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COUNTRY ROADS, TAKE ME AWAY:  
COAL MINING AND MIGRATION IN WEST VIRGINIA, 1971-2010

by  
James J. Slaughter

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of  
the requirements of the Sally McDonnell Barksdale Honors College.

Oxford  
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## ABSTRACT:

JAMES J. SLAUGHTER: Country Roads, Take Me Away:  
Coal Mining and Migration in West Virginia, 1971-2010

West Virginia's population peaked in 1950. Parallel to this, employment in the coal mining industry peaked in 1948. Popular discourse links these two trends together. It is suggested that the decline of the coal mining industry, which was previously a stable source of employment, has led West Virginians to leave the state searching for better job opportunities elsewhere. This thesis uses first-difference regression models to analyze the relationship between lagged year-to-year changes in coal-mining employment and year-to-year changes in net-migration to and from West Virginia. A positive and statistically significant relationship is found between 1-year lagged changes in coal mining employment and changes in net-migration. Specifically, the average effect is that as coal employment increases (decreases) by 100 people in year  $t-1$ , then net-migration increases (decreases) by 59 people in year  $t$ . The relationship remains when using coal mining employment as a percentage of total employment in West Virginia. The average effect is that as coal mining employment as a percentage of total employment increases (decreases) by one percentage point in year  $t-1$ , there is an increase (decrease) in net-migration of approximately 4,438 people in year  $t$ . Evidence is also presented that net-migration is positive if per capita personal income in West Virginia grows faster than that of neighboring states. The implications of these results for understanding the decline of coal mining and population decline are discussed.

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## I. INTRODUCTION

Coal has come to dominate life and politics in West Virginia. Many electoral races in the state solely come down to which candidate would be best for supporting the coal industry. In 2014 for example, during a contentious election for West Virginia Senate, candidate Nick Rahall said: “Coal is a way of life in West Virginia... Coal is everything for our state of West Virginia. I have always stood for coal.” His opponent Evan Jenkins only echoed similar thoughts: “We need to step up to the plate and free up our coal miners and make sure they can mine the coal that God has given us and blessed us with” (VICE News, 2014). Coal’s power in West Virginia politics is probably most revealed by the fact that the current governor of West Virginia, Jim Justice, himself owns shares in more than a dozen coal-mining companies (West Virginia Ethics Commission, 2019).

Coal commands so much influence that many West Virginians often attribute the problems and the successes in their state solely to the changing fortunes of the coal industry. For instance, one of the biggest concerns in West Virginia is the problem of population loss. The population of West Virginia peaked in 1950 – it has remained less than its 1950-level every year since. A common refrain is that the decline of coal mining jobs has driven young people to move elsewhere, and this loss in population has not been replenished by any new migrants entering the state (Knabb, 2016; Leins, 2017). Similar connections between coal mining and population have been made throughout West Virginia’s history, of which a short survey is relevant.

While there are references to discovering and using coal since the first humans explored the area, coal mining as a sustained industry did not begin until the early nineteenth century. Around this time, the production of salt became a major business in modern-day Kanawha County. For the industry to expand, it needed more furnaces to evaporate water from the collections of salt, and more furnaces required more energy to fuel them. As a result, the first coal mine in Kanawha County was opened in 1817 to supply that demand (Laing, 1966). However, throughout the remainder of the nineteenth century, West Virginia coal mines only made up a fraction of what larger mining industries in Illinois and Pennsylvania produced (Adams, 2003).

As historian Rebecca Bailey (2008) has discussed, coal production continued to increase throughout the years leading up to World War I, paralleling increased population. However, the rise of automation in the coal mines and intense competition between coal companies made employment increasingly precarious. In the early 1910s, coal fields like the Williamson-Thacker field in southern part of the state began to lag behind in terms of production, wages, and employment opportunities. Tensions between workers and mine owners over these conditions erupted into the West Virginia Mine Wars. Despite the successive governors William Glasscock and Henry Hatfield using martial law and military tribunals to break the strike (an act which would later be condemned by West Virginia Senate), the striking miners were able to eventually win union recognition through the United Mine Workers in many of the state's southern coal mines. Poor wages and miserable working conditions would continue to cause unrest, however, leading to many more strikes and armed skirmishes such as the Matewan Massacre in 1920 and Battle of Blair Mountain in 1921.

The demand for coal during the 1910s produced a boom in the coal-mining industry, leading to many new mines opening throughout West Virginia. However, as historian Jerry Bruce



Thomas (2010a) has recorded at length, this boom quickly subsided by the mid-1920s. Many of these mines closed, miners were laid-off, and United Mine Workers membership fell by 300,000. The Great Depression in the 1930s brought further troubles as coal production was cut by nearly half and over thirty thousand more jobs were lost in just the first few years. Rather than fleeing the state, many coal miners returned to farming, which rose as a proportion of the labor force during this period.

However, the need for coal and other resources during World War II brought another sudden boom to coal mining. West Virginia's industries also began diversifying outside of coal: employment in manufacturing nearly doubled, while chemical plants and steel foundries began multiplying throughout the state (Thomas, 2010b). Veterans Administration Loans, which provided guaranteed mortgages to returning American soldiers, resulted in massive home and suburban construction projects (Thomas, 2010b). However, like the previous boom, this too would prove brief. Coal-mining employment would reach an all-time high of 125,669 miners in 1948 (Barnes, 2017; Thomas, 2010b). Similarly, West Virginia's population would register its highest peak of approximately 2,006,000 in the 1950 census (U.S. Census Bureau, 2019). This time period would prove to be the high-water mark of West Virginia's romance with coal as a sustainable and driving industry in the state.

Many theories abound as to why coal mining had declined. Jerry Bruce Thomas (2010b) again has suggested that it was due to the twin trends of increasing automation in the coal mines and the introduction of alternative forms of energy – such as hydropower, natural gas, nuclear power, and oil. Technological change in the post-war years brought a switch from coal-powered to diesel-powered trains as well as a switch from coal furnaces to gas furnaces in homes and businesses. In addition, the introduction of continuous mining machines and mechanical loaders

resulted in thousands of layoffs within the coal mines. These innovations allowed for triple the amount of coal production with only one-eighth the manpower of previous manual mining and loading techniques.

Simultaneous to the decline in the coal industry in West Virginia was a period of sustained population loss. From 1950 to 1970, population decreased from approximately 2,006,000 down to 1,744,237, a drop of over 13% (U.S. Census Bureau, 2019). Similarly, coal-mining employment dropped from its 1948 peak down of 125,669 down to 41,941 by 1969, a drop of over 66% (Barnes, 2017). In 1964, during a conference on the state of Appalachian labor, then-Assistant Secretary of Labor Daniel Patrick Moynihan squarely blamed automation in the coal industry as the root cause of population loss, “A lot of people in the rest of the country think that Appalachia has never caught up with the times, but this isn’t true... The problems in Appalachia are largely the result of progress rather than stagnation – of a superbly advanced technology rather than a primitive technology” (Thomas, 2010b). Subsequent research from economists at West Virginia University also has suggested “mechanization of coal production, which considerably reduced the demand for miners” as the chief culprit of population loss during this period (Christiadi, 2014). Coal-mining employment increased slightly from its 1970 low to 62,982 in 1978, but thereafter it continued its decline. By the year 2014, there were only 18,159 coal miners in the state, a drop of over 85% from peak employment in 1948 (Barnes, 2017).

Despite the decline of coal-mining employment being associated with population loss, there have been no attempts to quantitatively assess this association. To that end, this thesis uses West Virginia state-level data on coal-mining employment and net-migration to empirically assess links between changes in coal industry employment and migration. Evidence is found that changes

in coal employment, as well as changes in the ratio of per capita income between West Virginia and neighboring states, significantly affects changes in net-migration.

## II. DATA AND EMPIRICAL METHODOLOGY

The objective of this thesis is to assess the effect of coal mining employment on migration in West Virginia. This section describes data and methodology used in the analysis.

Annual data on births, deaths, and migration for the period 1970-2010 was gathered from the West Virginia Health Statistics Center (WVHSC). Net-migration is the key variable of interest and is defined as the total overall number of people that either moved to the state (in-migration) or moved away from the state (out-migration). A positive net-migration number means that there was more in-migration than out-migration that year, and a negative net-migration number means there was more out-migration than in-migration that year.

The annual net-migration data that WVHSC uses is an estimate based on the equation:

$$NetMigration_t = (population_t - population_{t-1}) - (births_t - deaths_t),$$

where  $population_t$  refers to state population at year  $t$ ,  $births_t$  refers to the number of recorded births within the state in year  $t$ , and  $deaths_t$  refers to the number of deaths recorded in the state in year  $t$ .

The annual population estimates WVHSC uses are based on postcensal population estimates rather than intercensal yearly estimates.<sup>1</sup> An intercensal estimate is generally considered more accurate and reliable since it is based upon more census data. Therefore, intercensal annual population estimates for the state of West Virginia were obtained from the U.S. Census Bureau, and then these population data were substituted into the net-migration equation above in order to

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<sup>1</sup> A postcensal estimate is an estimate of population in the years following an official census based upon the known data of the decennial census. An intercensal estimate is an estimate of population for the years between two official censuses based upon the known data of both censuses.

create a corrected net-migration variable.

Two measures of coal employment, the key independent variables, are used in the analysis. One measure used is the total number of people employed in coal mining each year, and the second measure is coal employment as a percentage of total employment in the state. Coal employment as a percentage of total employment in order to capture the effect of former coal miners switching to employment in other industries rather than leaving the state (and likewise people entering the state for employment in industries other than coal mining). Annual data on the number of people employed in coal mining was gathered from the West Virginia Blue Book. Data on the total number of people employed in West Virginia annually was obtained from the Bureau of Economic Analysis (BEA).

Other variables that may affect migration are also included in the statistical analysis. One variable is the presence of a national recession. If a recession happens, there could be a tendency for those in relatively lower income economies like West Virginia to leave the state in search of better opportunities, regardless of what is occurring in the coal industry. Data on recession occurrences was obtained from the National Bureau of Economic Research, and a dummy variable was created which took the value of “1” if a recession occurred for six months or more in year  $t$  (and “0” if otherwise).

The analyses also consider the ratio of West Virginia per capita income to per capita income of neighboring states to control for the effect of people migrating in or out of West Virginia to neighboring states as a result of differences in relative overall income growth. An increase (decrease) in this ratio means that West Virginia’s per capita personal income is increasing (decreasing) in comparison to that of neighboring states.<sup>2</sup>

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<sup>2</sup> To create this variable, annual data was gathered on total personal income and resident population for the surrounding states of Virginia, Pennsylvania, Maryland, Ohio, and Kentucky. Personal income data is from the

The data are non-stationary, so first difference regressions were utilized in order to obtain a meaningful statistical estimate of the relationship between coal mining employment and net-migration. The first-difference of each variable is:

$$\Delta M_t = NetMigration_t - NetMigration_{t-1},$$

$$\Delta C_t = CoalEmployment_t - CoalEmployment_{t-1},$$

$$\Delta P_t = CoalEmploymentPercentage_t - CoalEmploymentPercentage_{t-1},$$

$$\Delta I_t = IncomeRatio_t - IncomeRatio_{t-1},$$

where  $CoalEmploymentPercentage_t$  is coal mining employment as a percentage of total employment at time  $t$ ;  $CoalEmployment_t$  is the number of people employed in coal mining in year  $t$ ;  $NetMigration_t$  is the net amount of migration to or from West Virginia in year  $t$ ; and  $IncomeRatio_t$  is the ratio of per capita personal income between West Virginia and neighboring states in year  $t$ . A description of summary statistics is found in Table 1.

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BEA, and resident population data is from the U.S. Census Bureau. The personal incomes of each state were summed together, as was population. A variable was then created for “neighboring states per capita income” by dividing neighboring states population by neighboring states personal income. Data on West Virginia’s per capita personal income was gathered from the BEA, and then it was divided by neighboring states per capita income in order to create a single variable describing the ratio between the two.

Table 1 – Summary of Statistics					
1971 - 2010 (T = 40)					
Variable	Mean	Median	Std. Dev.	Min	Max
NetMigration	-1001	1858	13853	-29439	28327
CoalEmployment	34501	28854	14456	16272	62982
CoalEmploymentPercentage	4.443	3.727	2.112	1.858	8.158
IncomeRatio	76.193	75.976	2.293	72.75	80.22
Recession	0.205	0.000	0.409	0.000	1.000
1972 - 2010 (T = 39)					
$\Delta M$	-205.0	-79.00	7366.2	-17101	20871
$\Delta C$	-356.3	-414.0	4225	-18110	9230
$\Delta P$	-0.087	-0.062	0.533	-2.32	1.236
$\Delta I$	0.036	-0.098	1.089	-1.968	2.517

To estimate the statistical association between coal mining employment and net-migration, the following regressions are performed:

1.  $\Delta M_t = \alpha_0 + \alpha_1 \Delta C_{t-1} + \alpha_2 \Delta C_{t-2} + \alpha_3 \Delta C_{t-3} + \varepsilon$ ,
2.  $\Delta M_t = \alpha_0 + \alpha_1 \Delta C_{t-1} + \alpha_2 \Delta C_{t-2} + \alpha_3 \Delta C_{t-3} + \alpha_4 \Delta I_{t-1} + \alpha_5 R_t + \varepsilon$ ,
3.  $\Delta M_t = \beta_0 + \beta_1 \Delta P_{t-1} + \beta_2 \Delta P_{t-2} + \beta_3 \Delta P_{t-3} + \varepsilon$ ,
4.  $\Delta M_t = \beta_0 + \beta_1 \Delta P_{t-1} + \beta_2 \Delta P_{t-2} + \beta_3 \Delta P_{t-3} + \beta_4 \Delta I_{t-1} + \beta_5 R_t + \varepsilon$ ,

where  $R_t$  refers to the dummy variable for whether a recession occurred in year  $t$ . In addition,  $\Delta C_t$  and  $\Delta P_t$  are lagged by one, two, and three years in order to account for any delayed effect between employment changes and net-migration.

There is no prior hypothesis as to what effect these variables will have upon net-migration. The signs of the relevant coefficients will explain the association. If the coefficients on the lagged employment variables are positive (negative), this implies that increases in lagged year-to-year employment are associated with an increase (decrease) in subsequent net-migration growth. This reflects the possibility that, as coal mining employment increases, people move to the state to take

advantage of the greater employment opportunities in that industry or those in other industries as a result of spillover effects. If the coefficients on the lagged income ratio are positive (negative), then net-migration increases (decreases) as West Virginia's income increases relative to neighboring states.



### III. RESULTS

This section presents the estimates obtained from the four first-difference equations shown in Table 2. Columns 1 and 2 present the regressions including coal employment. The results in column 1 demonstrate that the relationship is statistically significant between changes in 1-year lagged coal mining employment changes in net-migration. As coal mining employment increases (decreases) by 100 people in year  $t-1$ , net-migration increases (decreases) by approximately 62 people in year  $t$ . Longer lags of coal employment have no significant effect on net-migration. The results in column 2 also reveal a positive and statistically significant relationship between changes in 1-year lagged coal mining employment and changes in net-migration. As coal mining employment increases (or decreases) by 100 people in year  $t-1$ , there is an increase (or decrease) in net-migration by approximately 56 people in year  $t$ . There is no significant relationship between net-migration and longer lagged years of coal mining employment. There is also no statistically significant relationship between changes in net-migration and occurrences of national recessions. There is a statistically significant relationship between changes in net-migration and changes in the per capita personal income ratio of West Virginia to neighboring states. The coefficient implies that as the ratio increases (decreases) by one percentage point in year  $t-1$ , then net-migration increases (decreases) by approximately 2,121 people in year  $t$ .

Columns 3 and 4 present the results using coal employment as a percentage of total employment in the state. The results in column 3 reveal a statistically significant relationship between changes in 1-year lagged coal mining employment as a percentage of total employment in the state and changes in net-migration. Recall that coal employment as a percentage of the total

accounts for employment in other industries within the state that may be filled with coal miners. The coefficient implies that as coal mining employment as a percentage of total employment increases (decreases) by one percentage point in year  $t-1$ , there is an increase (decrease) in net-migration of approximately 4,662 people in year  $t$ . The relationship with longer lagged years is not significant. The results in column 4 are consistent with the previous regression. The relationship between changes in 1-year lagged coal mining employment as a percentage of total employment and changes in net-migration is positive and statistically significant. The coefficient implies that as coal mining employment increases (decreases) by one percentage point in year  $t-1$ , there is an increase (decrease) in net-migration of approximately 4,213 people in year  $t$ . The relationship with 1-year lagged changes in the income ratio is statistically significant. The coefficient implies that as the ratio increases (decreases) by one percentage point in year  $t-1$ , then net-migration increases (decreases) by approximately 2,189 people in year  $t$ .

The results from all regressions show there is a positive and statistically significant relationship between coal mining employment and subsequent net-migration. The average effect from columns 1 and 2 reveals that as coal employment increases (decreases) by 100 in year  $t-1$ , then net-migration increases (decreases) by 59 people in year  $t$ . The average effect from columns 3 and 4 implies that as coal mining employment as a percentage of total employment increases (decreases) by one percentage point in year  $t-1$ , there is an increase (decrease) in net-migration of approximately 4,438 people in year  $t$ . There is also a positive and statistically significant relationship between changes in the ratio of per capita personal income of West Virginia with neighboring states and changes in subsequent net-migration. The average effect from columns 2 and 4 reveals that as the ratio increases (decreases) by one percentage point in year  $t-1$ , then net-migration increases (decreases) by approximately 2,154 people in year  $t$ .

Table 2 – Regression Results				
OLS, using observations 1975-2010 (T = 36)				
Dependent variable: $\Delta M_t$ (year-to-year change in net-migration)				
Variables	(1)	(2)	(3)	(4)
$\Delta C_{t-1}$	0.617 ** (0.276)	0.564 ** (0.271)	---	---
$\Delta C_{t-2}$	-0.224 (0.272)	-0.338 (0.272)	---	---
$\Delta C_{t-3}$	-0.255 (0.277)	-0.343 (0.276)	---	---
$\Delta P_{t-1}$	---	---	4662.19 ** (2157.75)	4213.15 ** (2091.87)
$\Delta P_{t-2}$	---	---	-1969.15 (2130.54)	-2919.43 (2104.38)
$\Delta P_{t-3}$	---	---	-2262.01 (2143.83)	-3082.53 (2110.59)
$\Delta I_{t-1}$	---	2120.60 * (1121.96)	---	2187.82 ** (1096.36)
$R_t$	---	-1814.01 (2840.06)	---	-2401.44 (2774.53)
constant	179.864 (1159.42)	469.165 (1250.98)	106.808 (1196.00)	409.081 (1259.10)
Adj. R-squared	0.079	0.128	0.094	0.158
<p><math>\Delta C_t</math> is the year-to-year change in coal mining employment in year <math>t</math>, <math>\Delta P_t</math> is the year-to-year change in coal mining employment as a percentage of total employment in year <math>t</math>, <math>\Delta I_t</math> is year-to-year change in the ratio of West Virginia's per capita personal income to that of neighboring states as a whole in year <math>t</math>, <math>R_t</math> is the dummy variable for whether a national recession occurred in year <math>t</math>. Standard errors are in parentheses.</p>				
<p>** significant at the 95% confidence level  * significant at the 90% confidence level</p>				

#### IV. CONCLUSION

Popular discourse in West Virginia attributes the state's population loss to declining coal mining employment. It is alleged that as employment in this sector declines, former or potential coal miners leave their communities for better employment prospects outside the state. This narrative seems further credible considering that the period 1948-1950 marked the high-water mark for both coal mining employment and population in the state. As popular as this narrative is, however, there has been no attempt to empirically analyze this relationship before.

As one part of this larger issue, this thesis empirically examined the purported link between coal mining and migration. It has focused specifically on the relationship between year-to-year lagged changes in coal mining employment and changes in net-migration. Evidence is found for a positive and statistically significant relationship between specifically 1-year lagged changes in coal mining employment and changes in net-migration. It is important to note that this relationship remains regardless of whether coal mining employment is measured in absolute numbers or as a percentage of total employment in the state.

Evidence is also found for a positive, statistically significant relationship between changes in the 1-year lagged per capita personal income ratio of West Virginia to its neighboring states and changes in net-migration. This could be because as the income ratio declines and West Virginians face relatively lower-income prospects at home or become aware of higher-income prospects in neighboring states, they decide to move out of the state. This means that whenever migration into West Virginia increases from increases in the income ratio, people are always moving from a higher-income area (neighboring states) to a lower-income area (West Virginia). This behavior

seems counter-intuitive at first, but the income measures are averages for the entire state and do not consider that changes in income at the local level are more likely to influence migration decisions. People could move from a low-income county in Kentucky to a high-income county in West Virginia, for instance. Or it could be dependent upon an individual's personal connections such that finding a job in West Virginia through those connections is easier than finding a job through other means in that individual's home state. Analyzing data on per capita personal income and migration at the county or municipal level of all relevant states could be productive grounds for further research.

While potential causal mechanisms have been discussed, this analysis does not assert what causal mechanisms link net-migration to either coal mining employment or the income ratio with neighboring states. It only analyzes the association in changes between these variables. Potential omitted variables and causes should give one pause before drafting any policy targeted to coal mining or migration. The decline of coal mining employment being related to out-migration could be a factor of coal mining simply being a higher-income employment sector relative to other forms of employment within the state. Hence the observed out-migration is more a property of the decline of a certain sector of high-income employment rather than any special property of coal or coal mining. There could also be many more even larger factors affecting migration – quality and availability of social services like education and health, access to attractions and amenities like parks and nightlife, and so forth. In addition, migration is only one factor that affects population growth. It is possible that excessive deaths are an even larger factor causing the stagnation in West Virginia's population, which in turn could be the result of public health crises or an aging average population. Further research is needed in order to gain a fuller understanding of the causes and consequences of West Virginia's stagnant population growth and the decline of coal mining.

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