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SECTORAL GROWTH ACROSS U.S. STATES: FACTOR CONTENT, LINKAGES, AND TRADE

J. David Richardson
Pamela J. Smith

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ABSTRACT

Employing a "factor-content" model that relates sectoral growth to regional factor endowments, we find:

- that U.S. state factor endowments are reasonably strong correlates of cross-state sectoral growth in value-added, with patterns that accord well with intuition;
- that inter-sectoral differences in productivity change are marked -- estimates range from negative to annual rates over 10 percent;
- little evidence of unusual growth linkages either from sector to sector or state to state, such as might be expected from recent discussions of externalities,...
- ...nor of correlation between unusually strong sectoral growth and unusual levels of export dependence, another putative channel of externalities.

Our principle data set is a 1987-89 panel of: sector-by-sector, state-by-state value added and international exports, as well as state endowments of patents, structural capital, and as many as six types of labor. "Unusual" growth and exports are defined as the residual growth and international exports left unexplained by endowments.

J. David Richardson
Department of Economics
Maxwell School
Syracuse University
Syracuse, NY 13244
and NBER

Pamela J. Smith
Department of Economics
University of Delaware
Newark, DE 19716

I. Overview

Empirical cross-country studies of sectoral international trade patterns based on national factor endowments have a long history. So do cross-country and cross-regional, endowments-based explanations of industrial and overall growth rates. Cross-country and cross-regional studies of disaggregated sectoral growth are more rare, although they are in principle ingredients to both the trade and growth studies.

In this paper, we report results from this last type of study, using US state-by-state data from 1987 through 1989.

We find that factor endowments are reasonably strong correlates of cross-state sectoral growth, and that inter-sectoral differences in productivity change are marked. We find little trace of externalities. There is little indication of either unusual growth linkages from sector to sector or from state to state. Nor does unusual growth correlate with atypically high levels of export dependence.

II. Background

Typical general-equilibrium approaches to production assume that sectoral outputs are essentially just embodied services of labor skills, capital endowments, land, and other resources. These approaches are very closely related to the typical trade economist's "factor-content" conception of trade -- the assumption that net inter-regional trade in a sector is essentially just embodied trade in the region's abundant and scarce resources.

We follow these leads in this paper and develop a "factor-content" specification for sectoral growth rates. Our specification includes a role for both generic sectoral technological progress and for specific technological indicators, in our case, patents. We then ask what, if anything, simple measures of spillovers might add to factor-content explanations of sectoral growth. The spillovers we have in mind are those from nearby regions, those from "nearby" (related) sectors, and those from unusual export success.

There are some particular advantages to applying this "factor content" approach in a cross-regional context for the United States. First, its validity rests on inter-regional factor-price equalization, on inter-regionally comparable technological opportunities, and on reasonably similar, but not identical, relative factor endowments across regions.[1] We would maintain that each of these assumptions characterizes the 50 United States (plus the District of Columbia) more accurately than the 60 or so countries on which factor-content international-trade studies are typically done.[2] Second, the endowments data for the U.S. states are richer, and arguably of higher quality, with less measurement

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[1]See Leamer (1984, pp. 11-44). The last of these conditions assures that state endowment vectors fall within the same "cone of diversification," as required by "factor content" theory.

[2]The accuracy is not perfect, of course. Giese and Testa (1989) find, for example, that compared to other US regions, New England, the Mid Atlantic states, and the Pacific region employ production techniques that are more intensive in their use of "high tech labor" in <u>all</u> industries. This makes suspect any <u>simultaneous</u> assumption of <u>perfect</u> comparability of technological opportunities and <u>perfect</u> factor price equalization.

error, than even the extensive national data compiled by other researchers.[3] As described below, we are able: to disaggregate labor into six (and more) categories corresponding to different types and levels of skill acquisition; to differentiate between regionally mobile and immobile ("structural") capital;[4] and to devise indicators of "technological momentum" (e.g., a state "patent count" in this paper) that allow a flexible generalization of the assumption of identical technological opportunities. Appendix A provides details on technological and other endowment measures.

Studies of cross-regional growth performance for highly aggregate indicators, of course, have a long history. Barro and Sala-i-Martin (1992,1994), Helliwell (1992), Holtz-Eakin (1994), and Mankiw, Rosen, and Weil (1992) are five of the more recent and distinctive studies of growth determinants, especially of whether poorer regions converge on richer through faster growth. Backus, Kehoe, and Kehoe (1992), Harrison (1991), Knight, Loayza, and Villanueva (1993), and Levine and Renelt (1992) are four recent studies that focus especially on the role of international trade

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[3]For example, the data sets of Barro and Sala-i-Martin (1992,1994), Leamer and associates (1984,1987), Maskus (1991), and Trefler (1993,1994).

[4]As Leamer (1984, pp. 21-23) shows, only immobile endowments should be linear determinants of cross-regional trade. Each flow of a mobile factor in and out of a region should be treated as a form of trade itself, and linearly related across states to their immobile endowments. If, by contrast, mobile factors are left to be "right-hand-side" determinants themselves, then the specification invites simultaneity problems (lack of independence between the disturbance terms in a sectoral commodity-trade equation and the mobile-factor explanatory variables).

and trade policy in determining growth.

Most of these studies are caried out at a macroeconomic level[5] using log-linear (Cobb-Douglas) functional forms suggested by the long tradition of postulating aggregate production functions. For aggregate gross product, the approach to cross-sectional growth suggested in this paper would boil down to almost the same approach except for functional form. The functional form chosen here allows for a fairly natural estimate of generic sectoral technological progress.

For studying the determinants of sectoral growth, as undertaken here, our approach differs in another important way. In our specification, the right-hand determinants of growth are regional factor endowments, not sectoral factor inputs (as in a production-function approach at a sectoral level). The two approaches are not inconsistent, of course. But general-equilibrium economists, especially international economists, would claim that the endowments approach is more fundamental (endowments are "more" exogenous). Regional endowments are ultimately the primitive determinants of sectoral inputs.

Furthermore, the specification with regional endowments as determinants is much more interesting from a policy perspective. Regional governments have more natural and dependable policy

[5]Barro and Sala-i-Martin (1991, pp. 136-141) contains some limited results for disaggregated categories. And Backus, Kehoe, and Kehoe (1992) conduct their analysis for both aggregate growth and growth in manufactures, with quite different results for the influence of geographical scale effects (no influence on aggregate growth, robust influence on growth in manufactures).

instruments for influencing regional endowments than they have for influencing sectoral inputs.

III. Basic Specification and Estimation

A (Static) Base Specification. For any given set of factor prices, and assuming constant returns to scale and general market clearing for goods and factors, factors are allocated across sectors according to input-output relationships:

$$V_i = \sum_{j=1}^{n} a'_{ij} Y_j \qquad (1)$$

where V_i = an endowment of factor i, Y_j = the jth sector's output, and the a'_{ij} terms are standard input-output coefficients for direct and indirect requirements of primary factors of production (i.e., the a'_{ij} terms already reflect and embody intermediate goods and services).[6] If there happened to be exactly the same number of factors, say m, as sectors (n=m), then the set of all m equations (1) could be written in matrix form and inverted, so that

$$Y = aV \qquad (2)$$

where Y = an $n \times 1$ vector of outputs, matrix "a" is an $n \times m$ "Rybczynski matrix" --the inverse of the standard primary input-output matrix,

[6] See Leamer (1984), pp. 33-35.

and V is an $m \times 1$ vector of endowments.

What if the number of factors and sectors are different? Clearly the number of equations like (2)[7] could be increased beyond n without loss of generality by any arbitrary disaggregation of a sector's output: disaggregated sub-components of some given Y_j would all have proportional a_i coefficients, with identical relative values. This is one way of illustrating the familiar point[8] that the linear factor-content relations expressed in equation (2) can be as valid in an environment with more goods than factors (n>m) as they are in "even" environments (n=m).[9] The $n \times m$ matrix "a" would, of course, be expected to have sets of rows that were proportional transformations of each other in the environment with more goods than factors.

Base Estimation. These equations alone could be estimated across regions if the same technology and factor prices ruled (factor price equalization).[10] Table 1 shows the coefficient estimates from doing so, along with their standard errors. The

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[7]There are, of course, n sectoral equations in (2).

[8]Familiar at least to international-trade theorists.

[9]See Leamer (1984), pp. 16-21, 49-50 and Leamer (199 for a more formal demonstration. The exact validity depends on important assumptions underlying traditional trade theories such as the absence of factor-intensity reversals and of "complete specialization" (zero $Y_{j's}$) across sectors. Only one of our sectors, tobacco (SIC 21) has significant non-representation in production across states.

[10]Using country data, Leamer's ((1984), pp. 144-146) attempts to do so at the aggregate level produce unsatisfying results.

endowments employed are the labor groups, structural capital, and measures of technological momentum described above, and in more detail in Appendix A. A question addressed in the alternative specification below is whether these particular endowments really are sufficiently immobile across state borders to match the theory; a closely related question is whether the regressors are really exogenous. The underlying regresssions were pooled over the three years of the data sample; the data were all scaled by aggregate gross state product;[11] and a constant term was (arbitrarily) added.[12]

The estimates in Table 1 are of the Rybczynski coefficients of the static base equation. They have interesting regularities in their own right, and by comparison with those from Table 2, as described below.

In general, the coefficients suggest sensible patterns.[13] States with large endowments of structural capital and "blue-

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[11]See Leamer (1984, pp. 121-22, 162), who scales his observations by powers of GNP to alleviate heteroskedasticity.

[12]Residuals and other details from the regressions are available from Richardson. Because of the focus below on percentage growth rates, observations were omitted when a region had no value added in 1987 for a given sector. Only tobacco products (SIC 21) had significant numbers of omissions. See Appendix B, "Number of Observations" line. SIC 39, Miscellaneous Manufactures, is not included in either durables or non-durables sub-aggregates. Total manufactures in our data ignores it. Coefficients in Table 1 equations for durables and non-durables, therefore, sum exactly to their counterparts in the total equation.

[13]These regressions differ from their close counterparts in Richardson and Smith (1994), Table 1, by omitting observations where no growth rates could be defined because 1987 value-added was zero, and by estimating with ordinary least squares methods rather than Tobit.

collar" labor (Labor 5) have large manufacturing and small non-manufacturing sectors. States with large endowments of patents[14] and professional labor (Labor 1), as well as capital and blue-collar labor, are especially well represented in durable manufactures sectors, as opposed to non-manufacturing. But structural capital and professional labor endowments are negatively related to non-durables value added. Other sensible correlations can be observed by a close study of the table, along with some anomalies, of course.[15]

But equations (2) can also provide an informative foundation for cross-regional estimates of sectoral growth rates and their determinants.

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[14]The patent count in question is a regional, not a sector-specific, measure, as is true of all the other endowments. It is the total number of utility patents issued to residents of each state (whether individuals or groups, e.g., laboratories or universities). It is in our framework one possible measure of technological or techno-entreprenurial momentum. It is interesting that the effect of patents remained qualitatively the same for patent "stock" constructions -- cumulation of a state's overall patenting activity over a number of years, appropriately discounted.

[15]We recognize the issue of causality is not addressed here, and that the endowments list excludes resource endowments such as land and oil that likely contribute to sectors such as food and petroleum. In other, ongoing research we investigate the causality issue in several ways. One involves direct estimation of Equations (1) instead of (2). Another involves lagging either the outputs or endowments once or twice and seeing if one particular lag specification dominates the others. When we tried this for 1987-92 export equations, the alternate specifications had virtually the same explanatory power, showing how smooth the temporal variation is in the data set compared to the cross-sectional variation. In past research we have included natural resource endowments. Smith and Richardson (1991) reports cross-sections for 1989 alone that include three measures of land endowments and four measures of mineral endowments. These have insignificant effects except in the obvious sectors.

A Growth Specification. Under almost the same assumptions as above, we can rewrite equations (2) to more revealingly focus on the determinants of sectoral growth. Instead of assuming cross-time stability of the a-matrix (the implicit assumption in pooling observations from 1987-89 for the Table 1 estimates), we can imagine it evolving with a specialized form of technological change that preserves factor price equalization. Rewrite equations (2) as:

$$Y^t = (A^t a)(eV^t) \tag{3}$$

where superscript t is an index for year; where A^t is an n×n diagonal matrix of technology factors, indexes of each sector's generic technological capabilities (productivity) against some external (say, world) benchmark, and assumed to grow over time[16]; where $A^t a$ is then the (n×m) matrix of primary-factor output-input (Rybczynski) coefficients from (2) with each row of the matrix scaled by A^t; where eV^t is the endowment vector in efficiency units -- the vector of primary-factor endowments pre-multiplied by an m×m diagonal matrix of positive factor (productivity) augmentation scalars e_i. These productivity scalars e_i are assumed to be the same in every state, and scale generic (A) technological capability up (e_i>1) for factors whose sectoral productivity is especially augmented by it, or down (e_i<1, but always non-negative) for

[16]It would not be wrong to think of these as indexes of sectoral "X-efficiency."

factors that are not so especially augmented, or possibly even diminished in productivity.[17]

The output equations (3), once they are normalized, are effectively no different from (2), but can be re-oriented to describe sectoral growth with some assumptions about the evolution of A^t and e (in our case, cross-time as well as cross-state stability of e). We will assume:

$$A^{t+1} = (1 + a_o)A^t; \text{ and that} \qquad (4)$$

e is stable over time;

where $(1+a_o)$ is an n×n diagonal matrix of technological growth factors.

The particular structure captured in (3) and (4) is very flexible, allowing for technological change that is common across states, yet simultaneously both distinctively sector-specific and differentially factor-productivity-augmenting. The structure also implies a convenient econometric specification and interpretation of coefficients, as follows for each sector j:[18]

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[17]This algebra has some similarity to Trefler's (1993) conception. His cross-regional productivity differences differ from factor to factor. Our cross-sectoral productivity differences differ from factor to factor.

[18]The derivation of (5) from (3) using (4) is somewhat tedious. For some particular sector divide (3) for year t by A^t and (3) for year t+1 by $(1+a_o)A^t$, using (4). Subtract the first from the second and divide the result by $Y^t{}_j/A^t$. The right-hand side is the sum of $A^t a_{ij} e_i \Delta V_i$ terms; the left-hand side is $[Y^{t+1}/(1+a_o) - Y^t]$ divided by Y^t. The left-hand side simplifies to $[1/(1+a_o)]\%\Delta Y - [a_o/(1+a_o)]$. Bringing the last term to the right-hand side and multiplying by $(1+a_o)$ yields (5).

$$\%\Delta Y_j^t = a_{oj} + \sum_{i=1}^{m} b_i(\Delta V_i/Y^t_j) + u_j \qquad (5)$$

where $b_i = (1+a_{oj})A^t_j a_{ij} e_i$, and Δ is the difference operator across time. The equation is not as daunting as it may look. In words it says that a sector's proportional growth rate is a linear combination of scaled growth in its various endowments (a "factor content of growth" formulation). The linear combination is more precisely the coefficient-weighted sum of a region's endowment growth, where each factor's growth is scaled by base-period output, and an intercept. The intercept is the sector's "total factor-endowment productivity" -- the sector's percentage growth rate of generic technology (a_{oj}).[19] Each slope coefficient (weight) in the summation of endowment growth is the product of $(1+a_{oj})$, the factor's own constant productivity augmentation scalar (e_i), and its (base-period) output-input coefficient ($A^t_j a_{ij}$).[20]

In estimating equation (5), the estimated intercept is the sector's distinctive rate of generic technological change, and the ratio of the coefficients on any two factors is the product of their relative Rybczynski coefficients and their relative

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[19]In contrast to total factor productivity, it is a measure of a sector's productivity growth after accounting for a <u>region's endowment</u> growth, rather than the sector's own input growth.

[20]If omitted endowments such as land or resources do not grow much from year to year, then the problem of bias from omitting them vanishes in this specification: the values of their numerators are zero. If mis-measured endowments retain the same proportional degree of mis-measurewment from year to year, then the problems associted with measurement error in the regressors vanish also.

augmentation scalars (e.g., for factors 1 and 2, $(a_{1j}/a_{2j})(e_1/e_2)$). Extraneous information about either ratio would thus allow an estimate of the other ratio.

Growth Estimation. Table 2 records estimates for equation (5), along with standard errors. There are a number of interesting patterns. First, the estimated rates of sectoral technological change, given by the constant term, are ordered in accord with rough expectations. The gaps between them, however, seem unexpectedly large. Putative high-technology sectors such as machinery, equipment, and instruments (SIC 35-38) have estimated sectoral technological change of 6 to 26 percent over the two-year period.[21] Metals have 10 to 15 percent. Tobacco, textiles, furniture, paper, and printing have negative sectoral technological change. Other sectors are in between. Non-manufacturing (services, etc.) in particular is estimated to have had general technological progress of roughly 2 1/2 percent over the two-year period.

Second, the slope coefficient patterns are interesting. States with large growth in their blue-collar workforces and patenting activity had high growth rates in a number of manufacturing sectors. In terms of size and significance of

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[21]Tables 7, 8, and 9 of Richardson and Smith (1994) summarize results for a sub-aggregation of high- and low-technology manufacturing, proxied, respectively, by SIC sectors 35-38 and all other SIC manufacturing sectors. Over the two-year period, sectoral productivity is estimated to grow by 15 percent in high-technology manufacturing, versus 4 percent in other manufacturing.

coefficient, growth in blue-collar labor was especially associated with growth in non-durables sectors, while growth in patenting was associated with growth of durables.[22] A state's structural capital growth was often negatively correlated with the growth rate of manufacturing sectors, and positively associated with growth in non-manufacturing. Non-manufacturing (services, etc.) grew most rapidly where services workforces grew.

Table 2's estimates of the determinants of sectoral growth rates are also interesting in comparison with Table 1's estimates of the determinants of the level of sectoral value added.

Table 3 reports the comparison, identifying instances in which both growth-rate and levels coefficients were precisely estimated (relatively speaking, according to standard errors). A grade is assigned, similar to a grade-point scale. A blank denotes imprecise estimates, a "1" indicates a situation in which both Table 1 and Table 2 estimates had t-values between 1.0 and 2.0, a "2" indicates that a coefficient's t-value exceeds 1.0 in one table and 2.0 in the other, and a "3" indicates that both exceed 2.0. In general, the significant endowments-based determinants of the level of value added also determined its growth rate with the same sign. In several cases, however, the signs differed, due presumably, among other things, to technological change that did not match our maintained hypothesis of common cross-state rates that could differ

[22]One anomaly of the Table 2 estimates is that coefficients in the equations for aggregates are often more precisely estimated than those in the equations for the two-digit disaggregated categories.

by sector and factor. There are enough such instances to cause concern. Nevertheless, it is interesting that the simple attempt described above to infer relative productivity augmentation factors does support conventional wisdom that blue-collar workers have been especially hard hit by recent technological change.[23]

An Alternative Base and Growth Estimation. Among other reasons to doubt the estimates of either Table 1 or Table 2 is the question of cross-state factor mobility. Professional labor and technological endowments, especially non-rival technological factors, seem likely to be highly mobile across state borders. Their inclusion as regressors above would be inappropriate in theory (it is the immobile endowments that should determine output patterns), and econometrically troublesome; mobile endowment stocks are themselves endogenously related to immobile endowments, and the regressors above would include endogenous variables, causing simultaneity bias.

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[23]Define the most precise Table 3 cells as those with scores of 2 and 3. There are seven instances with mutually precise estimates of a sector's level and growth coefficients for blue-collar labor and either capital, professional labor, or patents. In each of the seven, the relative factor-productivity augmentation ratio for blue collar labor is fractional (or negative, again suggesting failure of our maintained hypotheses). We use the Table 1 estimates to purge the relative Rybczynski coefficient ratio (e.g., a_{1j}/a_{2j}, for factors 1 and 2) from ratios of Table 2 estimates within a given sector (a_{1j}/a_{2j} times e_1/e_1), though to be fully consistent, Table 1 estimates for a 1987 cross-section alone should be used. In overall manufacturing, for example, 1987-89 technological change is estimated by this approximation to have augmented the productivity of professional labor by slightly more than ten times the amount that it augmented the productivity of the blue collar labor force.

To determine the sensitivity of our results to these concerns, we re-estimated equations (2) and (5) leaving out the professional labor force and the patent endowment.[24] We also aggregated our second and third labor groups into a white-collar aggregate, and our fourth and fifth labor groups into a blue-collar aggregate (each pair was much more highly correlated across states than with other labor groups). Tables 4 and 5 record the estimates. They are qualitatively very similar to the results of Tables 1 and 2.

IV. Searching for Externalities and Growth From Export Dependence

Many of the newer theories of the determinants of regional growth emphasize externalities and international trade. Externalities are sometimes geographical (e.g., agglomeration), sometimes inter-industry, sometimes concerned with factor markets, and sometimes channelled through international trade. To explore these themes in a very preliminary way, we asked ourselves whether the residuals from our endowments-based regressions revealed any evidence of geographical or inter-sectoral externalities, or whether they showed any correlations with unusually strong state export performance. We identified unusually strong state export performance with state fixed effects (a form of residual) from sectoral export-to-aggregate-output equations estimated in

[24]We also left out the last labor group (forestry workers, fishermen, and farmworkers) since it, unlike the others, could not be ranked with respect to skills and education required.

Richardson and Smith (1994).[25]

It was difficult to detect any geographical or inter-sectoral externalities. Charts "21" through "31" are one way of summarizing this conclusion. They show residuals from the growth-rate regressions of Table 2 for the putative high-technology machinery and equipment sectors (SIC 35-38), arrayed in the 11 US Census Bureau regions. There is no very graphic pattern that is apparent. Only a few states have uniformly positive or negative residuals in all these sectors; even fewer regions do (but see the largely negative residuals for New England, except Maine, and for the Mid-Atlantic states). There is not that much parallelism in the cross-sector residuals patterns between states in the same region, nor between regions. Finally there is little parallelism across states in the residuals pattern of one sector compared to that of any of the other three (SIC 35 and 36 come closest).

Of course, these sectors are just a sample, and the most important externalities may flow from them to other sectors, rather than among them. But if so, it would be very surprising to see so little trace of geographical or inter-sectoral externalities in these charts. Some of the categories, transportation equipment for example (SIC 37), involve both high-technology and standard-technology sub-sectors.

With regard to the effects of "openness" on growth rates, we started with simple measures of unusual exports and growth, and a

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[25]See also Smith (1994b) on detecting inter-state and inter-sectoral externalities.

series of sectoral scatter plots that arrayed one against the other. We defined unusual growth by the residuals from the growth-rate regressions of Table 2 -- that is, the part of measured sectoral growth of the states that is not explained by their respective factor endowments. We defined unusual exports by the coefficients on state dummy variables from 1987-89 regressions explaining state exports abroad (relative to output) by the same set of factor endowments, and summarized in Richardson and Smith (1994); these coefficients should be interpreted as "unusual" state export performance, judged through the lens of factor endowments -- the part of state export performance unexplained by those endowments.

The scatter plots revealed little correlation between unusual state growth and unusual state ability to penetrate international export markets. Table 6 summarizes these results in a more compact form than the scatter plots themselves. Unusual growth rates are regressed against unusual exports. Subsequent lines for some sectors re-run each simple regression omitting a state that was an influential outlier in the scatter plots. Only stone, clay, and glass growth (SIC 32) seems robustly correlated to export performance in the way that the new externalities-based literature expects. Contrary to it, unusually strong export performance is, if anything, negatively correlated with unusually strong growth for important sectors such as fabricated metal products (SIC 34) and scientific and professional equipment (SIC 38). Otherwise the lack of relationship between exports and growth is quite overwhelming!

V. Conclusion.

This paper assesses statistically the roles of technological and other factor endowments as determinants of US state growth rates of value-added from 1987-89 in broad sectoral aggregates. In general, endowments do moderately well in explaining cross-state differences in sectoral growth. The paper's most surprising positive conclusion is the striking inter-sectoral differences in estimated rates of productivity growth. The paper's most surprising negative conclusion is the failure to find any marked evidence of the geographic, inter-sectoral, or openness-determined externalities that have played so important a role in modern theories of growth.

In sum, the main message seems similar to the "what-miracle?" counter-revolution in explaining East Asian growth patterns (e.g., Young (1993, 1994a,b)). Endowments explain growth reasonably well; exotic externalities do not.

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APPENDIX A

DATA SOURCES AND DEFINITIONS

GROSS STATE PRODUCT. The gross state product data are compiled by ... at both aggregated and disaggregated levels. The aggregate data are the state-by-state equivalents of Gross Domestic Product at the national level. The disaggregated data are value added in sectors defined by two-digit Standard Industrial Classification categories.

CAPITAL. Immovable capital stock data for the 50 states plus the District of Columbia are assembled by Ruder (1991) by first recording the dollar value of the private nonresidential construction authorized annually in each state. These data are from various issues of Construction Review published monthly by the U.S. Department of Commerce. The data series collected covers the years 1978 through 1992.[26]

Next, the value of private nonresidential construction for each year and each state are converted from current dollars into both 1982 and 1986 constant dollars.[27]

The adjusted constant dollar value of private nonresidential construction is then depreciated at an annual rate of 0.09. This depreciation rate was chosen on the assumption that buildings have a useful life of 50 years.[28]

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[26]Adjustments were made to improve comparability of the data across years that have varying numbers of permit-issuing places from which the data are collected. From 1978 through 1983, data on nonresidential construction were collected from 16,000 permit-issuing places. After 1984, the data were collected from 17,000 such places. Both the 17,000-and 16,000-place data are reported for 1984. To improve comparability, the pre-1984 number for each state was multiplied by the ratio of the 17,000-and 16,000-place 1984 numbers for that state.

[27]These adjustments from current to constant dollar values are made using the Boeckh index for construction cost of commercial and factory buildings reported in the Survey of Current Business and published by the U.S. Department of Commerce, Bureau of Economic Analysis.

[28]The annual depreciation rate that reduces a building to one percent of its value after 50 years is 0.09. It is also assumed that construction authorized in one year is put into place in the following year--construction authorized this year adds to the capital stock next year.

A state's endowment stock of immovable capital, C, for the years 1987, 1988 and 1989 is then calculated as the sum of the depreciated value of authorized private nonresidential construction

$$C_{1987} = \sum_{i=1-8} (c_{1978+i} * (1 - 0.09)^{(8-i)})$$
$$C_{1988} = \sum_{i=1-9} (c_{1978+i} * (1 - 0.09)^{(9-i)})$$
$$C_{1989} = \sum_{i=1-10} (c_{1978+i} * (1 - 0.09)^{(10-i)})$$

... and so on,

where C is the adjusted constant dollar value of private nonresidential construction and i denotes the year in which it is authorized.

LABOR. Labor data are 1987-89 annual averages of numbers, in thousands, in the experienced civilian labor force by occupation. Experienced is defined as persons with prior work experience. Data are from the Geographic Profile of Employment and Unemployment published annually by the U.S. Department of Labor, Bureau of Labor Statistics. These data are derived from the Current Population Survey (CPS) conducted by the Bureau of the Census.

In determining a meaningful aggregation scheme for the occupational categories, labor force data were supplemented with data on the significant sources of training for occupations. Data on training sources are from Occupational Projection and Training Data, 1988 which is published by the U.S. Department of Labor, Bureau of Labor Statistics. Information used to identify the significant sources of training for each occupation was taken from responses to a supplemental questionnaire in the January 1983 CPS.

The labor endowments are defined as

Labor1: Professional specialty
Labor2: Executive, administrative and managerial
Labor3: Technical, sales, service occupations, and administrative/clerical support
Labor4: Precision production, craft and repair
Labor5: Operators, fabricators and laborers
Labor6: Farming, forestry and fishing

The occupation-training relationships that serve as the basis for these aggregates are as follows: labor1 includes occupations generally requiring at minimum a 4-year college degree or graduate/professional level training; labor2 includes occupations generally requiring at most a 4-year college degree; labor3 includes occupations for which post-secondary school training, but less than a bachelor's degree, is significant, as well as occupations generally requiring high school vocational training as the significant source of skills preparation; labor4 includes occupations for which formal employer training is generally provided; labor5 includes occupations generally requiring no formal training; and labor6 includes farming, fishing and forestry occupations for which there is no single principal source of formal training.

PATENTS. Patents data are total numbers of utility patents granted to residents of the U.S. states in 1987-89. Utility patents cover inventions of new and useful process, machine, manufacture, and composition of matter, and exclude patents for designs, botanical plants and reissues. These data were provided by the U.S. Patents and Trademark Office, and are published by the Patents and Trademark Office in Patenting Trends in the United States, State Country Report, 1963-1987, and updated.

Several alternative patent "stock" variables were constructed, which in theory should have provided better measures of state endowments. Patents are a type of durable technological capital, similar to other capital in that "units produced" in prior years still have current production values. In practice, discounted cumulations of patents over multiple-year intervals, our proxy for patent stocks, had the same or inferior explanatory power in our regressions.

EXPORTS. See Richardson and Smith (1994).

APPENDIX B

DATA SUMMARY STATISTICS

Summary Statistics for GSP

Level of GSP:	GSP20	GSP21	GSP22	GSP23	GSP24	GSP25	GSP26	GSP27	GSP28	GSP29	GSP30	GSP31
Number of observations:	51	19	46	51	51	49	50	51	51	49	51	45
Avg. 87	1307.157	271.737	377.674	430.451	490.118	260.510	673.100	876.922	1410.706	869.388	578.843	67.222
Avg. 88	1330.098	196.000	363.957	439.314	518.392	249.163	691.120	912.059	1519.627	907.265	586.941	65.844
Avg. 89	1378.078	161.947	363.435	439.157	502.941	249.857	659.820	884.608	1492.725	916.531	604.588	64.378
Std. Dev. 87	1508.222	650.780	884.120	698.834	545.874	385.508	706.790	1304.309	1822.976	1840.216	640.245	89.257
Std. Dev. 88	1531.134	475.467	849.283	715.725	575.788	369.611	723.524	1371.800	2000.398	1921.638	640.825	86.870
Std. Dev. 89	1593.586	389.541	845.022	721.315	563.594	369.012	685.268	1301.540	1943.752	1953.785	656.173	81.730
Coef. Var. 87	1.154	2.395	2.341	1.623	1.114	1.480	1.050	1.487	1.292	2.117	1.106	1.328
Coef. Var. 88	1.151	2.426	2.333	1.629	1.111	1.483	1.047	1.504	1.316	2.118	1.092	1.319
Coef. Var. 89	1.156	2.405	2.325	1.642	1.121	1.477	1.039	1.471	1.302	2.132	1.085	1.270

Change of GSP:	GSP20	GSP21	GSP22	GSP23	GSP24	GSP25	GSP26	GSP27	GSP28	GSP29	GSP30	GSP31
Avg. 88-87	22.941	-75.737	-13.717	8.863	28.275	-11.347	18.020	35.137	108.922	37.878	8.098	-1.378
Avg. 89-87	70.922	-109.789	-14.239	8.706	12.824	-10.653	-13.280	7.686	82.020	47.143	25.745	-2.844
Std. Dev. 88-87	44.187	175.651	37.120	25.130	55.057	22.082	24.187	71.207	189.797	142.657	30.436	5.348
Std. Dev. 89-87	101.123	261.607	49.676	58.500	52.283	33.207	43.788	48.735	153.324	158.348	53.310	10.486

% Growth of GSP:	GSP20	GSP21	GSP22	GSP23	GSP24	GSP25	GSP26	GSP27	GSP28	GSP29	GSP30	GSP31
Avg. 88-87	1.736	-25.701	2.355	5.220	7.768	-3.169	2.993	3.092	7.188	4.564	-0.077	-3.621
Avg. 89-87	4.300	-50.354	4.106	6.383	6.369	-0.031	-1.308	1.119	3.316	9.036	4.946	-2.804
Std. Dev. 88-87	4.611	15.746	14.020	17.684	15.280	5.358	10.430	4.162	7.322	12.906	19.856	15.795
Std. Dev. 89-87	10.254	26.304	26.523	22.031	18.974	15.119	13.820	4.823	11.923	32.378	24.214	35.122

Coef. Var.: Coefficient of Variation = Std.Dev. / Average

Number of Observations: Observations with GSP(87) = 0 were deleted since % Growth =100 (GSP(8x)-GSP(87)) / GSP(87) is not defined

Level of GSP:	GSP32	GSP33	GSP34	GSP35	GSP36	GSP371	GSP379	GSP38	GSPMAN	GSPNONDUR	GSPDUR	GSPNONMAN
Number of observations:	51	49	51	51	50	50	51	50	51	51	51	51
Avg. 87	431.686	709.286	1155.078	2708.098	1657.800	895.820	1091.745	515.020	16417.431	6600.471	9816.961	59010.412
Avg. 88	448.000	770.347	1298.353	3213.922	1761.160	990.060	1166.078	558.900	17666.373	6796.863	10869.510	61401.373
Avg. 89	461.824	752.306	1290.549	3428.529	1816.780	945.640	1250.255	532.800	17899.216	6771.588	11127.627	63061.510
Std. Dev. 87	507.700	1023.044	1555.621	3406.988	2799.378	2309.947	2489.294	1047.005	19485.189	7386.887	12740.371	71743.734
Std. Dev. 88	524.320	1111.587	1733.857	4042.355	2905.779	2455.902	2658.681	1131.851	21087.780	7699.638	14013.631	75073.441
Std. Dev. 89	544.630	1084.032	1703.372	4323.612	2956.538	2339.143	2889.244	1078.802	21466.153	7662.094	14415.368	77465.988
Coef. Var. 87	1.176	1.442	1.347	1.258	1.689	2.579	2.280	2.033	1.187	1.119	1.298	1.216
Coef. Var. 88	1.170	1.443	1.335	1.258	1.650	2.481	2.280	2.025	1.194	1.133	1.289	1.223
Coef. Var. 89	1.179	1.441	1.320	1.261	1.627	2.474	2.311	2.025	1.199	1.132	1.295	1.228

Change of GSP:	GSP32	GSP33	GSP34	GSP35	GSP36	GSP371	GSP379	GSP38	GSPMAN	GSPNONDUR	GSPDUR	GSPNONMAN
Avg. 88-87	16.314	61.061	143.275	505.824	103.360	94.240	74.333	43.880	1248.941	196.392	1052.549	2390.961
Avg. 89-87	30.137	43.020	135.471	720.431	158.980	49.820	158.510	17.780	1481.784	171.118	1310.667	4051.098
Std. Dev. 88-87	29.787	97.107	181.431	644.581	127.031	174.976	190.052	121.627	1657.879	399.464	1313.834	3611.501
Std. Dev. 89-87	52.061	83.350	169.715	940.864	201.399	137.482	424.786	111.288	2138.538	458.416	1763.524	6184.199

% Growth of GSP:	GSP32	GSP33	GSP34	GSP35	GSP36	GSP371	GSP379	GSP38	GSPMAN	GSPNONDUR	GSPDUR	GSPNONMAN
Avg. 88-87	3.663	8.347	13.889	23.304	12.773	18.668	14.251	14.903	7.434	3.132	10.430	3.494
Avg. 89-87	7.742	9.291	15.064	33.474	22.022	20.020	23.549	14.296	9.715	3.185	14.944	6.427
Std. Dev. 88-87	6.902	14.595	5.553	21.675	23.388	23.594	22.940	32.545	3.023	3.027	6.205	2.983
Std. Dev. 89-87	10.909	17.288	10.727	30.139	38.087	25.642	35.870	39.300	5.097	5.118	8.747	4.168

Coef. Var.: Coefficient of Variati
Number of Observations: Observ

Summary Statistics for Endowments:

Level of GSP:	CAP	LAB1	LAB2	LAB3	LAB4	LAB5	LAB6	PAT
Avg. 87	8141.777	288.863	268.020	1039.569	283.294	378.314	74.373	853.059
Avg. 88	8777.840	298.745	284.882	1049.176	283.275	379.294	72.902	793.725
Avg. 89	9414.977	310.294	298.235	1064.059	285.843	383.882	71.863	979.627
Std. Dev. 87	11345.128	336.487	325.829	1154.836	299.490	381.005	74.409	1197.928
Std. Dev. 88	12094.827	348.479	349.090	1164.602	299.343	378.391	74.675	1116.812
Std. Dev. 89	12861.907	364.342	366.452	1184.896	302.308	391.541	75.220	1375.455
Coef. Var. 87	1.393	1.165	1.216	1.111	1.057	1.007	1.000	1.404
Coef. Var. 88	1.378	1.166	1.225	1.110	1.057	0.998	1.024	1.407
Coef. Var. 89	1.366	1.174	1.229	1.114	1.058	1.020	1.047	1.404

Change of:	CAP	LAB1	LAB2	LAB3	LAB4	LAB5	LAB6	PAT
Avg. 88-87	636.062	9.882	16.863	9.608	-0.020	0.980	-1.471	-59.333
Avg. 89-87	1273.200	21.431	30.216	24.490	2.549	5.569	-2.510	126.569
Std. Dev. 88-87	918.530	17.505	27.498	28.580	16.563	21.930	6.944	102.596
Std. Dev. 89-87	1913.527	34.309	44.245	47.226	20.126	22.672	10.695	204.458

Coef. Var.: Coefficient of Variation = Std.Dev. / Average

NOTES, TABLES 1-2, 4-5.

Tables 1 and 2, 4 and 5.

Tables 1 and 2 record coefficients from estimating equations (2) and (5), with standard errors in parentheses below.

Value added is in ? of dollars; capital in ? of dollars; labor categories in ? of persons; and patents are ? of patents granted.

In Tables 1 and 4, all variables are scaled by aggregate gross state product in constant ? of 1982 dollars.

NOTES, TABLE 3

Table 3.

Table 3 records a "1" when t-values on the hypothesis that a coefficient is zero lie between 1 and 2 for a respective entry in both Table 1 and Table 2. Table 3 records a "2" when one of the t-values lies between 1 and 2 and the other exceeds 2. Table 3 records a "3" when both t-values exceed 2. Blank spaces denote one or both t-values falling short of 1.

The sign of the coefficient in Table 1's "levels" regressions lies to the left of the numerical entry; the sign of the coefficient in Table 2's "growth" regressios lies to the right.

Table 1 - Ordinary Least Squares Estimation of the Output (Rybczynski) Equations, by Industry

		Constant	Capital	Labor 1	Labor 2	Labor 3	Labor 4	Labor 5	Labor 6	Patents	R^2
SIC20	Food	0.007	-21.309	-6.361	3.644	0.894	-5.162	3.936	4.525	0.558	0.440
		(0.00)	(27.81)	(1.90)	(2.26)	(0.68)	(1.80)	(0.85)	(0.86)	(0.13)	
SIC21	Tobacco	0.001	27.449	4.001	3.370	-3.142	0.630	1.672	5.417	-0.182	0.366
		(0.01)	(33.38)	(2.69)	(2.72)	(0.78)	(2.23)	(1.00)	(3.39)	(0.20)	
SIC22	Textile	-0.008	96.153	1.949	2.103	-2.811	2.081	4.393	-0.957	-0.311	0.390
		(0.01)	(33.46)	(2.18)	(2.70)	(0.79)	(2.18)	(1.00)	(1.19)	(0.15)	
SIC23	Apparel	0.001	-6.747	-0.827	2.603	-0.582	-0.860	2.391	-0.805	-0.175	0.527
		(0.00)	(11.02)	(0.75)	(0.89)	(0.27)	(0.71)	(0.34)	(0.34)	(0.05)	
SIC24	Lumber	-0.006	31.998	0.254	5.477	-1.999	-2.300	4.718	2.895	-0.048	0.266
		(0.01)	(32.85)	(2.24)	(2.66)	(0.80)	(2.12)	(1.01)	(1.01)	(0.15)	
SIC25	Furniture	0.000	12.495	-0.072	0.781	-0.538	-0.899	2.021	-0.212	-0.056	0.447
		(0.00)	(9.71)	(0.66)	(0.79)	(0.25)	(0.63)	(0.30)	(0.30)	(0.05)	
SIC26	Paper	0.000	28.750	3.000	-0.846	-1.799	1.214	3.368	-0.249	0.084	0.268
		(0.01)	(32.06)	(2.18)	(2.61)	(0.78)	(2.10)	(0.99)	(0.99)	(0.15)	
SIC27	Printing	0.011	-42.240	1.864	1.464	0.185	-3.649	0.860	-1.571	0.011	0.315
		(0.00)	(13.82)	(0.94)	(1.12)	(0.34)	(0.89)	(0.42)	(0.43)	(0.06)	
SIC28	Chemicals	0.020	-131.930	-16.619	-0.523	2.920	1.057	1.446	-1.086	2.921	0.496
		(0.01)	(61.11)	(4.17)	(4.96)	(1.48)	(3.95)	(1.87)	(1.89)	(0.29)	
SIC29	Petroleum	0.022	-26.868	-1.401	-3.081	1.440	-1.681	-0.630	-0.357	-0.204	0.042
		(0.01)	(49.80)	(3.46)	(4.06)	(1.25)	(3.33)	(1.55)	(1.70)	(0.23)	
SIC30	Rubber	-0.001	-19.398	-1.971	1.695	-0.295	-0.006	2.783	-0.330	0.245	0.612
		(0.00)	(12.95)	(0.88)	(1.05)	(0.31)	(0.84)	(0.40)	(0.40)	(0.06)	
SIC31	Leather	-0.001	-11.777	0.517	0.453	-0.211	0.698	0.091	-0.398	-0.059	0.132
		(0.00)	(7.32)	(0.57)	(0.61)	(0.22)	(0.50)	(0.24)	(0.28)	(0.05)	

Table 1 - Ordinary Least Squares Estimation of the Output (Rybczynski) Equations, by Industry

		Constant	Capital	Labor 1	Labor 2	Labor 3	Labor 4	Labor 5	Labor 6	Patents	R^2
SIC32	Stone	-0.001	2.452	0.107	-0.121	0.082	0.556	0.675	-0.646	0.028	0.473
		(0.00)	(6.42)	(0.44)	(0.52)	(0.16)	(0.41)	(0.20)	(0.20)	(0.03)	
SIC33	Prim Metal	-0.006	-39.951	2.199	-4.300	1.714	-2.119	2.330	-3.464	0.228	0.416
		(0.00)	(22.25)	(1.52)	(1.83)	(0.59)	(1.44)	(0.68)	(0.72)	(0.11)	
SIC34	Fab Metal	0.002	-21.317	2.097	-3.239	0.149	-2.725	4.081	-1.814	0.711	0.539
		(0.00)	(23.37)	(1.59)	(1.90)	(0.57)	(1.51)	(0.72)	(0.72)	(0.11)	
SIC35	Machinery	0.001	236.680	15.375	-8.546	-7.543	6.492	6.305	5.840	2.049	0.325
		(0.01)	(82.29)	(5.61)	(6.68)	(2.00)	(5.31)	(2.52)	(2.54)	(0.39)	
SIC36	Electronics	-0.005	6.978	6.189	5.681	-4.933	9.760	1.049	0.655	0.475	0.405
		(0.01)	(37.86)	(2.58)	(3.09)	(0.92)	(2.47)	(1.17)	(1.17)	(0.18)	
SIC37	Transport	-0.002	139.480	4.202	-6.842	0.653	-9.422	7.387	-3.246	1.116	0.222
		(0.01)	(70.41)	(4.80)	(5.71)	(1.71)	(4.55)	(2.16)	(2.17)	(0.33)	
SIC38	Instruments	0.001	-30.095	1.802	1.207	-0.442	0.345	-0.257	-0.246	0.321	0.324
		(0.00)	(13.88)	(0.94)	(1.12)	(0.35)	(0.89)	(0.42)	(0.43)	(0.07)	
	Durables	-0.020	336.240	32.125	-8.863	-12.914	-0.773	28.706	-0.208	4.860	0.574
		(0.02)	(149.20)	(10.17)	(12.10)	(3.62)	(9.63)	(4.57)	(4.60)	(0.70)	
	Non-Durables	0.053	-131.880	-20.418	9.784	-0.711	-7.752	19.902	-1.666	2.947	0.549
		(0.02)	(101.70)	(6.93)	(8.25)	(2.47)	(6.57)	(3.11)	(3.14)	(0.48)	
	Manufacturing	0.033	204.360	11.707	0.921	-13.625	-8.525	48.608	-1.874	7.806	0.796
		(0.02)	(138.50)	(9.44)	(11.24)	(3.36)	(8.94)	(4.24)	(4.28)	(0.65)	
	Non-Manufacturing	0.967	-204.360	-11.707	-0.921	13.625	8.525	-48.608	1.874	-7.806	0.796
		(0.02)	(138.50)	(9.44)	(11.24)	(3.36)	(8.94)	(4.24)	(4.28)	(0.65)	

Table 2 - Ordinary Least Squares Estimates of the Sectoral Growth Equations by Industry

		Constant	Capital	Labor 1	Labor 2	Labor 3	Labor 4	Labor 5	Labor 6	Patents	R^2
SIC20	Food	3.618	-59.275	1.645	0.761	0.142	0.320	0.408	1.148	0.304	0.658
		(1.53)	(15.14)	(0.44)	(0.48)	(0.13)	(0.45)	(0.26)	(0.73)	(0.09)	
SIC21	Tobacco	-47.170	-0.078	-0.014	0.011	-0.015	-0.004	0.025	0.002	0.002	0.686
		(6.23)	(0.50)	(0.02)	(0.02)	(0.02)	(0.03)	(0.08)	(0.04)	(0.00)	
SIC22	Textile	-3.927	1.265	-0.079	0.005	0.022	-0.143	0.028	-0.054	0.017	0.477
		(4.24)	(1.53)	(0.05)	(0.05)	(0.04)	(0.05)	(0.06)	(0.07)	(0.01)	
SIC23	Apparel	1.676	5.249	-0.027	-0.133	-0.031	-0.179	0.326	0.009	-0.014	0.852
		(1.58)	(1.83)	(0.07)	(0.08)	(0.01)	(0.09)	(0.06)	(0.06)	(0.01)	
SIC24	Lumber	3.850	-13.531	0.334	0.259	-0.209	0.354	0.246	-0.340	0.005	0.725
		(2.05)	(8.65)	(0.26)	(0.17)	(0.04)	(0.24)	(0.14)	(0.20)	(0.04)	
SIC25	Furniture	-4.310	-1.167	-0.123	0.200	-0.009	0.015	0.049	-0.211	0.002	0.211
		(3.06)	(3.93)	(0.08)	(0.08)	(0.02)	(0.10)	(0.07)	(0.11)	(0.01)	
SIC26	Paper	-1.308	-9.023	-0.089	0.269	-0.042	-0.243	0.116	-0.040	0.028	0.744
		(1.35)	(5.21)	(0.13)	(0.14)	(0.01)	(0.13)	(0.05)	(0.14)	(0.03)	
SIC27	Printing	-0.581	25.477	0.034	-0.313	-0.016	-0.241	0.096	0.141	-0.056	0.523
		(0.92)	(5.04)	(0.15)	(0.17)	(0.09)	(0.16)	(0.11)	(0.18)	(0.02)	
SIC28	Chemicals	4.633	16.874	-0.321	-0.675	0.161	-0.060	-0.011	0.382	0.045	0.425
		(1.76)	(10.71)	(0.25)	(0.31)	(0.11)	(0.32)	(0.14)	(0.23)	(0.07)	
SIC29	Petroleum	7.940	-4.717	0.077	0.125	-0.141	0.011	0.055	0.236	0.038	0.862
		(2.18)	(1.07)	(0.03)	(0.09)	(0.04)	(0.04)	(0.03)	(0.08)	(0.01)	
SIC30	Rubber	9.829	-2.821	-0.567	0.128	0.161	-0.141	0.651	1.318	-0.106	0.663
		(3.21)	(7.83)	(0.23)	(0.23)	(0.05)	(0.33)	(0.15)	(0.41)	(0.05)	
SIC31	Leather	-9.083	-2.016	0.093	0.085	0.049	0.071	-0.018	0.052	-0.012	0.250
		(6.74)	(1.60)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.06)	(0.01)	

Table 2 - Ordinary Least Squares Estimates of the Sectoral Growth Equations by Industry

		Constant	Capital	Labor 1	Labor 2	Labor 3	Labor 4	Labor 5	Labor 6	Patents	R^2
SIC32	Stone	3.950	-6.679	0.112	0.759	0.060	1.042	-0.129	0.023	-0.048	0.493
		(1.91)	(6.57)	(0.18)	(0.21)	(0.05)	(0.24)	(0.17)	(0.24)	(0.02)	
SIC33	Prim Metal	10.836	-19.152	-0.110	0.401	0.067	0.049	0.511	0.043	0.010	0.339
		(2.87)	(9.11)	(0.31)	(0.30)	(0.04)	(0.34)	(0.25)	(0.22)	(0.03)	
SIC34	Fab Metal	15.274	-11.712	-0.199	0.327	-0.009	0.157	-0.265	-0.562	0.036	0.157
		(2.11)	(11.11)	(0.33)	(0.43)	(0.06)	(0.43)	(0.24)	(0.41)	(0.06)	
SIC35	Machinery	25.911	50.261	1.278	-1.620	-1.121	-1.270	-0.100	-2.645	0.201	0.783
		(2.83)	(26.44)	(1.03)	(1.10)	(0.28)	(1.27)	(0.87)	(2.15)	(0.13)	
SIC36	Electronics	11.872	37.911	-1.237	-1.490	-0.892	-0.761	-0.156	-2.497	0.550	0.646
		(4.74)	(27.36)	(1.21)	(1.04)	(0.43)	(1.45)	(1.09)	(0.92)	(0.27)	
SIC37	Transport	11.195	-56.228	0.767	0.801	-0.068	0.820	1.737	0.804	0.368	0.745
		(3.43)	(21.66)	(0.79)	(0.62)	(0.42)	(1.08)	(0.56)	(1.21)	(0.14)	
SIC38	Instruments	6.212	7.189	-0.116	0.056	0.085	-0.318	0.565	0.009	-0.026	0.651
		(4.58)	(10.58)	(0.19)	(0.29)	(0.04)	(0.24)	(0.19)	(0.22)	(0.03)	
	Durables	11.943	-260.700	6.905	8.480	0.861	4.242	-2.360	-6.550	0.591	0.535
		(1.25)	(79.07)	(2.51)	(2.77)	(0.68)	(2.89)	(1.85)	(2.98)	(0.41)	
	Non-Durables	2.381	-75.469	1.493	1.593	-0.040	-1.979	4.809	4.369	0.265	0.414
		(0.96)	(50.69)	(1.49)	(1.65)	(0.81)	(1.47)	(1.06)	(1.78)	(0.30)	
	Manufacturing	7.876	-349.060	11.342	5.930	0.885	3.526	4.451	3.310	1.440	0.496
		(0.89)	(111.20)	(3.34)	(3.65)	(1.38)	(3.71)	(2.24)	(3.69)	(0.64)	
	Non-Manufacturing	2.451	780.200	10.223	25.961	5.831	51.991	9.319	15.104	1.332	0.536
		(0.92)	(450.90)	(13.14)	(15.39)	(8.00)	(14.37)	(9.32)	(20.21)	(2.12)	

Table 3 - Precisely Estimated Coefficients from Tables 1 and 2, Sectoral Output and Growth Equations

		Capital	Labor 1	Labor 2	Labor 3	Labor 4	Labor 5	Labor 6	Patents
SIC20	Food		- 3 +	+ 1 +	+ 1 +		+ 2 +	+ 2 +	+ 3 +
SIC21	Tobacco								
SIC22	Textile								- 2 +
SIC23	Apparel			+ 2 -	- 3 -	- 2 -	+ 3 +		- 2 -
SIC24	Lumber			+ 2 +	- 3 -	- 1 +	+ 2 +	+ 2 -	
SIC25	Furniture								
SIC26	Paper				- 3 -		+ 3 +		
SIC27	Printing	- 3 +		+ 1 -		- 2 -			
SIC28	Chemicals	- 2 +	- 2 -		+ 1 +				
SIC29	Petroleum				+ 2 -				
SIC30	Rubber		- 3 -				+ 3 +		+ 3 -
SIC31	Leather	- 1 -				+ 2 +			- 1 -
SIC32	Stone					+ 2 +			
SIC33	Prim Metal	- 2 -		- 2 +	+ 2 +		+ 3 +		
SIC34	Fab Metal						+ 2 -	- 2 -	
SIC35	Machinery	+ 2 +	+ 2 +	- 1 -	- 3 -			+ 2 -	+ 2 +
SIC36	Electronics		+ 2 -	+ 1 -	- 3 -				+ 3 +
SIC37	Transport	+ 2 -		- 1 +			+ 3 +		+ 3 +
SIC38	Instruments				- 1 +				
	Durables	+ 3 -	+ 3 +		- 2 +		+ 2 -		+ 2 +
	Non-Durables	- 1 -				- 1 -	+ 3 +		
	Manufacturing	+ 2 -	+ 2 +				+ 2 +		+ 3 +
	Non-Manufacturing	- 1 +					+ 2 +		

Table 4 - Ordinary Least Squares Estimation of the Output (Rybczynski) Equations, by Industry[1]. Aggregated Immobile Endowment.

	Constant	Capital	Labor 23	Labor 45	R2
SIC20 Food	-0.003 (0.01)	-59.077 (26.81)	1.111 (0.39)	0.768 (0.40)	0.173
SIC21 Tobacco	0.010 (0.01)	62.871 (27.42)	-1.389 (0.64)	0.977 (0.34)	0.170
SIC22 Textile	-0.006 (0.01)	108.480 (28.44)	-1.850 (0.47)	3.466 (0.42)	0.341
SIC23 Apparel	0.002 (0.00)	10.939 (9.79)	-0.645 (0.14)	1.393 (0.14)	0.406
SIC24 Lumber	-0.008 (0.01)	-0.086 (27.63)	0.051 (0.40)	1.773 (0.41)	0.173
SIC25 Furniture	0.002 (0.00)	13.706 (8.03)	-0.582 (0.13)	1.107 (0.12)	0.393
SIC26 Paper	0.005 (0.01)	18.784 (25.83)	-1.122 (0.39)	2.472 (0.38)	0.241
SIC27 Printing	0.016 (0.00)	-33.266 (12.61)	0.128 (0.18)	-0.517 (0.19)	0.092
SIC28 Chemicals	0.018 (0.01)	3.138 (67.42)	-0.935 (0.98)	1.761 (0.99)	0.024
SIC29 Petroleum	0.019 (0.01)	-36.335 (41.03)	-0.068 (0.61)	-0.359 (0.60)	0.013
SIC30 Rubber	0.000 (0.00)	0.766 (11.63)	-0.531 (0.17)	1.888 (0.17)	0.503
SIC31 Leather	0.000 (0.00)	-7.360 (6.36)	-0.011 (0.12)	0.188 (0.10)	0.060

[1] File E:\MISLAM\RAMURSI_\ELENA\TABLE4.DOC

[2]Table 4 - Ordinary Least Squares Estimation of the Output (Rybczynski) Equations, by Industry, Aggregated Immobile Endowment.

		Constant	Capital	Labor 23	Labor 45	R2
SIC32	Stone	0.000 (0.00)	10.987 (5.42)	-0.136 (0.08)	0.709 (0.08)	0.401
SIC33	Prim Metal	0.004 (0.00)	-25.613 (20.28)	-0.423 (0.32)	1.627 (0.31)	0.225
SIC34	Fab Metal	0.009 (0.00)	-21.277 (23.48)	-0.718 (0.34)	2.149 (0.35)	0.259
SIC35	Machinery	0.014 (0.01)	110.830 (75.69)	-1.572 (1.10)	4.127 (1.12)	0.091
SIC36	Electronics	0.007 (0.01)	41.755 (36.51)	-0.666 (0.54)	2.202 (0.54)	0.115
SIC37	Transport	0.009 (0.01)	117.420 (61.23)	-1.378 (0.89)	2.697 (0.90)	0.063
SIC38	Instruments	0.007 (0.00)	-19.173 (13.14)	0.251 (0.21)	-0.419 (0.19)	0.034
	Durables	0.033 (0.03)	221.490 (153.70)	-4.595 (2.23)	16.033 (2.27)	0.280
	Non-Durables	0.054 (0.02)	20.556 (98.47)	-4.361 (1.43)	11.425 (1.45)	0.328
	Manufacturing	0.088 (0.03)	242.050 (180.30)	-8.956 (2.62)	27.458 (2.66)	0.450
	Non-Manufacturing	0.912 (0.03)	-242.050 (180.30)	8.956 (2.62)	-27.458 (2.66)	0.450

[2] File E:\MISLAM\RAMURSI_\ELENA\TABLE4.DOC

Table 5 - Ordinary Least Squares Estimates of the Sectoral Growth Equations by Industry, Aggregated Immobile Endowments.[1]

		Constant	Capital	Labor 23	Labor 45	R^2
SIC20	Food	5.979 (1.50)	-21.634 (9.39)	0.319 (0.05)	0.047 (0.18)	0.462
SIC21	Tobacco	-46.104 (7.04)	0.021 (0.10)	-0.003 (0.00)	0.008 (0.01)	0.248
SIC22	Textile	2.476 (4.25)	-0.715 (1.12)	0.023 (0.02)	0.007 (0.01)	0.044
SIC23	Apparel	1.712 (2.48)	5.213 (1.23)	-0.002 (0.01)	0.003 (0.02)	0.453
SIC24	Lumber	4.859 (2.00)	-1.113 (2.60)	-0.095 (0.02)	0.378 (0.11)	0.607
SIC25	Furniture	-1.757 (2.77)	1.451 (1.74)	0.000 (0.01)	0.019 (0.04)	0.029
SIC26	Paper	1.049 (1.61)	-3.950 (1.00)	-0.006 (0.01)	0.014 (0.02)	0.419
SIC27	Printing	-1.201 (0.83)	20.446 (3.82)	-0.128 (0.08)	-0.078 (0.07)	0.387
SIC28	Chemicals	3.915 (1.97)	-7.277 (4.54)	0.163 (0.11)	-0.049 (0.07)	0.075
SIC29	Petroleum	8.491 (5.24)	-0.568 (1.48)	0.016 (0.04)	0.020 (0.04)	0.009
SIC30	Rubber	4.677 (2.69)	0.741 (875.00)	0.072 (0.01)	0.069 (0.03)	0.470
SIC31	Leather	-3.943 (6.39)	0.216 (0.46)	-0.002 (0.01)	0.027 (0.01)	0.101

[1] File E:\MISLAM\RAMURSI_\ELENA\TABLE5.XLS

[2]Table 5 - Ordinary Least Squares Estimates of the Sectoral Growth Equations by Industry, Aggregated Immobile Endowments.

		Constant	Capital	Labor 23	Labor 45	R^2
SIC32	Stone	2.571 (1.92)	13.788 (4.36)	0.027 (0.02)	0.206 (0.11)	0.266
SIC33	Prim Metal	8.856 (2.76)	-1.956 (4.09)	0.105 (0.04)	0.045 (0.06)	0.181
SIC34	Fab Metal	15.266 (1.64)	-3.046 (2.63)	-0.030 (0.02)	0.023 (0.11)	0.081
SIC35	Machinery	29.903 (2.25)	8.310 (1.43)	-0.621 (0.13)	0.083 (0.16)	0.752
SIC36	Electronics	15.404 (5.72)	-0.825 (3.60)	0.638 (0.50)	0.699 (0.29)	0.151
SIC37	Transport	19.232 (4.58)	-20.152 (9.24)	-0.067 (0.40)	0.986 (0.28)	0.243
SIC38	Instruments	8.774 (5.24)	3.245 (0.95)	0.043 (0.05)	-0.143 (0.08)	0.236
	Durables	13.977 (1.28)	-8.185 (20.78)	1.688 (0.79)	1.531 (1.20)	0.134
	Non-Durables	3.222 (0.92)	-43.884 (42.69)	0.597 (0.83)	1.086 (0.61)	0.074
	Manufacturing	10.132 (0.87)	-137.570 (68.09)	0.948 (1.59)	3.508 (1.44)	0.140
	Non-manufacturing	2.613 (0.80)	1.409 (0.38)	7.787 (6.56)	22.234 (7.39)	0.444

[2 2] File E:\MISLAM\RAMURSI_\ELENA\TABLE5.XLS

[1]Table 6. Unusual (Residual) growth Rates Regressed on Unusual Export Performance, by Industry.

		Regression Coefficient	t-ratio	Prob |t| > x
SIC 20	Food	0.235	1.898	0.064
	w/o outlier: AK	-0.103	-0.760	0.451
SIC 21	Tobacco	1.068	1.101	0.286
SIC 22	Textile	-0.257	-0.101	0.920
SIC 23	Apparel	2.878	0.895	0.375
SIC 24	Lumber	-0.014	-0.039	0.969
	w/o outlier: AK	-0.356	-0.977	0.334
SIC 25	Furniture	6.904	0.647	0.521
	w/o outlier: MI	3.428	0.259	0.796
SIC 26	Paper	0.487	1.310	0.197
	w/o outlier: WA	0.170	0.461	0.647
SIC 27	Printing	-0.054	-0.062	0.951
SIC 28	Chemicals	0.274	1.530	0.132
	w/o outlier: WY	0.142	0.916	0.364
SIC 29	Petroleum	-0.304	-0.353	0.725
	w/o outlier: ME	-0.172	-0.252	0.802
SIC 30	Rubber	1.707	0.945	0.349
SIC 31	Leather	-1.701	-0.311	0.757
SIC 32	Stone	4.288	2.051	0.046
SIC 33	Prim Metal	0.266	0.352	0.727
	w/o outlier: UT	0.273	0.527	0.600
SIC 34	Fab Metal	-1.281	-1.706	0.094
	w/o outlier: MI	-2.137	-2.132	0.038
SIC 35	Machinery	0.018	0.087	0.931
SIC 36	Electronics	-0.022	-0.080	0.937
	w/o outlier: NV	-0.161	-0.652	0.518
SIC 37	Transport	-0.015	-0.155	0.877
	w/o outlier: WA	-0.142	-1.112	0.272
SIC 38	Instruments	-3.166	-2.858	0.006

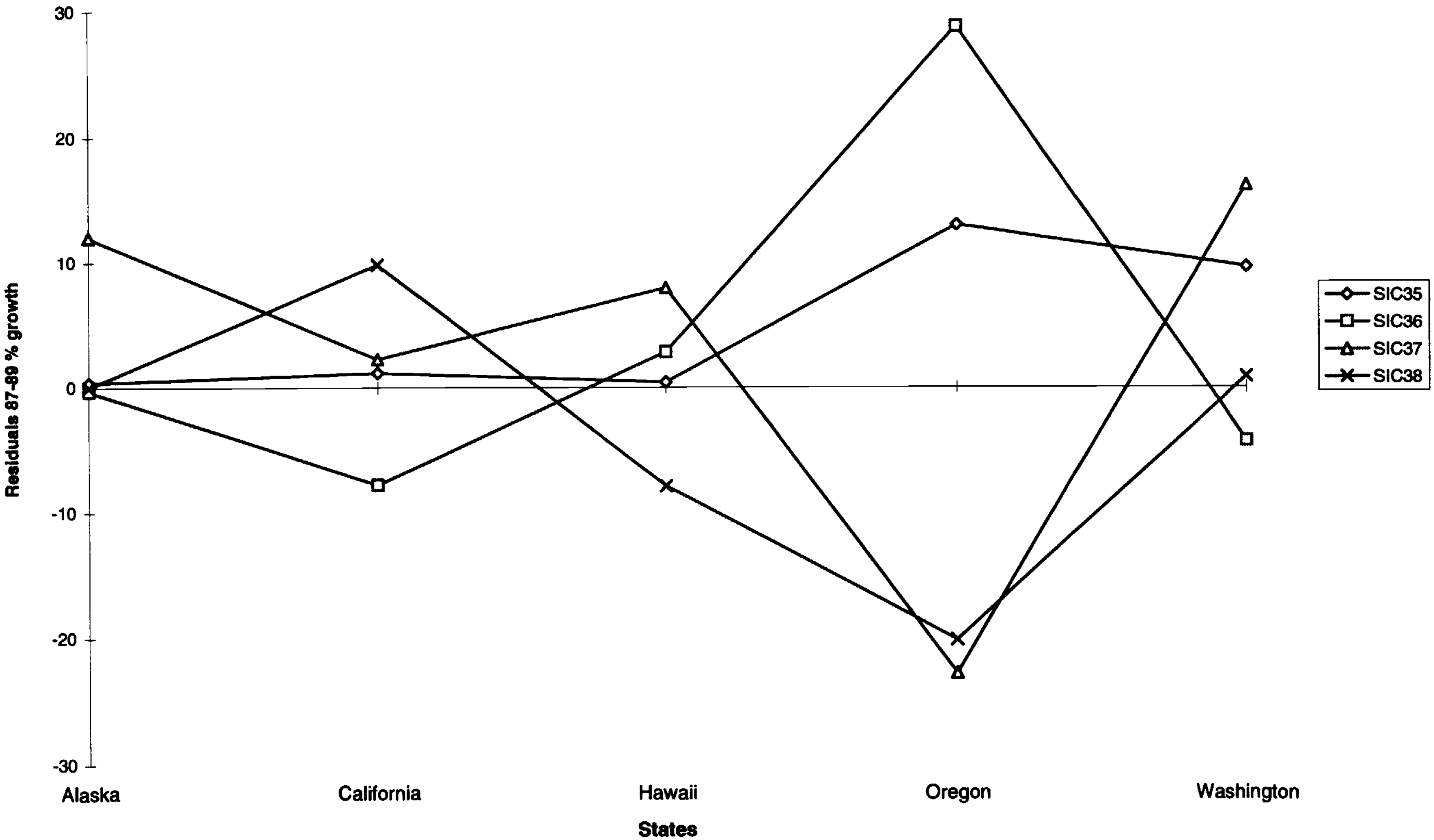
[1] File E:\MISLAM_\ELENA\TABLE6.doc

[2]Table 6. Unusual (Residual) growth Rates Regressed on Unusual Export Performance, by Industry.

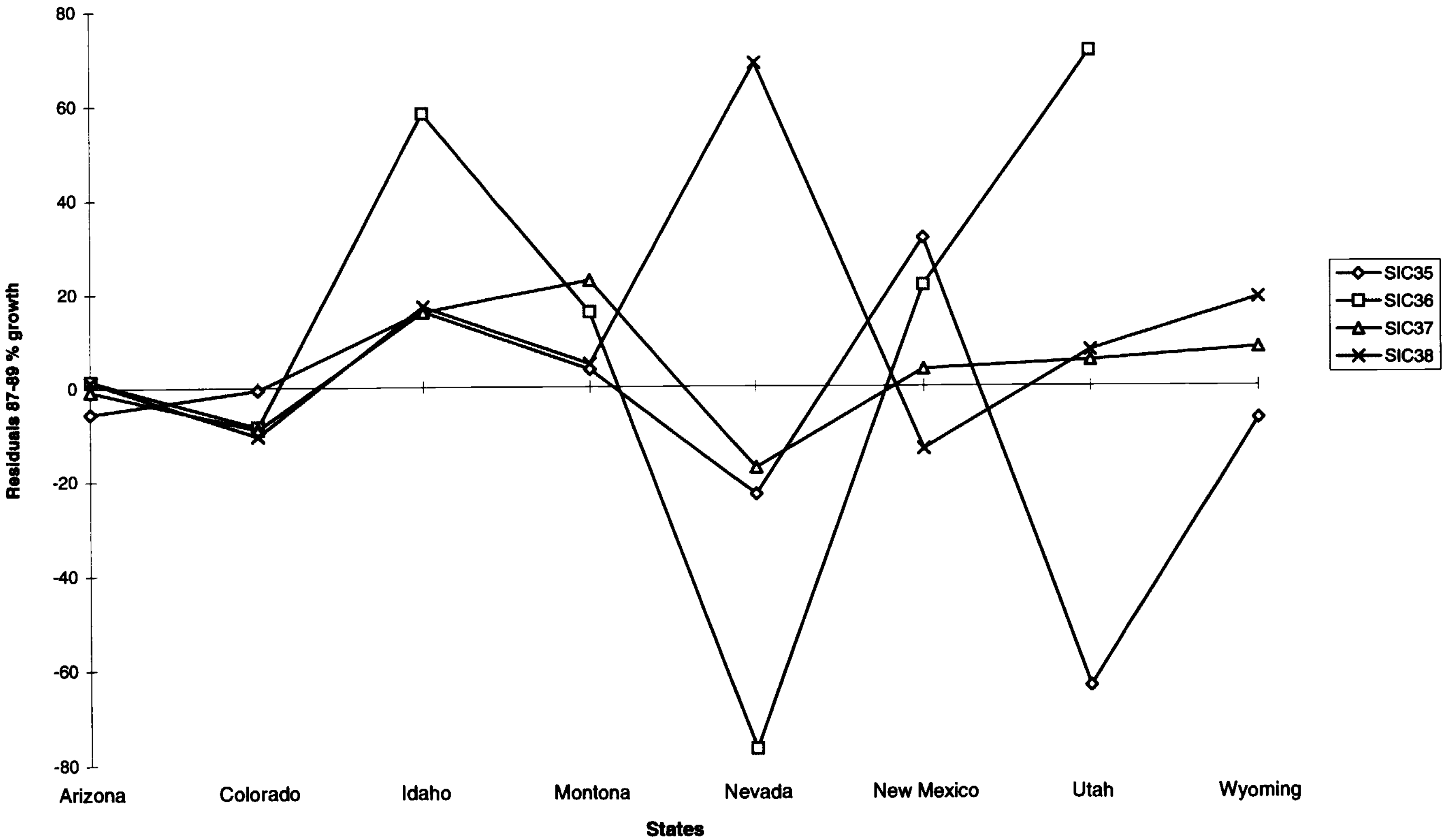
	Regression Coefficient	t-ratio	Prob |t| > x
Durables	0.015	0.533	0.596
w/o outlier: WA	0.007	0.200	0.843
Non-Durables	0.009	0.225	0.823
w/o outlier: AK	-0.033	-0.787	0.435
Manufacturing	-0.013	-1.165	0.250
w/o outlier: SD	-0.009	-0.968	0.338
NV,SD	-0.002	-0.183	0.855
NV,SD, WA	0.008	0.681	0.500

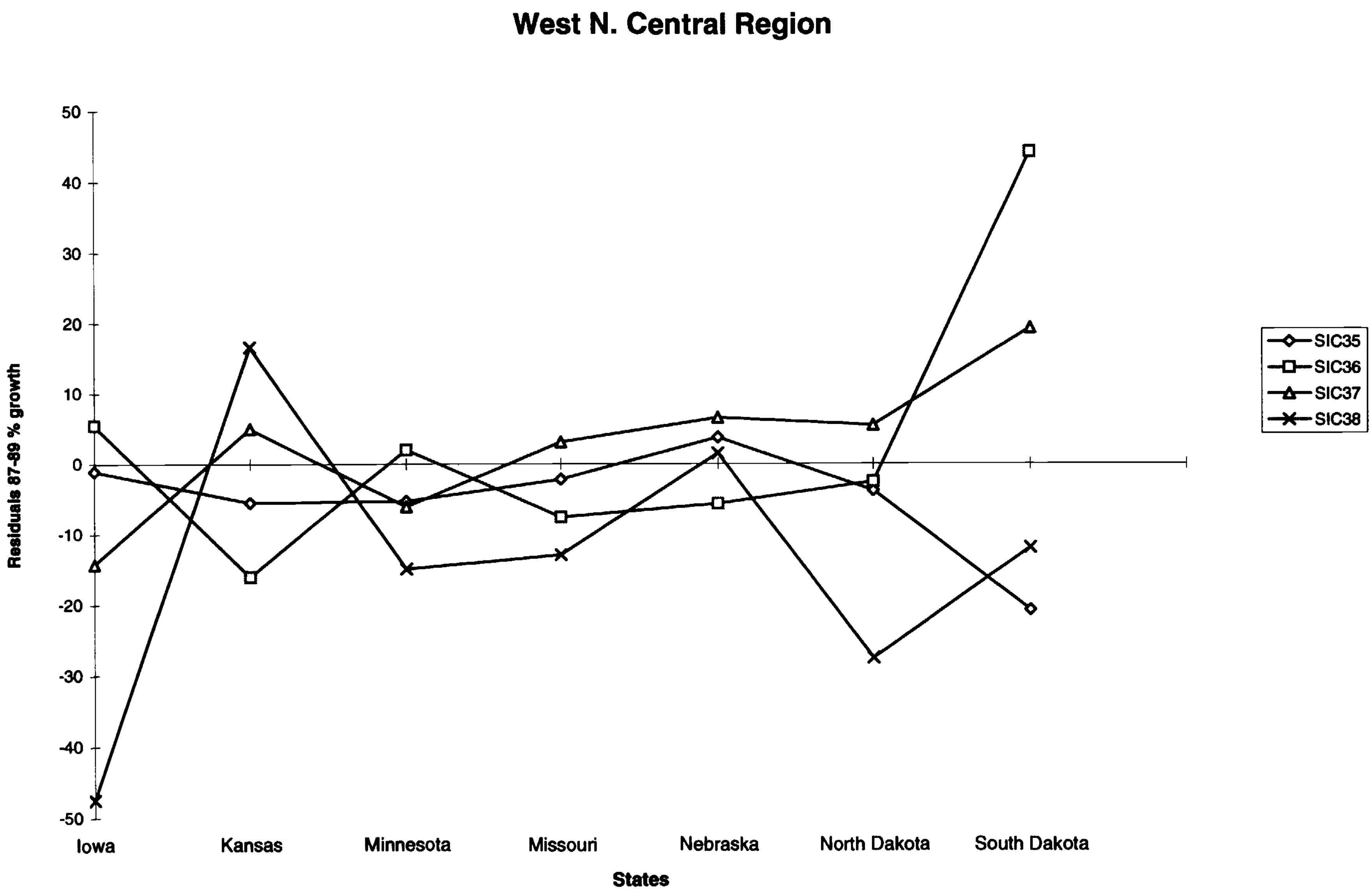
2 Data used for calculations are from E:\... regdat.xls; limdep program is E:\outlier.lim.

Pacific Region

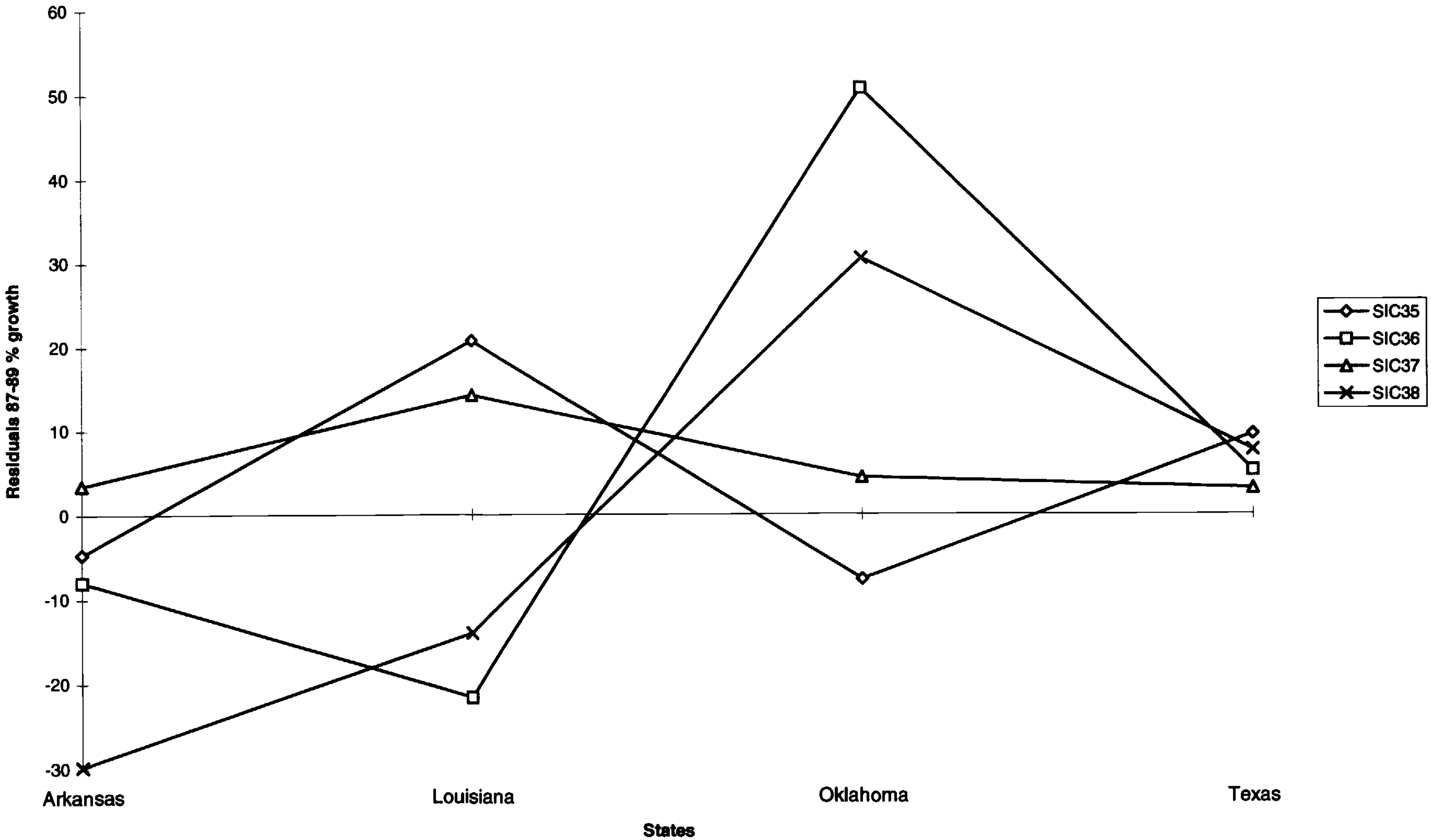


Mountain Region

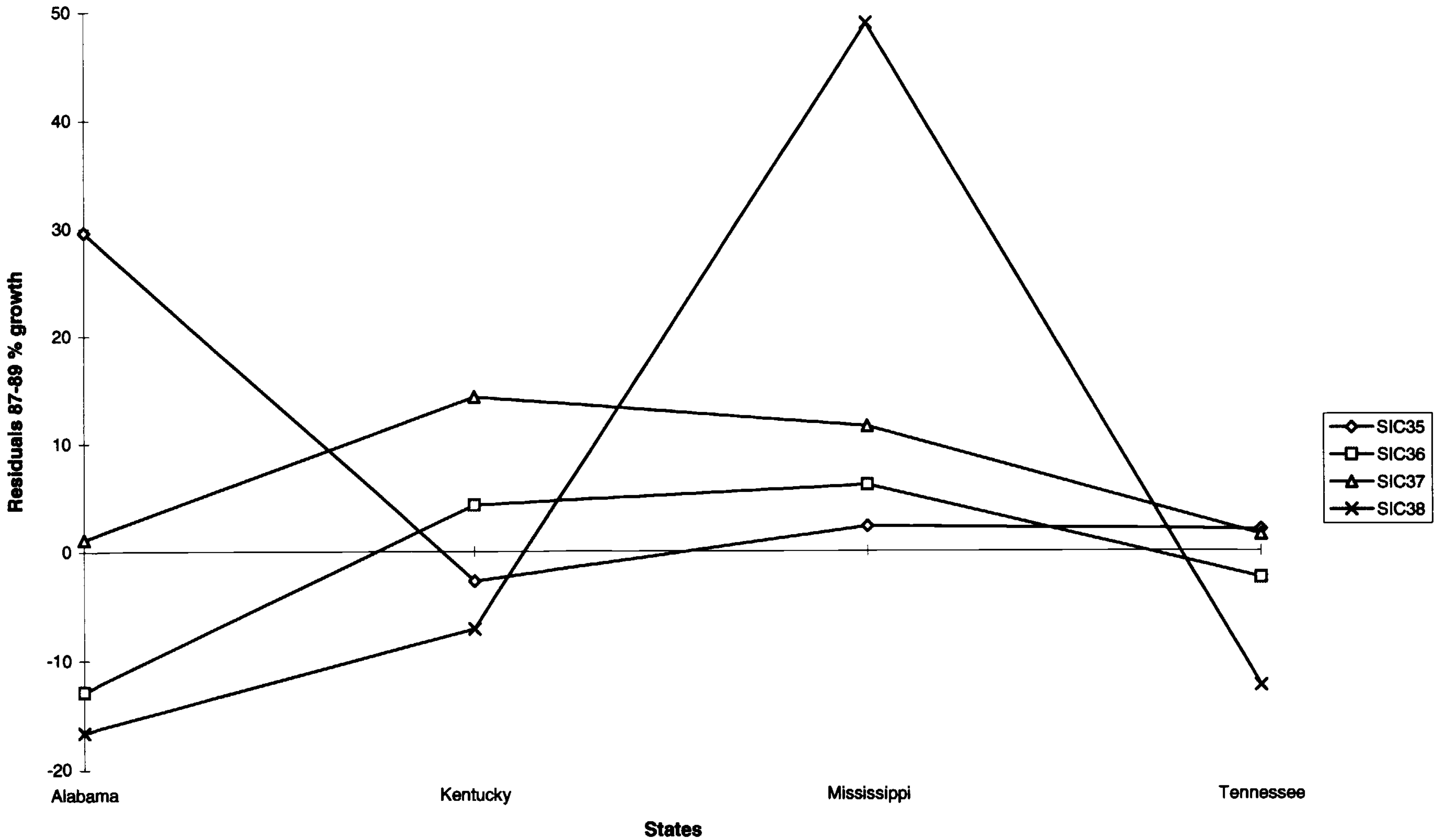



West N. Central Region
50
40
30
20
10
0
-10
-20
-30
-40
-50
Residuals 87-89 % growth
Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota
States
SIC35
SIC36
SIC37
SIC38

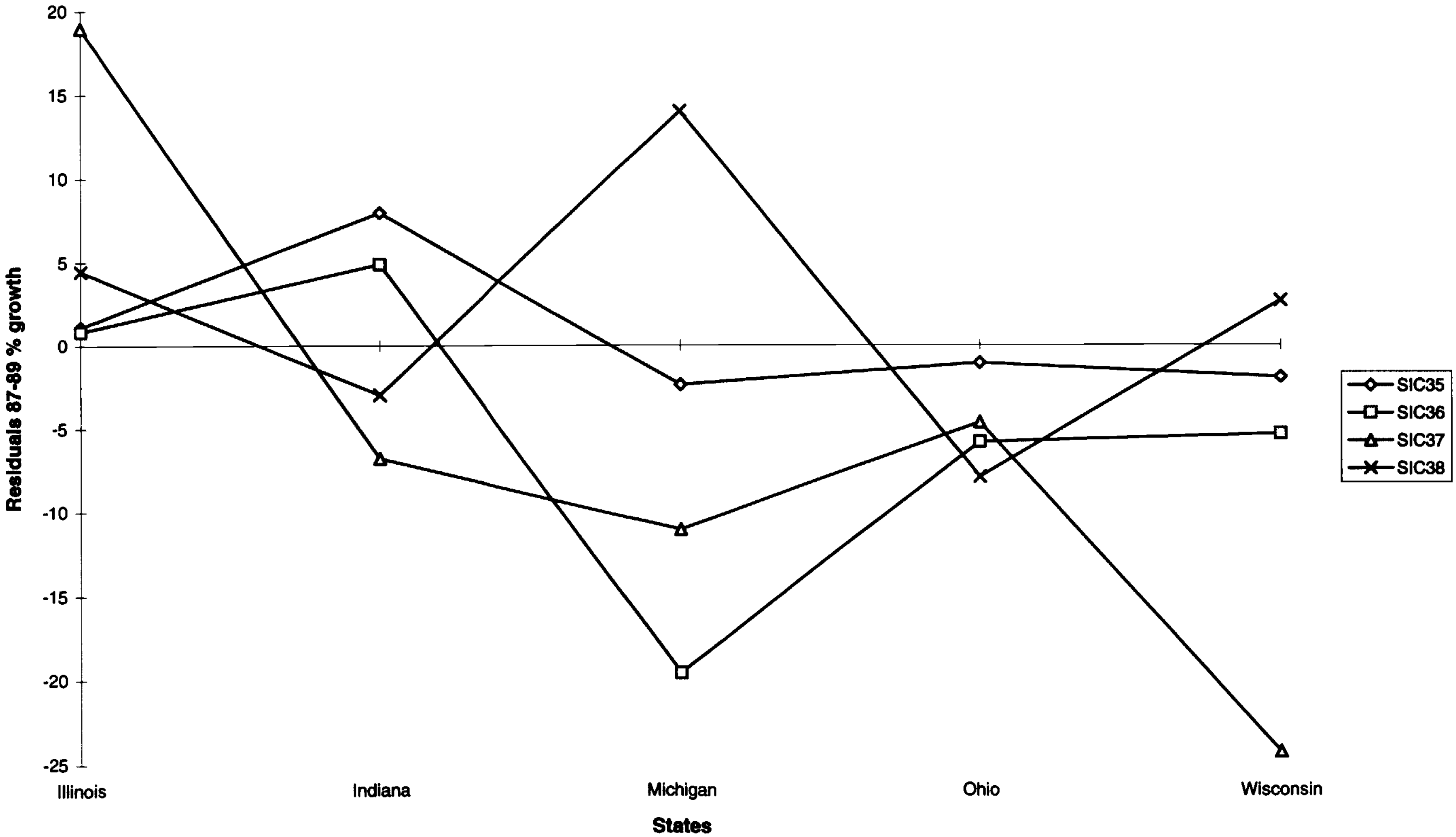
West S. Central Region

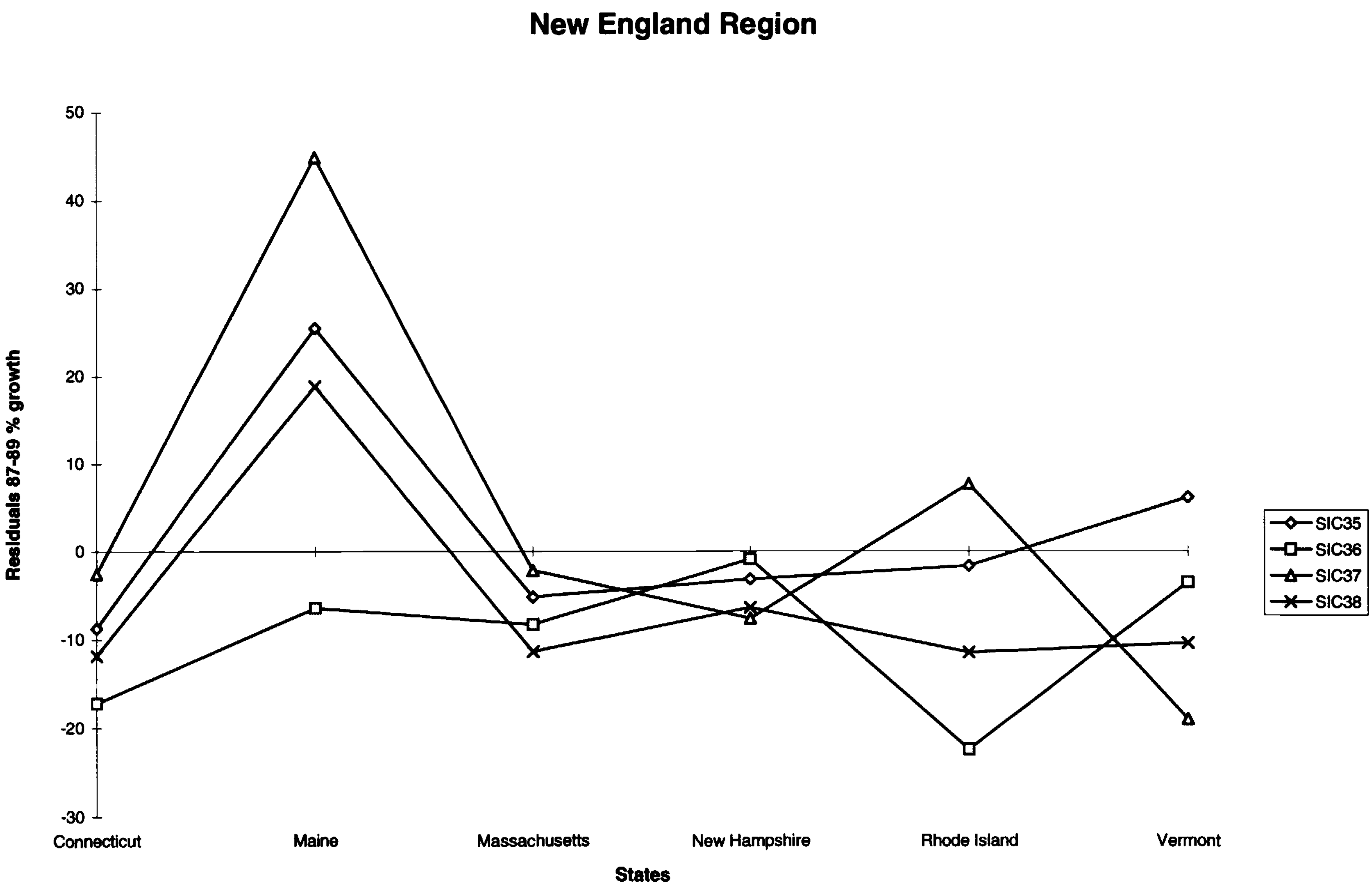


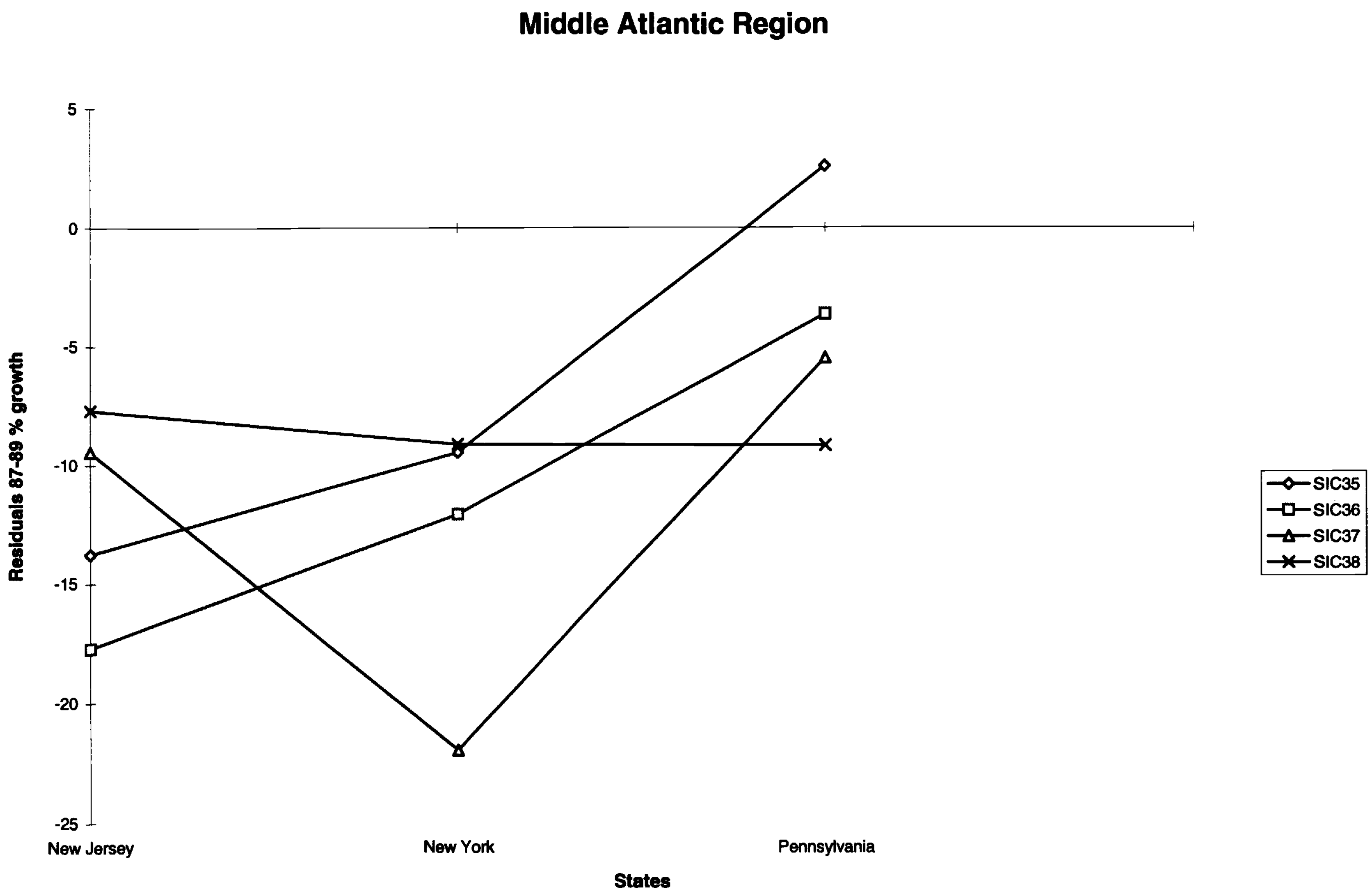
East S. Central Region

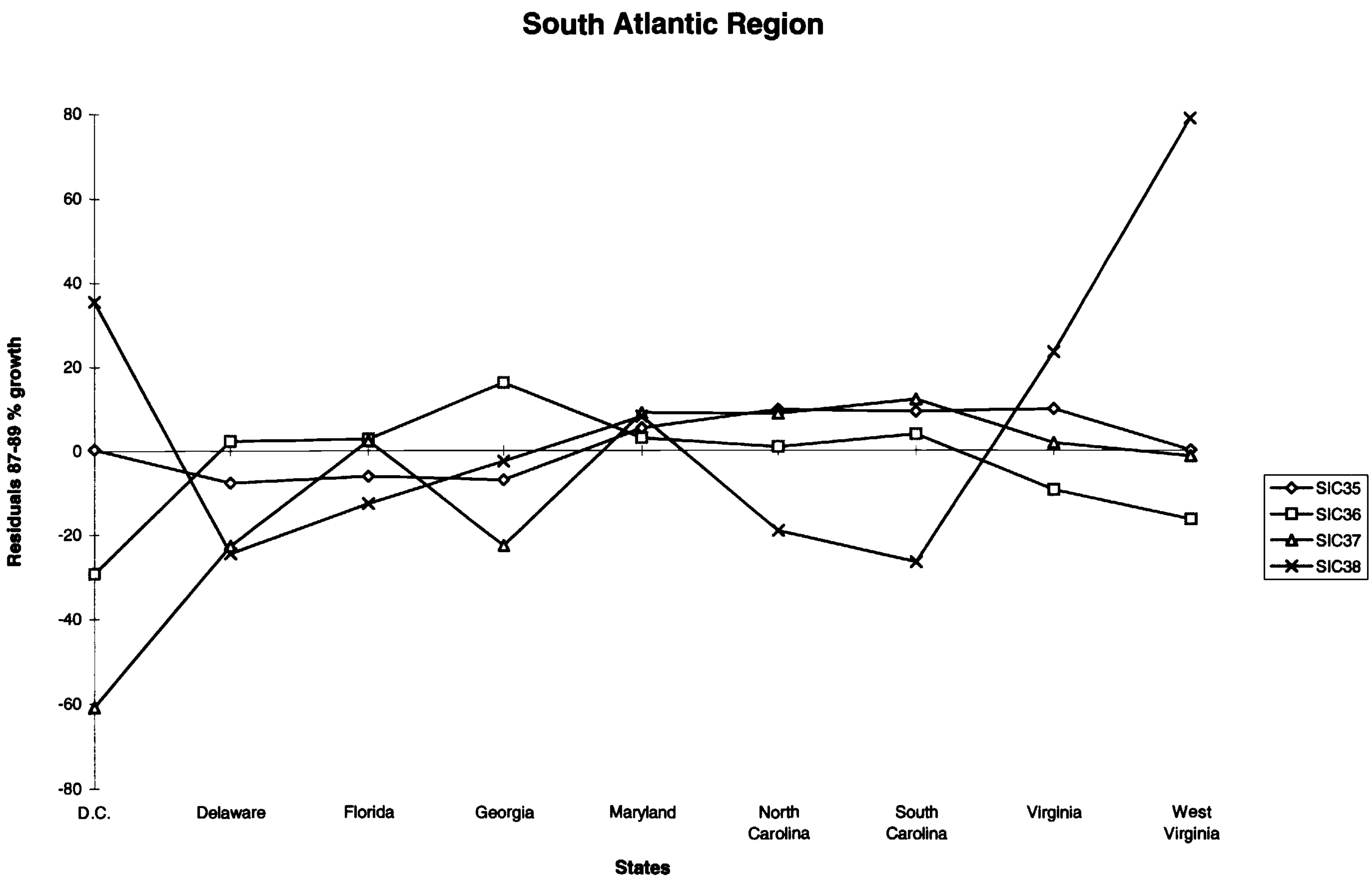


East N. Central Region




New England Region
50
40
30
20
10
0
-10
-20
-30
Residuals 87-89 % growth
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont
States
SIC35
SIC36
SIC37
SIC38


Middle Atlantic Region
5
0
-5
-10
-15
-20
-25
Residuals 87-89 % growth
New Jersey
New York
Pennsylvania
States
SIC35
SIC36
SIC37
SIC38


South Atlantic Region
80
60
40
20
0
-20
-40
-60
-80
Residuals 87-89 % growth
D.C.
Delaware
Florida
Georgia
Maryland
North Carolina
South Carolina
Virginia
West Virginia
States
SIC35
SIC36
SIC37
SIC38