AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Staff Papers Series

Staff Paper P88-43 November 1988

SENSITIVITY OF GROSS STATE PRODUCT TO CYCLICAL AND STRUCTURAL CHANGE

Wilbur R. Maki and Zakari T. Jutila

University of Minnesota and University of Toledo

Department of Agricultural and Applied Economics

University of Minnesota
Institute of Agriculture, Forestry and Home Economics
St. Paul, Minnesota 55108

SENSITIVITY OF GROSS STATE PRODUCT TO CYCLICAL AND STRUCTURAL CHANGE

Wilbur R. Maki and Zakari T. Jutila
University of Minnesota and University of Toledo

Staff Papers are published without formal review within the Department of Agricultural and Applied Economics.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status or sexual orientation.

Table of Contents

	Page
Abstract	1
Introduction	1
Problem focus	4
Analytical approach	7
Distiguishing Business Cycles	12
Industry Structure and Regional Growth	14
Industry Specialization and Cyclical Sensitivity	18
Summary and Conclusions	22
References	23

SENSITIVITY OF GROSS STATE PRODUCT TO CYCLICAL AND STRUCTURAL CHANGE

Wilbur R. Maki and Zakari T. Jutila
University of Minnesota and University of Toledo

Abstract

The sensitivity of regional industry to business cycles has been widely documented. Responses of individual businesses and industries in a specific region or state to each phase of the business cycle has been less well analyzed and understood. Lacking in all the documentation, moreover, is reference to the impact of business cycles on interregional trade and regional interindustry structure and to the separation of these impacts from those due to business activity location and dislocation. To deal with these limitations, state-level location quotient and shift-share analyses of year-to-year changes in industry-specific contribution to gross state product are used in differentiating the varying degrees of cyclical sensitivity among industries and regions and then, in later studies, to account for these differences in parallel analyses of the structure of inter-regional trade and interindustry transactions among selected groups of states. A micro-to-macro analytical framework is offered, finally, for testing working hypotheses pertaining to the sensitivity of businesses, industries and regions to the business cycle and to structural dislocation.

Introduction

This paper focuses on the linkage between business cycles and business activity location and dislocation. It draws on a major distinction between the stimulus at a macro level generating responses at a micro level (e.g. general economic conditions influencing firm level decision making) and the stimuli generated at micro levels affecting macro level activity (e.g., corporate decisions to relocate a plant that affect areawide disposable income and tax support for public services). This two-way stimulus-response flow system and relates to the relative power of micro level actors, such as corporations, labor unions, and federal, state and local government agencies, operating in an environment of conflict, compromise or cooperation.

An example of modeling macro-to-micro stimulus-response behavior is the

"rational expectations" concept with firm level decisions being influenced by expectations about the business cycle. In an opposite direction, powerful micro-level actors can directly or indirectly influence the collective or macro level economic structure and performance that affect the timing and duration of business cycles.

To understand the differences in the industry shares, industry mixes and regional economic dynamics among the 50 states of the United States, we propose to complement the usual macro-to-micro analysis with micro-to-macro analysis, especially for the purposes of policy making. The macro-to-micro structural approach is quite different from the micro-to-macro approach. In the former, economic activities are identified by industry, not by the specific actors involved in these activities. A typical large corporation is multi-product and multi-regional. Its management decisions affect many business activities in many regions. Similarly, these decisions influence the input-output linkages and power relationships among a large number of different institutions (e.g. labor unions, political parties, local, state and federal governments, and those of many foreign nations).

Several methods have been suggested and used in the studies of micro-to-macro processes as distinct from macro-to-micro processes, including the following:

a. Case oriented impact analyses: behavior of the micro-actors is related to their impacts upon the "rest of the system". A typical illustration of this kind of an approach is the impact of the job creation or destruction of a corporation upon a local economy. Another illustration a "benefit-cost" analysis to support various private and public decisions.

b. Political analysis of power structures: commonly used in the identification of powerful local, regional and national actors, their

interests, goal orientation and behavior. In particular, this relates to business and economic interests and behavior augmented by considerations of cultural and military power. Closely related to the political analytic approaches are the specific policy analyses, where the impact of a particular policy decision on a system is analyzed and assessed.

c. Institutional economics: behavior of actors is singled out as the driving element of the macro level economic dynamics.

d. Actor oriented micro-to-macro dynamics: this approach is of considerable interest to sociologists, political economists and political scientists and increasingly important to a variety of private and public sector decision makers (Burns, Baumgartner, and Deville, 1984).

A special application of an actor-oriented micro-to-macro modeling is that of the Swedish economy (Eliasson, 1977, 1985). In this model the powerful Swedish corporations are singled out as actors that can create disequilibrating impacts upon the "rest of the economy".

Dynamic micro-to-macro models dealing with the diffusion and propagation of the stimuli by micro sources upon a macroeconomic system of interacting regions have been developed since the sixties and seventies (e.g. Jutila, 1971, 1972, 1973a, 1973b, 1974, 1980, 1981). These types of micro-to-macro models assumed typically equilibrating dynamic behavior.

Dynamic micro-to-macro models dealing also with structural or impact dislocations have been investigated (e.g., Jutila and Muraco, 1978; Jutila, 1977a,b, 1978, 1980). In this kind of modeling a micro level power structure, consisting of actors gaming with each other (i.e. an oligopoly and/or oligopsony), distributes or locates various microeconomic product sources (e.g. plants, shopping centers, and service facilities) over several regions. The actors create an adaptive input-output network connecting these

microeconomic product sources.

Recent availability of a 50-state gross state product (GSP) series for the 24-year period from 1963 to 1986 is an important recent addition to the statistical bases for monitoring regional economic well-being that makes possible a first-stage in the development of micro-to-macro model for monitoring and assessing the differential senstivity of individual state and regional economies to the business cycle. The economic contribution of 61 individual, essentially two-digit, industries is documented in the new GSP series for each state.

Problem focus

The purpose of this paper is to account for the differential sensitivity of individual state economies to the general business cycle and to structural change in a region using the new GSP series, starting with simple analytical models of state-to-national economic dependence. The differential sensitivity of individual industries and states to the business cycle is measured with reference to the eight turning points of five recoveries and four recessions over the 1963-86 period that are documented by year as follows:

Peak Year	Trough Year
1969 (Dec)	1970 (Nov)
1973 (Nov)	1975 (Mar)
1979 (Jan 80)	1980 (July)
1981 (July)	1982 (Nov)

The timing of cyclical peaks and troughs of the aggregate gross state product for the 50 states correspond most closely with the peaks and troughs of durable goods manufacturing, with the manufacturing peaks and troughs being much higher and lower than the aggregate series, as shown in Table 1. The mining and construction industries and, less so, nondurable goods manufacturing also are cyclically sensitive. The gross state product of agriculture on the other hand, is largely counter-cyclical. Thus, a state with

Table 1

Annual Change in Total Gross State Product, 50 States, 1970-86

Industry	1970-73	1973-75	1975-79	1979-80	1980-81	1981-82	1982-86
	(pct.)	(pct.)	(pct.)	(pct.)	(pct.)	(pct.)	(pct.)
Agr., ag. serv., fo	.7	2.0	1.0	.0	15.5	1.8	2.9
Mining	5.7	-3.7	4.1	1.9	1.7	.0	.4
Construction	.5	-6.3	3.8	-6.9	-8.8	-4.4	4.5
Durable goods mnfg.	7.3	-7.1	6.8	-5.2	.9	-10.5	9.3
Nondurable goods mn	6.5	-4.6	5.3	-3.0	1.6	1.7	1.8
Trans., comm., util	6.0	.7	4.5	- .0	1.0	-2.6	3.3
Wholesale trade	6.1	1.1	4.0	-1.8	2.3	.3	6.6
Retail trade	5.8	-1.6	4.4	-2.5	.7	- .5	5.9
Fin., ins., real es	4.7	2.7	4.3	1.1	2.1	.2	3.8
Private services	5.9	.2	5.1	3.0	4.5	.2	5.1
Government	1.2	2.0	1.7	1.4	.9	- .5	1.3
Total	4.5	-1.2	4.2	- .8	1.7	-1.9	4.3

much durable goods manufacturing, like Minnesota, suffers from cyclical sensitivity, especially as the agricultural sector of its economy diminishes in overall importance.

During every year of the 1963-86 period one or more states experienced a peak or a trough. For some states, industry mix and unusual market conditions for the dominant industries in the state accounted for the divergent state business cycles. States with dominantly above-average or below-average growth industries, on the other hand, experienced prolonged recession, like Michigan in the late 1970s and early 1980s, or recovery, like Massachusetts in the 1980s.

Over the 1963-86 period, real gross state product grew by three percent in the US. Its growth varied from 3.7 percent above the US rate in the Rocky Mountain region to 4.6 percent below the US rate in the Great Lakes region. Contrasting patterns of growth were experienced between the 1970s and the 1980s.

The "rustbelt" regions--New England, Mideast, Great Lakes and Plains--lagged in GSP growth in the 1970s. The Great lakes region continued to lag in the 1980s. In addition, three of the "sunbelt" regions--Southwest, Rocky Mountain and Far West-- lagged US growth in one or more periods in the 1980s, as shown below:

Region	1970-73	1973-75	1975-79	1979-80	1980-81	1981-82	1982-86
				(pct.)			
New England (6)	-1.2	-2.0	-0.5	0.9	1.4	1.7	2.8
Mideast (5)	-1.5	-1.7	-2.2	-0.9	0.2	0.9	0.3
Great Lakes (5)	0.4	-2.4	-0.4	-4.6	-1.9	-3.2	0.0
Plains (7)	0.3	0.4	-0.2	-1.6	1.2	-0.8	-0.8
Southeast (12)	1.7	-0.1	0.8	1.4	1.1	0.7	0.2
Southwest (4)	0.3	3.1	1.4	2.8	2.2	1.8	-2.1
Rocky Mountain (5)	1.5	3.7	1.8	3.6	0.5	0.7	-2.2
Far West (4)	-0.5	2.9	1.5	1.9	-2.5	-0.3	1.0
U.S. Average	4.4	-1.0	4.2	-0.8	1.8	-2.0	4.4

Gross state product series of four states--Massachusetts (New England),

Michigan (Great Lakes), Minnesota (Plains) and Washington (Far West)--have been selected for closer examination of their industry-related sensitivity to the general business cycle over the 17-year period from 1970 to 1986 (Figure 1). While positive growth in GSP is indicated for almost the entire 17-year period, two of the four states--Massachusetts and Michigan--experienced below-average growth in two or more periods in the 1970s.

Differences in GSP growth patterns are attributed to differences in basic economic structure. Of the four states, Michigan is the least diversified in its economic base. It depends almost entirely on durable goods manufacturing, primarily motor vehicles, for its dollar-generating exports. For each of the four states, durable goods manufacturing is by far the largest basic industry group, ranging from 83.7 percent for Michigan to 28.4 percent for Washington in the 1975-86 period. Massachusetts is the most diversified, followed closely by Minnesota. Both states depend on a wide mix of export-producing industry, although durable goods manufacturing accounts for nearly a third or more of the economic base in the two states.

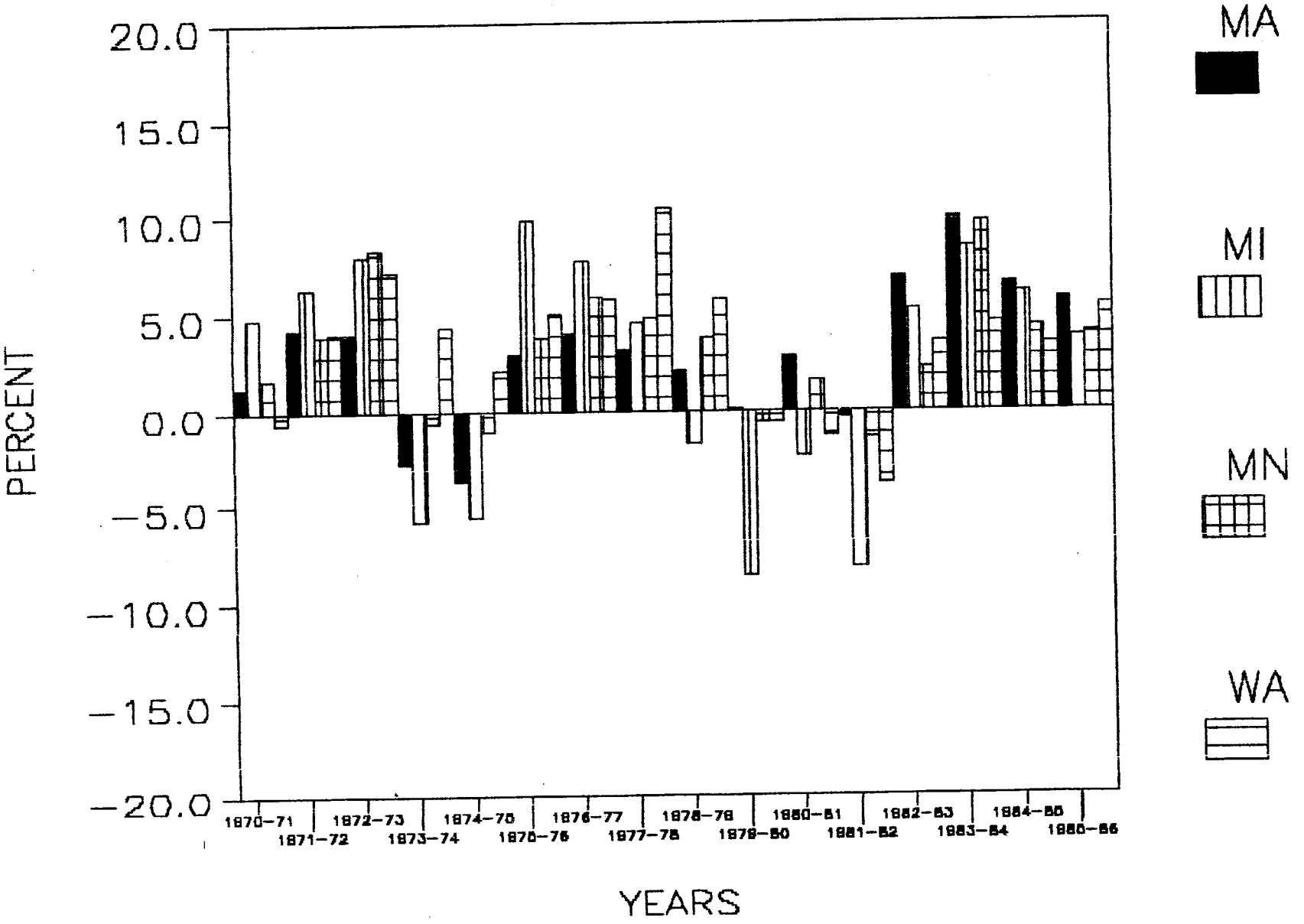
Analytical approach

In this presentation, the modified location quotient and shift-share approaches are used in the context of testing a simply stated working hypothesis. This hypothesis is to the effect that in a macro-economic context the differential sensitivity of the gross state product to the US business cycle is accounted for by (1) the industry mix, (2) the economic base, and (3) the changing industry structure due to business location and dislocation.

State-to-state differences in industry mix account for a large part of state-to-state differences in GSP growth rates. Much of the remaining state-to-state differences in GSP growth rates are due to differences in the economic base of individual states and the changing competitive position of

Figure 1

Gross state product annual growth rates in Massachusetts (MA), Michigan (MI), Minnesota (MN) and Washington (WA), 1970-71 to 1985-86.



the basic industries in US regional and world markets.

The modified location-quotient approach used in deriving the excess real GSP cited earlier is based on the accounting relationship defined as:

$$exgsp_i = gsp_i * \left[\frac{gsp_i}{gsp} - \frac{GSP_i}{GSP}\right],$$

where,

$esgsp_i$	is total excess gross state product (in million 1982 dollars) originating in the i-th industry in an individual state;
gsp	is aggregate gross state product (in million 1982 dollars) in an individual state;
gsp_i	is gross state product (in million 1982 dollars) orginating in the i-th industry of an individual state;
GSP_i	is overall US gross state product (in million 1982 dollars) orginating in i-th industry; and
GSP	is aggregate gross state product (in million 1982 dollars) of 50 states and District of Columbia.

The economic base of any state is represented by the total excess gross product and its component parts originating from individual industries. This is represented by the form,

$$ecbase = \sum_{i=1}^{n} exgsp_i.$$

The shift-share model is also represented by the individual state and industry GSP series used in the deriving the state economic base. However, the shift-share deals with sucessive time periods rather than a single year. It provides a dynamic rather than a static representation of a regional economy. It is defined by the form,

$$gsp_i(t+1) = gsp(t)*(a + b_i + c_{ir})$$

where,

$gsp_i(t+1)$ is the gross state product originating in the i-th industry in the next period;

gsp(t) is the total gross state product in the current time period;

a is the national-growth coefficient representing the rate of change in aggregate gsp for all states and industries

b_i is the industry-mix coefficient representing the differential (above or below the agregate) rate of change of an individual industry, and

c_{ir} is the regional-share coefficient representing the differential (above or below the aggregate industry) rate of change of an individual industry.

Use of the three components of the shift-share model is illustrated in Figure 2. Total change (in million 1982 dollars) is accounted for by the sum of its three component parts--the national-growth effect, the industry-mix effect, and the regional-share effect. Typically, the national-growth effect accounts for most of the total change. If it accounts for less than the total change from one period to the next, then the industry-mix affect or the regional-share effect or both make a positive contribution. Conversely, a national-growth effect larger than the total change signifies (1) an adverse industry-mix effect because of the dominance of below-average growth industries in the state or (2) an adverse regional-share effect because of the currently weak competitive position of its industry.

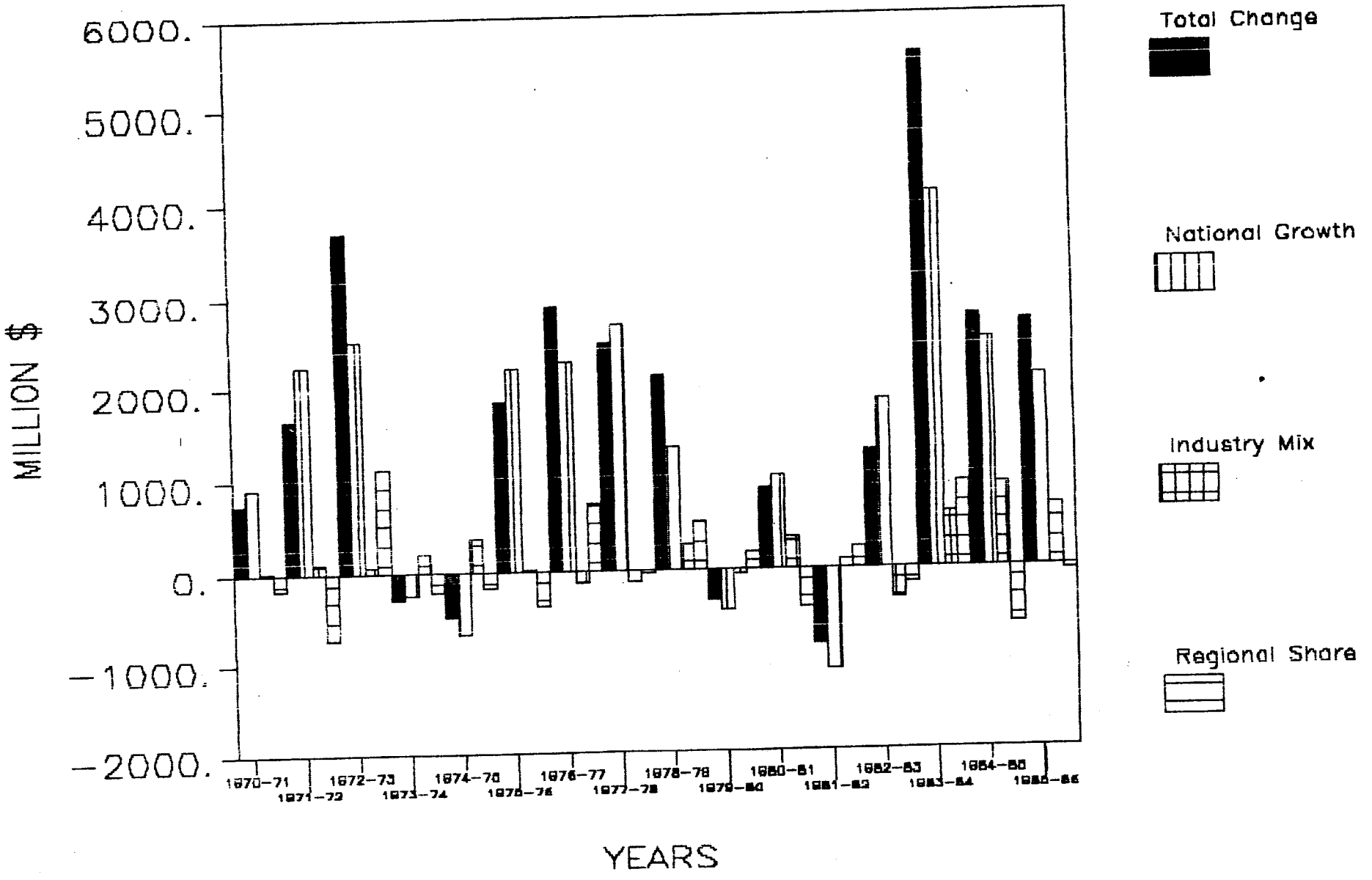
For the four states, the contribution of the three growth sources during the 1970-86 period is estimated as follows:

Change Sources	Mass	Mich	Minn	Wash
		(million 1982 dollars)		
Regional Share	-3551	-21040	533	5870
Industry Mix	8077	3195	2848	-648
National Growth	33322	52103	23108	22711
Total Change	37848	34258	26382	27933

The shift-share analysis shows that three of the four states lead the Nation in GSP growth. Michigan lagged in growth because of a strongly negative regional-share effect. Its competitive position deteriorated markedly during

Figure 2

Total annual change in gross state products (in million 1982 dollars) due to national growth, industry-mix and regional-share effects, Minnesota, 1970-71 to 1985-86



the 17-year period from 1970 to 1986.

Distinguishing Business Cycles

Turning points in US and state business cycles are identified by a directional change in gross state product, as shown in Table 2. Even among the four states, however, period-to-period changes in GSP depart from the aggregate US pattern, with Washington missing the 1973-75 recession and Massachusetts missing the 1979-80 recession. Both Michigan and Washington, on the other hand, missed the 1980-81 recovery. Market behavior for the dominant durable goods manufacturing industries differed markedly in the four states.

The differential sensitivity of gross state product to the business cycle is illustrated by the percentage contribution of each of the four states to total GSP and the change in GSP over the 1970-86 period. Contrasts among the four states are particularly evident in the comparison of the pre-1982 change with the post-1982 change in GSP which are summarized as follows:

Period	US	Mass	Mich	Minn	Wash	Other
			(percent)			
1970, total	100.0	2.7	4.3	1.8	1.6	89.6
1970-82	100.0	1.8	0.9	2.0	2.4	92.9
1982-86	100.0	4.4	4.8	2.1	1.8	86.9
1986, total	100.0	2.8	3.7	1.8	1.8	89.9

While the four states accounted for only 7.1 percent of the total growth of $719.3 billion in the 1970-82 period, they accounted for 11.1 percent of $577 billion of growth in the 1982-86 period.

Annual growth rates for the four states ranged from -9.7 percent for Michigan in the 1979-80 period to 7.0 percent for Washington in the 1975-79 period. Annual rates for the entire 17-year period varied much less--from 1.8 percent for Michigan to 3.4 percent for Minnesota.

The timing of GSP peaks and troughs during the 1970-86 period corresponded roughly with the US business cycle, particularly its investment and net

Table 2

Total change in GSP in recession and recovery, Massachussets, Michigan, Minnesota, Washington and US,1970-1986.

Period	US	Mass	Mich	Minn	Wash
		(million 1982 dollars)			
1970, total	2384793	64429	102172	41734	39224
1970-73	328421	6448	20815	6070	4242
1973-75	-55014	-4429	-13772	-838	2900
1975-79	479338	8732	23627	9278	13807
1979-80	-26332	111	-11487	-370	-381
1980-81	55182	2197	-3005	879	-816
1981-82	-62261	-320	-9725	-835	-2235
1982-86	577017	25109	27805	12205	10415
Change 1970-86	1296351	37850	34261	26382	27934
1986, total	3681144	102279	136433	68117	67158

foreign trade components. Again, however, each of the four states departed from the US pattern at least once, even on an annual basis, during the 17-year period.

Industry Structure and Regional Growth

The macro economic findings show significant differences in regional share, industry mix, and the respective economic dynamics, including the regional interconnections with other regions and "rest of the world". The micro-level actors (e.g. multinational corporations, government agencies and educational institutions) have very much to do with these differences. For example, the three big auto companies have a huge impact on the economy of Michigan. Since automobile sales are highly cyclical, the economy of Michigan has been also highly cyclical. This sensitivity to cyclical stimuli is being reduced by a gradual shift to a more diversified economic base that is less sensitive to cyclical stimuli.

The location of facilities by individual firms or agencies is a widely researched subject matter. Large firms, however, take a global point of view in facility location. They depend on technological progress in their strategic planning that critically affect both investment and location decisions (as noted by Galbraith, 1986). Sometimes political deals are made between large firms and state governments that may escape the rationale of conventional location theory and analysis.

In the micro-to-macro analysis an understanding of corporate planning and gaming behavior becomes essential. For example, in the Toledo, Ohio region the merger and leveraged buy-out behavior of some major local corporations has generated a significant loss of jobs. The Small Business Assistance Corporation in Toledo, with the help of an Economic Development Administration 302(a) Urban Planning Grant, has kept a company specific file on major Toledo

area manufacturing-related displacements from 1980 to 1988. This list gives the year, jobs lost and the reasons for the displacements. This type of information is helpful in micro-to-macro analysis.

Serious practical problems arise in the identification and documentation of the activities of micro actors. An example of such a problem area relates to the secrecy of corporate strategic planning, the present-day example being the leveraged buy-out activity. Most of the micro level information, e.g. corporate annual reports and related business information, is after the fact. Those corporations that become completely "privatized" have lessened the accounting of their activities to shareholders.

The current merger movement also may profoundly affect market shares, structure and dynamics of some regional economies. One major macro level indication of the merger and takeover activity is the rapid increase in the indebtedness of U.S. non-financial corporations (from about 33 percent of GNP in 1980 to about 42 percent in 1988). The net interest payments as a percentage of the aggregate pre-tax earning were around 15 percent in the 1950s and 1960s, increasing to about 30 percent in the 1970s. In 1988, they account for more than 50 percent of aggregate pre-tax earnings. One consequence of this is a sharp rise in business bankrupticies.

Micro level decisions that lead to increasing internationalization of business have important implications for the kinds of structural changes that occur within regions, including changes in interregional input-output linkages. This has already been dramatically observed in the case of the auto industry and its effects upon the economies of Michigan and Ohio.

As businesses become increasingly global, the leverage of state and local governments upon the behavior of a business enterprise has lessened. Critical decisions affecting regional economic activity have become increasingly

subject to decisions made at global levels, while state and regional economic policy decisions have become increasingly reactive and defensive.

In the macro context, again, the differential sensitivity of GSP to the business cycle is demonstrated in the shift-share analysis cited earlier, particularly regional industry mix when it includes a disproportionate share of slow-growing or fast-growing industries. But even a positive industry-mix effect may not be enough to counter a negative regional-share effect and from regional business dislocation, as shown by the Michigan data for the pre-1982 period.

The regional-share effect was strongly negative for both Massachusetts and Michigan in the pre-1982 period--a measure of the negative impact of one or more declining basic industries--textiles, apparal and leather products in Massachusetts and motor vehicles in Michigan. During the 1970-82 period, gross state product was reduced by $6.2 billion in Massachusetts and $24.1 billion in Michigan because of the loss of a previously strong competitive position of basic industry in the two states. Meanwhile, a strong regional-share effect helped Minnesota and Washington to outpace overall national growth, as shown below:

Period	Mass	Mich	Minn	Wash
	(million 1982 dollars)			
1970-73	-3356	-1510	204	-441
1973-75	2348	-6489	-414	3393
1975-79	-7374	-876	800	5707
1979-80	1407	-4570	163	75
1980-81	137	-5294	-445	-1128
1981-82	553	-5396	208	-1183
Total, 1970-82	-6285	-24135	516	6423
1982-86	2734	3095	533	5870

In the 61-industry breakdown of GSP, the industry-mix effect for the four states was generally positive. The highest positive values were attained by Massachusetts and Minnesota in the 1970-82 period and by Massachusetts and

Michigan in the 1982-86 period. Massachusetts and Michigan also experienced the largest negative industry-mix effects during the 1973-75 and 1979-80 recessions, as shown below:

Period	Mass	Mich	Minn	Wash
	(million 1982 dollars)			
1970-73	1029	7893	180	-574
1973-75	-5372	-4885	543	425
1975-79	4340	3827	13	-401
1979-80	-662	-5796	-62	46
1980-81	727	136	329	-749
1981-82	651	-1999	78	109
Total, 1970-82	713	-824	1081	-1141
1982-86	7374	4019	1767	496

Negative industry-mix effects generally coincided with the trough of the business cycle. The Washington economy, however, behaved counter-cyclically during the entire 17-year period through three business cycles. This was due in part to above-average growth of the government sector during the recession and its relative decline during recovery periods. (Public utility districts are organized in this state to provide services that come generally from the private sector in other states.) Private services followed this growth pattern, also.

According to the shift-share analysis, gross state product in Minnesota, for example, would have been only $23 billion (in 1982 dollars), rather than $26.4 billion larger in 1986 than 1970 had not Minnesota experienced a positive industry-mix effect of nearly $2.9 billion and a positive regional-share effect of more than $0.5 billion. The somewhat larger total change than attributed to the national-growth effect alone for Minnesota is the result of a favorable industry-mix and a favorable regional-share in all but one of the three business cycles since 1970. This is due largely to the disproportionately large dependence on cyclically-sensitive, but above-average growth, durable goods manufacturing, primarily machinery, fabricated metals,

and scientific and controlling instruments

Industry Specialization and Cyclical Sensitivity

A large company can have a major effect on a regional economic structure and dynamics (e.g., Chrysler, Ford and General Motors in Michigan and Boeing Aircraft in Washington). Such companies can be cyclically sensitive when in durable goods manufacturing or insensitive when in nondurable goods manufacturing. This cyclical sensitivity or insensitivity translates into varying degrees of instability in local employment, disposable income and tax revenues for the support of public infrastructure.

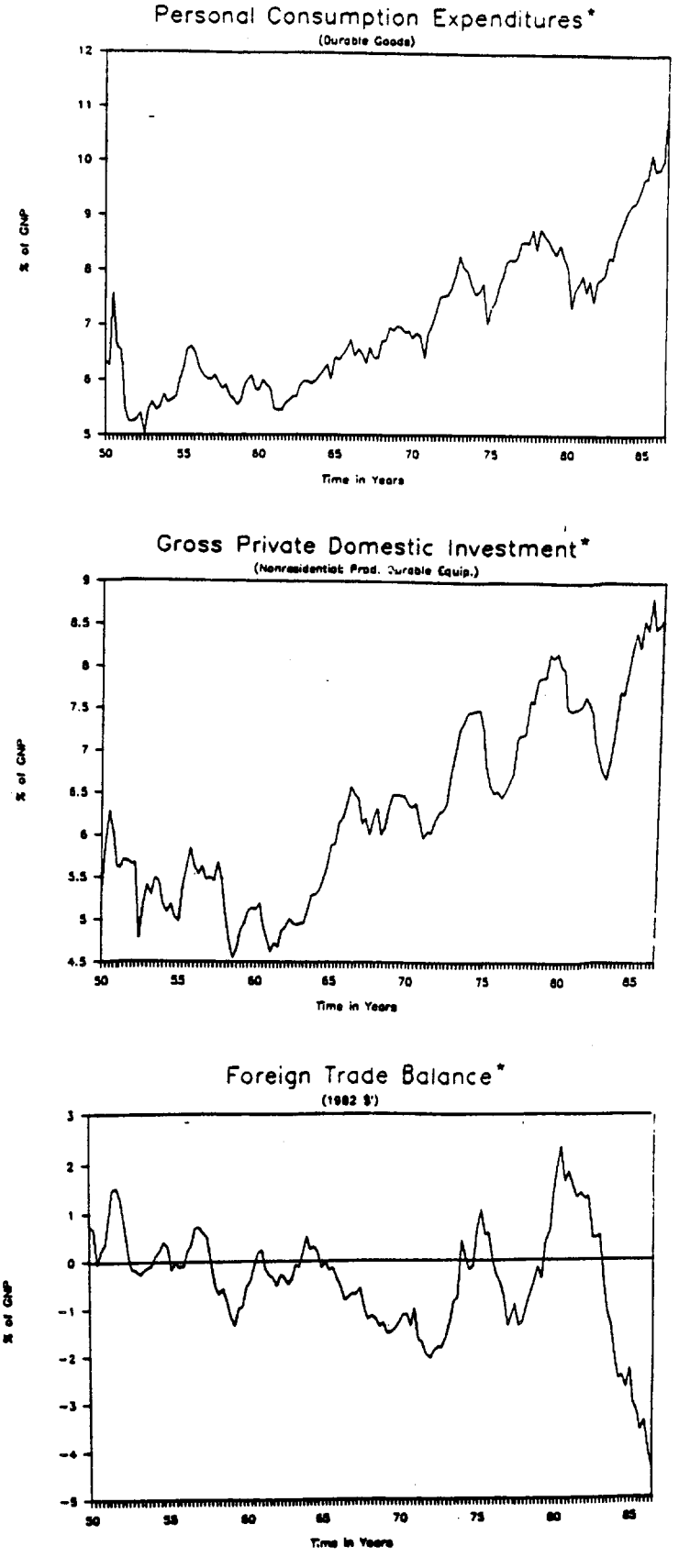
Macro-to-micro effects of a national business cycle may stimulate individual business decisions to locate a facility in a particular region, or relocate it in another region, or close an old facility, or open a new facility in a particular region. It is quite possible, however, that these decisions may be independent of the the business cycle. They may result from micro-to-macro corporate strategic planning processes. In either case, a regional economy would experience a structural dislocation.

To what extent GSP volatility is related to the business cycle or, alternatively, to micro level planning decisions, remains problematic. Its resolution requires both micro-to-macro and macro-to-micro investigation and analysis. Associated with this issue is the determination of how much of the volatility is due to structural dislocation and how much is purely cyclical and, finally, what is the interaction between these two change sources.

The cyclical volatility of the GSP is traced ultimately, as noted earlier, to industry specialization in durable goods manufacturing. Gross private domestic investment, foreign exports and, to a much lesser extent, personal consumption expenditures are the principal demand-generated sources of volatility, as shown in Figure 3. The large fluctuations in the demand for

Figure 3

Sources of demand-generated volatility in durable goods manufacturing.



producer durable equipment in domestic investment, for example, are affected by a host of factors, including interest rates, exchange value of the US dollar, US fiscal and trade deficits, and imminent labor shortages. The consequent fluctuations in GSP originating from durable goods manufacturing alone are large enough to affect the direction of change in overall GSP.

Excess GSP (in excess of the levels based on the industry distribution of GSP in the US) is used as a measure of export-producing, or basic, industry. This distribution is summarized for the beginning and end of the 24-year period from 1963 to 1986 in Table 3.

The growth or decline of the export-producing industries, particularly durable goods manufacturing, has accounted for the changing economic fortunes of the four states relative to the rest of Nation. The four states differ, however, in the individual industries that make up durable goods manufacturing with each industry having its unique markets and market determinants.

Fabricated metal products, nonelectrical machinery, electrical machinery, and instruments manufacturing are dominant in the economic base of Massachsetts and Minnesota. The finance, insurance and real estate sector is also important in both states. Health services, on the other hand, contribute significantly to the economic base in Massachusetts and Minnesota, while educational services are net export-producing only in Massachusetts. In comparison, industry concentration and specialization is much more extreme in Michigan and Washington than Massachusetts or Minnesota, with transportation equipment manufacturing dominating the economic base of the forst two states.

Contribution of durable goods manufacturing to the cyclical sensitity of gross state product is represented by the industry-mix effect in Table 4. The downside changes in durable goods manufacturing are nearly as large as, or larger than, the downside changes in total GSP in most recessions for each of

Table 3

Excess real GSP originating in specified industry group, Massachusetts, Michigan, Minnesota and Washington, 1963-69 and 1983-86.

Industry	MA 1963-69	MA 1983-86	MI 1963-69	MI 1983-86	MN 1963-69	MN 1983-86	WA 1963-69	WA 1983-86
	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)	(mil.$)
Farms	.0	.0	.0	.0	21.2	16.3	1.4	4.1
Agr.serv.,for.,fish.	.2	.0	.0	.0	.2	.0	1.5	2.9
Metal mining	.0	.0	.5	.0	9.3	2.5	.0	.0
Coal mining	.0	.0	.0	.0	.0	.0	.0	.0
Oil and gas extraction	.0	.0	.0	.0	.0	.0	.0	.0
Nonmetallic minerals, exc. fu	.0	.0	.0	.0	.0	.0	.0	.0
Construction	1.7	.0	.0	.0	7.5	.0	2.9	9.4
Food and kindred products	.0	.0	.0	.0	5.2	4.4	.0	.0
Tobacco manufacturing	.0	.0	.0	.0	.0	.0	.0	.0
Textile mill products	1.6	.4	.0	.0	.0	.0	.0	.0
Apparel and other textile pro	1.8	.3	.0	.1	.0	.0	.0	.0
Lumber and wood products	.0	.0	.0	.0	.0	1.6	11.9	9.7
Furniture and fixtures	.0	.0	.7	2.3	.0	.0	.0	.0
Paper and allied products	3.2	.3	.0	.0	7.5	11.6	5.1	2.4
Printing and publishing	3.7	2.7	.0	.0	.3	1.8	.0	.0
Chemicals and allied products	.0	.0	.0	.0	.0	.0	.0	.0
Petroleum and coal products	.0	.0	.0	.0	.0	.0	.0	.0
Rubber and misc. plastic prod	4.0	1.3	.2	.9	.0	.0	.0	.0
Leather and leather products	5.3	1.4	.0	.0	.0	.0	.0	.0
Stone, clay and glass prod.	.0	.0	.0	.0	.0	.5	.0	.0
Primary metal industries	.0	.0	6.6	3.9	.0	.0	.0	.1
Fabricated metal products	2.7	1.6	13.9	10.9	.0	3.2	.0	.0
Machinery, except electrical	7.3	21.6	13.0	7.6	9.3	26.8	.0	.0
Electrical machinery	6.3	16.0	.0	.0	.0	.0	.0	.0
Motor vehicles and equipment	.0	.0	63.4	59.0	.0	.0	.0	.0
Transportation equip, except	.0	.0	.0	.0	.0	.0	34.2	18.6
Instruments and related produ	4.8	8.9	.0	.0	2.9	3.1	.0	.0
Miscellaneous mfg products	3.7	2.8	.0	.0	.0	.0	.0	.0
Railroad transportation	.0	.0	.0	.0	4.3	1.2	.6	.4
Local and interurban passenge	.7	.8	.0	.0	.1	.1	.0	.0
Trucking and Warehousing	.0	.0	.0	.4	2.1	1.1	.0	.0
Water transportation	.0	.0	.0	.0	.0	.0	2.5	2.3
Transportation by air	.0	.0	.0	.0	1.1	3.6	.6	1.0
Pipelines, ex natural gas	.0	.0	.0	.0	.1	.0	.0	.0
Transportation services	.0	.1	.0	.0	.0	.0	.0	1.0
Communication	1.5	.2	.0	.0	.0	.0	.0	1.1
Electric, gas and sanitary se	.1	.0	.4	1.0	.5	.0	.0	.0
Wholesale trade	2.8	1.7	.0	.0	4.3	5.9	4.3	7.5
Retail trade	4.7	.2	.0	.0	3.4	.5	5.6	8.9
Banking	.9	.0	.0	.0	.7	.0	.0	.0
Credit agencies, other than b	.0	.0	.1	.0	.0	.6	.0	.0
Holding cos. and investment s	1.0	.4	.0	.0	.2	.0	.0	.0
Insurance carriers	3.5	2.8	.0	.0	.0	1.0	.0	.0
Insurance agents, brokers and	.9	.3	.0	.0	.9	.4	.2	.2
Real estate	8.9	6.0	.6	5.5	9.7	3.4	8.2	5.7
Hotels and other lodging plac	.0	.0	.0	.0	.1	.0	.0	.0
Personal services	.8	.0	.0	.0	.1	.7	.0	.7
Business services	6.9	9.4	.0	.0	.0	.0	.0	.0
Auto repair, services, and ga	.0	.1	.0	.0	.1	.3	.3	1.0
Misc. repair services	.0	.0	.0	.0	.0	.0	.1	.7
Motion pictures	.0	.0	.0	.0	.0	.0	.0	.0
Amusement and recreation serv	.0	.0	.0	.0	.0	.0	.0	.0
Health services	7.3	7.7	.0	3.0	3.3	1.7	.4	.0
Legal services	1.9	.8	.0	.0	.0	.0	.0	.0
Educational services	7.7	7.3	.0	.0	.0	.0	.0	.0
Social services and membershi	.0	.9	.0	.3	.0	1.4	.0	.4
Misc. and professional servic	2.0	3.9	.1	.5	.0	.0	.0	.0
Private households	.0	.0	.0	.0	.0	.0	.0	.0
Federal civilian government	.0	.0	.0	.0	.0	.0	4.6	4.0
Federal military government	.0	.0	.0	.0	.0	.0	5.8	5.5
State and local government	2.2	.1	.5	4.6	5.3	2.6	9.6	12.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4

Total Change in GSP Due to Regional-Share, Industry-Mix and National-Growth Effects in Durable Goods Manufacturing, Massachusetts, Michigan, Minnesota and Washington, 1970-86

Change Source	1970-73	1973-75	1975-79	1979-80	1980-81	1981-82	1982-86
			(million 1982 dollars)				
Massachusetts:							
Regional Share	-424	594	192	511	-34	574	754
Industry Mix	682	-881	1399	-130	182	-883	3875
National Growth	1173	-205	1844	-112	239	-271	2821
Total, Durables	1431	-492	3435	269	387	-580	7450
Total Change	6448	-4429	8732	111	2197	-320	25109
Michigan:							
Regional Share	-698	-2387	-575	-976	-2689	-1914	3200
Industry Mix	7381	-6940	4508	-6356	-136	3257	5733
National Growth	4237	-734	6430	-338	575	-596	5340
Total, Durables	10920	-10061	10363	-7670	-2550	-5767	14273
Total Change	20815	-13772	23627	-11487	-3005	-9725	27805
Minnesota:							
Regional Share	-20	161	628	-66	-53	465	539
Industry Mix	382	-445	679	-174	56	-557	2523
National Growth	599	-113	985	-61	127	-140	1513
Total, Durables	961	-397	2292	-301	130	-232	4575
Total Change	6070	-838	9278	-370	879	-835	12205
Washington:							
Regional Share	246	797	440	-227	-709	-108	475
Industry Mix	-92	-512	104	-146	-576	-643	1252
National Growth	725	-148	1228	-74	144	-137	1219
Total, Durables	897	137	1772	-447	-1141	-888	2895
Total Change	4242	2900	13807	-381	-816	-2234	10415
United States:							
Total, Durables	72178	-51745	98289	-22024	3423	-42419	155244
Total Change	328421	-55014	479338	-26332	55182	-62261	577017

the four states and the US. The upside changes in durable goods manufacturing, on the other hand, are small compared to upside total changes. Net long-term economic growth occurs, of course, during extended periods of economic recovery.

The negative national-growth effect derived from the aggregate GSP series is accentuated by a negative industry-mix effect, especially in states most dependent on durable goods manufacturing. In addition, the regional-share effect--a measure of the competitive position of an individual industry in a state or region--tends to become negative when the industry-mix effect is negative. The two series appear to move in tandem.

Summary and Conclusions

A micro-to-macro approach in modeling economic behavior is offered as part of a multi-faceted strategy for relating period-to-period fluctuations in gross state product to the individual industries that include a variety of actors in the pursuit of diverse corporate and personal interests. A first step in this effort is the use of industry-sepcific gross state product series that account for the differential sensitivity of gross state product to the business cycle.

Four states in four census regions--Massachussetts, Michigan, Minnesota, and Washington--were selected to illustrate the central working hypothesis of this paper. We argue that in a macro-economic context the differential sensitivity of the gross state product to the US business cycle is accounted for by (1) the industry mix, (2) the economic base, and (3) the changing industry structure due to business location and dislocation.

Preliminary findings show the persistent and pervasive influence of the durable goods industries in accounting for year-to-year volatility in gross state product. State-to-state differences exist because of differences in the

industry mix and, also, because of the unique micro-to-macro relationships among the principal economic actors in each state.

The volatility of durable goods manufacturing is attributed largely to the volatility of gross private domestic investment, net foreign trade, and personal consumption expenditures for consumer durables. Those states with a disproportionate share of durable goods manufacturing are thus strongly dependent on essentially uncontrolled external forces for their economic well-being insofar as the demand-driven volatility is not reduced in its total impact by the existence of more stable export-producing industries.

While much research has been done on macro-to-micro and micro-to-macro processes, these two approaches still remain isolated from each other. Much more empirical research is needed to bring them together. While this investigation has been primarily in the macro-to-micro direction, we attempt to interpret the results in the micro-to-macro direction, thereby providing a starting point for future investigations.

References

Burns, Tom R., Thomas Baumgartner and Philippe Denville. 1985. Man Decisions, Society: The Theory of Actor System Dynamics for Social Scientists. Gordon and Breach Science Publishers, New York.

Drucker, Peter F. 1986. "The Changed World Economy", Foreign Affairs, Spring.

Eliasson, Gunnar (ed.). 1977. A Micro-to-Macro Model for the Swedish Economy. Stockholm: Almquist and Wiksell International.

Eliasson, Gunnar. 1985. The Firm and Financial Markets in the Swedish Micro-to-Macro Model-Theory, Model and Verification. Stockholm: The Industrial Institute for Economic and Social Research.

Fishkind, Henry H. 1977. "The Regional Impact of Monetary Policy: An Economic Simulation Study of Indiana, 1958-1973." Journal of Regional Science, Vol. 17, No. 1, pp. 77-88.

Friedenberg, Howard and Robert Bretzfelder. 1980. "Sensitivity of Regional and State Nonfarm Wages and Salaries to National Business Cycles, 1948-79," Survey of Current Business, May, pp. 15-27.

Jamsa, Juha, Jari Kamanen & Esko Toivianen. 1985. "On the Transmission of the

Effects of Monetary Policy to the Regions", Planning Outlook, Vol. 28, No. 1, pp. 28-36.

Jutila, Zakari T. 1971. "A Linear Model for the Agglomeration, Diffusion and Growth of Regional Economic Activity," Regional Science Perspectives, Vol. 1, No. 1, pp. 83-108.

Jutila, Zakari T. 1972. "Dynamics of Regional Economic Development," Regional Science Perspectives, Vol. 2, No. 1, pp. 95-110.

Jutila, Zakari T. 1973a. "Generation of Regional Business Cycles Through Interregional Feedback Mechanisms," Regional Science Perspectives, Vol. 3, No. 1, 1973, pp. 52-67.

Jutila, Zakari T. 1973b. "Spatial Macroeconomic Development," Papers of the Regional Science Association, Vol. XXX, pp. 39-57.

Jutila, Zakari T. 1974. "Space-Time Modeling of Macroeconomic Development," Automatica, Vol. 10, No. 6, December, pp. 607-615.

Jutila, Zakari T. 1977a. "Continuous System Modeling of Economic and Population Development with Possible Dislocations," Proceedings, The First World Conference on Mathematics at the Service of Man, Vol . II, Universidad Politecnica, Barcelona, Spain, pp. 154-171.

Jutila, Zakari T. 1977b. "Modeling of Interregional Population and Economic Development with Impact Dislocations," Proceedings, 1977 International Conference on Cybernetics and Society, September 19-21, Washington, D.C., pp. 135-139.

Jutila, Zakari T. 1978. "Social Gaming by Impact Dislocations: An Antithesis of a Gradual Social Change," Modeling and Simulation, Instrument Society of America, Pittsburgh, Pennsylvania, Vol. 9, Part 2, pp. 523-527.

Jutila, Zakari T. 1980a. "Modes of Propagation of Regional Economic Stagnation: A Dynamic Perspective," Regional Development under Stagnation, Vol. 56, Schriften zur offentlichen Verwaltung und Offentlichen Wirtschaft, Walter Buhr and Peter Friedrich (eds.), Nomos-Verlagsgesellschaft, Baden-Baden, pp. 29-54.

Jutila, Zakari T. 1980b. "Social Gaming and Control by Dislocations," International Journal of General Systems, Vol. 6, pp. 139-153.

Jutila, Zakari T. 1981. Micro-to-Macro Models of Urban Spatial Dynamics," Urban Problems and Policies, Peter Nijkamp and Piet Rietveld, editors, Sijthoff International Publishing Company, The Netherlands.

Jutila, Zakari T., with William A. Muraco. 1978. "Space-time Interactions and Interregional Growth Policies," Regional Science Perspectives, Vol. 8, No. 1, pp. 52-67.

Maki, Wilbur R., et al, 1984. "Forecasting State Economic Growth in Recession and Recovery." Regional Science Perspectives. 12(1); 39-49.

Mass, Nathaniel J. 1980. "Monetary and Real Causes of Investment Booms and Declines," Socio-Econ. Plan. Sci. Vol. 14, pp. 281-290.

Mathur, V. K. and S. Stein. 1980. "Regional Impact of Monetary and Fiscal Policy: An Investigation into Reduced Form Approach," Journal of Regional Science, Vol. 20, pp. 334-352.

Mathur, V. K. and S. Stein. 1982. "The Regional Impact of Monetary and Fiscal Policy: Some Further Results," Papers of the Regional Science Association, Vol. 50, pp. 67-74.

Meade, Arthur C. and Glenworth A. Ramsey. 1982. "Analyzing Differential Responses of a Region to Business Cycles," Growth and Change, Vol. 13, No. 3, pp. 38-42.