Racial Unemployment Gaps and the Disparate Impact of the Inflation Tax*

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*The views expressed are those of the authors and do not reflect the official position of the Federal Reserve System or the Board of Governors.

Agenda

Motivation

Some stylized facts from US unemployment data:

Table: Labor market statistics (quarterly US data, 1972-2019)

	Population U rate	White U rate	Black U rate
Average	6.23%	5.48%	11.80%
Standard deviation, HP-cycle	0.77%	0.73%	1.20%
Standard deviation, log HP-cycle	11.32%	11.97%	9.63%

- higher black unemployment rate;
- more volatile black unemployment rate in levels;
- less volatile black unemployment rate in logs.

Motivation: a simple explanation I

We can explain the stylized facts with a simple job-flows model:

- two groups, A and B, in a single labor market with tightness θ;
- group-specific job-finding rate $(1-\rho^j)f(\theta)$;
- exogenous, group-specific job destruction rate δ^j.

The s.s. group-specific unemployment rate is

$$u^j = \frac{\delta^j}{\delta^j + (1-\rho^j)f(\theta)};$$

- a lower exogenous separation rate $\delta_A < \delta_B$ and a higher exogenous job-finding efficiency $\rho_A < \rho_B$ can explain $u_A < u_B$.

Motivation: a simple explanation II

The (semi-)elasticity of u^j w.r.t. market tightness is

$$\varepsilon_{u_j,\theta} \equiv \frac{\partial u_j}{\partial \theta}\frac{\theta}{u_j} = -(1-u_j)\varepsilon_{f,\theta},$$
$$\tilde{\varepsilon}_{u_j,\theta} \equiv \frac{\partial u_j}{\partial \theta}\theta = -u_j(1-u_j)\varepsilon_{f,\theta}.$$

- with $u_A < u_B$, we have $|\varepsilon_{u_A,\theta}| > |\varepsilon_{u_B,\theta}|$—the group with low unemployment has a higher elasticity;
- this explains the higher volatility of log unemployment for whites;
- with $u_A < u_B \leq 0.5$, we have $|\tilde{\varepsilon}_{u_A,\theta}| < |\tilde{\varepsilon}_{u_B,\theta}|$—the group with low unemployment has a lower semi-elasticity;
- this explains the higher volatility of unemployment for blacks.

Motivation: the long-run relevance of nominal rates I

Unemployment is positively correlated with the nominal rate in the long-run:

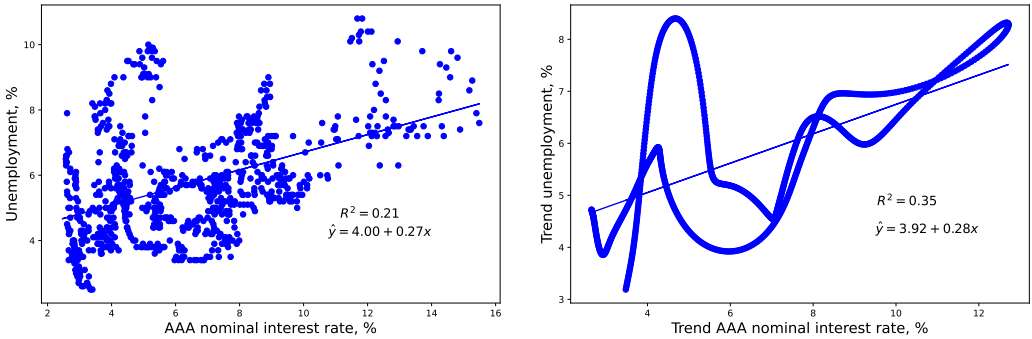

Figure: Pop U on AAA rate, raw (left) and HP filter (right).

Motivation: the long-run relevance of nominal rates II

This holds true for the unemployment gap between black and whites, too:

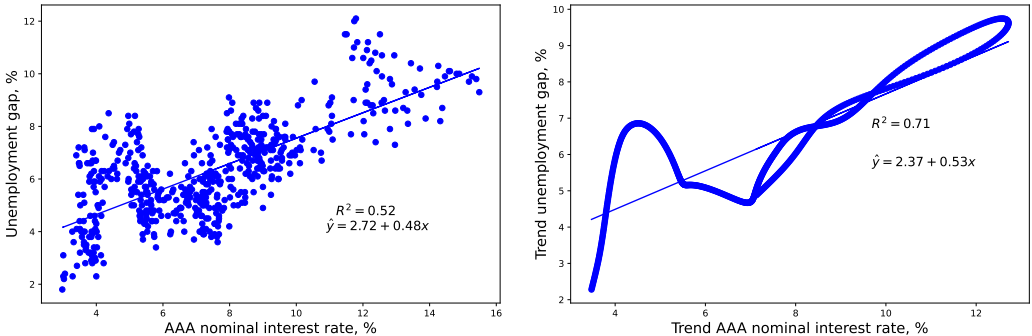

Figure: U-gap on AAA rate, raw (left) and HP filter (right).

Contribution

We expand on the insight from the basic job-flows model by constructing a labor-search model with monetary frictions:

- Diamond-Mortensen-Pissarides (DMP) with a twist;
- firm output depends on productivity and the nominal interest rate.

The model combines:

- Fisher logic, inflation and nominal rates co-move;
- monetarist inflation-tax logic, higher user cost of money reduce firm profits;
- DMP logic, lower firm profits reduce labor-market tightness;
- labor-flow logic, different worker groups respond differently to tightness.

We calibrate the model to US data.

Results

The calibrated model matches the (untargeted) stylized facts quite well.

The calibrated model documents a state-dependent unemployment gap:

- a one s.d. negative productivity shock implies that the unemployment gap increases by 0.62pp more when unemployment is above average;
- an increase in trend inflation from 2.5% to 5% increases the unemployment gap by 0.71pp and increases unemployment volatility for black workers by 0.57pp compared to 0.33pp for white workers.

The calibrated model documents differential welfare effects of trend inflation:

- moving from the FR to 10% inflation reduces welfare for black workers by 7.13% compared to 6.25% for white workers.

Related literature

Economics of discrimination: Lang and Lehmann (2012).

Unemployment gaps and business cycles: Freeman (1973); Couch and Fairlie (2010); Cajner, Radler, Ratner, Vidangos (2017); Kuhn and Chanci (2021).

Unemployment gaps and monetary policy: Zavodny and Zha (2000); Carpenter and Rodgers (2004); Lee, Macaluso, and Schwartzman (2021); Bartscher et al (2021).

Labor search: Shimer (2005); Hagedorn and Manovskii (2008); Hall and Milgrom (2008); Ljungqvist and Sargent (2017); Petrovsky-Nadeau et al. (2018); Petrovsky-Nadeau and Zhang (2020); Bernstein et al. (2021).

Labor search and liquidity: Berentsen et al. (2011); Gomis-Porqueras et al. (2013); Rocheteau and Rodriguez-Lopez (2014); Bethune et al. (2015); Gomis-Porqueras et al. (2020); Ait Lahcen et al. (2022).

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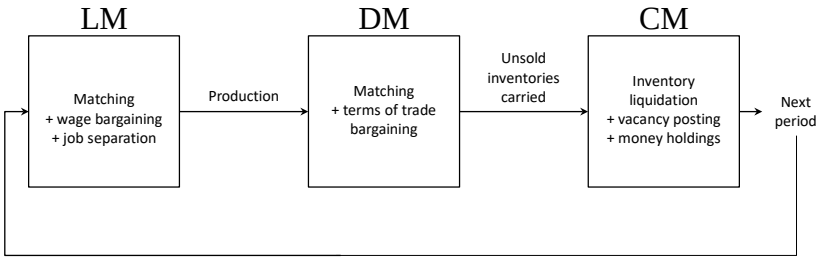
Timing

Discrete-time model with three rounds of trade in each period:



Environment

Two perishable goods: CM good x (numeraire) and DM good q.

Unit mass of households, either employed ($i = 1$) or unemployed ($i = 0$):

- fraction λ^A (λ^B) from group A (resp. group B), $\lambda^A + \lambda^B = 1$;
- preferences described by $\sum_{t=0}^{\infty} \beta^t [\mathrm{u}(q_t) + x_t + (1 - i_t)b]$;
- b combines unemployment benefits, leisure, and home production.

Large number of potential firms:

- preferences described by $\sum_{t=0}^{\infty} \beta^t x_t$;
- produce y_t CM goods when matched to a worker;
- can produce q DM goods from $\mathrm{c}(q)$ CM goods.

Central bank controls the nominal interest rate ι, the cost of holding money.

Key equations I

DM quantity determined by $\mathrm{u}'(q) = (1 + \iota/\alpha(n))[(1-\varphi)\mathrm{u}'(q) + \varphi \mathrm{c}'(q)]$

- $n = \lambda^A(1-u^A) + \lambda^B(1-u^B)$ is aggregate employment;
- $\alpha(n)$ the matching probability for a buyer-household in the DM;
- φ is the buyer-household's DM bargaining power.

Matched firm's expected output is $\mathcal{O} = y + \frac{\alpha(n)}{n}(1-\varphi)[\mathrm{u}(q) - \mathrm{c}(q)]$

- $\mathcal{O}$ depends on y, n, and ι.

Surplus of a worker-firm match is $\mathcal{S}^j = \mathcal{O} - b + \beta\mathbb{E}[1 - \delta^j - \xi(1-\rho^j)f(\theta_{+1})]\mathcal{S}^j_{+1}$

- $(1-\rho^j)f(\theta)$ is the LM job-finding probability;
- δ^j is the separation probability;
- wages are set to give the worker-household a share ξ of match surplus.

Key equations II

A free-entry condition governs market tightness:

$$\kappa = \beta q(\theta)(1-\xi)\frac{\lambda^A u_{-1}^A(1-\rho^A)\mathcal{S}^A + \lambda^B u_{-1}^B(1-\rho^B)\mathcal{S}^B}{\lambda^A u_{-1}^A + \lambda^B u_{-1}^B};$$

- κ is the cost of posting a vacancy;
- $q(\theta) \equiv f(\theta)/\theta$;
- $q(\theta)\frac{\lambda^j u_{-1}^j(1-\rho^j)}{\lambda^A u_{-1}^A + \lambda^B u_{-1}^B}$ is the probability of matching with a worker from group j.

The group-specific unemployment rates develop according to the lob-flows logic:

$$u^j = (1-u_{-1}^j)\delta^j - (1-\rho^j)f(\theta)u_{-1}^j.$$

Calibration strategy I

We choose standard functional forms:

- LM matching as in Den Haan et al. (2000), $f(\theta) = \theta/(1+\theta^{\chi})^{1/\chi}$;
- DM matching as in Berentsen et al. (2011), $\alpha(n) = \zeta n/(1+n)$;
- DM utility and costs $\mathrm{u}(x) = Ax^{1-\gamma}/(1-\gamma)$ and $\mathrm{c}(x) = x$.

We choose a standard process for productivity

$$\log y = (1-\rho_y)\log \overline{y} + \rho_y \log y_{-1} + \varepsilon_y.$$

We decompose the nominal rate into a trend and cycle:

$$\iota = \bar{\iota} + \hat{\iota}, \quad \hat{\iota} = \rho_{\hat{\iota}}\hat{\iota}_{-1} + \varepsilon_{\hat{\iota}};$$

- $\bar{\iota}$ follows a (very persistent) Markov chain with 5 states.

Calibration strategy II

Directly calibrated parameters:

Table: Directly calibrated parameters

Parameter	Description	Value
β	Discount factor	0.997
λ^B	Measure of Blacks in the labor force	0.117
ρ^A	Normalization	0
ρ^B	Degree of hiring discrimination	0.301
δ^A	Whites job separation rate	0.023
δ^B	Blacks job separation rate	0.045
$\bar{y}$	Average labor productivity	1.000
$\rho_{\hat{\imath}}$	Autocorrelation of interest-rate shocks	0.939
$\varepsilon_{\hat{\imath}}$	SD of interest-rate shocks	0.0002

Calibration strategy III

We construct moments from labor market data, monetary data, and data on markups to calibrate the remaining parameters using SMM:

Table: SMM calibrated parameters

Parameter	Description	Value	Moment	Frequency	Data	Model
κ	Vacancy cost	1.462	Average θ	Monthly	0.567	0.577
b	Flow value of unemployment	0.952	Unemployment volatility	Quarterly	0.113	0.113
χ	Parameter of the LM matching fun.	1.427	Average JFP	Monthly	0.399	0.399
ξ	Worker bargaining weight	0.041	Elast. of avg. wage to labor prod.	Quarterly	0.526	0.526
ρ_y	Persistence parameter of y_t process	0.967	Autocorr. of labor prod.	Quarterly	0.778	0.756
σ_y	Volatility parameter of y_t process	0.011	SD of labor prod.	Quarterly	0.006	0.006
A	Level parameter of DM utility	1.495	Average money demand	Quarterly	0.249	0.249
a	Curvature parameter of DM utility	0.228	Elast. of money demand to ι	Quarterly	-0.806	-0.806
ζ	Parameter of the DM matching fun.	0.130	Elast. of u to ι	Monthly	0.241	0.241
φ	Buyer bargaining weight	0.414	Average price markup	Monthly	0.381	0.381

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Model versus data I

The calibrated model explains the (untargeted) labor-market data quite well:

Table: Labor market statistics: Model v. Data

	Population U rate	White U rate	Black U rate
US data			
Average	6.23%	5.48%	11.80%
Standard deviation	1.61%	1.47%	3.09%
Standard deviation, HP-cycle	0.77%	0.73%	1.20%
Standard deviation, log HP-cycle	**11.32%**	11.97%	9.63%
Model simulations			
Average	6.47%	5.51%	13.64%
Standard deviation	1.77%	1.58%	3.20%
Standard deviation, HP-cycle	1.00%	0.90%	1.74%
Standard deviation, log HP-cycle	**11.32%**	11.74%	10.01%

Model versus data II

The model also matches the relationship between the unemployment gap and labor-market tightness:

Table: Regression of racial unemployment gap on θ: Model v. Data

	LM tightness θ, log-HP cycle	
	Data	Simulations
	(1)	(2)
Constant	0.000	0.000***
	(0.000)	(0.000)
Racial U gap, HP cycle	-0.016***	-0.018***
	(0.001)	(0.000)
Observations	192	192'000
R^2	0.413	0.396

*p<0.1; **p<0.05; ***p<0.01

State-dependent behavior of the unemployment gap I

Theory implies that the semi-elasticity of the unemployment gap w.r.t. tightness depends positively on unemployment under mild conditions.

The calibrated model confirms this insight:

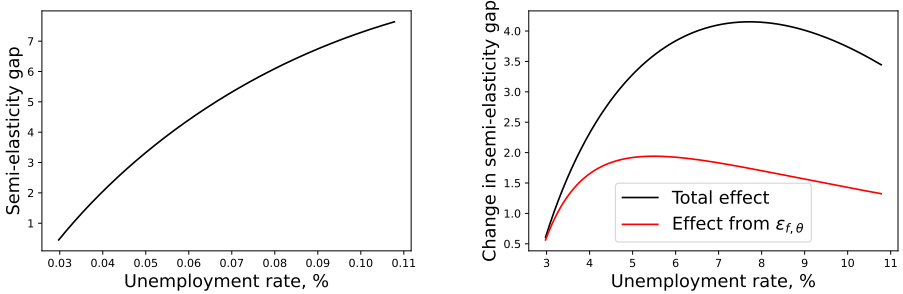

Figure: The local responsiveness of the unemployment gap to changes in market tightness.

State-dependent behavior of the unemployment gap II

We investigate the behavior of the unemployment gap by looking at GIRFs:

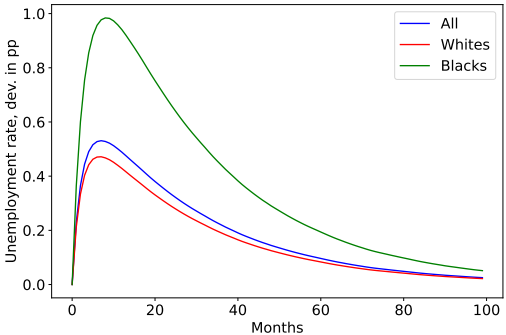

Figure: Reaction of unemployment to a negative productivity shock.

State-dependent behavior of the unemployment gap III

We investigate the behavior of the unemployment gap by looking at GIRFs:

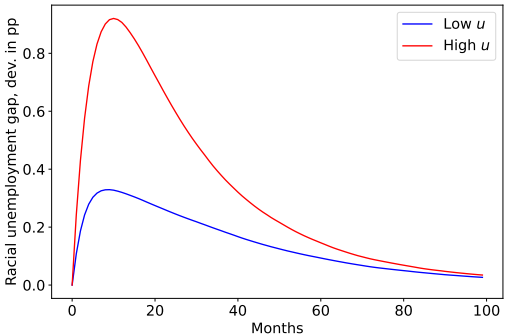

Figure: Reaction of the racial unemployment gap to a negative productivity shock under high and low aggregate unemployment.

State-dependent behavior of the unemployment gap IV

We investigate the behavior of the unemployment gap by looking at GIRFs:

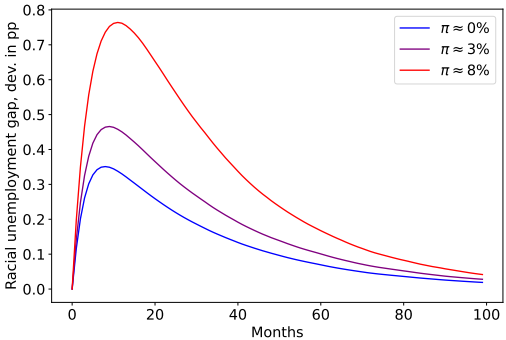

Figure: Reaction of the racial unemployment gap to a negative productivity shock for various trend inflation levels.

Unemployment-level effects of trend inflation

Table: Unemployment cost of trend inflation for Blacks and whites

Inflation rate	Interest rate	Average unemployment		Difference with FR	
		Whites	Blacks	Whites	Blacks
-3.26%	0.00% (FR)	4.48%	11.38%	-	-
0.00%	3.37%	4.67%	11.81%	0.19pp	0.43pp
2.50%	5.95%	5.04%	12.64%	0.55pp	1.26pp
5.00%	8.54%	5.64%	13.95%	1.15pp	2.56pp
10.00%	13.70%	8.22%	18.84%	3.73pp	7.46pp

Unemployment-volatility effects of trend inflation

Table: Unemployment volatility as a function of trend inflation for Blacks and whites

Inflation rate	**Interest rate**	**Average unemployment volatility**	
		Whites	**Blacks**
-3.26%	0.00% (FR)	0.36%	0.79%
0.00%	3.37%	0.42%	0.92%
2.50%	5.95%	0.58%	1.21%
5.00%	8.54%	0.91%	1.78%
10.00%	13.70%	2.72%	4.33%

Welfare cost of trend inflation

Table: Welfare cost of inflation for Blacks and whites for different levels of $\bar{\iota}$

Trend inflation	**Trend interest rate** $\bar{\iota}$	**Average welfare cost,** $(1-\Delta(\bar{\iota}))\%$	
		Whites	**Blacks**
-3.26%	0.00%	-	-
0.00%	3.37%	0.66%	0.68%
2.50%	5.95%	1.74%	1.81%
5.00%	8.53%	3.05%	3.26%
10.00%	13.70%	6.25%	7.13%

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Conclusion

We expand on a basic insight from a job-flows model—a group with higher s.s.unemployment will have a higher (lower) variability in (log) unemployment:

- use this to understand the dynamics of the racial unemployment gap;
- a DMP model with monetary frictions and a disadvantaged group of workers matches a range of non-targeted moments quite well.

Black unemployment increases more strongly following a negative shock and the racial unemployment gap is strongly counter-cyclical.

A high inflation regime has a more negative impact on black workers.