Modeling and Forecasting U.S. Labor Force Participation and Unemployment Rates by Race

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Abstract

Abstract: We jointly estimate and analyze the dynamics of the U.S. labor market through cointegrated vector autoregressive models of race-disaggregated unemployment rates (URs) and labor force participation rates (LFPRs). Using monthly data for 1980-2019, three principal models are formulated that compare the White population with (respectively) Asian, Black, and Hispanic populations. This presentation focuses on relationships between White and Black LFPRs and URs, with three key long-run results. Unemployment has a strong and equal discouraged-worker effect for Black and White LFPRs; Black and White LFPRs move one-for-one; and Black and White unemployment rates move proportionately. Adjustments to disequilibrium are strongly heterogeneous by race. Ex ante forecasts for 2020 onward highlight the differential effects of the COVID-19 pandemic on LFPRs and URs by race.

Relevance

The Washington Post
Democracy Dies in Darkness

[April 7, 2023]

ECONOMY

Black unemployment rate hits record low 5 percent

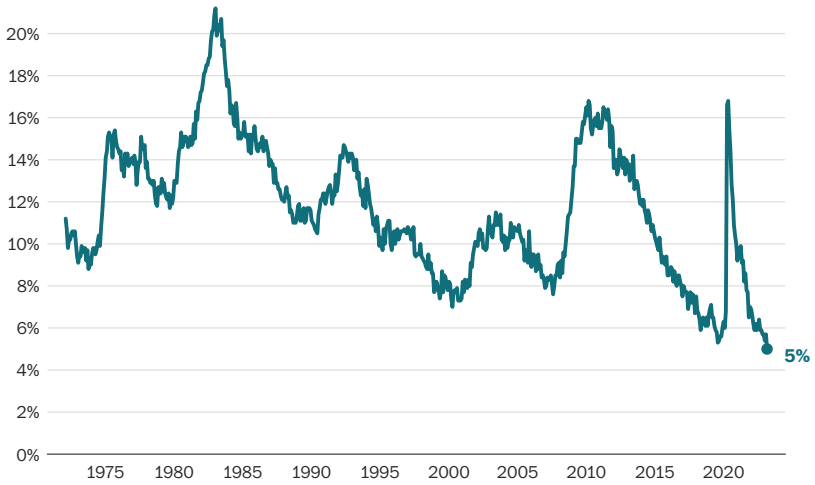
During the coronavirus pandemic, the Black unemployment rate soared to as high as 16.8 percent

By Lauren Kaori Gurley, Abha Bhattarai and Naomi Nix
Updated April 7, 2023 at 3:27 p.m. EDT | Published April 7, 2023 at 11:32 a.m. EDT

The Black unemployment rate sank to a record low 5 percent in March, a testament to the economic recovery following the coronavirus pandemic.

Just three years ago, the Black unemployment rate had spiked to reached a pandemic high of 16.8 percent, compared to the record White unemployment rate of 14.1 percent.

Black unemployment rate since 1972



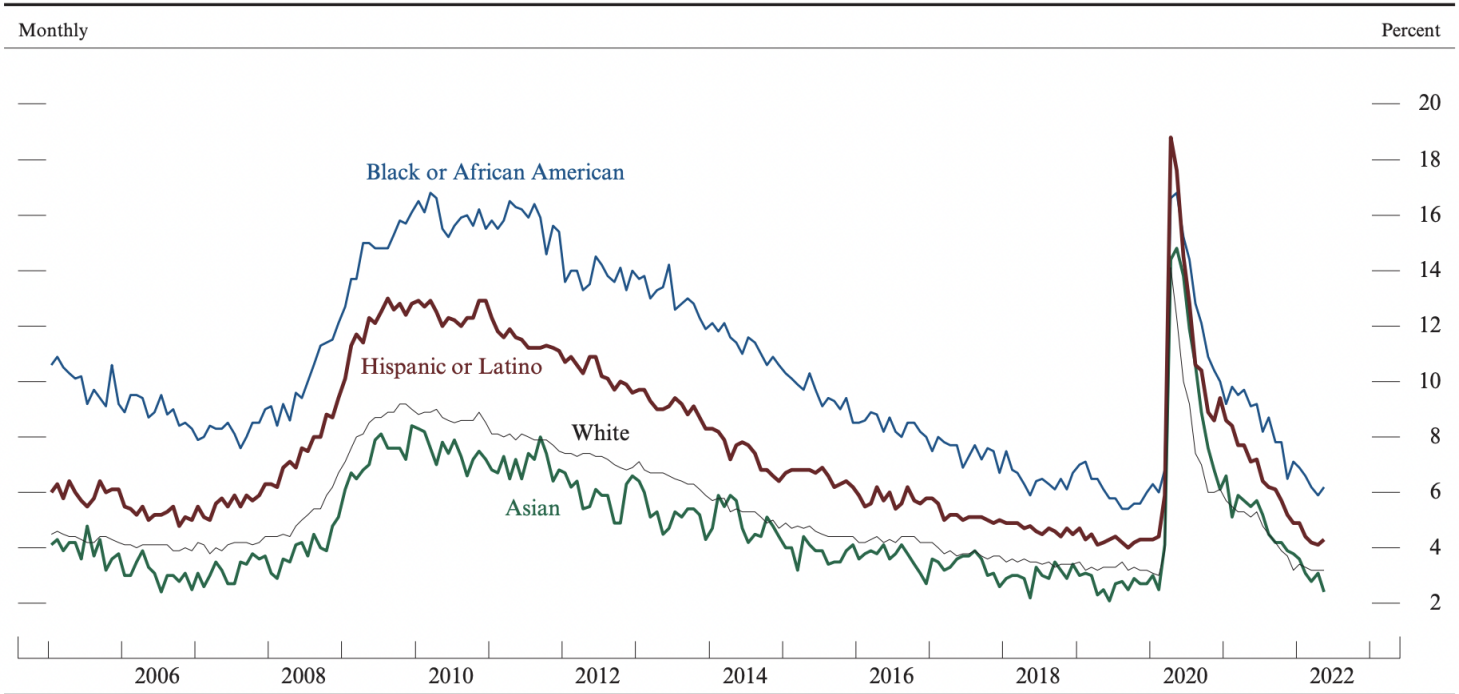
Source: Bureau of Labor Statistics

LAUREN KAORI GURLEY / THE WASHINGTON POST

Relevance

Monetary Policy Report, June 2022
Board of Governors of the Federal Reserve System

10. Unemployment rate, by race and ethnicity



NOTE: Unemployment rate measures total unemployed as a percentage of the labor force. Persons whose ethnicity is identified as Hispanic or Latino may be of any race. Small sample sizes preclude reliable estimates for Native Americans and other groups for which monthly data are not reported by the Bureau of Labor Statistics.
SOURCE: Bureau of Labor Statistics via Haver Analytics.

Motivation

- U.S. Labor Force Participation Rate (LFPR)
- Unemployment Rate (UR)
  - Key macroeconomic variables for assessing the U.S. economy's productive capacity and joblessness
- Some potential reasons for persistent decline in LFPR
  - COVID-19 fear, child/elderly care, early retirement
- Sharp fluctuations in URs and LFPRs
  - Sectors/groups affected differentially
    - Restaurants, airlines, hotels, education, health-care, ...
    - gender, age, race, education, location, ...
- Many potential implications
  - labor shortages, economic recovery, hidden unemployment
- This paper focuses on the differentials in UR and LFPR by race

Literature Review and Research Statement

Paper	Disaggregation	Notes
Emerson (2011)	Gender	Larger Sample; No Trend
Bernstein, Martinez (2021)	Gender	Same Sample; Trend
Victoria Tribone (2021)	Gender, Age	+Ericsson, Martinez
Fabian Leal, Kaythari Maw (2022)	Race/Ethnicity	+ Ericsson
Junie Joseph (2022)	Gender, Ethnicity	In Progress

Aspects of the cointegration analysis (long-run relationships)

- Level of disaggregation
- Variables in system
- Sample period

Our paper analyzes the long-run relationships between LFPR and UR by race, which expands upon the work in Leal and Maw (2022).

A Glimpse Ahead

- Disaggregating by race for cointegration analysis provides several long-run relationships between LFPR and UR
- Forecasting LFPRs and URs provide insight on counterfactuals
  - What if no pandemic/no pandemic effect
  - Differences in post-pandemic LFPR recovery by race

Our Approach: Potential Relationships

- Relationship between LFPR and UR
  - Discouraged worker effect; "added" worker effect
  - Recessions vs expansions?
- Relationship within LFPRs and URs for given disaggregation
  - Systematic gap between LFPRs by race, and between URs by race
  - Interpretation/methodological issues in subsystem analysis
  - Level of disaggregation (race)
  - Sample period (data availability? measurement errors?)
- Cointegration (CI) analysis
  - Assess presence of relationships, adjustments to disequilibrium
  - Bivariate VAR approach first, then 4-variable VAR
- The pandemic effect
  - Temporary? Prolonged? Permanent?
  - Heterogeneous? Differentially affecting subgroups?

  $\rightarrow$ Scenario analysis (by ex ante multi-step forecasts)

Data

Table 1.

Variable	Definition	Description
E	–	Number of employed
U	–	Number of unemployed
LF	E+U	Number in the labor force
N	–	Number not in the labor force
P	E+U+N	Working-age population
UR	U/LF	Unemployment rate
ur	log(UR)	Log of unemployment rate
LFPR	LF/P	Labor force participation rate (=1-(N/P))

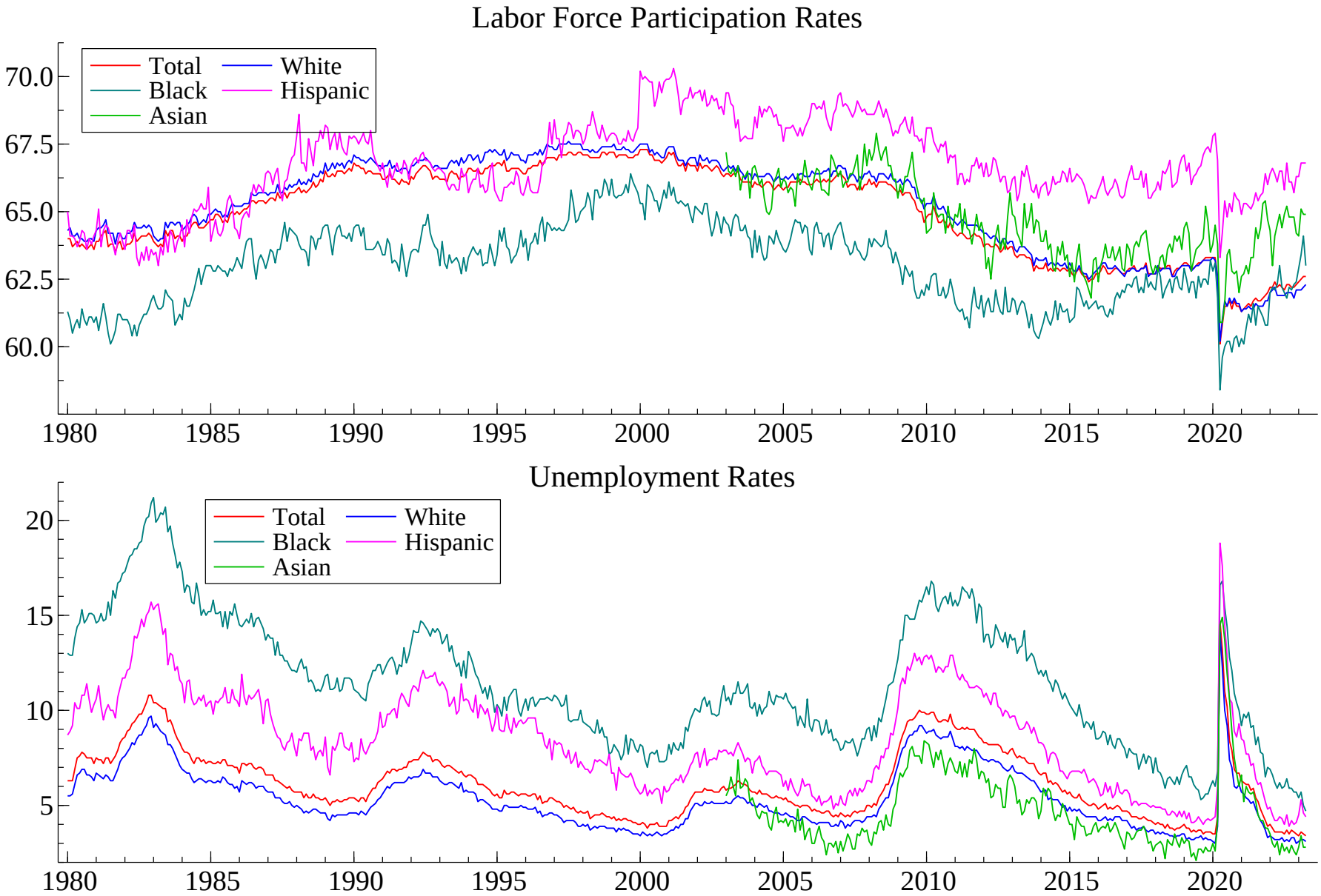
Civilian, not incarcerated, of working age ($\geq$ 16 years old)
Rates are expressed as percentages
Current Population Survey, monthly, seasonally adjusted; BLS

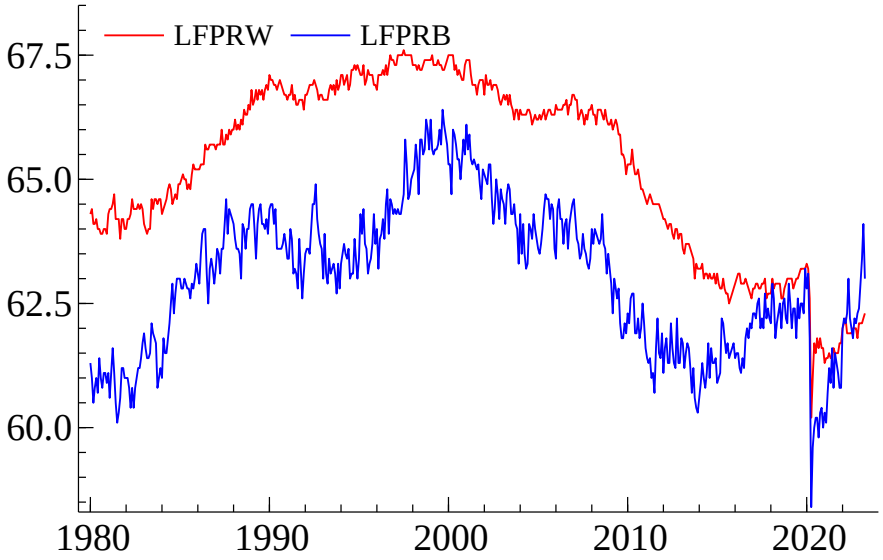
Disaggregations of the Data

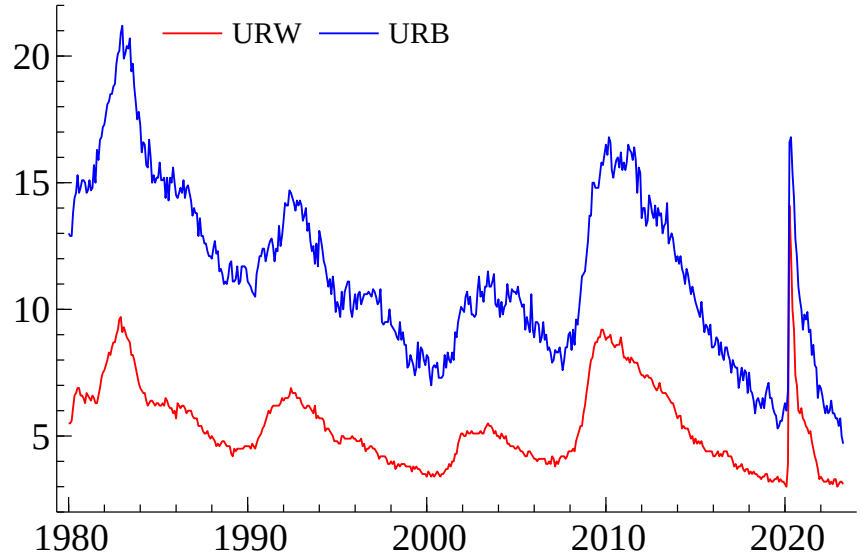
Table 2.

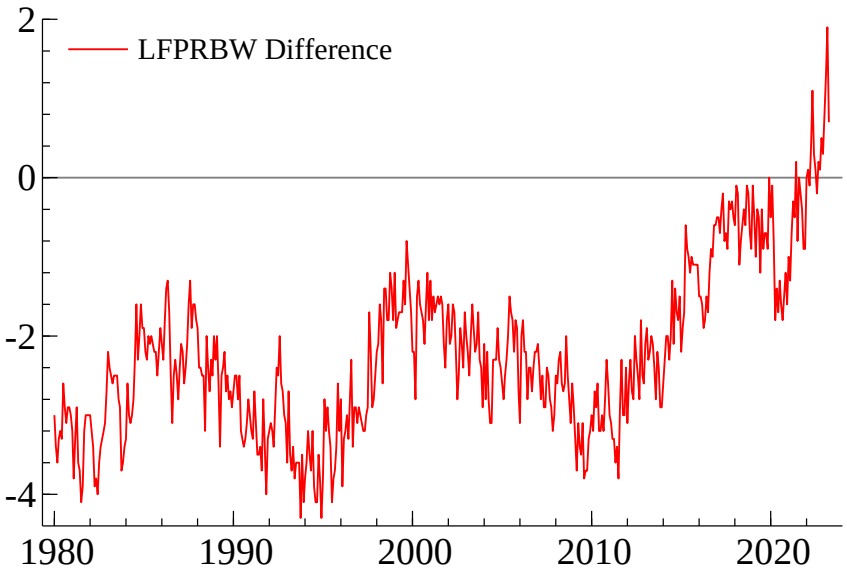
Dimension	Notation	Category
Race\Ethnicity	W	White
	B	Black
	H	Hispanic
	A	Asian

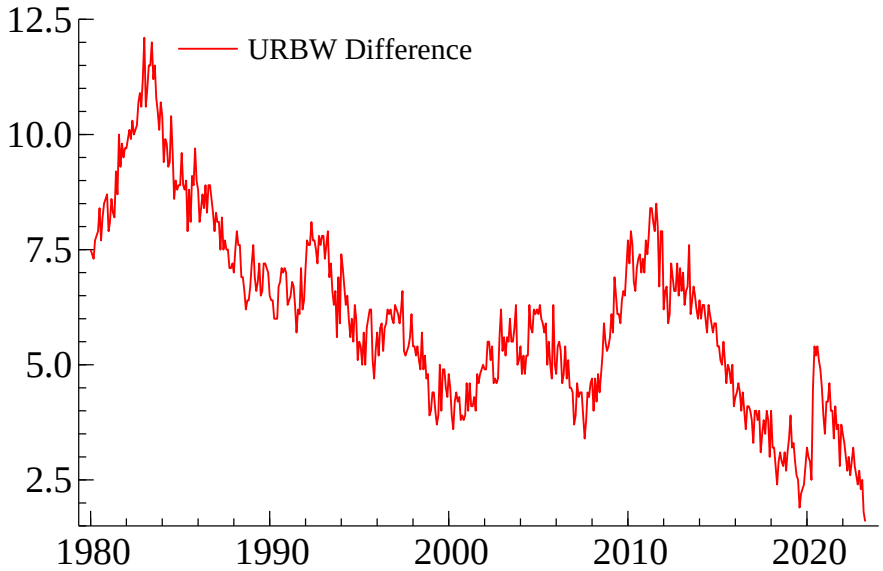
Race is categorized according to the definitions by the Current Population Survey.

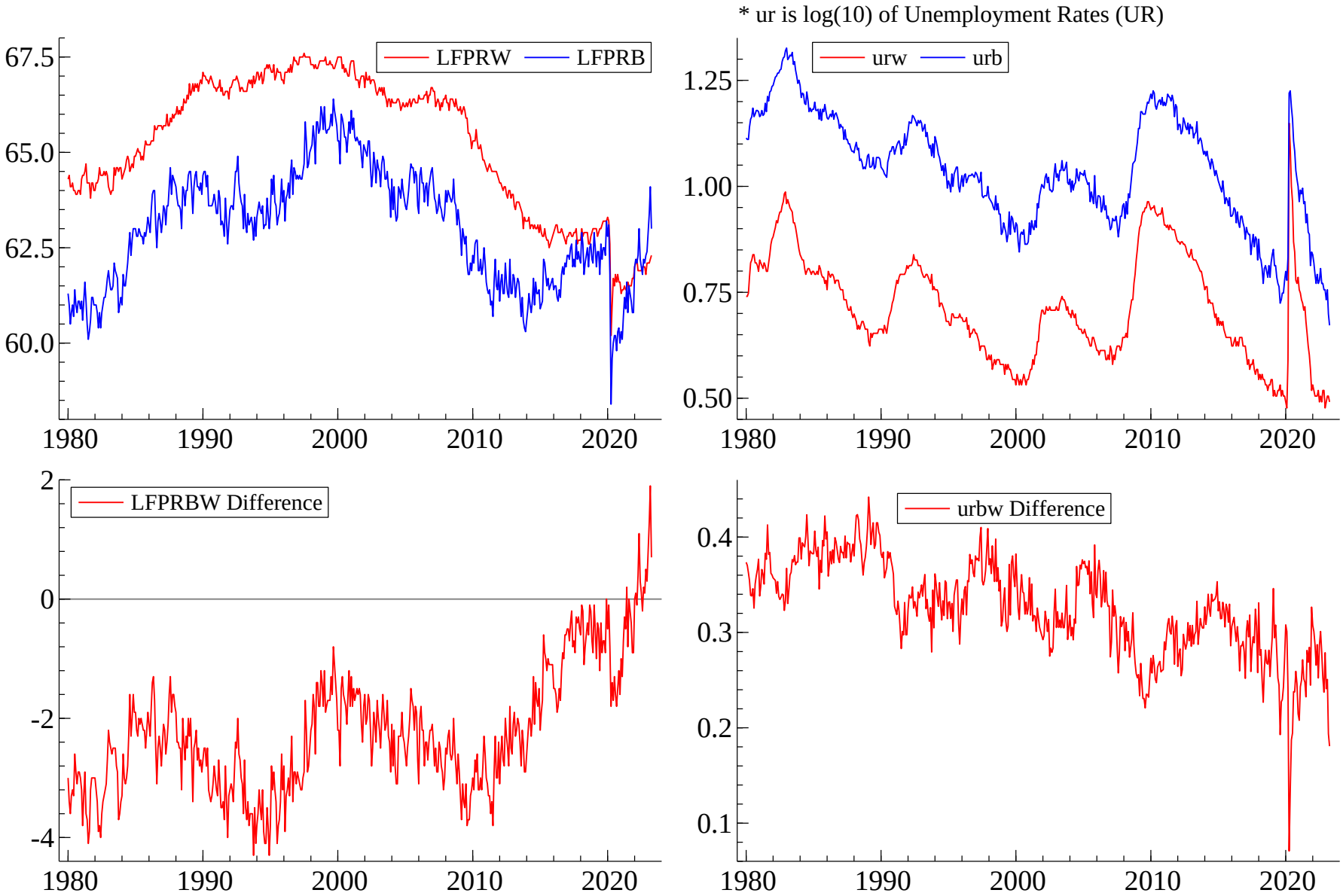

Labor Force Participation Rates
Total
White
Black
Hispanic
Asian
70.0
67.5
65.0
62.5
60.0
1980
1985
1990
1995
2000
2005
2010
2015
2020
Unemployment Rates
Total
White
Black
Hispanic
Asian
20
15
10
5
1980
1985
1990
1995
2000
2005
2010
2015
2020


LFPRW
LFPRB
67.5
65.0
62.5
60.0
1980
1990
2000
2010
2020


URW
URB
20
15
10
5
1980
1990
2000
2010
2020


LFPRBW Difference
2
0
-2
-4
1980
1990
2000
2010
2020


URBW Difference
12.5
10.0
7.5
5.0
2.5
1980
1990
2000
2010
2020


* ur is log(10) of Unemployment Rates (UR)
LFPRW
LFPRB
67.5
65.0
62.5
60.0
1980
1990
2000
2010
2020
urw
urb
1.25
1.00
0.75
0.50
LFPRBW Difference
2
0
-2
-4
urbw Difference
0.4
0.3
0.2
0.1

Methodology - Cointegrated VAR

Vector Error Correction Model via reduced rank regression:

$$\Delta x_t = \alpha(\beta' x_{t-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \textit{trend} + \textit{recession} + \epsilon_t$$

Systems Analyzed:

- 5 Choices for dependent variables:
  - *x' = (LFPRW, LFPRB)*
  - *x' = (urw, urb)*
  - *x' = (LFPRW, urw)*
  - *x' = (LFPRB, urb)*
  - *x' = (LFPRW, LFPRB, urw, urb)*
- Independent Variables: Lagged dependent variables, trend, constant, NBER recession dummy and its lags.

Table 3. Bivariate system: White LFPR and Black LFPR

Trace Statistics:		
$H_0 : rank = 0$	33.73 [0.003]**	
$H_0 : rank \leq 1$	6.24 [0.441]	
	Unrestricted	Restricted
Cointegrating Vectors (β):		
LFPRW	1	1
LFPRB	-0.961 (0.118)	-1
Trend	0.009 (0.001)	0.009 (0.001)
Adjustment Parameters (α):		
LFPRW	-0.038 (0.008)	-0.038 (0.008)
LFPRB	0.007 (0.021)	0.009 (0.008)
LR test of restrictions: $\chi^2(1)$		0.094 [0.759]
Vector Normality test: $\chi^2(4)$	3.854 [0.426]	3.795 [0.435]
Vector Hetero test: F(204,1227)	1.119 [0.139]	1.121 [0.134]

*Standard errors shown in parenthesis. P-values shown in brackets.

Table 4. Bivariate system: White ur and Black ur

Trace Statistics:		
$H_0 : rank = 0$	35.21 [0.002]**	
$H_0 : rank \leq 1$	9.08 [0.180]	
	Unrestricted	Restricted
Cointegrating Vectors (β):		
urw	1	1
urb	-1.012 (0.046)	-1
Trend	-0.00062 (0.00008)	-0.00061 (0.00007)
Adjustment Parameters (α):		
urw	-0.048 (0.028)	-0.050 (0.027)
urb	0.182 (0.042)	0.177 (0.042)
LR test of restrictions: χ^2 (1)		0.034 [0.854]
Vector Normality test: χ^2 (4)	14.899 [0.005]**	14.957 [0.005]**
Vector Hetero test: F(204,1227)	1.0627 [0.275]	1.0612 [0.279]

Table 5. Bivariate system: White Discouraged Worker Effect

Trace Statistics:		
$H_0 : rank = 0$	47.93 [0.000]**	
$H_0 : rank \leq 1$	10.79 [0.096]	
	Unrestricted	Restricted
Cointegrating Vectors (β):		
LFPRW	1	
urw	12.110 (2.365)	
Trend	0.031 (0.005)	
Adjustment Parameters (α):		
LFPRW	-0.014 (0.002)	
urw	-0.00061 (0.00045)	
LR test of restrictions: χ^2 (1)		
Vector Normality test: χ^2 (4)	7.6530 [0.105]	
Vector Hetero test: F(204,1227)	1.0485 [0.319]	

Table 6. Bivariate system: Black Discouraged Worker Effect?

Trace Statistics:		
$H_0 : rank = 0$	16.34 [0.474]	
$H_0 : rank \leq 1$	7.03 [0.352]	
	Unrestricted	Restricted
Cointegrating Vectors (β):		
LFPRB	1	
urb	1.375 (2.058)	
Trend	0.006 (0.004)	
Adjustment Parameters (α):		
LFPRB	-0.029 (0.014)	
urb	0.002 (0.002)	
LR test of restrictions: χ^2 (1)		
Vector Normality test: χ^2 (4)	7.4026 [0.1161]	
Vector Hetero test: F(204,1227)	1.2915 [0.0064]**	

Table 7. Four Variable VECM: 3 Cointegrated Vectors (Unrestricted)

H_0: *rank of* π	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Trace Statistics:	82.23 [0.000]**	43.87 [0.038]*	18.75 [0.302]	7.75 [0.282]
Cointegrating Vectors (β):	LFPR Gap	ur Gap	Discouraged Worker	
LFPRW	1	0	1	
LFPRB	-0.4326 (0.16549)	0	0	
urw	0	1	11.2690 (2.0091)	
urb	0	-1.6586 (0.15170)	0	
Trend	0.01238 (0.0017)	-0.0019 (0.0001)	0.0293 (0.0044)	
Adjustment Parameters (α):				
LFPRW	-0.0011 (0.0086)	-0.0113 (0.0969)	-0.0152 (0.0063)	
LFPRB	0.0021 (0.0236)	0.0156 (0.2654)	-0.0054 (0.0173)	
urw	0.0045 (0.0016)	-0.0079 (0.0185)	-0.0024 (0.0012)	
urb	-0.0068 (0.0025)	0.1264 (0.0278)	0.0070 (0.0018)	
LR test of restrictions: $\chi^2(1)$				

Table 8. Four Variable VECM : 3 Cointegrated Vectors (Restricted)

H_0: *rank of* π	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Trace Statistics:	82.23 [0.000]**	43.87 [0.038]*	18.75 [0.302]	7.75 [0.282]
Cointegrating Vector (β):	LFPR Gap	ur Gap	Discouraged Worker	
LFPRW	1	0	1	
LFPRB	-1	0	0	
urw	0	1	11.4620 (1.8944)	
urb	0	-1	0	
Trend	0.0081 (0.0017)	-0.00063 (0.00009)	0.0297 (0.0044)	
Adjustment Parameters (α):				
LFPRW	-0.0005 (0.0152)	-0.0193 (0.1441)	-0.0141 (0.0044)	
LFPRB	0.0959 (0.0411)	0.2752 (0.3920)	-0.0285 (0.012)	
urw	0.0043 (0.0029)	-0.0467 (0.0277)	-0.0016 (0.0009)	
urb	0.0025 (0.0044)	0.1666 (0.0416)	-0.0005 (0.0013)	
LR test of restrictions: χ^2 (1)		4.155 [0.125]		

Summary of Pre-Pandemic Results

Bivariate cointegration analysis w/ trend: β' = (+1 : -1: *)

- x' = (LFPRW, LFPRB)
- x' = (urw, urb)

Multivariate cointegration analysis w/ trend: three β's

- x' = (LFPRW, LFPRB, urw, urb)
- β_1 = (1 : -1 : 0 : 0 : *)
- β_2 = (0 : 0 : 1 : -1 : *)
- β_3 = (1 : 0 : 11.5 : 0 : *)

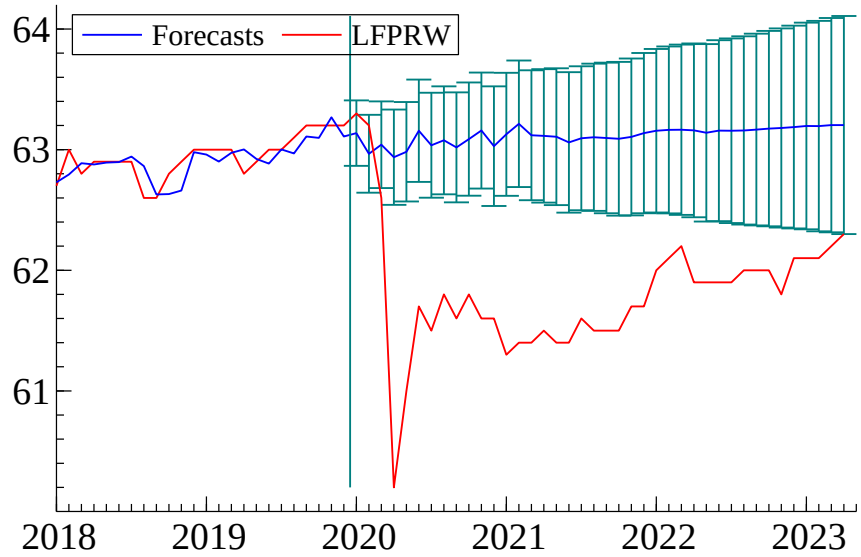
Interpretation of β's and α's:

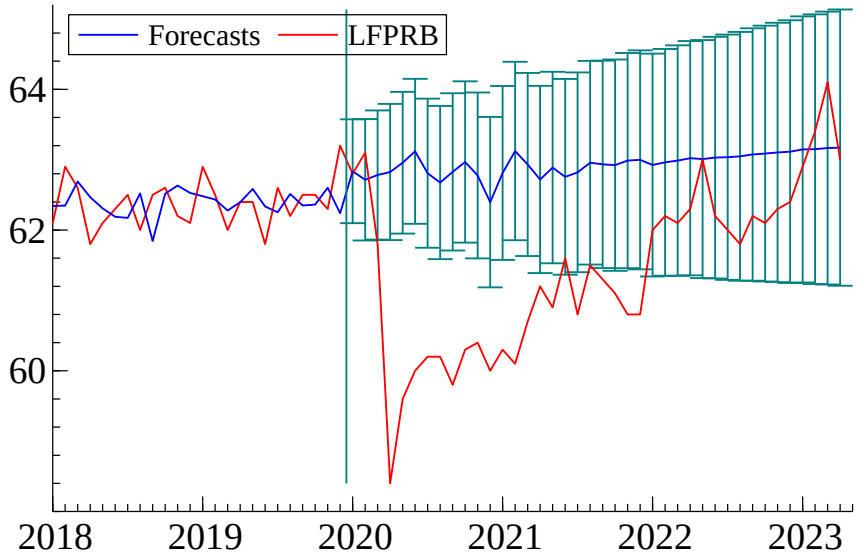
- LFPR Gap and a proportional UR Gap.
- Restricted 4 variable VECM implies the same discouraged worker effect for black and white populations.
- Strong adjustment occurs through Black rates.

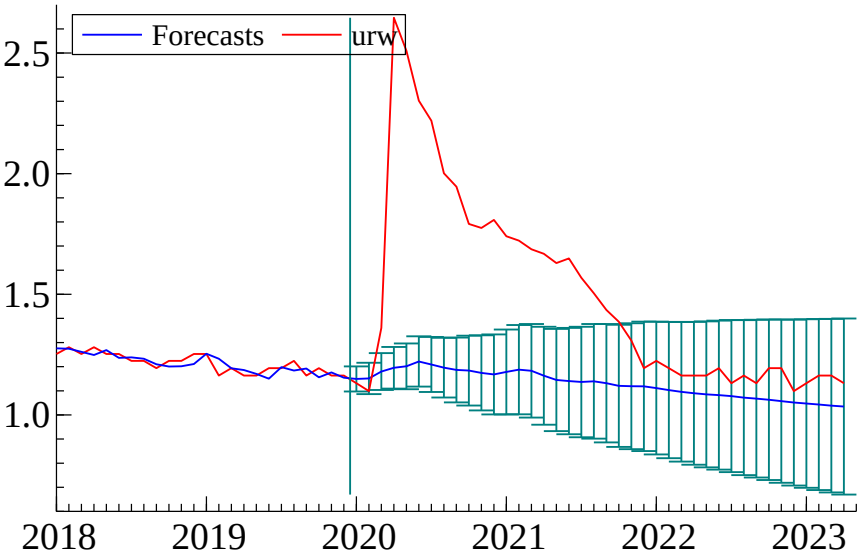
Forecasting into the Pandemic

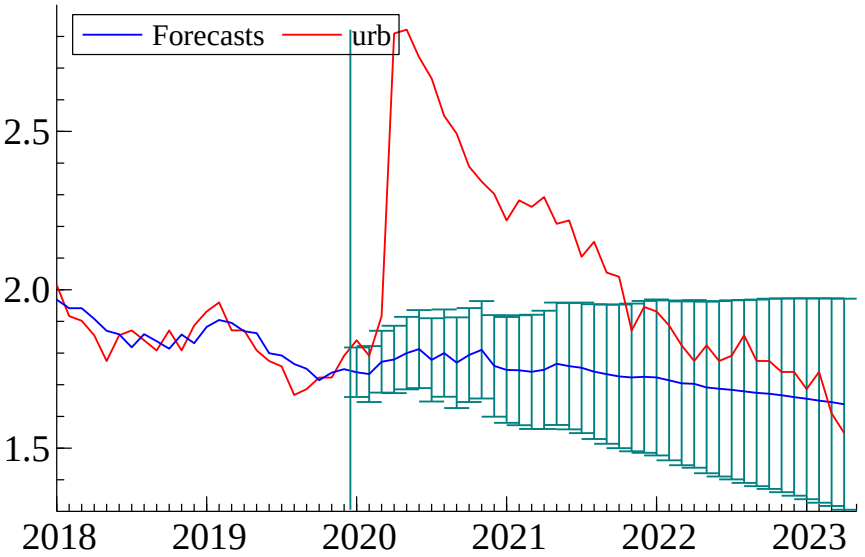
- Estimation: 1980-2019
- Forecasts: 2020-2023(4) (ex ante multi-step)
- Counterfactual $\rightarrow$ No pandemic
- Forecasts design
  - What would have happened without the pandemic?
  - What if the pandemic hadn't affected economic behavior (LFPR, UR)?
  - Models "break down" by design
- Assess differential effects and recovery across race

Forecasts of White and Black LFPRs and URs









Conclusions

- URs: returned to pre-pandemic levels by late 2021. Nearing full recovery towards the counterfactual scenario.
- Strong differences in pre and post-pandemic behaviors by race/ethnicity.
- White LFPR remains suppressed well beyond pre-pandemic levels.
- Black LFPRs and URs dominate adjustment in disequilibrium.
- Disaggregation affects the results in modeling and forecasting.

Directions Forward

- How much disaggregation is needed and in which directions?
  - Necessary level of disaggregation not known a priori. Must learn it from the data.
  - Aggregation tests available; cf. Ericsson (2011).
  - Forecasting with dis/aggregates: Hendry and Hubrich (2011).
- Joint (4-variable) modeling vs bivariate modeling. Both approaches appear fruitful, usually complementary.
  CI vectors invariant to expansion of information; but power?
- Further directions.
  - NSA vs SA: feedback and other dynamics (Tribone)
  - Lag selection
  - Potential outliers in the data; Impulse indicator saturation
  - NBER recession dummies; differences across recessions?
  - Other economic variables

Thank You!

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