The Interactions Between Economic Growth and Environmental Quality: A Comparison of the TVA Region with the United States as a Whole

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About the Author

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"TVA's mission includes the protection of the public good by caring for the land, water, and other natural resources of the Tennessee Valley."

"TVA: Dedicated to Environmental Quality." http://www.tva.gov/environment/

Introduction

The relationship among economic growth, in terms of job opportunities, income, and environmental quality has been a source of great controversy for a very long time. Is economic development incompatible with environmental quality? What is the effect of an increase in employment or wages on the environment in a particular industry? How do environmental conditions or regulations influence firm location and expansion decisions, and thus economic growth in a community?

At one extreme, some economists have argued that greater economic activity inevitably leads to environmental degradation or that spending resources for environmental protection and environmental improvement results in slower economic growth and the loss of jobs. At the other extreme, is the belief that environmental problems worth solving will be addressed automatically as economic growth proceeds. The ongoing nature of this debate has been mostly due to the lack of substantial empirical evidence on how environmental quality changes with increased economic activities and higher income levels and vice versa (Shafik, 1994; Byrne, 1997).

Objectives

This paper examines the interactions between environmental quality and economic activities in TVA counties and compares the results to similar conditions at the national level(Johansson 2000).

Two main hypothesizes are tested:

- ***The first is whether communities with higher recorded levels of pollution experienced slower employment growth rates but increases in per-worker earnings growth rates. Higher earnings would reflect reduced labor supplies and the need to compensate remaining workers for the higher pollution levels.***

We expect higher levels of pollution to have a negative impact on employment growth due to the following reasons:

(a) Better environmental quality attracts more skilled workers at lower wages and firms have access to those workers more easily in regions where environmental quality is higher (Izraeli and Mobley, 1995; Gottlieb, 1995).

(b) Production costs may be lower in regions with higher environmental quality if cleaner air and water result in lower rates of sick leaves and higher worker productivity (Goetz, Ready, and Stone, 1996).

(c) Executives of firms prefer to live in less-polluted areas (Wheat, 1986; Plaut and Pluta, 1983; Schemmer et al., 1987; Gottlieb, 1995; Schmenner, 1982; Calzonetti and Walker, 1991).

We also expect that higher pollution will have a positive impact on earnings growth since workers require higher wages to compensate them for working in more polluted areas (Izraeli 1987; Roback 1982; Blomquist et al., 1988, among others). Also, utility-maximizing individuals may migrate out of polluted areas, decreasing the labor supply, which in turn places upward pressure on wages.

- ***The second hypothesis is that higher earnings and lower employment growth rates contribute to decreases in pollution growth rates, resulting in better environmental conditions in a county, ceteris paribus.***

The usual hypothesis is that earnings and environmental quality are positively correlated, since as earnings rise, the demand for environmental quality increases through an income effect, as do the public and private resources available for environmental improvement and clean-up (Grossman and Krueger, 1995; Hilton and Levinson, 1998; Seldon and Song, 1994; Stern et al., 1996; Shafik, 1994; Goetz et al., 1998).

Increases in employment might increase pollution-intensive activities in the region due to a scale effect. "The scale effect reflects the increase in the level of economic activity in the relevant jurisdiction, holding constant the techniques of production and composition of final output" (Copeland and Taylor, 1994). However, if "clean" ("dirty") industries experience employment growth but the "dirty" ("clean") industries contract, we would realize a decrease (increase) in the amount of pollution created. This is called the composition effect. We hypothesize that the scale effect dominates the composition effect and expect a positive relationship between employment and pollution growth rates. However, given that this is an empirical matter, we are interested to see what our simultaneous model will conclude.

Thus, this study attempts to determine whether employment and per-worker earnings growth rates in a county affected per-worker pollution growth rates and whether pollution growth rates, in turn, affected growth rates of employment and per-worker earnings in the TVA region, using a three-stage least squares estimation.

The study tests the above hypotheses for all industries combined, as well as for five major industry divisions, including agriculture; manufacturing; transportation, communication and utilities; retail trade; and services.

Previous Work

Factors that influence the location decision of firms have interested researchers and government decision-makers for many years. What determines business location and expansion decisions? Do unions discourage new business? How important are wage rates or the level of human capital on business activities? What is the effect of tax differentials, or tax incentives, on the location or expansion decisions of firms? Effects of tax differentials or tax incentives on the location and expansion decision of firms are examined by Carlton (1983), Wasylensko (1991), Bartik (1989), Newman-Sullivan (1988), Papke (1991), and in the volume edited by Herzog and Schlottman (1991), while

the impacts of wages, unionization, human capital and energy price differences are studied by Goetz (1997), Goetz, Hu and Debertin (1996), Bartik (1985), Miernyk (1977), Wasylensko and McGuire (1985), and Plaut and Pluta (1983).

Although these variables (unionization, fiscal policies, wages, human capital, energy price differences) remain important in location theory and in empirical studies, more recently, quality of life and environmental concerns of the public and local governments have brought an additional dimension to firm location studies. Especially, environmental regulations that deal with a range of concerns, including clean air, clean water and hazardous waste disposal, is believed to create a significant new influence on economic activity and firm location decisions. Even though regulations are defined at the national level, implementation and enforcement is done by state and local authorities, while some states impose additional regulations of their own. So there are clear, significant differences among states in terms of the degree of stringency for environmental regulations and compliance costs.

Economists often argue that more stringent environmental regulations impose higher operational costs on profit-maximizing firms, and this in turn results in lower plant birth rates, less expansion, and higher rates of plant closures in areas where the environmental regulations are more strict. For example, surveys such as the Economic Research Service's rural manufacturing survey reveal that environmental regulations are the third major local problem facing manufacturers, following quality of labor, and taxes.

Many recent studies empirically test whether environmental regulations really affect firm location decisions (Wayne, 1997; Izraeli and Mobley, 1995; Bartik, 1988; Stafford, 1985; Levinson, 1996a, b; McConnell and Schwab, 1990; Mo and Abdalla, 1997). Many of these studies find weak or insignificant effects of environmental regulations on firm location and expansion decisions, and argue that compliance costs of environmental regulations are small relative to other costs, so they do not have a major impact on firm location and expansion decisions. However, none of the studies consider the simultaneous interactions among environmental regulations, environmental quality, and wages on industry location decisions. Izraeli and Mobley (1995) conceptually raise this issue and state that strict environmental regulations developed to increase the environmental quality might actually attract firms to an area. They argue that higher environmental quality might result in lower wages due to larger supply of labor. Indeed, there is a large amount of literature suggesting workers migrate to regions with better environmental quality (Cebula and Vedder, 1973; Graves and Linneman, 1979; Graves, 1980 and 1983; Carlino and Mills, 1985; Knapp and Graves, 1989; Greenwood and Hunt, 1989; and Clark and Cosgrove, 1991, among others). Also, the literature on compensating wage differentials suggests that workers accept lower wages in exchange for a higher quality of life (Izraeli, 1987; Roback, 1982; Blomquist et al., 1988). Further, firms might recruit unique skilled workers to the area where environmental quality is higher, much more easily and cheaply.

A review of the literature reveals that many studies examine various portions of the larger problem. While some

examine the interactions between the growth rates in employment and wages, some focus on the relationship between environmental regulations or quality and firm location and expansion decisions. Some others study the interactions between wages and environmental quality, or the interactions between worker migration and environmental quality. However, none of the studies empirically analyze the simultaneous interaction among environmental quality, wages and the location or expansion decisions of firms. However, it is clear that the different variables that affect a county's growth rate cannot be separated from one another. For example, higher earnings growth in a county is expected to be associated with reduced employment growth, ceteris paribus. However, a cleaner environment induces workers to accept lower wages and can help firms to recruit skilled workers at a lower wage. Conversely, firms that locate in a county with lower environmental quality may discharge higher levels of emissions that, in turn, deter other firms from locating in that area.

Ignoring these simultaneous interactions can yield biased results and inappropriate policy recommendations. Only a simultaneous analysis of wages, employment, and environmental conditions can reveal the trade-offs among these variables and the direct and indirect effect of various public policies. Johansson (2000) recognizes these trade-offs among employment, wages, and environmental conditions, and simultaneously analyses the interactions among the three variables. Yet, her study is quite aggregate in nature, since she examines these interactions for the United States as a whole. However, all regions in the United States have their differences and are likely to react differently to the same broad set of influences. Therefore, this report analyzes the interactions among the growth rates of employment, wages, and pollution in the TVA region to assess how well TVA counties have done relative to the nation as a whole.

Methodology and Data

To analyze the impacts of pollution on economic growth and vice versa, a regression analysis is conducted based on a model developed by Johansson (2000). This framework allows controlling for factors thought to influence the growth rates of the endogenous variables—the growth rates of employment, earnings, and pollution—thus providing an estimate of the marginal influence of the relations of interest. A three-equation model is specified as follows to analyze the interactions among these three endogenous variables:[1]

$$\Delta EMP = a_{10} + a_{11}EMP_o + a_{12}W_o + a_{13}E_o + \Gamma X_0 + b_{12}\Delta W + b_{13}\Delta E + u_1 \ldots\ldots\ldots\ldots (1)$$

$$\Delta W = a_{20} + a_{21}EMP_o + a_{22}W_o + a_{23}E_o + \Theta S_0 + b_{22}\Delta EMP + b_{23}\Delta E + u_2 \ldots\ldots\ldots (2)$$

$$\Delta E = a_{30} + a_{31}EMP_o + a_{32}W_o + a_{33}E_o + \vartheta Z_o + b_{32}\Delta W + b_{33}\Delta E + u_3 \ldots\ldots\ldots\ldots\ldots (3)$$

where ΔEMP, ΔW, ΔE represent percentage changes in employment, earnings, and pollution in the TVA region between 1987 and 1995; EMP_0, W_0, E_0 measure their initial levels; X_0, S_0, Z_0 respectively, are groups of county-level independent control and socioeconomic variables in each equation measured at their 1987 initial levels; Γ,

[1] For detailed information on the specifications of model and the included control variables see Johansson (2000).

Θ, ϑ are sets of parameters to be estimated; and u_1, u_2, u_3 are error terms. Variable selection of *X, S,* and *Z* were guided by previous empirical studies.

Explanatory variables for employment growth include labor force factors such as unionization, education, availability of labor supply (measured by unemployment rate); market characteristics (population density, industry density); access to markets (dummy variables measuring factors such as presence of an entry/exit ramp to an interstate highways, proximity to railroads, seaports, and airports); electric and land prices; fiscal and regulatory variables, including property tax rates, per capita public expenditures, unemployment and workers compensation benefit systems, environmental regulations; environmental conditions and local specific amenities (amenity index, pollution level); and urbanization measured by metro dummy.

Explanatory variables included in the earnings growth equation are workers characteristics such as education, ages, gender, race; labor market conditions (union, firm size, unemployment rate); unemployment benefits; housing cost; environmental conditions and amenities; and urbanization. The pollution growth equation includes formal regulations (green policies), education, population density, firm size, as well as the degree of urbanization, as explanatory variables.

Data on employment (total full- and part-time) and per-worker earnings is obtained from the U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996 (see Figures 1-4 for initial employment levels, employment growth, initial per-worker earnings and earnings growth for all industries combined). Data for per-worker pollution is constructed from Rosebank Research and Statistical Analysis, Environmental Impact data (1997), and Department of Commerce, County Business Patterns, county data, 1987 (see Figures 5 and 6 for initial per-worker pollution levels and per-worker pollution growth for all industries combined).

Rosebank Research and Statistical Analysis, Environmental Impact data (1997) contains nationally-representative coefficients on total, air, water, land, and underground pollution, plus, public sewage and offsite treatment pollution measured in pounds per employee for 166 industrial sector aggregations. We used the total pollution pounds per employees coefficients to construct the initial pollution levels and per-worker pollution growth, assuming that the technical coefficient for pollutants per worker have not materially changed over time. This is done by allocating total pollution amounts per worker to each Standard Industrial Classification (SIC) category in 1987 and 1995. The employment numbers for both periods are derived from the Department of Commerce's County Business Patterns data for all 4 digit SIC categories. The non-disclosed employment is estimated from the information contained in the County Business Patterns data using the Kreahling, Smith, and Frumento (1996) method. After obtaining the employment numbers for 4 digit SIC categories in each county, all SICs from County Business Patterns data are matched with SICs from Rosebank Environmental Impact data. Next, the total pollution level in each county is calculated by multiplying the number of employees in each SIC category by pollution pounds per employee coefficients in that SIC category and then summing them up in both periods 1987 and 1995. Dividing the county total pollution level by total

employment in each county in 1987 and 1995 then gives us per-worker pollution levels for both periods. Percentage changes in total per-worker pounds of pollution released between 1987 and 1995 are easily calculated.

Data on green policies that reflect states rankings on 77 environmental policies and programs were obtained from the Hall and Kerr green index book (1991). The amenity index was obtained from Lorin Kusmin, USDA/ERS. This index includes three variables that measure the natural amenities: climate, topography, and bodies of water. Data for most of the other independent variables are complied from well-known sources such as Department of Commerce's U.S.A. County Data, State Energy Price and Expenditures Data System (1987), and the U.S. Department of Agriculture. Tables 1-6 present summary statistics of the variables included in the TVA study.

Estimation Results

This study empirically analyzes the relationship between percent changes in employment, earnings per worker and pollution per worker in TVA counties. The results are compared to results obtained from Johansson (2000) to assess how well TVA counties have done relative to the United States as a whole.

All Industries Combined

As expected in a cross-sectional model estimated with a large data set, the total explanatory power of the model is quite low (System weighted R^2=0.24). Convergence across all TVA counties over time was observed for per-worker pollution, earnings per-worker, and also for employment. The proposed simultaneous interaction among the growth rates of employment, earnings, and pollution is partially supported: three of the six variables were statistically different from zero.

The study revealed that while higher initial per-worker pollution levels and pollution growth rates had a negative and statistically significant effect on employment growth rates in the nation as a whole, they had no effect in the TVA region. These results suggest that even though U.S. counties in general can stimulate economic activity by increasing environmental quality, counties in the TVA region are indifferent with respect to their environmental quality in creating new jobs.

Higher initial per-worker pollution levels and pollution growth rates were negatively associated with per-worker earnings growth rates in both instances. For each ten-percent increase in initial per-worker pollution and per-worker pollution growth rates, per-worker earnings growth rates fell by 0.86 and 0.32 percentage points respectively (Table 13) Our results, which counter those of previous studies (Izraeli 1987; Roback 1982; Blomquist et al., 1988, among others), may be due to the fact that the pollution variable used in this study only accounts for the pollution created in the county and ignores spillover effects of pollution from adjacent counties (transboundary pollution) as well as consumption-related pollution. Therefore, our study might underestimate the impact of pollution on the rate of growth of per-worker earnings and employment, and the results should be interpreted cautiously. In sum, the TVA region study rejects the first hypothesis.

In terms of the second hypothesis tested, Table 7 reveals that higher initial levels of employment had no statistically significant effect on pollution growth rates in either instance. Even though faster employment growth rates were

associated with lower per-worker pollution growth rates in U.S. counties as a whole, employment growth rate had no statistically significant effect on per-worker pollution growth rates in the TVA region. These results suggest that while U.S. counties in general experienced employment growth mostly in cleaner industries over the period 1987-1995, employment growth possibly occurred in both types of industries—"clean" and "dirty"— in TVA counties.

Higher initial levels of earnings per worker and per-worker earnings growth rates were associated with lower per-worker pollution growth rates in both cases. One possible reason for this negative correlation is that, as earnings rise, the demand for environmental quality increases through an income effect, as do the public and private resources available for environmental improvement and clean-up. Elasticities reveal that per-worker pollution growth rates in the TVA region are more sensitive to initial per-worker earnings levels and to per-worker earnings growth rates than the nation as a whole (while the elasticity of per-worker pollution growth with respect to initial per-worker earnings and per-worker earnings growth is 6.18 and 2.52 in the United States, it is 38.56 and 3.23, respectively, in the TVA region (Tables 13 and 14)). Therefore, communities whose objective is to increase environmental quality should try to attract high-paying and low pollution intensive industries. Hence, we confirm the first part of our second hypothesis that higher earnings contribute to decreases in pollution growth rates, resulting in better environmental conditions in a county, ceteris paribus.

The study also attempted to determine the relationship between the number of jobs created and the quality of these jobs, measured in the form of earnings per job. The results reveal that TVA counties with higher initial employment levels and higher employment growth rates experienced higher earnings growth rates (for each ten-percent increase in initial employment levels employment growth rates, earnings growth rates increased by 0.17 and 1.1 percentage points respectively, see Table 13), suggesting faster employment growth in high-paying industries. Yet, employment growth occurred at the expense of reduced earnings growth rates at the national level.

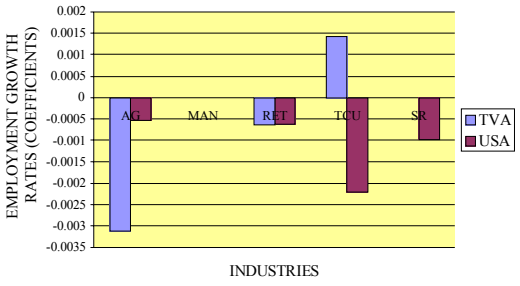
For each ten-percent increase in initial per-worker earnings, the rate of employment growth declined by 10.1 and 6.09 percentage points in the TVA region and for the United States, respectively (Tables 13 and 14). This result implies that jobs were not attracted to counties with higher initial per-worker earnings, lending support to economic theory, previous surveys, and empirical studies (Statford 1985; Schemmer, 1982; Carlton, 1979; Wheat, 1986; Bartik, 1985; Wasylenko and McGuire, 1985). On the other hand, earnings growth rates had no statistically significant effect in the rate of employment growth in the TVA region.

Individual Industries

When we focused on the individual industries (Tables 8-12), the hypothesized simultaneous interactions among the growth rates of employment, per-worker earnings, and per-worker pollution were also partially supported. Convergence across all TVA counties over time was observed for per-worker pollution levels and per-worker earnings, but not for employment in all industries studied.

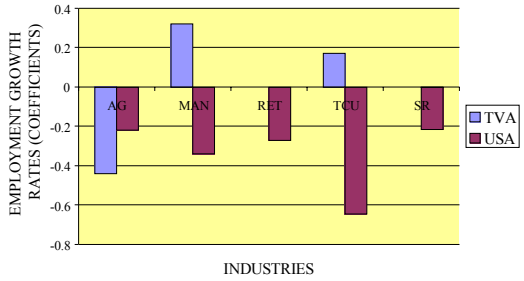
For individual industries, the study showed (Tables 8-12 and Figure 1[2]) that the effect of initial per-worker pollution levels on employment growth rates was negative for agriculture and retail trade but positive for the transportation, communication, and utilities industries in the TVA region. However, the effect was negative and statistically significant for almost all industries in nationwide study. These results imply that TVA counties with lower initial per-worker pollution levels had an advantage in creating new jobs in agriculture and in retail trade industries. Yet, TVA counties with relatively higher pollution levels experienced faster employment growth rates in the transportation, communication, and utilities industries.

FIGURE 1: THE EFFECT OF INITIAL PER-WORKER POLLUTION LEVELS ON EMPLOYMENT GROWTH RATES



Tables 8-12 and Figure 2 also show that counties that had lower per-worker pollution growth rates were at an advantage in stimulating employment growth rates between 1987 and 1995 in all industries in the nationwide study. The TVA study is consistent with the findings of the nationwide study—the greater the reduction in pollution per worker in a county, the faster the employment growth in that county—only for agriculture. It counters the nationwide study for the manufacturing, transportation, communication, and utilities industries. Thus, TVA counties whose objective is to increase employment growth rates in transportation, communication, utilities, or manufacturing industries, may be able to forgo investments in environmental quality. However, if the objective is to increase agricultural employment growth rates, authorities should impose policies that would decrease the pollution growth rates in that county.

FIGURE 2: THE EFFECT OF PER-WORKER POLLUTION GROWTH RATES ON EMPLOYMENT GROWTH RATES



Initial pollution levels and pollution growth rates were positively associated with per-worker earnings growth in all of the industries studied except for services in nationwide study (Figures 3 and 4). However, counties in the TVA region with higher initial total pounds of per-worker pollution levels and higher pollution growth rates experienced lower per-worker earnings growth in all industries except for manufacturing (Figures 3 and 4). These results suggest that only manufacturing workers do require, and only manufacturing firms do pay, higher wages in more polluted areas in the TVA region.

[2] Figures 1-12 present only statistically significant coefficients.

FIGURE 3: EFFECT OF INITIAL POLLUTION ON PER-WORKER EARNINGS GROWTH RATES

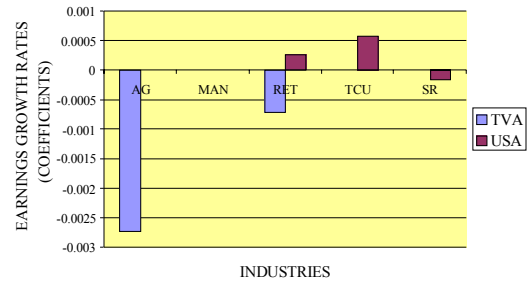


FIGURE 4: THE EFFECT OF POLLUTION GROWTH RATES ON EARNINGS GROWTH RATES

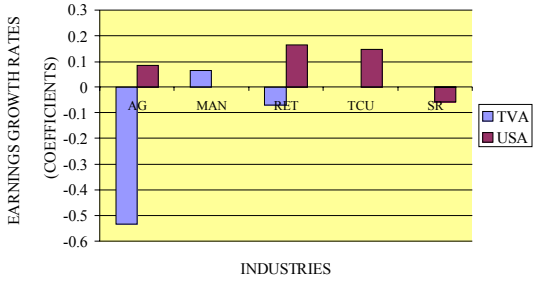


FIGURE 5: THE EFFECT OF INITIAL EMPLOYMENT (1000 JOBS) ON PER-WORKER POLLUTION GROWTH

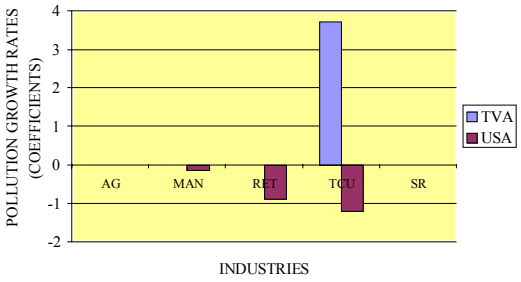
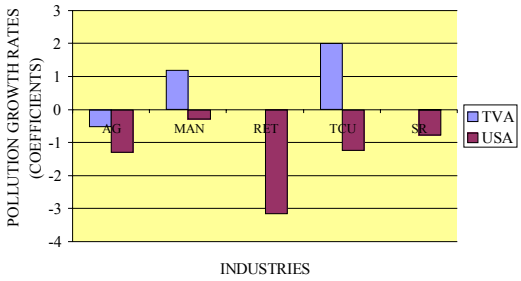


FIGURE 6 : EFFECT OF EMPLOYMENT GROWTH RATES ON PER-WORKER POLLUTION GROWTH RATES



At the national level, counties with higher initial employment and higher employment growth rates experienced lower pollution growth rates in all the industries studied. However, in the TVA region, the effect of initial employment was statistically insignificant for all industries, except for transportation, communication, and utilities, where it was significant and positive. In addition, while higher agricultural employment growth rates led to lower pollution growth rates, higher manufacturing and transportation, communication, and utilities employment growth rates led to higher pollution growth rates. These results suggest that while the composition effect dominated in agriculture, the scale effect dominated in the manufacturing, transportation, communication, and utilities industries in the TVA region over the period 1987-1995.

Higher initial levels of earnings per worker were associated with lower per-worker pollution growth rates in transportation, communication, and utilities for the TVA region, and in the agriculture and retail trade industries for the United States as a whole (Figure 7). Effect of the growth rates of per-worker earnings on the growth rates of per-worker pollution was significant and negative for the retail trade industry. The effect of per-worker earnings growth rates on per-worker pollution growth rates was positive for all industries in the nation, which is unexpected since as earnings rise, the demand for environmental quality rises, as do the resources available for environmental improvement and clean-up (Figure 8). These results suggest that TVA counties whose objective it is to increase environmental quality should try to attract more transportation,

communication, utilities, and retail trade industries.

FIGURE 7:THE EFFECT OF INITIAL PER-WORKER EARNINGS ON PER-WORKER POLLUTION GROWTH RATES

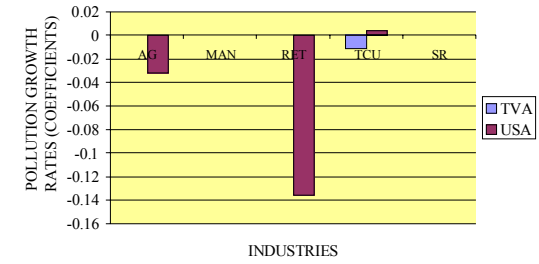
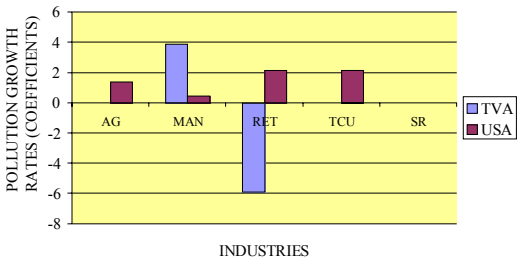
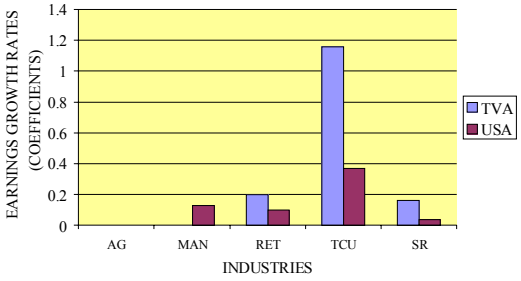


FIGURE 8: THE EFFECT OF PER-WORKER EARNINGS GROWTH RATES ON PER-WORKER POLLUTION GROWTH RATES



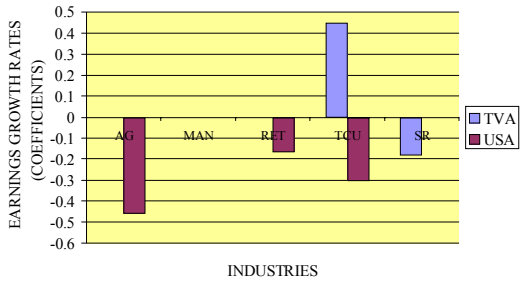
Counties with higher initial levels of employment had significantly higher growth rates of earnings in most industries in both the TVA region and in the U.S. studies (Figure 9).

FIGURE 9: THE EFFECT OF INITIAL EMPLOYMENT (1000 JOBS) ON PER-WORKER EARNINGS GROWTH RATES



However, employment growth rates were positively associated with per-worker earnings growth rates only in the transportation, communication, and utilities industries in the TVA region (Figure 10). These results suggest that even though almost all industries initially contained high quality jobs, only transportation, communication, and utilities added new high paying jobs over time in the TVA region. However, employment growth occurred at the expense of reduced earnings growth rates for the United States in almost all industries (Figure 10).

FIGURE 10: THE EFFECT OF EMPLOYMENT GROWTH RATES ON PER-WORKER EARNINGS GROWTH RATES



Those TVA counties with higher initial per-worker earnings experienced lower employment growth rates in transportation, communication, and utilities, but higher employment growth rates in the retail trade and service industries (Figure 11). In addition, the effect of per-worker earnings growth rates on employment growth rates was negative for all the industries studied in the TVA region (Figure 12). On the other hand, initial per-worker earnings and earnings growth rates were positively associated with employment growth rates for all industries in the United States (Figures 11 and 12). These results suggest that even though firms were attracted to counties with high rates of

earnings growth in the nation, firms shifted employment away from TVA counties with high rates of earnings growth.

FIGURE 11: THE EFFECT OF THE INITIAL PER-WORKER EARNINGS ON EMPLOYMENT GROWTH RATES

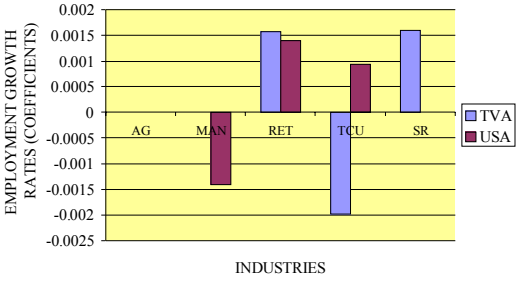
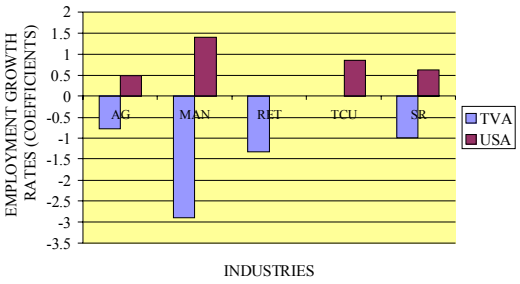


FIGURE 12: THE EFFECT OF PER-WORKER EARNINGS GROWTH RATES ON EMPLOYMENT GROWTH RATES



Summary and Conclusion

This study analyzed the relationship among the percentage change in employment, earnings per worker and per-worker pollution in TVA counties over the period 1987-1995, using a three-stage least-squares estimation technique. It focused on five major industry divisions, as well as the all industries combined. The results are compared to results for a national study (Johansson, 2000), assessing how well TVA counties have done relative to the nation as a whole. The simultaneous nature of the relationship among employment, earnings, and pollution is partially supported in the TVA study.

The study revealed that while U.S. counties with lower pollution in general had an advantage in creating jobs when all industries combined are considered, the same cannot be said for TVA counties. However, the results for individual industries suggest that TVA counties whose objective is to increase employment growth rates in agriculture and in the retail trade should strive to increase environmental quality. Yet, faster pollution growth rates are associated with greater employment growth rates in the manufacturing, transportation, communication, and utilities industries in the TVA region. In addition, industry level analysis for manufacturing confirms the compensating wage theory, since higher pollution growth rates led to faster earnings growth in manufacturing.

Further, the faster the rate of agricultural employment growth in a TVA county, the greater the reduction in pollution per worker in that county. However, job growth in manufacturing and transportation, communication, and utilities occurred at the expense of an increased pollution growth rates in TVA region. In addition, the study suggest that communities whose goal is to decrease rates of pollution growth should try to attract high-paying industries, while, of course, paying close attention to the pollution intensity (per worker) of that industry.

Further, TVA counties with higher initial employment levels and higher employment growth rates experienced faster earnings growth rates in general, suggesting they experienced employment growth in high paying industries. Only the service sector was not able to sustain this over time. In addition, TVA counties that maintained lower earnings growth rates experienced higher employment growth rates over time, suggesting an employment shift to lower wage counties.

References

Bartik, T.J., "Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States." *Journal of Business & Economic Statistics,* Vol. 3(1), (January 1985), pp.14-22.

Bartik, T.J., "Small Business Start-Ups in the United States: Estimates of the Effects of Characteristics of States." *Southern Economic Journal,* Vol. 46, (1989), pp.51-58.

Bartik, T.J., "The Effects of Environmental Regulation on Business Location in the United States." *Growth and Change,* (Summer 1988), pp.22-43.

Blomquist G.C., Berger, M.C., Hoehn, J.P., "New Estimates of Quality of Life in Urban Areas." *The American Economic Review,* Vol. 78 (1) (March 1988), pp.89-107.

Byrne, M.M., "Is Growth a Dirty Word? Pollution, Abatement and Endogenous Growth." *Journal of Development Economics*, Vol. 54 (1997), pp.261-284.

Calzonetti, F.J.and Walker R.T., Factors Affecting Industrial Location Decisions: A Survey Approach. Chapter 11 in *Industry Location and Public Policy,* edited by H. W. Herzog, Jr. and A. M. Schlottmann, (1991), Knoxville, TN: University of Tennessee Press, pp.221-240.

Carlino, G.,A., and Mills, E.S., "The Determinants of County Growth." *Journal of Regional Science,* Vol. 27 (1), (1987), pp.39-54.

Carlton, D.W., Why Do Firms Locate Where They Do: An Econometric Model. Chapter 2 in *Interregional Movements and Regional Growth,* edited by William Wheaton, (1979), Washington, DC: The Urban Institute, pp.13-50.

Carlton, D.W., "The Location and Employment Choices of New Firms: An Econometric Model With Discrete and Continuous Endogenous Variables." *The Review of Economics and Statistics,* (1983) Vol. 65, pp.440-449.

Cebula, R.J., Vedder, R.K., "A Note on Migration, Economic Opportunity, and the Quality of Life." *Journal of Regional Science,* Vol. 13(2), (1973), pp.205-211.

Clark D.E. and Cosgrove, J.C., "Amenities versus Labor Market Opportunities: Choosing the Optimal Distance to Move." *Journal of Regional Science,* Vol. 31 (3), (1991), pp.311-328.

Goetz, S.J., Hu, D., and Debertin, D.L., "A Structural Model of Human Capital and Manufacturing Sector Change." *International Advances in Economic Research,* Vol. 2(4) (November 1996), pp.355-367.

Goetz, S.J., Ready, R.C., Stone, B., "U.S. Economic Growth versus Environmental Conditions." *Growth and Change,* Vol. 27 (Winter 1996), pp.97-110.

Goetz, S.J., "State and County Level Determinants of Food Manufacturing Establishment Locations: 1987-1993." *American Journal of Agricultural Economics,* Vol. 79 (3), (1997), pp.838-850.

Goetz, S.J., Debertin, D.L., and Pagoulatos A., "Human Capital, Income, and Environmental Quality: A State-Level Analysis." *Agricultural and Resource Economics Review* Vol. 27 (2), (October 1998), pp. 200-208.

Gottlieb, P.D., "Residential Amenities, Firm Location and Economic Development." *Urban Studies,* Vol. 32(9), 1995, pp.1413-1436.

Grant/Thornton, Chicago, IL, *Manufacturing Climates Study*, Annual.

Graves, P.E. and Linneman, P.D., "Household Migration: Theoretical and Empirical Results." *Journal of Urban Economics,* Vol. 6 (1979), pp.383-404.

Graves, P.E., "Migration and Climate." *Journal of Regional Science,* Vol. 20(2), (1980), pp.227-237.

Graves, P.E., "Migration with a Composite Amenity: The Role of Rents." *Journal of Regional Science,* Vol. 23(4), (1983), pp.541-545.

Greenwood, M.J. and Hunt, G.L., "Jobs versus Amenities in the Analysis of Metropolitan Migration." *Journal of Urban Economics,* Vol. 25 (1989), pp.1-16.

Grossman, G. and Krueger, A., "Economic Growth and the Environment." *Quarterly Journal of Economics,* Vol. 110 (2), (1995), pp.353-377.

Hall, B. and Kerr, M.L., "1991-1992 Green Index: A State-by-State Guide to the Nation's Environmental Health." (1991) Island Press, Institute for Southern Studies, Washington, DC.

Herzog, H.W. Jr. and Schlottmann A.M., *Industry Location and Public Policy*. (1991) Knoxville TN; University of Tennessee Press.

Hilton, F.G.H. and Levinson A., "Factoring the Environmental Kuznets Curve: Evidence from Automotive Lead Emissions." *Journal of Environmental Economics and Management,* Vol. 35, (1998), pp.126-141.

Izraeli, O. and Mobley L., "Are Jobs and the Quality of the Environment Mutually Exclusive?" *Environment and Planning A,* Vol. 27, (1995), pp.781-791.

Izraeli, O., "The Effects of Environmental Attributes on Earnings and Housing Values Across SMSAs." *Journal of Urban Economics,* Vol. 22, (1987), pp.361-376.

Johansson, T.O., "Interactions between Economic Growth and Environmental Quality: A County-Level Analysis." (Forthcoming) Ph.D. Dissertation, University of Kentucky.

Knapp, T.A. and Graves, P.E., "On the Role of Amenities in Models of Migration and Regional Development." *Journal of Regional Science,* Vol. 29 (1), (1989), pp.71-87.

Kreahling, K.S., Smith, S.M., and Frumento, C., "A Procedure for Estimating Nondisclosed Employment in the County Business Patterns Data Set." *Staff Paper 299* Department of Agricultural Economics and Rural Sociology, Pennsylvania State University, (March 1996).

Levinson, A., (a) "Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufactures." *Journal of Public Economics,* Vol. 62, (1996a), pp.5-29.

Levinson, A., (b) Environmental Regulations and Industry Location: International and Domestic Evidence. Chapter 11 in *Fair Trade and Harmonization: Prerequisites for Free Trade? Vol. 1*, edited by J.N. Bhagwati and R. E. Hudec, Cambridge: MIT Press (1996b).

McConnell, V.D. and Schwab, R.M., "The Impact of Environmental Regulation on Industry Location Decisions: The Motor Vehicle Industry." *Land Economics,* Vol. 66(1), (February 1990), pp.67-81.

McGranahan, David A., "Local Problems Facing Manufacturers: Results of the ERS Rural Manufacturing Survey." United States Department Of Agriculture, Economic Research Service*, Agriculture Information Bulletin.* No 736-03 (March 1998), pp.1-6.

Miernyk, W.H., "Rising Energy Prices and Regional Economic Development." *Growth and Change,* (July1977), pp.2-7.

Mo, Y. and Abdalla, C.W., "Factors Influencing the Location of Agricultural Production in the U.S.: Do State Environmental Pollicies Affect Growth in the Swine Industry?" Paper presented at the 36th Annual Meetings of the Southern Regional Science Association, (April 1997).

Newman, R. J. and Sullivan, D.H., "Econometric Analysis of Business Tax Impacts on Industrial Location: What Do We Know and How Do We Know It?" *Journal of Urban Economics,* Vol. 23, (1988), pp.215-234.

Papke, L.E., "Interstate Business Tax Differentials and New Firm Location: Evidence from Panel Data." *Journal of Public Economics,* Vol. 45, (1991), pp.47-68.

Plaut, T.R. and Pluta, J.E., "Business Climate, Taxes and Expenditures, and State Industrial Growth in the United States." *Southern Economic Journal,* Vol. 50, (July 1983), pp.99-119.

Roback, J., "Wages, Rents, and the Quality of Life." *Journal of Political Economy*, Vol. 90 (6) (December 1982), pp. 1257-1278.

Rosebank, Research and Statistical Analysis, "Total Pollution Pounds Per Employee Coefficients." (May 1997) Marshville, NC.

Schmenner, R.W., *Making Business Location Decisions.* Englewood Cliffs, NJ: Prenticehall (1982).

Schmenner, R.W., Huber, J., Cook, R., "Geographic Differences and the Location of New Manufacturing Facilities." *Journal of Urban Economics,* Vol. 21 (1987), pp.83-104.

Selden T.M. and Song, D., "Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions?" *Journal of Environmental Economics and Management,* Vol. 27, (1994), pp.147-162.

Shafik, N., "Economic Development and Environmental Quality: An Econometric Analysis." *Oxford Economic Papers* Vol. 46, (1994), pp.757-773.

Stafford, H.A., "Environmental Protection and Industrial Location." *Annals of the Association of American Geographers,* Vol. 75 (2), (1985), pp.227-240.

State Energy Price and Expenditures Data System (1987), EIA Personal Computer Products.

Stern, D.L., Common, M.S. and Barbier, E.B., "Economic Growth and Environmental Degradation: The Environmental Kuznets Curve and Sustainable Development." *World Development,* Vol. 24 (7), (1996), pp.1151-1160.

U. S Department of Commerce, County Business Patterns, County Data, 19871995 Washington DC.

U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996, Washington DC.

U.S. Department of Agriculture, Economic Research Service, Washington DC.

U.S. Department of Commerce, U.S.A. County CD-ROM 1996, Washington DC.

Walker, R., GreenStreet, D., "The effect of Government Incentives and Assistance on Location and job Growth in Manufacturing." *Regional Studies,* Vol. 25 (1) (February, 1991), pp.13-30

Wasylenko, M., Empirical Evidence on Interregional Business Location Decisions and the Role of Fiscal Incentives in Economic Development. Chapter 2 in *industry Location and Public Policy,* edited by H.W. Herzog, Jr. and A. M. Schlottmann, (1991), Knoxville TN: University of Tennessee Press, pp.13-30.

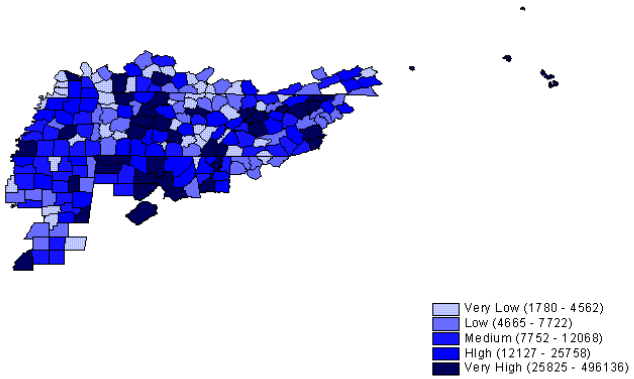
Wasylensko, M. and McGuire, T., "Jobs and Taxes: The effect of Business Climate On States' Employment Growth Rates." *National Tax Journal* Vol. 38(4) (1985), pp.497-512.

Wayne, B.G., "Manufacturing Plant Location: Does State Pollution Regulation Matter?

Weber, A., "Theory of the Location of Industries." Translated by C. Friedrich, University of Chicago Press, Chicago III. (1929).

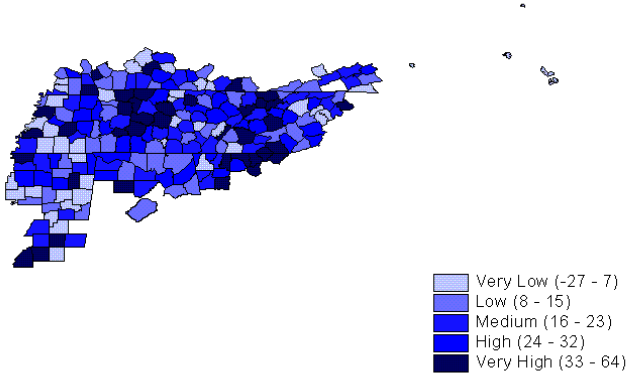
Wheat, L.F., "The Determinants of 1963-77 Regional Manufacturing Growth: Why the South and West Grow?" *Journal of Regional Science,* Vol. 26 (4) (1986), pp.635-660.

Map 1: Initial (1987) Levels of Employment



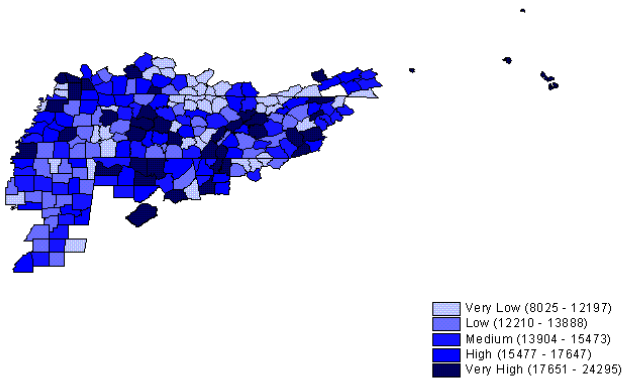
Source: U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996

Map 2: Employment Growth



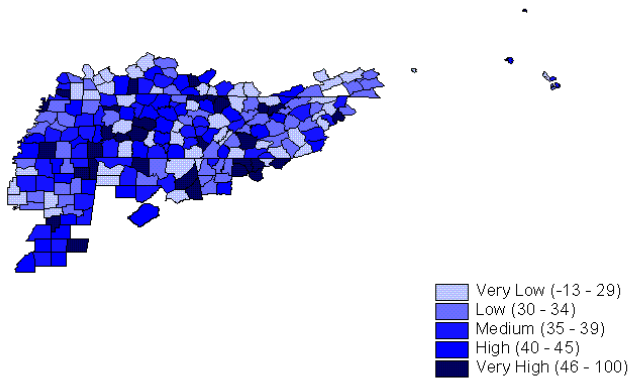
Source: U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996

Map 3: Initial (1987) Levels of Per-Worker Earnings



Source: Author's Calculations Using U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM, 1996a

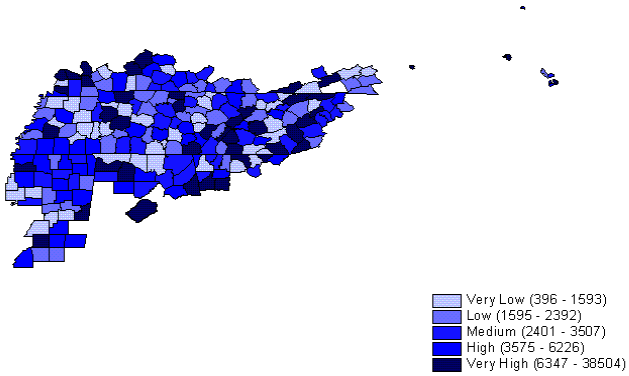
Map 4: Per-Worker Earnings Growth



Source: Author's Calculations Using U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM, 1996

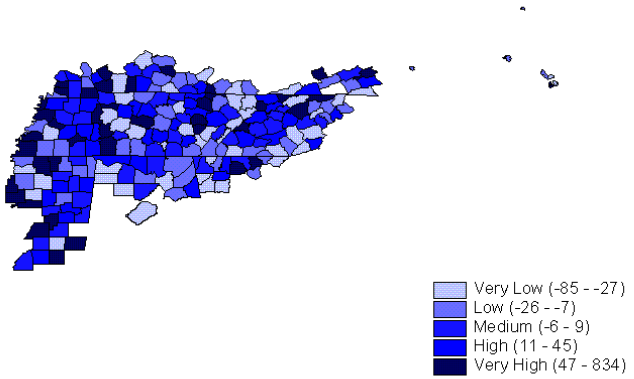
Map 5: Initial (1987) Levels of

Per-Worker Pollution



Source: Author's Calculations Using Rosebak, Research and Statistical Analysis, Environmental Impact Data, 1997 and Department of Commerce, County Business Patterns, County Data, 1987

Map 6: Per-Worker Pollution Growth



Source: Author's Calculations Using Rosebak, Research and Statistical Analysis, Environmental Impact Data, 1997 and Department of Commerce, County Business Patterns, County Data, 1987, 1995

Table 1: Definition and Summary Statistics for the Variables Used in the Study (All Industries Combined)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	25523.46	59077.17	1780	496136
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	15049.95	3373.16	8024.79	24295.03
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4680.19	5647.64	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	24.74025	5.722882	12.7008	51.525
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.36268	1.185757	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.66577	2.751536	24.6	43
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	58.57283	8.746599	39.47196	86.90665
Black [e]	1990 Population shares of African Americans	0.109563	0.142084	0	0.590372

Table 1 (Continued): Definition and Summary Statistics for the Variables Used in the Study (All Industries Combined)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	485.9144	111.087	299	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.63559	3.895274	2.9	28.9
Union [f]	1987 percent of workers unionized (State level)	14.11171	5.242952	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.450256	0.021308	0.381939	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.68018	17.36412	17	113
Property Taxes [e]	1987 Per capita property taxes ($)	166.6667	97.45962	36	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	977.3829	291.796	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	143.9753	666.8402	3.533794	7305.8

Table 1 (Continued): Definition and Summary Statistics for the Variables Used in the Study (All Industries Combined)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	1004.84	468.0151	463	2534
Population Density [e]	1987 Population divided by land area	201.7248	710.682	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	17.42262	17.79445	1.312887	92.00666
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2726.91	332.4677	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.43525	1.041712	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.405405	0.49208	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.626126	0.484924	0	1
Runways [J]	# of runways exist	1.130631	1.253433	0	10

Table 1 (Continued): Definition and Summary Statistics for the Variables Used in the Study (All Industries Combined)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.027027	0.162529	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.207207	0.406221	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	19.67145	15.08473	-26.9582	63.60279
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	35.68551	12.29108	-13.2794	100.3437
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	27.24232	109.9685	-84.9675	833.6984

Number of observations[3]=222

3 Due to disclosure and data constraints, some counties are excluded.

Table 2: Definition and Summary Statistics for the Variables Used in the Study (Agriculture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	539.6507	2817.29	5	29162
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	10985.43	6851.3	1315.79	62655.74
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4675.46	5347.93	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	158.2398	787.9034	0.330827	8746
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.292645	1.177571	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.49041	2.792387	24.6	42.7
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	59.25048	8.750255	44.12168	86.90665
Black [e]	1990 Population shares of African Americans	0.122881	0.15051	0	0.583892

Table 2 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Agriculture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	493.8904	111.5389	329	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.55274	3.9163	3.2	28.9
Union [f]	1987 percent of workers unionized (State level)	14.17397	5.303975	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.452487	0.021023	0.395045	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.09589	16.53974	17	95
Property Taxes [e]	1987 Per capita property taxes ($)	172.5753	106.7787	43	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	988.1164	312.7692	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	1.564443	7.971097	0.020291	70.03243

Table 2 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Agriculture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	1007.5	469.8381	463	2534
Population Density [e]	1987 Population divided by land area	256.124	848.1641	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	16.63382	15.81313	1.430779	77.4864
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2731.04	329.3314	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.41331	1.045327	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.438356	0.497894	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.657534	0.476168	0	1
Runways [j]	# of runways exist	1.246575	1.392401	0	10

Table 2. (Continued): Definition and Summary Statistics for the Variables Used in the Study (Agriculture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.034247	0.182488	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.212329	0.410364	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	53.23227	63.44974	-58.3333	310.1576
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	29.14807	72.5048	-89.3939	614.4
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	14.97184	76.43813	-84.9675	474.9966

Number of observations[4]=146

4 Due to disclosure and data constraints, some counties are excluded.

Table 3: Definition and Summary Statistics for the Variables Used in the Study (Manufacture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	4928.43	7432.61	79	50335
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	19720.55	6042.18	5767.41	41561.56
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4680.19	5647.64	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	78.29056	34.98695	13.16667	263.4237
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.36268	1.185757	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.66577	2.751536	24.6	43
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	58.57283	8.746599	39.47196	86.90665
Black [e]	1990 Population shares of African Americans	0.109563	0.142084	0	0.590372

Table 3 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Manufacture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	485.9144	111.087	299	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.63559	3.895274	2.9	28.9
Union [f]	1987 percent of workers unionized (State level)	14.11171	5.242952	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.450256	0.021308	0.381939	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.68018	17.36412	17	113
Property Taxes [e]	1987 Per capita property taxes ($)	166.6667	97.45962	36	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	977.3829	291.796	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	18.22563	55.0592	0.246977	498.0289

Table 3 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Manufacture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	1004.84	468.0151	463	2534
Population Density [e]	1987 Population divided by land area	201.7248	710.682	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	17.42262	17.79445	1.312887	92.00666
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2726.91	332.4677	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.43525	1.041712	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.405405	0.49208	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.626126	0.484924	0	1
Runways [j]	# of runways exist	1.130631	1.253433	0	10

Table 3 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Manufacture)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.027027	0.162529	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.207207	0.406221	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	15.11779	35.3868	-63.2219	190.5769
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	37.43965	20.31254	-9.52223	176.1952
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	27.24232	109.9685	-84.9675	833.6984

Number of observations[5]= 222

5 Due to disclosure and data constraints, some counties are excluded.

Table 4: Definition and Summary Statistics for the Variables Used in the Study (Retail Trade)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	3996.19	9911.37	65	85779
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	11537.67	1503.94	7972.6	19481.7
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4611.87	5626.78	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	11.6427	2.591514	4.888889	23.38462
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.351641	1.185441	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.645	2.755024	24.6	43
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	58.47317	8.718857	39.47196	86.90665
Black [e]	1990 Population shares of African Americans	0.110235	0.142554	0	0.590372

Table 4 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Retail Trade)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	485.3818	111.4324	299	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.66455	3.900909	2.9	28.9
Union [f]	1987 percent of workers unionized (State level)	14.11273	5.266828	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.450256	0.021399	0.381939	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.74545	17.42797	17	113
Property Taxes [e]	1987 Per capita property taxes ($)	166.4136	97.72848	36	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	977.5	293.0167	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	22.05084	103.0188	0.265651	1234.11

Table 4 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Retail Trade)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	1000.65	467.4893	463	2534
Population Density [e]	1987 Population divided by land area	202.045	713.9035	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	17.3361	17.84821	1.312887	92.00666
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2725.86	333.7964	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.4266	1.042471	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.4	0.491015	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.622727	0.485809	0	1
Runways [j]	# of runways exist	1.140909	1.254457	0	10

Table 4 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Retail Trade)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.027273	0.163249	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.204546	0.404289	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	29.73476	26.08899	-35.9528	238.4977
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	18.76849	12.88126	-23.867	62.97814
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	28.16272	110.0362	-81.0558	833.6984

Number of observations[6]=220

6 Due to disclosure and data constraints, some counties are excluded.

Table 5: Definition and Summary Statistics for the Variables Used in the Study (Transportation, Communication, and Utilities)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	1166.93	3930.53	12	40693
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	23380.7	5442.25	11231.88	43605.99
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4581.7	5300.39	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	19.72296	10.83227	3	72.33333
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.35337	1.184285	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.62694	2.749638	24.6	43
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	58.59294	8.754942	39.47196	86.90665
Black [e]	1990 Population shares of African Americans	0.111009	0.142513	0	0.590372

Table 5 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Transportation, Communication, and Utilities)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	487.1826	111.1517	299	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.57397	3.867378	2.9	28.9
Union [f]	1987 percent of workers unionized (State level)	14.01461	5.177764	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.450726	0.021021	0.381939	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.40639	16.97932	17	113
Property Taxes [e]	1987 Per capita property taxes ($)	167.6849	97.66694	36	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	981.411	291.5894	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	6.929476	34.84281	0.087337	363.0657

Table 5 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Transportation, Communication, and Utilities)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	1009.86	469.096	463	2534
Population Density [e]	1987 Population divided by land area	204.1055	715.2608	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	17.16275	17.66394	1.312887	92.00666
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2727.32	334.5126	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.43508	1.04596	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.406393	0.492285	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.630137	0.483873	0	1
Runways [j]	# of runways exist	1.146119	1.254943	0	10

Table 5 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Transportation, Communication, and Utilities)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.027397	0.163612	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.210046	0.408274	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	30.16342	43.51136	-57.971	285.7143
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	28.91861	25.21333	-43.0399	141.3984
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	23.88953	103.8734	-84.9675	833.6984

Number of observations[7]=219

7 Due to disclosure and data constraints, some counties are excluded.

Table 6: Definition and Summary Statistics for the Variables Used in the Study (Services)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Initial Employment (Emp_0) [a]	1987 Total full- and part-time employment (# of jobs)	5595.24	15818.1	164	126843
Initial Per Worker Earnings (W_0) [b]	1987 Total earnings from full- and part-time employment divided by total full-and part-time employment ($)	12252.11	3332.03	4774.39	25158.93
Initial Per Worker Pollution (E_0) [c]	Total pounds of pollution released in 1987 divided by total employment	4660.49	5650.24	395.528	38504.47
Firm Size [c]	1987 Total full- and part-time employment / 1987 Total number of establishments	14.15821	3.211563	6.9	26.06042
Amenity Index[d]	Index reflecting 1-climate, 2-Topography, and 3-Bodies of Water	0.337335	1.184363	-3.77314	3.961534
Age [e]	1990 Median age (years)	34.64562	2.768455	24.6	43
Education [e]	Percent of persons 25-years-old and over completing 12 years and more of school	58.52319	8.707275	39.47196	86.90665
Black [e]	1990 Population shares of African Americans	0.111575	0.143065	0	0.590372

Table 6 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Services)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Housing Cost [e]	1990 Median selected monthly owner costs of specified owner-occupied non-condominium housing units with a mortgage ($)	484.9862	112.0087	299	1277
Unemployment Rate [e]	1986 Civilian labor force unemployment rate (percent)	10.70691	3.91029	2.9	28.9
Union [f]	1987 percent of workers unionized (State level)	14.12166	5.301977	4.9	24.8
Female [e]	1990 Proportion of female share in labor force	0.450591	0.021228	0.381939	0.509931
Unemployment Compensation Benefits [a]	1987 Per capita unemployment insurance benefits ($)	48.88479	17.46161	17	113
Property Taxes [e]	1987 Per capita property taxes ($)	166.0691	98.1119	36	991
Per Capita Total Expenditures [e]	1987 Per capita direct general expenditures ($)	979.9908	293.4957	536	2225
Industry Density [a,e]	1987 Total full- and part-time employment divided by land area	35.24621	194.5904	0.578919	2472.87

Table 6 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Services)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Land Prices [d]	1987 Average value per acre of farm real estate	999.6313	470.1092	463	2534
Population Density [e]	1987 Population divided by land area	204.2438	718.5947	13.5	7266.9
Worker's Compensation Benefits [a]	1987 Total federal-state workers compensation payments divided by total full and part-time employment	17.46496	17.9332	1.312887	92.00666
Green Policies [g]	Index reflects states rankings on seventy seven environmental policies and programs (State level)	2725.8	335.5811	1873	3212
Electric Prices [h]	1987 Electric utility prices for industrial consumption in dollars per million BTU (state level)	14.4243	1.041155	12.12211	15.38593
Highway Dummy [j]	Interstate highway access (DV=1 if entry/exit ramp present)	0.40553	0.49213	0	1
Railroad Dummy [j]	Railroad access (DV=1 if node known to exist)	0.626728	0.484792	0	1
Runways [j]	# of runways exist	1.152074	1.258272	0	10

Table 6 (Continued): Definition and Summary Statistics for the Variables Used in the Study (Services)

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
Seaport Dummy [j]	Seaport access (DV=1 if present)	0.02765	0.164346	0	1
Metro [k]	Metropolitan counties (DV=1 if metro)	0.202765	0.402989	0	1
Employment Growth (ΔEmp) [b]	Percentage change in total full- and part-time employment between 1987 and 1995	40.4581	32.09942	-27.2311	250.5618
Per Worker Earnings Growth (ΔW) [b]	Percentage change in total per worker earnings between 1987 and 1995	47.24966	20.43921	-1.95682	112.5275
Per Worker Pollution Growth (ΔE) [c]	Percentage change in total per worker pounds of pollution released between 1987 and 1995	27.76975	110.1707	-81.0558	833.6984

Number of observations[8]=217

8 Due to disclosure and data constraints, some counties are excluded.

Data Sources:

a-) U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996

b-) Author's calculations using U.S. Bureau of Economic Analysis, Regional Economic Information System, CD-ROM 1996

c-) Author's calculations using
1-Rosebank, Research and Statistical Analysis, Environmental Impact data, 1997 and
2-Department of Commerce, County Business Patterns, county data, 1987, 1995

d-) U.S. Department of Agriculture/Economic Research Service

e-) Department of Commerce's U.S.A. County CD-ROM 1996 (U.S. Census Data)

f-) Grant/ Thornton, Chicago, IL, Manufacturing Climates Study, Annual.

g-) Hall and Kerr, "1991-1992 Green Index: A State-by-State Guide to Nation's Environmental Health" Washington, D.C.: Island Press, 1991

h-) State Energy Price and Expenditures Data System (1987), EIA Personal Computer Products

j-) Constructed using Transcad©GIS software and geo-coded data from the U.S. transportation 1r CD-ROM by Dr. Stephan Goetz, University of Kentucky.

k-) Counties defined by U.S. Bureau of Census with 2500 residents or more.

Table 7: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (All Industries Combined):

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	-2.91067 (0.142)	-210.23 (1.512)^	541.583 (3.538)***
Initial Employment (Emp_0) 1000 jobs	-0.0813 (2.515)**	0.024 (1.408)^	0.088 (0.561)
Initial Per Worker Earnings (W_0)	-0.001316 (2.500)**	-0.002034 (5.078)***	-0.06988 (3.918)***
Initial Per Worker Pollution (E_0)	-0.000214 (0.840)	-0.000658 (3.550)***	-0.00576 (3.717)***
Firm Size	----	0.40386 (2.168)**	0.36773 (0.257)
Amenity Index	0.72012 (0.740)	0.41662 (0.584)	----
Age	----	11.57763 (1.883)*	----
Age Square	----	-0.12999 (1.861)*	----
Education	0.44796 (2.155)**	1.31607 (0.756)	2.3954 (1.761)*
Education Square	----	0.000218 (0.022)	----
Age *Education	----	-0.02998 (0.791)	----
Black	----	28.42716 (2.348)**	----
Housing Cost	----	0.01693 (1.246)	----
Unemployment	-0.54407 (1.128)	-0.2436 (0.718)	----
Union	0.10212 (0.334)	0.25031 (1.448)^	----

Table 7 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (All Industries Combined):

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	-20.15747 (0.357)	----
Unemployment Compensation Benefits	0.09418 (1.153)	0.04447 (0.655)	----
Property Taxes	0.0043 (0.215)	----	----
Per Capita Total Expenditures	-0.00621 (1.384)^	----	----
Industry Density	0.01124 (1.389)^	----	----
Land Prices	0.01003 (3.141)***	----	----
Population Density	-0.01411 (1.930)*	----	-0.007797 (0.539)
Workers Compensation Benefits	0.02652 (0.248)	----	----
Green Policies	0.00768 (1.550)^	----	0.02506 (1.002)
Electric Prices	-0.1283 (0.106)	----	----
Highway Dummy	4.7589 (2.074)**	----	----
Railroad Dummy	-1.70418 (0.747)	----	----
# Of Runways	2.64267 (2.149)**	----	----
Port Dummy	0.80609 (0.088)	----	----
Initial Earnings Square	----	----	0.00000185 (3.351)***

Table 7 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (All Industries Combined):

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	6.41326 (2.060)***	-2.80556 (1.089)	-17.08647 (0.737)
Employment Growth (ΔEmp)	----	0.200137 (1.475)^	-0.09812 (0.103)
Per Worker Earnings Growth (ΔW)	-0.25635 (0.746)	----	-2.47068 (1.507)^
Per Worker Pollution Growth (ΔE)	-0.01444 (0.624)	-0.04151 (2.084)**	----
System-Weighted R^2	0.2400		
Number of Observations	222		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 8: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Agriculture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	271.9344 (1.797)*	223.167 (0.228)	29.9122 (0.360)
Initial Employment (Emp_0) 1000 jobs	-4.173 (0.435)	1.0 (0.320)	-1.553 (0.459)
Initial Per Worker Earnings (W_0)	-0.001029 (1.121)	-0.003817 (4.320)***	0.00292 (1.221)
Initial Per Worker Pollution (E_0)	-0.00311 (1.641)^	-0.00273 (1.298)^	-0.00529 (4.098)***
Firm Size	----	-0.00135 (0.120)	0.00666 (0.551)
Amenity Index	-8.3816 (1.249)	-7.9777 (1.414)^	----
Age	----	11.0378 (0.249)	----
Age Square	----	-0.2187 (0.438)	----
Education	-1.83853 (1.408)^	-13.307 (1.071)	-0.12948 (0.141)
Education Square	----	0.0894 (1.300)^	----
Age *Education	----	0.0786 (0.278)	----
Black	----	55.861 (0.836)	----
Housing Cost	----	-0.11464 (1.095)	----
Unemployment	1.48463 (0.569)	0.60003 (0.236)	----
Union	-0.2058 (0.121)	1.6475 (1.159)	----

Table 8 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Agriculture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	226.505 (0.567)	----
Unemployment Compensation Benefits	-0.406012 (0.696)	-0.1617 (0.292)	----
Property Taxes	0.01845 (0.178)	----	----
Per Capita Total Expenditures	0.01678 (0.582)	----	----
Industry Density	1.30467 (0.383)	----	----
Land Prices	0.02425 (1.242)	----	----
Population Density	-0.00495 (0.387)	----	0.00267 (0.282)
Workers Compensation Benefits	0.35034 (0.562)	----	----
Green Policies	0.017057 (0.659)	----	0.01108 (0.525)
Electric Prices	-10.1458 (1.128)	----	----
Highway Dummy	18.90289 (1.419)^	----	----
Railroad Dummy	-11.84876 (0.825)	----	----
# Of Runways	8.87729 (1.456)^	----	----
Port Dummy	-21.9594 (0.422)	----	----
Initial Earnings Square	----	----	-5.90082E-8 (1.343)^

Table 8 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Agriculture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	-25.3193 (1.296)^	-13.1274 (0.673)	-20.4826 (1.057)
Employment Growth (ΔEmp)	----	-0.2345 (0.726)	-0.51768 (1.864)*
Per Worker Earnings Growth (ΔW)	-0.76935 (2.785)***	----	-0.1373 (0.637)
Per Worker Pollution Growth (ΔE)	-0.44089 (1.315)^	-0.53267 (1.802)*	----
System-Weighted R^2	0.1848		
Number of Observations	146		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 9: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Manufacture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	90.90113 (1.343)^	-50.4188 (0.248)	23.0505 (0.197)
Initial Employment (Emp_0) 1000 jobs	-0.337 (0.363)	0.03 (0.131)	0.34 (0.233)
Initial Per Worker Earnings (W_0)	-0.000355 (0.338)	-0.001301 (3.814)***	-0.01735 (0.233)
Initial Per Worker Pollution (E_0)	0.000249 (0.262)	0.00008 (0.256)	-0.00315 (1.721)*
Firm Size	----	0.08584 (1.770)*	-0.08461 (0.327)
Amenity Index	-2.14145 (0.672)	-1.2662 (1.149)	----
Age	----	3.1832 (0.393)	----
Age Square	----	-0.03502 (0.402)	----
Education	0.50273 (0.601)	0.2885 (0.124)	0.53435 (0.354)
Education Square	----	0.001379 (0.110)	----
Age *Education	----	0.002036 (0.037)	----
Black	----	12.5794 (0.993)	----
Housing Cost	----	0.00881 (0.491)	----
Unemployment	-0.81081 (0.442)	-0.27756 (0.527)	----
Union	1.27229 (1.311)^	0.3987 (1.106)	----

Table 9 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Manufacture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	9.46786 (0.119)	----
Unemployment Compensation Benefits	0.05830 (0.213)	-0.005263 (0.049)	----
Property Taxes	0.02328 (0.362)	----	----
Per Capita Total Expenditures	-0.00686 (0.570)	----	----
Industry Density	0.00092 (0.010)	----	----
Land Prices	-0.00495 (0.533)	----	----
Population Density	-0.003464 (0.286)	----	0.00119 (0.085)
Workers Compensation Benefits	-0.06487 (0.228)	----	----
Green Policies	-0.000616 (0.042)	----	0.01366 (0.482)
Electric Prices	-0.2417 (0.069)	----	----
Highway Dummy	0.69068 (0.110)	----	----
Railroad Dummy	3.3179 (0.540)	----	----
# Of Runways	0.92826 (0.278)	----	----
Port Dummy	-5.1852 (0.165)	----	----
Initial Earnings Square	----	----	0.0000003 (2.344)**

Table 9 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Manufacture)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	8.40992 (0.620)	2.97189 (0.712)	-8.76849 (0.338)
Employment Growth (ΔEmp)	----	-0.12637 (0.759)	1.1987 (1.978)**
Per Worker Earnings Growth (ΔW)	-2.88814 (2.635)***	----	3.9071 (2.522)**
Per Worker Pollution Growth (ΔE)	0.32189 (3.641)***	0.06698 (2.184)**	----
System-Weighted R^2	0.2416		
Number of Observations	222		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 10: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Retail Trade)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	-4.68489 (0.108)	-15.4732 (0.132)	75.9738 (0.300)
Initial Employment (Emp_0) 1000 jobs	-0.382 (1.136)	0.199 (1.881)*	1.18 (1.201)
Initial Per Worker Earnings (W_0)	0.001574 (1.318)^	-0.00243 (4.397)***	0.009686 (0.248)
Initial Per Worker Pollution (E_0)	-0.000637 (1.397)^	-0.000727 (4.160)***	-0.008252 (5.213***
Firm Size	----	1.25497 (3.695)***	4.64366 (1.366)^
Amenity Index	1.2084 (0.686)	-1.17378 (1.704)*	----
Age	----	3.7883 (0.734)	----
Age Square	----	-0.05869 (0.970)	----
Education	0.46661 (1.427)^	-1.84197 (1.176)	-1.3766 (1.132)
Education Square	----	0.01081 (1.193)	----
Age *Education	----	0.01574 (0.504)	----
Black	----	5.6267 (0.616)	----
Housing Cost	----	0.002517 (0.209)	----
Unemployment	-0.78401 (1.073)	0.20815 (0.669)	----
Union	-0.37339 (0.755)	-0.20479 (1.283)^	----

Table 10 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Retail Trade)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	60.70062 (1.270)	----
Unemployment Compensation Benefits	0.07056 (0.484)	0.02891 (0.466)	----
Property Taxes	-0.0168 (0.486)	----	----
Per Capita Total Expenditures	-0.00317 (0.379)	----	----
Industry Density	0.091418 (1.154)	----	----
Land Prices	0.005784 (1.042)	----	----
Population Density	-0.02247 (1.955)*	----	-0.00265 (0.189)
Workers Compensation Benefits	0.10598 (0.701)	----	----
Green Policies	0.007176 (1.026)	----	0.00386 (0.166)
Electric Prices	0.63304 (0.238)	----	----
Highway Dummy	11.48698 (2.867)***	----	----
Railroad Dummy	-11.43557 (2.994)***	----	----
# Of Runways	0.92268 (0.434)	----	----
Port Dummy	2.04355 (0.123)	----	----
Initial Earnings Square	----	----	1.4823694E-8 (0.010)

Table 10 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Retail Trade)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	8.61564 (1.520)^	0.70448 (0.282)	3.162312 (0.134)
Employment Growth (ΔEmp)	----	0.00767 (0.118)	-0.068313 (0.110)
Per Worker Earnings Growth (ΔW)	-1.33203 (3.151)***	----	-5.88189 (4.194)***
Per Worker Pollution Growth (ΔE)	-0.001279 (0.035)	-0.067719 (4.152)***	----
System-Weighted R^2	0.3574		
Number of Observations	220		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 11: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Transportation, Communication, and Utilities)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	-74.5764 (1.040)	-15.2717 (0.061)	332.1606 (2.546)**
Initial Employment (Emp_0) 1000 jobs	-0.583 (0.473)	1.16 (2.250)**	3.712 (1.542)^
Initial Per Worker Earnings (W_0)	-0.00198 (2.851)***	-0.002716 (7.386)***	-0.01132 (1.542)^
Initial Per Worker Pollution (E_0)	0.001431 (2.042)***	-0.000183 (0.416)	-0.006001 (3.840)***
Firm Size	----	0.37413 (1.593)^	1.27838 (1.185)
Amenity Index	0.32882 (0.119)	-0.60498 (0.398)	----
Age	----	11.70913 (1.042)	----
Age Square	----	-0.20804 (1.590)^	----
Education	1.55392 (2.66)***	-5.4534 (1.593)^	-2.17996 (1.676)*
Education Square	----	0.03131 (1.478)^	----
Age *Education	----	0.05428 (0.772)	----
Black	----	5.90969 (0.335)	----
Housing Cost	----	0.00598 (0.223)	----
Unemployment	-0.02411 (0.020)	1.43387 (1.993)**	----
Union	1.43928 (1.847)*	-0.71952 (1.838)*	----

Table 11 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Transportation, Communication, and Utilities)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	75.3716 (0.723)	----
Unemployment Compensation Benefits	-0.06091 (0.266)	-0.16396 (1.158)	----
Property Taxes	-0.001265 (0.024)	----	----
Per Capita Total Expenditures	0.00861 (0.787)	----	----
Industry Density	0.09806 (0.434)	----	----
Land Prices	-0.001226 (0.156)	----	----
Population Density	-0.0123 (1.043)	----	0.00704 (0.487)
Workers Compensation Benefits	-0.21404 (0.985)	----	----
Green Policies	-0.000203 (0.016)	----	-0.02787 (0.945)
Electric Prices	1.75264 (0.466)	----	----
Highway Dummy	0.9589 (0.155)	----	----
Railroad Dummy	7.47682 (1.320)^	----	----
# Of Runways	-4.54448 (1.331)^	----	----
Port Dummy	-1.04757 (0.049)	----	----
Initial Earnings Square	----	----	0.00000018 (1.120)

Table 11 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Transportation, Communication, and Utilities)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	6.4634 (0.613)	-9.64831 (1.788)*	-19.3486 (0.769)
Employment Growth (ΔEmp)	----	0.44856 (2.414)**	2.006556 (2.620)***
Per Worker Earnings Growth (ΔW)	0.18776 (0.418)	----	-0.11967 (0.151)
Per Worker Pollution Growth (ΔE)	0.17276 (2.463)**	-0.03644 (0.827)	----
System-Weighted R^2	0.2797		
Number of Observations	219		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 12: 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Services)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Intercept	115.6451 (1.474)^	171.3350 (0.972)	-100.6908 (0.642)
Initial Employment (Emp_0) 1000 jobs	-0.273 (0.973)	0.16 (1.620)^	0.17 (0.283)
Initial Per Worker Earnings (W_0)	0.001601 (1.399)^	-0.004507 (8.621)***	0.005217 (0.395)
Initial Per Worker Pollution (E_0)	0.000531 (1.018)	-0.000309 (1.063)	-0.004448 (3.206)***
Firm Size	----	1.01544 (1.844)*	6.4078 (2.222)**
Amenity Index	-0.93278 (0.354)	0.47149 (0.417)	----
Age	----	0.687438 (0.087)	----
Age Square	----	-0.050991 (0.557)	----
Education	-0.580846 (1.036)	-3.46125 (1.494)^	-0.29267 (0.228)
Education Square	----	0.016735 (1.263)	----
Age *Education	----	0.051099 (10.56)***	----
Black	----	4.68343 (0.242)	----
Housing Cost	----	0.011395 (0.551)	----
Unemployment	-0.7177 (0.642)	-0.60443 (1.193)	----
Union	-2.17809 (3.060)***	-0.504885 (1.661)*	----

Table 12 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Services)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Female	----	13.67083 (0.158)	----
Unemployment Compensation Benefits	0.007625 (0.038)	0.08398 (0.837)	----
Property Taxes	-0.02969 (0.585)	----	----
Per Capita Total Expenditures	-0.01317 (1.309)^	----	----
Industry Density	0.01678 (0.445)	----	----
Land Prices	0.01635 (2.225)**	----	----
Population Density	-0.007748 (0.693)	----	-0.00494 (0.359)
Workers Compensation Benefits	0.3108 (1.579)*	----	----
Green Policies	0.00467 (0.374)	----	0.011957 (0.513)
Electric Prices	0.913058 (0.294)	----	----
Highway Dummy	0.810244 (0.132)	----	----
Railroad Dummy	-9.45589 (1.821)*	----	----
# Of Runways	-1.382405 (0.428)	----	----
Port Dummy	27.6664 (1.363)*	----	----
Initial Earnings Square	----	----	-0.00000023 (0.512)

Table 12 (continued): 3SLS Regression Results for Employment Growth, Earnings Growth Per Worker, and Pollution Growth Per Worker (Services)

Variables	Employment Growth (ΔEmp)	Per Worker Earnings growth (ΔW)	Per Worker Pollution Growth (ΔE)
Metro	2.35439 (0.291)	0.08885 (0.024)	-18.44629 (0.810)
Employment Growth (ΔEmp)	----	-0.1808 (1.372)^	0.016612 (0.035)
Per Worker Earnings Growth (ΔW)	-0.98826 (1.427)^	----	0.429537 (0.392)
Per Worker Pollution Growth (ΔE)	0.014417 (0.299)	0.00479 (0.188)	----
System-Weighted R^2	0.2852		
Number of Observations	217		

Notes: T statistics are reported in parentheses.
***= Significant at 1 percent or lower on two-tailed test;
** =Significant at 5 percent two-tailed test;
* = Significant at 10 percent two-tailed test;
^ = Significant at 10 percent on one-tailed test.

Table 13: Ranking of Elasticities (Derived form Table 7) of Endogenous Variables with Respect to Their Initial Values and Each Other: TVA Region

	Elasticities
$\varepsilon_{\Delta E,\ Wo}$ =Elasticity of Per-Worker Pollution Growth with respect to Initial Per-Worker Earnings	-38.5608
$\varepsilon_{\Delta E,\ \Delta W}$ =Elasticity of Per-Worker Pollution Growth with respect to Per-Worker Earnings Growth	-3.236415
$\varepsilon_{\Delta EMP,\ Wo}$ =Elasticity of Employment Growth with respect to Initial Per-Worker Earnings	-1.0068
$\varepsilon_{\Delta EMP,\ \Delta W}$ =Elasticity of Employment Growth with respect to Per-Worker Earnings Growth	-0.46503
$\varepsilon_{\Delta W,\ Eo}$ =Elasticity of Per-Worker Earnings Growth with respect to Initial Per-Worker Pollution	-0.086297
$\varepsilon_{\Delta E,\ \Delta EMP}$ =Elasticity of Per-Worker Pollution Growth with respect to Employment Growth	-0.0707
$\varepsilon_{\Delta EMP,\ Eo}$ =Elasticity of Employment Growth with respect to Initial Per-Worker Pollution	-0.0509
$\varepsilon_{\Delta W,\ \Delta E}$ =Elasticity of Per-Worker Earnings Growth with respect to Per-Worker Pollution Growth	-0.031688
$\varepsilon_{\Delta EMP,\ \Delta E}$ =Elasticity of Employment Growth with respect to Per-Worker Pollution Growth	-0.019997
$\varepsilon_{\Delta W,\ EMPo}$ =Elasticity of Per-Worker Earnings Growth with respect to Initial Employment	0.01716
$\varepsilon_{\Delta E,\ EMPo}$ =Elasticity of Per-Worker Pollution Growth with respect to Initial Employment	0.0824
$\varepsilon_{\Delta W,\ \Delta EMP}$ =Elasticity of Per-Worker Earnings Growth with respect to Employment Growth	0.1108

Table 14: Ranking of Elasticities of Endogenous Variables with Respect to Their Initial Values and Each Other: U.S. Nation

	Elasicites
$\varepsilon_{\Delta E,\ Wo}$ =Elasticity of Per-Worker Pollution Growth with respect to Initial Per-Worker Earnings	-6.1816
$\varepsilon_{\Delta E,\ \Delta W}$ =Elasticity of Per-Worker Pollution Growth with respect to Per-Worker Earnings Growth	-2.51675
$\varepsilon_{\Delta E,\ \Delta EMP}$ =Elasticity of Per-Worker Pollution Growth with respect to Employment Growth	-2.2746
$\varepsilon_{\Delta EMP,\ Wo}$ =Elasticity of Employment Growth with respect to Initial Per-Worker Earnings	-0.60921
$\varepsilon_{\Delta E,\ EMPo}$ =Elasticity of Per-Worker Pollution Growth with respect to Initial Employment	-0.5077
$\varepsilon_{\Delta EMP,\ \Delta W}$ =Elasticity of Employment Growth with respect to Per-Worker Earnings Growth	0.3768
$\varepsilon_{\Delta EMP,\ \Delta E}$ =Elasticity of Employment Growth with respect to Per-Worker Pollution Growth	-0.1967
$\varepsilon_{\Delta EMP,\ Eo}$ =Elasticity of Employment Growth with respect to Initial Per-Worker Pollution	-0.1485
$\varepsilon_{\Delta W,\ \Delta E}$ =Elasticity of Per-Worker Earnings Growth with respect to Per-Worker Pollution Growth	-0.08512
$\varepsilon_{\Delta W,\ \Delta EMP}$ =Elasticity of Per-Worker Earnings Growth with respect to Employment Growth	-0.05387
$\varepsilon_{\Delta W,\ Eo}$ =Elasticity of Per-Worker Earnings Growth with respect to Initial Per-Worker Pollution	-0.05149
$\varepsilon_{\Delta W,\ EMPo}$ =Elasticity of Per-Worker Earnings Growth with respect to Initial Employment	0.00238