectations. In counterfactual exercises they take an average Phillips curve coefficient (incorporating both shelter and non-shelter prices) of $\varphi/u = 0.0552$ per quarter for annualized inflation (which implies $0.0552 \times 6.16 = 0.34$).

Lastly, we set the steady-state unemployment rate for white households to 5%, close to the US long-run average over the post-war period, and for Black households to twice as much, equal to 10%.

4.2 Results

Table 3 shows values for different components of equation (6), the cross-effect between monetary accommodation and real income sensitivity to shocks. The first column reports is the sensitivity of real income Y to inflation π, while keeping unemployment u constant. Under the parametrization described in section 4.1, a one percentage point increase in inflation reduces the real income of Black households by 0.36%, and of white households by 0.30%. It follows that, in the absence of any inflation-unemployment trade-off, Black households would lose more from more accommodating monetary policy than white households.

[14] In particular, if we subdivide period 0 into N equal periods, $\pi_t = \varphi \widehat{u}_0 + \beta^{1/N} E_0 \widehat{u}_{1/N} + \beta^{2/N} E_0 \widehat{u}_{2/N} + ... + \beta E_0 u_1$.

However, we do postulate an inflation-unemployment trade-off. Therefore, the second column of table 3 expresses the benefits from unemployment reduction on the average real income of Black and white households, while keeping inflation constant. Empirically, at any time, about twice as many Black individuals are unemployed as white ones. Therefore, a one percentage point decrease in the overall unemployment rate leads to 2.2% increase in average real income of Black households, which is about twice the benefit for white households. We conclude that the unemployment reduction that accompanies an accommodative monetary policy is likely to have significant positive effects on Black households' income.

The last three columns in table 3 present the overall trade-off, taking into account both the costs of increased inflation and the benefits from reduces unemployment, for different values of the credibility parameter (b) and the Phillips Curve slope (φ).

Column three and four fix the Phillips Curve coefficient at the value estimated by Coibion, Gorodnichenko, and Kamdar [2018] ($\varphi = 1.42$). Column three then shows the net effect of inflation accommodation on income sensitivity, when inflation expectations are fairly "unanchored" ($\beta b = 0.9$). In this case, both Black and white households find that their income becomes even more negatively affected by cost-push shocks, so that accommodating inflation is a net negative. With fully credible policy, instead, that is with $\beta b = 0$ as in column four, the sign flips and now both types of households receive a net gain from more accommodative monetary policy. Furthermore, Black households gain disproportionately more, reflecting the greater benefits from unemployment stabilization precisely for those individuals who face higher unemployment risk.

Finally, Column 5 in table 3 shows the numbers that we obtain under a different estimate for φ, taken from Hazell, Herreno, Nakamura, and Steinsson [2020] ($\varphi = 0.34$). The flatter Phillips curve found by those authors suggests a more favorable trade-off between unemployment and inflation fluctuations, which in turns lead to larger gains from accommodative monetary policy in terms of mitigating the negative impact of cost-push shocks on real income.

5 Conclusions

This paper contributes to the active debate on whether monetary policy is a valid instrument to reduce racial income disparities. We study this question through a framework where the

Table 3: Real income sensitivity to shocks and Monetary Accommodation: the more credible is the monetary authority and the flatter is the Phillips curve, the larger the net income gains from tolerating higher inflation. These gains accrue disproportionately to Black households.

	$\partial Y_0^k/\partial \pi_0$	$\lvert\partial Y_0^k/\partial u_0\rvert$	$\partial Y_0^k/(\partial\Psi\partial\eta)$		
			$\beta b = .9$	$\beta b = 0$	φ^{NS}
Black	-0.36	2.22	-0.21	1.21	6.17
white	-0.30	0.94	-0.24	0.36	2.45

See text for baseline parametrization and definitions. All columns but last use Coibion, Gorodnichenko, and Kamdar [2018] estimated slope for the Phillips Curve. The last column is based off the estimate by Hazell, Herreno, Nakamura, and Steinsson [2020].

monetary authority faces a trade-off between unemployment and inflation, and characterize this trade-off with an eye to heterogeneity by race. Our assessment is therefore informed by four empirical regularities: (i) the unemployment rate for Black individuals is about twice as high than the unemployment rate for white individuals, *at all times*; (ii) though the levels differ, the unemployment rates for Black and white individuals move remarkably closely *over the business cycle*; (iii) labor income represents a larger portion of overall income for Black than for white households; (iv) Black households experience *higher* price volatility with respect to white households. Taken together, these four facts lead us to conclude that any policy proposal that suggests the Fed targets Black unemployment is effectively equivalent to simply accepting larger inflation fluctuations in order to have smoother unemployment rates for all. The facts we highlight, especially the 20% higher price volatility faced by Black households that we document using CES microdata, also imply that the real income of Black household is more affected by rising inflation than that of white households. When we quantitatively evaluate this trade-off, we find that the degree of credibility enjoyed by the monetary policy is key. Black households gain disproportionately more from accommodative monetary policy as long as inflation expectations remain anchored. With unanchored expectations, on the other hand, the benefit from reducing unemployment become smaller and the erosion of real income from higher inflation dominates.

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A Empirical Analysis — Additional labor market statistics by race

Table 4: Average Monthly Employment Measure 1978-1994, age 16-65

	All		Male		Female	
	white	Black	white	Black	white	Black
Labor Force Participation Rate	75.59	69.66	86.22	76.74	64.96	62.60
Employment-Population Ratio	71.20	59.64	81.21	65.59	61.19	53.69
Unemployment Rate	5.83	14.40	5.82	14.53	5.85	14.29
Employed to Unemployed Flow Rate	1.45	2.75	1.63	3.29	1.26	2.23
Unemployed to Employed Flow Rate	28.66	17.82	29.90	20.57	27.45	15.06
Employed to Non-Employed Flow Rate	4.23	6.20	3.35	6.17	5.13	6.27
Non-Employed to Employed Flow Rate	11.23	9.06	14.37	11.17	8.10	6.94

[1] $FlowRate = \frac{TotalState1toState2Flows}{TotalState1}$
[2] Active Non-Employed includes the unemployed and those not in the labor force for reasons other than retirement, disability, or illness.

Table 5: Average Monthly Employment Measure 1978-1994 (pre-CPS reform), age 25-54

	All		Male		Female	
	white	Black	white	Black	white	Black
Labor Force Participation Rate	82.60	79.64	94.84	87.72	70.38	71.58
Employment-Population Ratio	78.78	71.04	90.53	78.23	67.04	63.85
Unemployment Rate	4.67	10.80	4.55	10.82	4.78	10.82
Employed to Unemployed Flow Rate	1.17	2.22	1.32	2.71	1.02	1.74
Unemployed to Employed Flow Rate	27.55	18.78	29.51	22.49	25.62	15.09
Employed to Non-Employed Flow Rate	2.97	4.32	1.94	4.18	3.99	4.46
Non-Employed to Employed Flow Rate	13.29	10.84	18.50	14.21	8.11	7.49

[1] $FlowRate = \frac{TotalState1toState2Flows}{TotalState1}$
[2] Active Non-Employed includes the unemployed and those not in the labor force for reasons other than retirement, disability, or illness.

Table 6: Average Monthly Employment Measure 1994-2019 (post-CPS reform), age 16-65

	All		Male		Female	
	white	Black	white	Black	white	Black
Labor Force Participation Rate	76.58	69.99	82.34	71.86	70.85	68.14
Employment-Population Ratio	73.00	62.63	78.31	63.72	67.72	61.53
Unemployment Rate	4.67	10.55	4.92	11.38	4.41	9.72
Employed to Unemployed Flow Rate	1.07	2.00	1.19	2.27	0.95	1.72
Unemployed to Employed Flow Rate	27.28	19.08	27.65	19.73	26.90	18.43
Employed to Non-Employed Flow Rate	3.46	5.47	3.06	5.57	3.86	5.37
Non-Employed to Employed Flow Rate	9.48	8.74	11.01	9.25	7.94	8.23
Employed to Active Non-Employed Flow Rate	2.06	3.47	1.72	3.51	2.39	3.42
Active Non-Employed to Employed Flow Rate	18.75	16.52	25.84	18.79	11.66	14.25

[1] $FlowRate = \frac{TotalState1toState2Flows}{TotalState1}$

[2] Active Non-Employed includes the unemployed and those not in the labor force for reasons other than retirement, disability, or illness.

Table 7: Average Monthly Employment Measure 1994-2019 (post-CPS reform), age 25-54

	All		Male		Female	
	white	Black	white	Black	white	Black
Labor Force Participation Rate	84.42	80.03	91.28	82.78	77.57	77.28
Employment-Population Ratio	81.14	73.18	87.63	75.33	74.66	71.03
Unemployment Rate	3.89	8.57	4.01	9.03	3.76	8.11
Employed to Unemployed Flow Rate	0.92	1.73	1.02	1.97	0.82	1.48
Unemployed to Employed Flow Rate	26.90	20.16	27.77	21.66	26.02	18.66
Employed to Non-Employed Flow Rate	2.42	4.09	1.96	4.14	2.88	4.04
Non-Employed to Employed Flow Rate	11.04	10.77	13.78	11.95	8.30	9.59
Employed to Active Non-Employed Flow Rate	1.91	3.11	1.49	3.11	2.34	3.11
Active Non-Employed to Employed Flow Rate	17.86	17.32	25.46	20.64	10.27	14.00

[1] $FlowRate = \frac{TotalState1toState2Flows}{TotalState1}$

[2] Active Non-Employed includes the unemployed and those not in the labor force for reasons other than retirement, disability, or illness.