Natural Resources Endowment and Economic Growth in the Southeastern United States

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Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29-August 1, 2007

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This research was funded by USDA NRI GRANT: "Forestry and Community: Creating Local Markets for Local Resources." CSREES Grant No. 2005-00711.

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Introduction

Raw materials are scarce resources essential for manufacture. Historically, economic growth resulted from an expanding manufacturing sector which in turn depended on access to raw materials. Thus, nations fought and negotiated to gain access to abundant natural resources. An area abundant of a natural resource would attract entrepreneurs who would employ the resource in production; new jobs and support industries would follow and the cycle of growth would be perpetuated. Through this process, natural resource abundance came to be associated with the positive aspects of economic growth (Ding and Field, 2004).

Despite strong theoretical evidence indicating that natural resource abundance has a positive impact on economic growth, the reality was often to the contrary. The explosion of automobile production in the early twentieth century ensured that rubber was in high demand, and it was abundant in parts of Southeast Asia. Copper was employed in a number of communications and technology industries and was mined heavily in areas of Montana, Wyoming, Utah, Michigan, and Tennessee. Mineral resources were heavily extracted in the Netherlands and in the Scandinavian countries, and the export of these resources replaced manufacturing and other sectors (Sachs and Warner, 1997). Though these areas specialized in different raw materials, a common thread unites them—over time their economies suffered as a result of the specialization in the production and processing of a particular resource. While the discovery of a desirable resource initially produced positive economic growth, over time resource intensive economies became stagnant.

The study of the Netherlands's slow economic growth and abundant mineral and natural gas resources produced the term "Dutch Disease" which describes the phenomenon of slow growth in an economy dependent upon intensive use of natural resources. In a Dutch Disease economy, the normal channels of growth either do not function or produce perverse results. For example, in a normal economy, trade is a positive channel of economic growth, but for a Dutch Disease economy trade results in imbalances which produce low economic growth. While investments by the government, businesses, and individuals should increase economic growth, Dutch Disease causes these investments to be poorly allocated (Barro and Sala-i-Martin 1995). Dutch Diseases undermine consumption of and investment in education because resource intensive businesses do not reward workers with advanced educations.

For over a century, cotton was the dominant good in the southeastern United States ("South") to such an extent that the economy was almost wholly focused upon cotton's production and processing. In light of cotton's success, states supplemented their cotton income by specializing in the cultivation of another unique good. For example, Louisiana was known for rice, North Carolina for tobacco, Georgia for peaches, and Alabama for peanuts. Advances in preservation techniques, transportation technology, and production efficiency resulted in agricultural production becoming a smaller portion of the southern states' economies. It is important to keep in mind, nevertheless, that historically, economic development in the South was characterized by reliance on the intensive use of local natural resources.

In recent decades, the South has established itself as a dominant producer and processor of forest products. Forest Inventory Assessment (FIA) data provided by the USDA Forest Service reveals that in the 815 counties comprising the states of Alabama, Arkansas, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee, and Virginia, there are 255.22 million acres of land, and over half of it, or 133.25 million acres, is covered by trees (FIA 2006). The sheer size and concentration of forests throughout the south increases the economic importance of forest products because they occupy a huge land area that could be employed by some other industry (e.g., agriculture). Beyond the inherent opportunity costs, forests produce a number of products that compete in the local and global economy such as paper and lumber. In addition, small diameter timber and woody biomass can also be used for fuel, mulch, and other applications. Forests also provide recreational opportunities for hunters, hikers, and nature lovers. Entry into forest cultivation, furthermore, requires precious little advanced training – all that is needed are seedlings, land, and labor for planting and harvesting.

While the production of some agricultural crops declined, forests remain important in the South because of the region's suitable climate and soils and because of increase in demand for forest products generated by the increase in population, new industries, and construction. While imports have replaced domestic agricultural products in part due to cheap transportation methods, it is not yet cheap or time efficient for many forest products (e.g., paper and corrugated paper products) to be transported long distances. As the South's population and industries continue to expand, it would seem reasonable that the demand for forest products will not decrease, and instead will likely increasing (Zhu and Zhang 2006). Henceforth, the economic importance of forests is likely to increase over time, and forest products would remain important product of the South.

While forest production shows no signs of decreasing in value, growth in wages remains low and the overall economic conditions worse than the rest of the country. The South can be seen as an area that has historically relied on a resource intensive economy, and has experienced low level of economic growth. With forests occupying a high proportion of land area, the South is likely to remain a region dependent upon natural resources. Therefore, it would seem important to understand whether or not the South's economy reflects problems of low economic growth associated with Dutch Disease.

Using forest concentration data from Alabama, Arkansas, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, and Virginia, this paper tests whether or not low-level of economic growth is related to forest resource intensity and Dutch Disease. Specifically, cross sectional data from 815 counties are used to evaluate how changes in personal income growth is affected by concentration of forestry resources, government and business investment, educational investment and consumption. We find evidence that the county economies in the South may suffer from Dutch Disease.

The rest of the paper is organized as follows: part two presents the relevant literature, part three describes the empirical model and the data, party four discusses the results, and conclusions are offered in part five.

Review of Literature

Sachs and Warner's 1995 NBER paper, "Natural Resource Abundance and Economic Growth," introduced the concepts of Dutch Disease analysis to the economic research community. They used historical economic data to explain why leading exporters of raw materials had low rates of growth. Before this paper, a sizeable amount of economic history research had been devoted to showing that this phenomenon reflected little more than just a few anomalies. Sachs and Warner developed the main framework of analysis and demonstrated that a Dutch Disease did exist for economies with resource abundance. Resource abundance led to reliance on resource intensive industries, which had no guarantee of long-term stability. Long-term stability in resource intensive industries is conditional upon the resource maintaining value and exclusivity. If the resource is discovered elsewhere and is no longer sufficiently exclusive, prices fall, and the resource intensive industries fail. In addition, the authors determined that endowments of natural resources created an economic structure where normal channels of economic growth had few positive effects, and, in some countries, the abundance of resources had negative effect on economic growth.

Gylfason, and Herbertson used Sachs and Warner's (1995) framework in their , 1999 paper "A Mixed Blessing-Natural Resources and Economic Growth." In this work, they prove that natural resource endowments tend to respond to the organization of primary economics sectors, and that this was often the source of the "smothering" effect that seemed to slow economic growth. They reasoned that a society could choose certain economic practices which were very suitable for natural resource-based industries; however, it also creates a system where society's choices lead to poor investments in education and business.

Gylfason (2001) continued to examine the role of education in Dutch Disease economies. He examined economic growth as a function of natural capital, educational enrollment, educational investment, and a measure of initial wealth. He determined that the negative effects of natural capital outweigh any positive contributions offered by investment in education and the economy's resource endowments. He demonstrated that natural resource-based industries create a work force which is not highly skilled. Therefore, this work force is left with few job alternatives when structural shifts in employment occur.

Research from the same period confirms Gylfason's arguments that educational choices tend to create cyclical poverty. For example, Manning (2004) argues that communities choose to invest human capital in their resource-based economies; as a result, poor educational systems develop and have ramifications for future generations. By examining the effects on future generations, Manning clearly shows that poor education choices resulted in low returns to investment in education. This creates a continuous process that extends over time to multiple generations and explains how low rates of economic growth persist over time. Stijns (2003) also identifies a negative correlation between measures of natural capital and investment in education. This Dutch Disease literature reveals that educational investment may be negated by the policies and institutions resulting from economies heavily dependent upon natural resources.

The role of institutions, both private and public, is integral to conducting Dutch Disease analysis. When public institutions of government do not work to ensure social equality—in terms of equal access to healthcare, employment opportunities, and educational availability—the effects of Dutch Disease appear far more prevalent (Zoega 2001). The literature also concludes that the relationship between Dutch Disease and weak public institutions is synergistic. In other words, Dutch Disease due to natural resource abundance can worsen the quality of weak public institutions, which, in turn, makes weak public institutions intensify the existing Dutch Disease.

The literature also shows that particularly weak (corrupt or unstable) governments have an effect on the quality and size of economic growth but that the final effect is dependent upon the severity of the Dutch Disease. On the other hand, Kronenberg (2003) establishes that inefficient institutions result from a nation's Dutch Disease, but are not the source of the negative growth in weak economies predisposed to Dutch Disease.

Following this literature, this paper tests whether or not the South's economy suffers from Dutch Disease. Through measures of income growth, resource intensity, and government, business, and educational investment, this paper tests to see if such growth channels behave as though they exhibit Dutch Disease. The results from this paper compare favorably with the results established in the Dutch Disease literature.

Empirical Framework and Data

The empirical model uses data form 815 counties from the states of Alabama, Arkansas, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee, and Virginia. These states represent the cultural, geographic, and economic array of the Southeast. In particular, Kentucky, Louisiana, and Arkansas represent poor states; Alabama, Tennessee, and Georgia represent more affluent states; while North Carolina, South Carolina, and Virginia represent the most affluent states in the sample. Furthermore, there is representation of the progressive New South culture, as well as the traditional Deep South and the Appalachian influenced cultures. Consequently, this sample of states should not hold any biases resulting from regionally specific cultural, geographic, or economic nuances.

Following the Dutch Disease literature we estimate an empirical model of the form:

$$\textit{Income Growth} = \beta_1 \textit{Constant} + \beta_2 \textit{ Forest Concentration} \quad (1)$$
$$+ \beta_3 \textit{Per Pupil Expenditures} + + \beta_4 \textit{ Business Payrolls} +$$
$$\beta_5 \textit{ Federal Expend Per Capita} + \beta_6 \textit{ Education Consumption} + \varepsilon$$

The data on economic growth comes from the United States Census Bureau. A one year *Growth in Personal Income* was computed as the log difference between the years 2003 and 2002 and represents how individual personal incomes grew across the sample of 815 counties. This variable is used as the dependent variable. The explanatory variables are the standard channels of growth. In the absence of Dutch Disease, the explanatory variables should have positive impact on growth but if Dutch Disease is present, they could have negative or no impact.

According to Zoega and Gylfason (2001) government investment in Dutch Disease economies does not produce normal rates of growth because of corruption or misallocation. Dutch Disease economies are dependent upon a specific industry, and government institutions develop in response to the industry and not in response to the needs of citizens. Government accordingly acts as a support system for the natural resource intensive industry and neglects services needed by citizens; hence, government expenditures are inefficiently allocated. Because governments in Dutch Disease economies misallocate resources, increases in government expenditures may not result in positive economic growth, as the capital is often invested in areas that are no longer viable.

Historically, this process of misallocation matches the tendency of state governments within the Southt. North Carolina kept offering tax breaks and subsidies for its tobacco industry, even though tobacco had become a "social leper" as a cash crop. Louisiana's shellfish producers have faced stiff competition from more efficient foreign imports, but the state arduously maintained its support for the local industry.

Over the years, the forestry industry has also been protected. The federal government has maintained extensive areas of natural forests in parts of the South, and has used federal agencies to help support the cultivation and maintenance of forest lands. National forest lands are made available for logging, and organizations such as the USDA and USFS support programs and research that ensures the continued quality and sustainability of both private and National Forests. The primary source of governmental support provided to the forest products industry takes the form of property tax assessments that are discounted below the rates charged for other industries. This is true both for land and for industrial facilities (Joshi et al. 2000).

Dutch Disease in the South should manifest itself by causing *government expenditures* to be ineffective in increasing economic growth (Kronenberg 2003). The growth channel of government investment is represented by the 2003 Per Capita Federal Expenditures. The data represent a combination of Federal Funds on a per capita basis. This variable was chosen as proxy for government investment because it represents the full array of federal payments into a county, as well as how the money is distributed as the result of being calculated on a dollars per capita basis, and was acquired from the United States Census Bureau's collection of County Business Patterns statistics.

Business investment is another component of the investment channel that may be distorted by Dutch Disease, and must be analyzed to determine how private investment affects growth. In a non-Dutch Disease economy, business investment serves to expand output or improve productivity by making extra capital outlays on business operations. The increased capital outlays may increase employment, utilization of technology, or may improve facilities or working conditions, all with the intent of making business operations more efficient. In a Dutch Disease economy, public institutions may be so flawed and inefficient that business investments are negated such that no positive returns are produced (Gylfason, et al 1999).

In addition, Dutch Disease economies specialize in resource intensive industries, and there are few incentives for citizens to pursue higher education or advanced training. Hence, when businesses invest in technology, they find their workforce unable to efficiently implement the new technologies. What's more, graft and institutional corruption negate the positive effect of business investment in Dutch Disease economies. Regulatory bodies may ignore code infractions or substandard construction techniques, and, consequently, private investment is wasted on inadequate improvement projects. Thus, if *business investment* does not have a positive impact on growth, it would be another indicator that Dutch Disease is present.

Business investment is measured by the county level private payrolls and comes from the County Business Statistics of the Bureau of Economic Analysis (2007). It is in thousands of dollars, and represents all business interests in a county. In the presence of

Dutch Disease, this variable should have either an insignificant or negative impact on growth.

Educational investment and *consumption* represent two additional channels of growth which may become distorted in Dutch Disease economies. Educational investment represents funds used to provide educational instruction to a county's citizens, and educational consumption represents the rate at which citizens accumulate human capital through pursuing education. Dutch Disease economies specialize in a resource intensive industry that utilizes little formal training on the part of workers; thus, citizens who chose to work in the resource intensive industry do not perceive a need for advanced formal education. Because of the small demand for formal education, schools in general suffer in quality due to lack of participation, under-funding, or misallocation of funds. The combination of poor quality schools and apathetic citizens makes for a dangerous combination because successive generations become uncompetitive on a global scale, and consequently cannot perform jobs outside the resource intensive industries that they're trained for.

The southeastern United States has long had a reputation for being apathetic towards education. Historically, southern teacher salaries have remained some of the lowest in the nation, high school drop out rates remain some the highest in the nation, and low numbers of high school graduates receive college degrees. These conditions are symptomatic of Dutch Disease, in that southern children have traditionally had the option of dropping out of school and working in the manual labor environments of the logging, and forest products industries (Manning 2004).

Educational investment is measured by per pupil expenditures in a county. Per pupil expenditure is calculated by the individual states' Department of Education, and represents the county average per pupil expenditure of federal, state, and local funds. *Educational consumption* is measured by the number of county citizens with high school degree and with four year college degree using Census data.

Resource intensity is the key to detecting the presence of Dutch Disease in an area, and it is often the most difficult variable to estimate. Resource intensity demonstrates how concentrated a resource is in a particular area and, thus, represents the resource's availability to be employed in a resource intensive industry (Sachs and Warner, 1997). When a natural resource is concentrated in an area, it is likely to be used for the manufacturing and, in addition, there will be ancillary industries that support production through harvesting and processing. The dependence upon one resource creates enclave effects, where workers and businesses develop specializations which only apply to the resource intensive industry (Stijns, 2004). While the resource remains a viable economic good, such areas prosper and maintain reasonable standards of living. When the resource runs out or is replaced in use by some other good, the resource dependent enclave economy tends to falter and fails to maintain growth and standards of living. This pattern typifies Dutch Disease economies and can be detected through observing a resource concentration that has a negative effect on economic growth.

Forest concentration is the resource intensity variable. It was estimated by first determining the total forest acres in the 815 counties making up the data sample and then dividing it by the total county acres. Data on total forest acres per county were obtained from the Forest Inventory Analysis branch of the United States Forest Service. Total county land acreage was determined by converting land area from square mileage estimates provided by the US Census to total acres. Hence, the resource concentration variable is the percentage of total county acreage occupied by forests. In the presence of Dutch Disease, high resource concentration is associated with low economic growth because the usual channels that promote economic growth function inappropriately.

Results

Table 1 presents the summary statistics and Table 2 presents the correlation coefficient between the variables in the model. Regression results are presented in Table 3.

Equation 1 was first estimated using OLS and log-transformed variables. The overall R^2 was equal to 0.20, with an F value of 12.09. Results from value inflating factor (VIF) for Model 1 was computed at 6.73 and further tests revealed that although the variable for high school graduates was statistically significant, it was multicollinear with the variable for college graduates. Thus, in Model 2 only the variable measuring the percentage of college graduates was included.

Model 2 has an R^2 of 0.19, with F statistic of 14.38, and a lower VIF of 4.53. The Breusch-Pagan test revealed a highly significant Chi^2 for heteroscedasticity, so Model 1 and 2 were both re-estimated using robust standard errors. Robust estimates for Model 1 and 2 are presented in Table 3. Davidson and MacKinnon's J-test was used to determine if the models' specification in log form was acceptable, and the tests revealed that these were the preferred specifications.

Model 2 indicates that resource concentration, per pupil expenditures, the number of college graduates, and federal expenditures are statistically significant in explaining economic growth. For the Southern states considered in this analysis, increases in tree concentration results in lower economic growth, such that a one percent increase in resource concentration reduces income growth by -0.021 percent. When a resource endowment stifles economic growth instead of encouraging it, it is considered as evidence that the economy is suffering from Dutch Disease.

Educational investment is statistically significant at the 10% level, and while it has a positive impact, the coefficient is small (0.009). This indicates that a 1% increase in educational investment through per pupil expenditures creates only a .009% increase in economic growth. Manning's 2004 study demonstrates that educational investment is traditionally a strong channel of economic growth, but for Dutch Disease economies, educational investment is a weak method of stimulating economic growth. The results are consistent with the idea that educational institutions in Dutch Disease economies can not improve their quality and modernize curriculum quickly enough to overcome their history of low quality education and instruction.

The *educational consumption* results support the above results. The estimates for college graduates indicate that one percent increase in college graduates decreases economic growth by -.005% (Model 2). On the other hand, the results from Model 1 indicate that the percentage of high school graduates is positively related to economic growth. It seems that the traditional forest- and logging-based jobs available in the South may benefit lower-skilled workers with high school degree, and may not offer college graduates opportunity to advance or build skills consistent with their training. However, from Model 3, which includes interaction term between forest concentration and college graduates, it is clear that forest concentration and large number of college graduates could interact to accelerate economic growth.

The measure of business investment—*business payrolls—is* not statistically significant. Such results, according to Zoega and Gylfason (2001), indicate economies suffering from Dutch Disease. The variable for *federal expenditures* produces a small positive contribution to economic growth and support the hypothesis of Dutch Disease in the Southern states that make up the sample.

Conclusion

This paper studies the link between economic growth and resource endowment in the Southeastern United States. The results indicate that the South shows signs of Dutch Disease because concentration of forests affects negatively economic growth.

As much as this provides an answer to the question of why the South may have low levels of economic growth, it raises a more important question- 'What can be done to overcome Dutch Disease ?'. The answer is hinted by the results suggesting that forest concentration and large number of college graduates could interact to create positive economic growth. Improving educational opportunities available to Southerners is a possible solution. An example of such policy comes from the acceleration of economic growth in Georgia since the introduction of HOPE scholarship aimed at increasing the number of college graduates within the state.

Another possible solution is working within communities to facilitate more active markets in small areas, so businesses and individuals can use local resources to satisfy their local needs. It may also be necessary to explore the channels through which government, business, and educational investment affect economic growth in the Southeast. The amount of money being spent may be adequate to stimulate economic growth, but the current spending policies may need to be improved.

Previous research has indicated that a holistic approach must be undertaken to improve economic conditions in areas affected by the Dutch Disease. It may be necessary to redesign policies to promote education, improve efficiency of business and government investments in forest-dependent communities. “Curing” the Dutch Disease must involve finding a balance between the continued existence of forestry-based businesses and more diverse job opportunities for communities.

Table 1. Descriptive Statistics.

Variable	Observations	Mean	Standard Deviations	Min	Max
Log Difference of Income 2002-2003	815	0.029	0.031	-0.084	0.251
Log of Population w/ HS Diploma	815	8.806	0.925	6.146	11.892
Log of Population w/4 year Degree	815	7.809	1.309	4.691	12.787
Log of Per Pupil Expenditures	815	8.770	0.2184	8.139	9.596
Log of Federal Expenditures	815	8.668	0.388	7.355	10.615
Log of Business Payrolls	815	12.04	1.514	7.206	17.343
Tree Concentration	815	-0.777	0.520	-4.343	-0.044

Table 2: Correlation Coefficients

	Income Growth	*Resource Concentr.*	*Per Pupil Expend*	*Business Payrolls*	*High School Graduates*	*College Graduates*	*Federal Expend*
Income Growth	1.000						
Resource Concentration	-0.294*	1.000					
Per Pupil Expenditures	0.053	0.064	1.000				
Business Payrolls	-0.156*	-0.221*	-0.026	1.000			
High School Graduates	-0.158*	-0.191*	-0.069*	0.941*	1.000		
College Graduates	-0.174*	-0.212*	0.015	0.946*	0.942*	1.000	
Federal Expenditures	0.257*	-0.040	0.080*	-0.122*	-0.177*	-0.160*	1.000

* significant at the % percent level

Table 3. Regression Results

	Model 1	Model 2	Model 3
Constant	-0.216	-0.169	0.236
	(3.60)***	(3.04)***	(2.55)**
Tree Concentration	-0.021	-0.021	0.461
	(6.46)***	(6.30)***	(3.88)***
Per Pupil Expenditure	0.011	0.009	-0.028
	(2.13)**	(1.76)*	(3.32)***
Business Payrollls	-0.003	0.000	0.000
	(-1.3)	(-0.21)	-0.2
High School Graduates(#)	0.008		
	(2.34)**		
College Graduates(#)	-0.008	-0.005	0.000
	(2.88)***	(2.19)**	0.000
Federal Expenditures	0.018	0.017	0.002
	(6.10)***	(5.90)***	-0.35
*Forest Concentration*PPE*			-0.045
			(4.03)***
*Forest Concentration*Fed Exp*			-0.016
			(2.16)**
*Forest Concentration*College Grads*			0.007
			(5.39)***
Observations	815	815	815
R^2	0.20	0.19	0.27

The dependent variable is the log difference in individual income growth between 2003 and 2002.
t-values are in parentheses
* significant at the 10 percent level
** significant at the 5 percent level
*** significant at the 1 percent level

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