The Relationship Among African American Male Earnings, Employment, Incarceration and Immigration: A Time Series Approach

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Abstract

The advent of rising immigration has spurred research into a number of important issues insofar as the indigenous labor market is concerned. Some of these issues regarding the nature of the effect on native workers have been studied extensively. Others, like the interrelationships among immigration flows, African-American male earnings, employment, and incarceration rates have not been widely examined. In this paper, the association among these non-stationary variables is studied in the framework of a Vector Error Correction model and the associated cointegrating relationship. We find no statistically significant association among immigration, Black male employment rates, and Black male incarceration rates over the period 1962-2006, *ceteris paribus*.

JEL Codes: C32, J21, J23

Keywords: immigration, Vector Error Correction, cointegration, incarceration rates, Black male employment rates

Introduction

Over the past four decades, African-American males have realized a significant decline in employment. The employment rate (employment to population ratio) of Black males in the United States decreased from 89.6 percent in 1960 to 65.2 percent in 2006.[2] The decline observed among white men during that same period was from 82.4 to 73.7 percent.

At the same time the employment (and labor force participation rates) of Black males had been declining, the number of Black men in correctional institutions increased. In 1960, there were 149 Black men per 100,000 population incarcerated--by 2006, this number had increased more than fourfold to 825.[3] One noteworthy inquiry that has been raised in the literature regards the issue of whether or not this precipitous rise in Black incarceration rates is a result of increased immigration into low-skilled labor markets. This would lower wages and reduce Black employment--leading to criminal activity and thus higher incarceration rates. Another related question, which is important from both from an academic and policy perspective, is what are the factors, in addition to falling wages and higher incarceration rates, that can be identified as contributing to the declining employment/labor market participation of Black males over time?

While some of the above issues have already been examined in the literature, there has been no empirical studies of Black male employment over a long period of time involving time series methods. In this analysis, we will examine the trend and determinants of black male employment rates using annual data from 1960 to 2006 and employing Vector Error Correction and cointegration models.

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[2] The employment rate is defined as the employment to population ratio.

[3] Bureau of Justice Statistics Correctional Surveys, Correctional Populations in the United States 2005.

Literature

Social Security disability and the minimum wage have both been identified as significant in reducing the labor force participation rates of Black males (Bound and Freeman (1992); Bound, Schauenbaum, and Waidmann (1995); Parsons (1980); Stern (1989); and Welch (1990)). Moreover, the decline in the real wages of low-skilled workers may also have discouraged unskilled black men from entering the labor market (Juhn (1992), (2003)).

It is established that immigration has served to increase the number of unskilled workers in the United States. However, there is controversy over whether or not there has been adverse effects on indigenous workers (Borjas (2003); Card (2001)). Studies that have used local labor markets to measure the immigration impact have found minor effects, while those that have used national wages have found considerable effects. Any such impact has been more prevailing for black workers (Altonji and Card (1991) and Stevans (1998)).

While research exists pertaining to adjusting minority employment rates for incarceration (Western and Pettit (2000)) and the examination of the effect immigration has on African-American self employment (Fairlie and Meyer (1997)), there has been only one study that has considered the relationships among black male employment, immigration, and black incarceration rates. Borjas, Grogger, and Hanson (2006) used data from the micro data files of the 1960, 1970, 1980, 1990, and 2000 U.S. Censuses to examine the link and the evolution of these variables over a four-decade period, while adjusting for other factors that could account for shifts in the wage structure and changes in opportunities in the labor market and the crime sector. The authors have found a numerically large and statistically significant negative correlation between immigration and the wages of black males; a large and significant negative correlation between immigration and the employment rate of black males; and a large and significant

positive correlation between immigration and the incarceration rate of black males. They also found similar correlations for white men, but the magnitude of these correlations are different between the two groups--although the wage effect of immigration was similar for black and white men, the negative employment effect and the positive incarceration effect was larger for blacks. In sum, Borjas, et. al. (2006) concluded that as immigrants increased the supply of workers in a particular skill group, there was a reduction in the wages of black workers in that group, a reduction in the employment rate, and a corresponding increase in the incarceration rate.

We would like to further contribute to this line of research by examining the relationship among black male employment rates, incarceration, immigration, and wages using data measured over a four decade period. While the Borjas, et. al. (2006) study made use of data for five U.S. Censuses, our approach will yield a "long-run equilibrium" relationship amongst the variables that is free of the endogeneity problem plaguing many empirical studies. For instance, as mentioned in Borjas, et. al. (2006), in a study by Raphael and Ronconi (2005), the authors added incarceration rates as an explanatory variable in a regression of wages on immigrant shares. The authors claimed that this attenuated the wage impact of immigration using national-level data. However, the authors' results are likely biased because both incarceration rates and immigration are endogenous variables—any change in incarceration rates may be partially caused by immigration. In this paper, the procedure used will consider all variables as jointly endogenous in a VEC (Vector Error Correcting) framework—allowing us to circumvent the problem of endogeneity bias.

Empirical Model

Building on the above research, we begin by modeling the following four variables as a VEC process, using data from 1960 to 2006,

- $WEARN_t$ - Real Median Weekly Earnings of Black Males Full-Time Wage and Salary Workers,
- $EMPR_t$ - Employment to Population Ratio of Black Males,
- $INCR_t$ - Black Incarceration Rate (Per 100K Population),
- $IMMIG_t$ - U.S. Immigration,

$$t = 1960, 1961, ..., 2006 .$$

All of the above variables are expressed in natural log units. We would have preferred to use Black males' real wages, (real earnings per hour), but hourly wage data does not exist by race. However, this does not create an empirical problem, since many previous studies have used earnings rather than wages when estimating earnings functions. A complete description of all the variables and relevant sources may be found in Appendix A, and the time plot of each variable is in Figure 1. The econometric software EViews 6.0 was utilized in this analysis.

[Insert Figure 1 Here]

If all of the above variables are $I(1)$ (integrated of order one) then an error-correction model will necessarily imply cointegration (and vice versa) (Engle and Granger (1987)). The VEC representation for the above variables are,

$$\begin{aligned} \Delta \vec{X}_t &= \vec{\gamma} + \alpha \eta_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta \vec{X}_{t-i} + \vec{\varepsilon}_t, \\ \eta_{t-1} &= \beta' \vec{X}_{t-1}, \end{aligned} \tag{1}$$

where the vector $\vec{X}_t$ contains the variables,

$$\vec{X}_t' = \left(1, t, WEARN_t, EMPR_t, INCR_t, IMMIG_t\right)'.$$

"t" is a time trend variable.

The notion of cointegration as introduced by Engle and Granger (1987) considers a set of variables in ***long-run equilibrium*** when,

$$\beta' \vec{X}_{t-1} = \beta_0 + \beta_1 t + \beta_2 WEARN_{t-1} + \beta_3 EMPR_{t-1} + \beta_4 INCR_{t-1} + \beta_5 IMMIG_{t-1} = 0. \tag{2}$$

The deviation in long-run equilibrium, known as the *equilibrium error*, is η_t in equation (1). If the equilibrium is meaningful, the error process η_t is stationary. It is important to note here that the term "equilibrium" is the econometric definition which makes reference to any long-run relationship among non-stationary variables. Typically, one of the variables (Black employment rates) can be selected to normalize equation (2) by fixing its coefficient at unity,

$$EMPR_{t-1} = \delta_0 + \delta_1 t + \delta_2 WEARN_{t-1} + \delta_3 INCR_{t-1} + \delta_4 IMMIG_{t-1}, \qquad (3)$$

where,

$$\delta_j = \frac{\beta_j}{\beta_2}.$$

We will refer to this (equation (3)) as the "long-run" relationship among Black employment rates, Black incarceration rates, U.S. immigration, and Black real median weekly earnings. Moreover, since the interest here is in the long-run relationship, the focus in this paper will be on the empirical estimates of the cointegrating relationship (equation (3)), rather than on the parameter estimates of the VEC (equation (1)).[4]

There is no lack of theory in this approach, as the theory behind the relationship amongst Black wages, Black employment, Black incarceration rates, and immigration has already been developed quite extensively in Borjas, et. al. (2006). To put it succinctly, as immigrants disproportionately increase the supply of workers in a particular skill group, there is a reduction in the wage of Black workers in that group, a reduction in the employment rate, and a corresponding increase in the incarceration rate.[5] Past empirical analyses has shown that immigration has lowered the wage of Blacks. However, what are the behavioral consequences of

[4] Of course, the maximum likelihood estimates are based upon the entire system, (1), but we will only present the results for the cointegrating relationship.

[5] Borjas, G.J., J. Grogger, and G.H. Hanson, *Immigration and African American Employment Opportunities: The Response of Wages, Employment, and Incarceration to Labor Supply Shocks*, p. 4.

this reduction of economic opportunities in the "formal" labor market? Borjas, et. al. (2006) found that the immigration-induced reduction in the Black wage reduced Black employment rates--encouraging some Black males to exit the labor force and shift to illegal activities.[6] In this study, we would like to see if these behavioral consequences have been omnipresent over a forty year period.

Empirical Results

Before estimating equation (3), the first task is to test each of the variables for the presence of a unit root, since all must be $I(1)$. Although the results are not included in this paper for the purpose of brevity, the null hypothesis of a unit root has been accepted for each of the four variables using the more powerful Augmented Dickey-Fuller Test with GLS Detrending (DF-GLS) (Elliot, Rothenberg, and Stock (1996)).[7]

Although the VEC (equation (1))and the cointegrating relation (3), has been specified *a priori*, it is imperative to test whether the variables are indeed cointegrated and the degree of cointegration, since more than one linear combination is a possibility. We used the multivariate method developed by Johansen (1988) and the maximum eigenvalue statistic to test the null hypothesis,

H_0 : Number of Cointegrating Vectors = r ,

versus the alternative,

H_A : Number of Cointegrating Vectors = r + 1.

where "r" is the order of cointegration.

[6] Ibid.

[7] Unit root test results will be made available from the author upon request.

The results may be found in Table I, Part A. It is important to note that the maximum eigenvalue test indicates there is a single cointegrating relationship among the variables--so there is only one "long-run" relationship amongst these variables as specified in equation (3).

[Insert Table I Here]

The next step is to determine whether the Black incarceration rate and immigration has had an impact upon Black employment rates over the period of this analysis as specified in a VEC framework (equations (1) thru (3), above). We proceed by testing the null hypothesis,

$$H_0 : \delta_2 = \delta_3 = 0. \qquad (4)$$

The parameters in the null hypothesis, $\delta_2 = \delta_3 = 0$, impose the restriction on the cointegrating relationship (equation (3)) that both incarceration rates and immigration jointly have no effect on the Black employment rate.[8] If the hypothesis (4) is true, then there should be no significant difference between the number of cointegrating vectors under the null versus the alternative (or unrestricted) case. The results of this test are in Table II, Part A.[9] The χ^2 test denotes that the null hypothesis cannot be rejected, thus the restriction is not binding. As may be seen from the parameter estimates, it appears that the variable having the largest (and only statistically significant) effect on Black employment rates over the long-run is real earnings ($WEARN_t$). Since all variables are in natural logs, a ten percent decline in weekly earnings is associated with a 1.45 percent decline in Black employment rates over this period.[10]

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[8] We actually tested the full hypothesis $H_0 : \delta_2 = \delta_3 = 0, \alpha_1 = \alpha_3 = \alpha_4 = 0$ where the second set of restrictions, $\alpha_1 = \alpha_3 = \alpha_4 = 0$, indicate that all variables except the Black employment rate in the VEC are "weakly exogenous." In a VEC-cointegrated framework, if a variable does not respond to the discrepancy from long-run equilibrium, it is "weakly exogenous" (the adjustment parameter, α, is zero).

[9] As mentioned previously, only the parameter estimates of the cointegrating relation are presented. VEC estimates otherwise not presented will be made available upon request from the author.

[10] The coefficients as they appear in Table II are opposite in sign. This is because the equation is expressed as $EMPR_t - \delta_0 - \delta_1 t - \delta_2 INCR_t - \delta_3 IMMIG_t - \delta_4 WEARN$.

Given the above results, it appears that the decline in Black earnings was the only variable associated with the decline in Black employment rates over the period under study. However, there are other factors (in addition to earnings) that may affect Black employment rates. Theoretically, aggregate employment may be expressed minimally as a function of real wages and output (Webster (2000)), but in addition to these variables, education, minimum wages, transfer payments, and the degree of unionization may all influence Black employment rates. According to one school of thought, a higher minimum wage reduces Black adult male employment and transfer programs can diminish the incentives to look for and maintain gainful employment (Rector and Lauder (1995)).[11] According to another point of view, the decline of unionization over the past 20 years has led to diminished employment opportunities and lower earnings for unskilled workers, which includes African-American males (Stevans and Sessions (2008)). We include these factors in the cointegrating relationship (equation (3)).

$$\begin{aligned} EMPR_{t-1} = {} & \delta_0 + \delta_1 t + \delta_2 WEARN_{t-1} + \delta_3 INCR_{t-1} + \delta_4 IMMIG_{t-1} \\ & + \delta_5 BEDUC_{t-1} + \delta_6 BEN_{t-1} + \delta_7 GDP_{t-1} + \delta_8 MINW_{t-1} \\ & + \delta_9 UNION_{t-1} \end{aligned} \tag{5}$$

Empirically, we can examine what effect Black incarceration rates and immigration has on Black employment rates, *ceteris paribus*.

The first task is to test for the order of cointegration including these five additional variables.[12] The Johansen test results are in the bottom part of Table I (Part B). Once again, we reject the null hypothesis of no cointegration in favor of the alternative hypothesis of one cointegrating relationship, at the $\alpha = .01$ level., so there is evidence for the single equation specification (5).

[11] See http://www.ncpa.org/ba/ba292.html for a review of the minimum wage controversy.

[12] Actually, the first task to test for units roots but this is omitted for purposes of brevity. Results will be made available upon request by the authors.

Estimation of equation (5) above was approached in the same manner as the previous equation (3). We test for the null effect of Black incarceration rates and immigration,[13]

$$H_0 : \delta_2 = \delta_3 = 0. \qquad (6)$$

The null hypothesis cannot be rejected ($\text{Prob}(\chi^2 > \chi^2_{tabled}) = 88.7\ \%$), and it appears that even after controlling for education, transfer payments, GDP, and minimum wages, Black incarceration rates and immigration have no appreciable effect on Black employment rates over the long-run, *ceteris paribus*.

There are some interesting results insofar as the parameter estimates of the remaining variables are concerned. The decline in Black male employment in the United States appears to be significantly influenced by the decline in unionization over the long-run—*a one percent decline in unionization is associated with approximately an 8.9 percent decline in Black male employment rates over this period*. Moreover, once again, real earnings are found to have a strong impact on Black employment. A one percent increase (decrease) in real earnings is associated with a 3.3 percent increase (decrease) in Black male employment rates. We also find that a higher real minimum wage has a positive effect on Black employment, which runs counter to the conclusions reached by Neumark and Wascher (2006). In their review of the literature on the employment effects of minimum wages, they came across few studies that provide convincing evidence of positive employment effects of minimum wages. In fact, the studies that focused on the least-skilled groups provided relatively strong evidence of disemployment effects for these groups. Finally, it appears that transfer payments do not have the disincentive effect that is referred to by Rector and Lauder (1995). A one percent increase in Federal and State, and

[13] See footnote #6.

Local real social expenditures is associated with a less than proportionate .8 percent increase in Black male employment rates.

Conclusion

The revival of large-scale immigration has raised a number of important issues insofar as the indigenous labor market is concerned. Some of these issues regarding the nature of the effect on native workers have been studied extensively. Others, like the subject area dealt with by this paper, have not yet been widely examined. As mentioned previously, Borjas, et. al. (2006) was the first to study this phenomenon and basically found that the immigration induced reduction in the Black wage was associated with falling Black employment rates and increasing Black incarceration rates. The authors used micro-data files from the 1960 to 2000 U.S. Censuses.

In this study, we have found there to be no correlation among immigration, Black employment rates, and Black incarceration rates, *ceteris paribus*, over the "long-run," that is, over a 46 year period beginning in 1961. There are a few possible reasons for these divergent results. First and most prominent are the differences between the econometric models employed by each study. While Borjas, et. al. (2006) used standard regressions, in this study we incorporated the notion of a "long-run equilibrium" among the relevant variables along with a VEC design that allows us to avoid the endogeneity bias issue. Second, Borjas, et. al. (2006) used essentially cross-sectional, time series data while in this study, we employed just time series. Finally, it is clear that both studies may suffer from errors-in-variables bias since the immigration variable includes only legal immigration.

It is interesting to note that our results indicate that the most predominant variables that are associated with Black employment rates over the long-run are what one would consider to be

the “traditional” economic influences such as the degree of unionization, economic growth, earnings, and education.

Appendix A

Variable Descriptions

- $WEARN_t$ - Real Median Weekly Earnings of Black Males Full-Time Wage and Salary Workers
- $EMPR_t$ - Employment to Population Ratio of Black Males
- $INCR_t$ - Black Incarceration Rate (Per 100K Population)
- $IMMIG_t$ - U.S. Immigration
- $BEDUC_t$ - Percentage of Black Males Age 25 or Over Who Have Completed High School or College
- BEN_t - Federal and State Real Social Expenditures (Billions of $)
- GDP_t - Real Gross Domestic Product (Billions Chained 2000 $)
- $MINW_t$ - Real Minimum Wage
- $UNION_t$ - Wage and Salary Workers Who Are Union Members as a Percent of Civilian Employment

Note: All data/variables were downloaded from http://www.haverselect.com/dlx/home.htm except for $INCR_t$, $IMMIG_t$ and $BEDUC_t$. $INCR_t$ was obtained from the *Bureau of Justice Correctional Surveys, Correctional Populations in the United States*, $IMMIG_t$ was downloaded from http://www.dhs.gov/ximgtn/statistics/publications/yearbook.shtm and $BEDUC_t$ was downloaded from http://www.census.gov/population/www/socdemo/educ-attn.html.

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Figure 1


Black Males' Real Average Weekly Earnings (Log Units)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
60 65 70 75 80 85 90 95 00 05
Black Males' Employment Rate (Log Units)
4.5
4.4
4.3
4.2
4.1
60 65 70 75 80 85 90 95 00 05
Black Incarceration Rate (Log Units)
6.8
6.4
6.0
5.6
5.2
60 65 70 75 80 85 90 95 00 05
U.S. Immigration (Log Units)
14.5
14.0
13.5
13.0
12.5
12.0
60 65 70 75 80 85 90 95 00 05

Table I

Johansen Cointegration Test Results

Part A

Sample (adjusted): 1962 2006
Included observations: 45 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.577593	38.78032	32.11832	0.0066
At most 1	0.373540	21.04518	25.82321	0.1887
At most 2	0.181815	9.030006	19.38704	0.7214
At most 3	0.139816	6.777425	12.51798	0.3683

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Part B

Sample (adjusted): 1961 2006
Included observations: 46 after adjustments
Trend assumption: Linear deterministic trend
Lags interval (in first differences): No lags

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.866627	92.67173	57.12	62.80
At most 1 *	0.691056	54.03143	51.42	57.69
At most 2 *	0.655620	49.03650	45.28	51.57
At most 3	0.536052	35.32722	39.37	45.10
At most 4	0.453377	27.78382	33.46	38.77
At most 5	0.375350	21.64594	27.07	32.24
At most 6	0.280613	15.15039	20.97	25.52
At most 7	0.130714	6.443811	14.07	18.63
At most 8	0.048389	2.281548	3.76	6.65

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 1% level
*(**) denotes rejection of the hypothesis at the 5%(1%) level

Table II

Cointegrating Equation

Part A

Vector Error Correction Estimates
Sample (adjusted): 1962 2006
Included observations: 45 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,2)=1
B(1,3)=0
B(1,4)=0
A(1,1)=0
A(3,1)=0
A(4,1)=0
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 1):

Chi-square(5)	6.862060
Probability	0.231103

Cointegrating Equation	Estimated Coefficients
$WEARN_{t-1}$	-0.145475 (0.04902) [-2.96789]***
$EMPR_{t-1}$	1.000000
$INCR_{t-1}$	0.000000
$IMMIG_{t-1}$	0.000000
TREND	1.67E-05 (0.00152) [0.01096]
INTERCEPT	-3.338242

***** - statistically significant at .01 level**

Table II

Cointegrating Equation

Part B

Vector Error Correction Estimates
Sample (adjusted): 1961 2006
Included observations: 46 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,2)=1
B(1,3)=0
B(1,4)=0
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 1):

Chi-square(2)	0.240560
Probability	0.886672

Cointegrating Equation	Estimated Coefficients
$WEARN_{t-1}$	-3.339274 (0.59677) [-5.59554]***
$EMPR_{t-1}$	1.000000
$INCR_{t-1}$	0.000000
$IMMIG_{t-1}$	0.000000
$BEDUC_{t-1}$	-1.771484 (0.82288) [-2.15279]**
BEN_{t-1}	-0.822638 (0.28162) [-2.92106]***
GDP_{t-1}	-5.488903 (0.66493) [8.25481]***

Table II

Cointegrating Equation

Part B (Continued)

Cointegrating Equation	Estimated Coefficients
$MINW_{t-1}$	-1.263409
	(0.32919)
	[-3.83799]***
$UNION_{t-1}$	- 8.895787
	(0.81173)
	[-10.9590]***
INTERCEPT	-81.13450

***** - statistically significant at .01 level**
**** - statistically significant at .05 level**