

**Some Preliminary Evidence on the Relationship
Between Regional Consumption Growth and Income Growth:
Data from 49 States of the United States 1929-1986**

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1. Introduction:

The prediction that individuals should equate their marginal rate of substitution between any two goods to the price ratio between those two goods is a cornerstone of economic theory. When this prediction of the theory is combined with further assumptions about the preferences of individuals and the technology available for producing and trading goods, various specific further predictions can be made about the relationship between observed consumption growth and income growth which appear in the data. For example, if we assume that individuals in different regions cannot trade any goods among regions and that they cannot store any goods through time, then we predict that in each region, the current consumption of any good should always be equal to the current production or endowment of that same good. On the other hand, if we assume that all individuals can trade goods intertemporally and we assume that individuals have identical preferences within certain class of preferences ¹, then we can obtain the prediction that regions' consumption growth should be completely explained by aggregate consumption growth and that data on regions' income growth should have no additional power to explain variation in individuals' consumption growth. In this paper, I present results from a preliminary examination of the relationship between consumption growth and income growth on a regional basis within

¹ For instance, let all consumers i have a marginal rate of substitution between any two goods m and n given by

$$\frac{U_m^i(c^i)}{U_n^i(c^i)} = B\left(\frac{c_m^i}{c_n^i}\right)^\gamma$$

the United States with an eye towards providing a measure of the extent of regional market integration in the United States that can be directly compared to similar measures of international market integration.

To provide a measure of the extent of market integration within the United States, I measure both the extent to which consumption growth is equated across regions of the United States and the extent to which regional variation in income growth can serve to explain regional variation in consumption growth. I see three important regularities appearing in the data. The first regularity is that the observations on individual states' consumption growth vary substantially around the observations on aggregate consumption growth. It is also true that the observations on individual states' personal income growth also vary substantially around the observations on aggregate personal income growth. The second regularity is that there does not appear to be a significant and stable relationship between these observations on regional income growth and regional consumption growth when these growth rates are measured at the three to seven year horizon. The third regularity is that there is a strong relationship between regional income growth and regional consumption growth when these growth rates are measured at a horizon of several decades.

This paper is divided into three sections. The second section contains a discussion of the data which was used in this study. The third section presents the plots of the data and the regressions that I ran to explore the relationship between an individual state's consumption growth rate and its personal income growth rate.

2. The Theory:

This section describes two simple hypotheses which motivate my examination of the data. The first hypothesis I examine is that consumption grows at the same rate across all regions of the country. The second hypothesis I examine is that consumption growth within a region is determined by that regions income growth rate.

The hypothesis that consumption should grow at the same rate across all regions of the

country can be derived in a model in which intertemporal trade in consumption is allowed and all individuals have the same preferences. The derivation of this hypothesis begins with the necessary condition of competitive equilibrium that all individuals equate their marginal rate of substitution between two goods to the price ratio between those goods:

$$\frac{U_n^i(c^i)}{U_m^i(c^i)} = \frac{p_n}{p_m}$$

We interpret goods n and m as indicating consumption delivered at different dates and in different states of nature. We then specialize our formulation of preferences to a form in which the utility function is separable in consumption at different dates and in different states of nature to derive a relationship between marginal rates of substitution and actual levels of consumption. For instance, using the same power utility function

$$U^i(c^i) = E_0 \sum_t \beta^t u(c_t^i) = E_0 \sum_t \beta^t (c_t^i)^\gamma$$

for all individuals, we obtain the prediction that the ratio of consumption today to consumption at any other date and in any other state of nature should be the same for all individuals. Aggregating across individuals in a region, we obtain the implication that consumption should grow at the same rate at all times across all of the states of the United States.

The hypothesis that consumption growth within each state should be determined by income growth within that state can be obtained in a model in which the individuals in the various states are shut off from intertemporal trade with each other.

3. The Data:

This section describes data sources for the series used in this analysis of regional consumption and income patterns in the United States. To measure consumption, I look at retail sales data both for total sales and for food store sales collected on a state by state basis in Censuses conducted in various years between 1929 and 1986 by the Commerce Department

and *Sales and Marketing Management Magazine*. To measure income, I use data on personal income collected on a state by state basis and published annually by the Commerce Department. The data are described more fully below.

Sales Data Availability: This study examines data on the dollar volume of retail sales on a state by state basis. These data are gathered by two organizations. Data on retail sales at state, county, and city levels is gathered periodically by the Commerce Department through extensive surveys in Censuses of Retail Trade which, from now on, will be taken at regular five year intervals in years ending in digits two and seven. The data collected in these Censuses was collected earlier in Censuses of Business at irregular intervals (a census of retail activity for 1939 was included as part of the 1940 Census). In the last decade, the Commerce Department has also begun to survey retail establishments state by state and city by city both on an annual and a monthly basis to establish annual and monthly figures for retail trade.

Sales and Marketing Management Magazine, a private organization based in New York (formerly *Sales Management Magazine*), has been collecting data on population, retail sales, and personal disposable income, on a state, county, and city-wide basis since 1929. These data have been presented annually since 1952 in a special issue of the magazine entitled *The Survey of Buying Power*. These data are typically sold to advertisers and marketers who use the data to target their sales efforts on a local level. The retail sales data in the *Survey of Buying Power* is benchmarked to the most recent Census of Retail Trade and then interpolated on an annual basis using data such as sales tax receipts and bank debits.

In this paper I discuss data on retail sales on a state by state basis taken from the years 1929, 1933, 1935, 1939, 1948, 1952, 1955, 1959, 1964, 1970, 1974, 1979, 1984, and 1986. These data are taken from two different sources.

The data on total nominal retail sales for 1929, 1933, 1935, 1939, and 1948 are taken from an article entitled "Regional Trends in Retail Trade" published in the September 1956 issue of the *Survey of Current Business*. These data were adjusted to bring the treatment

of sales taxes into better conformity with the practices of the 1954 Census of Retail Trade. The data on food store sales for these years was obtained by applying the percentage of total retail sales represented by food store sales reported in the raw census numbers to the adjusted figures for total retail sales described earlier.

The data on total and food store nominal retail sales presented for 1952, 1955, 1959, 1964, 1970, 1974, 1979, 1984, and 1986 are taken from the *Survey of Buying Power*. The data for all but 1952 and 1986 are each from the first *Survey of Buying Power* to reflect a new Census of Retail Trade. The data for 1952 and 1986 are from the first and last years of the *Survey of Buying Power* available in the library at the University of Chicago. I took data from the *Survey of Buying Power* rather than from the Censuses themselves with the hope that the adjustments made for mail order sales in the *Survey of Buying Power* will result in superior data on retail sales for local consumption.

Income Data Availability: Tables reporting nominal personal income and personal disposable income state by state are presented annually in the *Survey of Current Business*. The personal income data is presented with an extensive breakdown of income by source and of labor income by industry. These data extend back to 1929. The personal disposable income data are less detailed and extend back to 1948.

Price Deflators: Regional price data is problematic. I have initially used the national personal consumption expenditure deflators (total and for food not consumed on the premises) to put disposable income and retail sales into real terms. I am awaiting the receipt of CPI data for census regions and selected cities extending back beyond 1929 from the Bureau of Labor Statistics. These data will allow some examination of the extent of changes in relative regional price levels.

Population Data: Population totals on a state by state basis are obtained from a comparison of the state by state personal income numbers on a raw and per capita basis. Further demographic information on the age and income distribution of the population within the state is available in the *Survey of Buying Power*.

4. The Plots and the Regressions:

In this section I present some plots of the data and some regression results to illustrate three main regularities in the data. The first regularity is that the observations on individual states' per capita consumption growth rates vary substantially around the observations on aggregate per capita consumption growth rates. It is also true that the observations on individual states' per capita personal income growth rates also vary substantially around the observations on aggregate per capita personal income growth rates. The second regularity is that there does not appear to be a significant relationship between these observations on regional income growth and regional consumption growth at the three to seven year horizon that remains stable over the entire period. The third regularity is that there is an exceptionally strong relationship between regional income growth and regional consumption growth when these growth rates are measured at a horizon of several decades. I will illustrate each of these regularities in turn.

The Variation in Consumption Growth: We can obtain the prediction that every region's consumption should grow at the same rate from a simple model in which all goods are freely traded and consumers have identical preferences within a certain class of preferences. The prediction of the model that a common component should completely summarize the data on individual states' per capita consumption growth rates is not well borne out in the data. In every time period studied, there appears in the data to be substantial variation in individual states' per capita consumption growth rates around the aggregate per capita consumption growth rate.

In plots 1 and 2, I present the observations on per capita total retail sales growth and per capita food store sales growth state by state for the time periods 1929-33, 1933-35, 1935-39, 1939-48, 1948-52, 1952-55, 1955-59, 1959-64, 1964-70, 1970-74, 1974-79, 1979-84, 1984-86, 1952-86, and 1929-86. For each of these time periods, (marked along the horizontal axis) the growth rate of per capita total retail sales or per capita food store sales on an annualized basis is represented along the vertical axis by one dot for each of the forty nine

states in the study. The plus sign in each column of dots represents the growth rate of per capita total retail sales or per capita food store sales on an annualized basis when these sales have been aggregated across all of the forty nine states. The height of each column of dots represents the dispersion of individual states' per capita retail sales growth rates around the aggregate per capita retail sales growth rate. The variation in the aggregate per capita retail sales growth rate over time can be seen by looking across the plus signs in each column of dots.

In plot 3, I present the same kind of picture as in plots 1 and 2 except that I present the annual data for individual states' per capita personal income growth rates. These data indicate that per capita personal income growth is also quite variable across the various states of the country. Plot 4 presents the same picture as plots 1 and 2, taking only the data to calculate the growth rates for the years 1929-33, 1933-35, 1935-39, 1939-48, 1948-52, 1952-55, 1955-59, 1959-64, 1964-70, 1970-74, 1974-79, 1979-84, 1984-86, 1952-86, and 1929-86.

In plot 8 I present the cross section of personal income across the 49 states of the United States observed in 1929, 1948, 1970 and 1986. The data that are presented are the logs of personal income. This graph shows that there has been considerable narrowing of the differential in income across the various states of the United States.

Consumption Growth and Income Growth in the Short Term: As we saw in the previous section, we can obtain the prediction that a regions' consumption growth should be completely explained by regions' income growth from a simple model in which no goods are traded and no goods can be stored. This prediction of the model that an individual states' income growth should have great power in explaining an individual states' consumption growth is also not borne out in the data when growth rates are measured at a horizon of three to seven years. I document this feature of the data in plots 5 and 6 and in the regressions that follow.

I plot 5, I plot all 637 observations of the deviation of individual states' per capita total

retail sales growth rates from the aggregate per capita retail sales growth rate against the deviation of those states' per capita personal income growth rates from the aggregate per capita personal income growth rate for the years 1929-33, 1933-35, 1935-39, 1939-48, 1948-52, 1952-55, 1955-59, 1959-64, 1964-70, 1970-74, 1974-79, 1979-84, 1984-86, for the same years. In plot 6, I present the same picture using per capita food store sales as opposed to per capita total retail sales. It is apparent from these pictures that there is at best a weak relationship at the three to seven year horizon between individual states' income growth rates and their consumption growth rates.

To further document the regularity that there is no clear relationship between a states' consumption growth rate and its income growth rate at the three to seven year horizon, I ran regressions of the form:

$$\Delta c = \alpha(\Delta \bar{c}) + \beta(\Delta y) + \epsilon$$

where Δc is a vector of individual states' growth rates of per capita retail sales, $\Delta \bar{c}$ is the growth rate in the per capita aggregate retail sales, and Δy is a vector of individual states' per capita income growth rates. Table 1A contains the results from these regressions when data on per capita total retail sales is used as the proxy for consumption growth. Table 2A contains the results from these regressions when data on food store sales is used as the proxy for non-durable consumption growth.

I first ran this regression for all 637 observations on retail sales and income growth rates for the years 1929-33, 1933-35, 1935-39, 1939-48, 1948-52, 1952-55, 1955-59, 1959-64, 1964-70, 1970-74, 1974-79, 1979-84, 1984-86. These regressions using data on total retail sales and food store sales essentially reproduce the information in plots 5 and 6 on the overall relationship between income growth and consumption growth and are reported in the first row of tables 1 and 2. The results from these regressions using all of the data give a conflicting picture of the relationship between consumption growth and income growth. When data on total retail sales are used, a strong relationship between states'

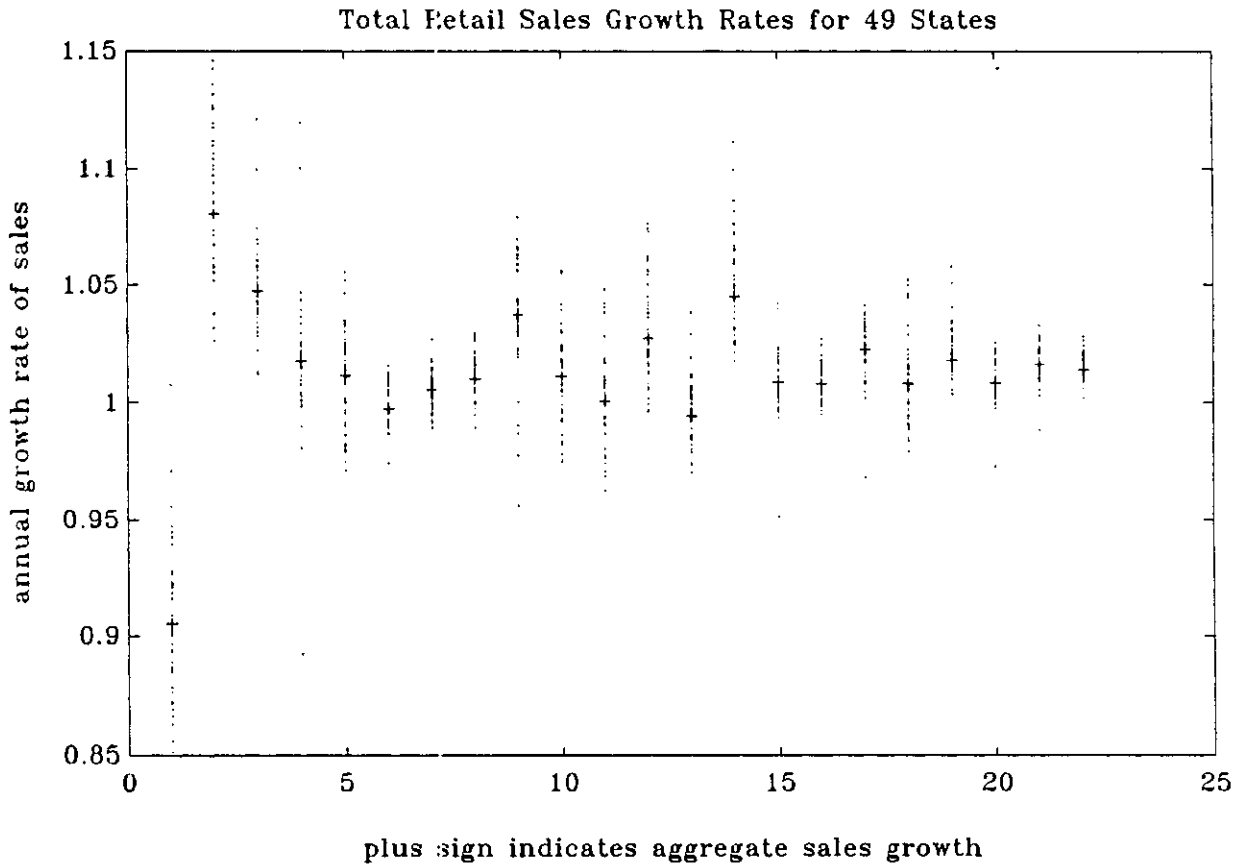
income growth rates and consumption growth rates appears. On the other hand, no such relationship emerges from the data on food store sales. This apparent contradiction may be due to the inclusion of durable goods sales in the figures for total retail sales.

I then ran this regression separately 12 times, one time for each of the time periods 1929-33, 1933-35, 1935-39, 1948-52, 1952-55, 1955-59, 1959-64, 1964-70, 1970-74, 1974-79, 1979-84, 1984-86 for which I have 49 observations on states' retail sales and income growth rates. These regression results are reported in rows 2 through 14 of tables 1A and 2A. As with the regressions using all of the data at once, it appears in these regressions that a states' income growth has more power in explaining that states total retail sales growth than it does in explaining its food store sales growth. It also appears that the relationship between income growth and consumption growth does not remain stable over the various periods studied.

Consumption Growth and Income Growth in the Long Term: Plot 7 shows the relationship between a state's income growth and its total retail sales growth or its food store sales growth over the full period 1929-1986 covered in the sample. These plots clearly show a strong relationship between these two variables in the very long term. In tables 1B and 2B I present results from the same regression of consumption growth on income growth when the time period covered is taken to be between 10 and 20 years. These regression results show that it is not until one reaches the longest horizons that the relationship between a state's income growth and its sales growth emerges most clearly.

In plots 9 and 10, I present the cross sectional relationship between a state's log level of retail sales and its log level of income taken at different dates. These plots demonstrate the decline over time in the fit of a standard cross sectional consumption function.

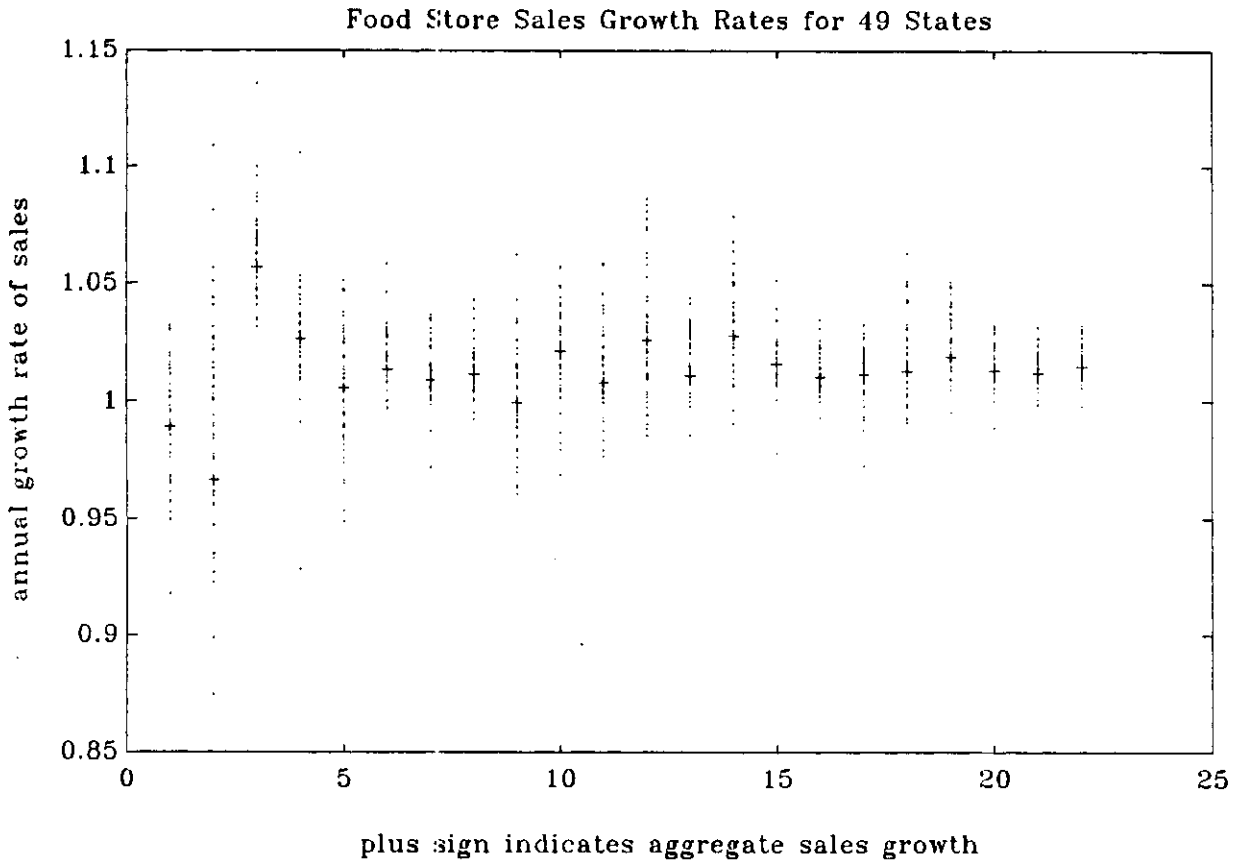
Plot 1:



Date key for horizontal axis:

- (1) 1929-33, (2) 1933-35, (3) 1935-39, (4) 1948-52, (5) 1952-55, (6) 1955-59, (7) 1959-64,
(8) 1964-70, (9) 1970-74, (10) 1974-79, (11) 1979-84, (12) 1984-86,
(13) 1929-39, (14) 1939-48, (15) 1948-59, (16) 1959-70, (17) 1970-79, (18) 1979-86,
(19) 1929-43, (20) 1948-70, (21) 1970-86, (22) 1929-86

Plot 2:

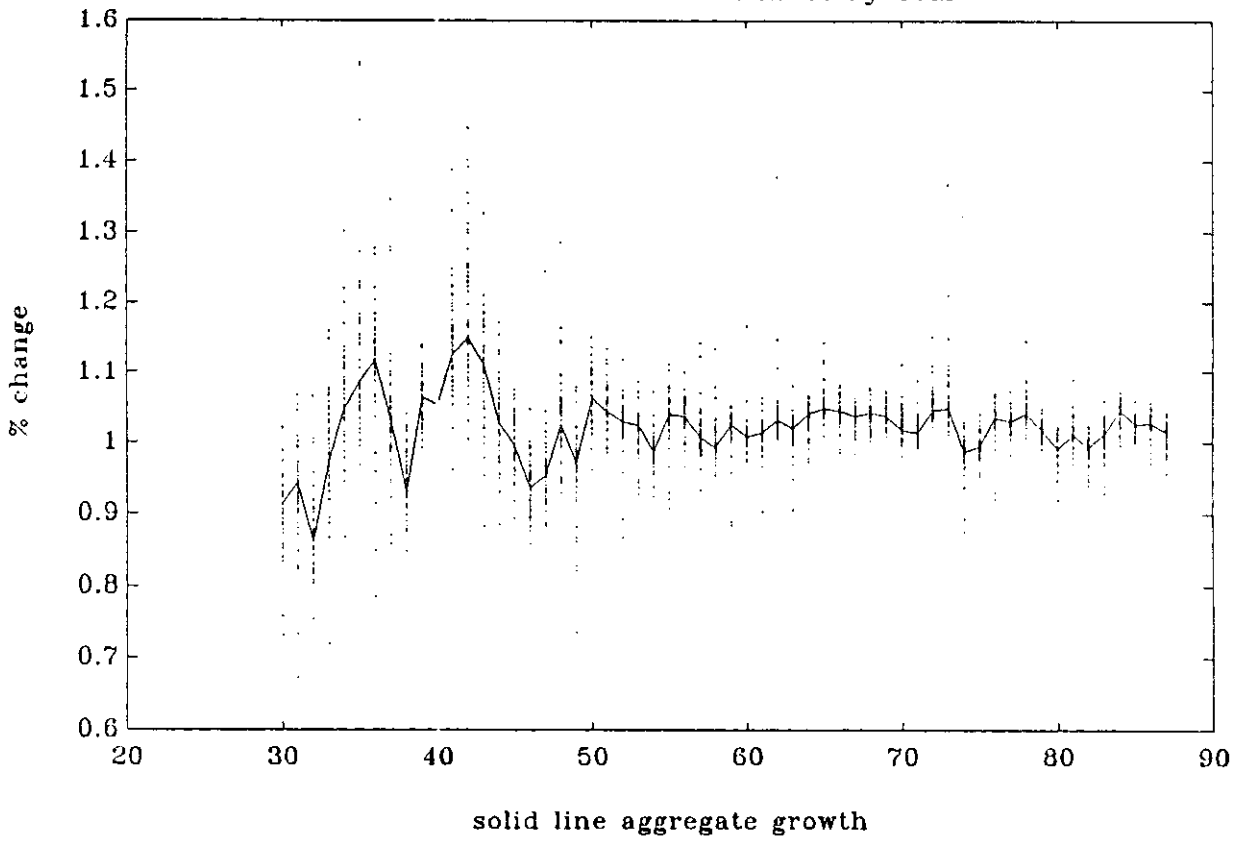


Date key for horizontal axis:

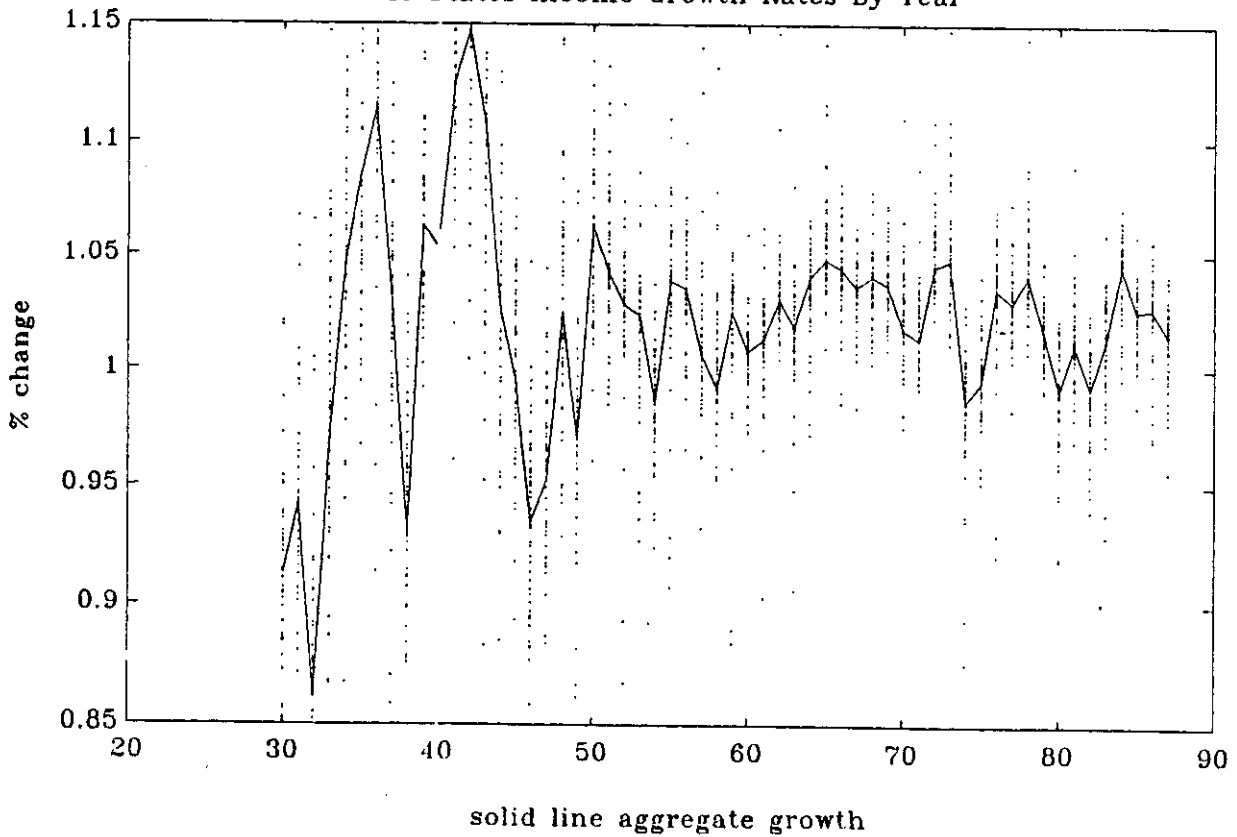
- (1) 1929-33, (2) 1933-35, (3) 1935-39, (4) 1948-52, (5) 1952-55, (6) 1955-59, (7) 1959-64,
(8) 1964-70, (9) 1970-74, (10) 1974-79, (11) 1979-84, (12) 1984-86,
(13) 1929-39, (14) 1939-48, (15) 1948-59, (16) 1959-70, (17) 1970-79, (18) 1979-86,
(19) 1929-43, (20) 1948-70, (21) 1970-86, (22) 1929-86

Plot 3:

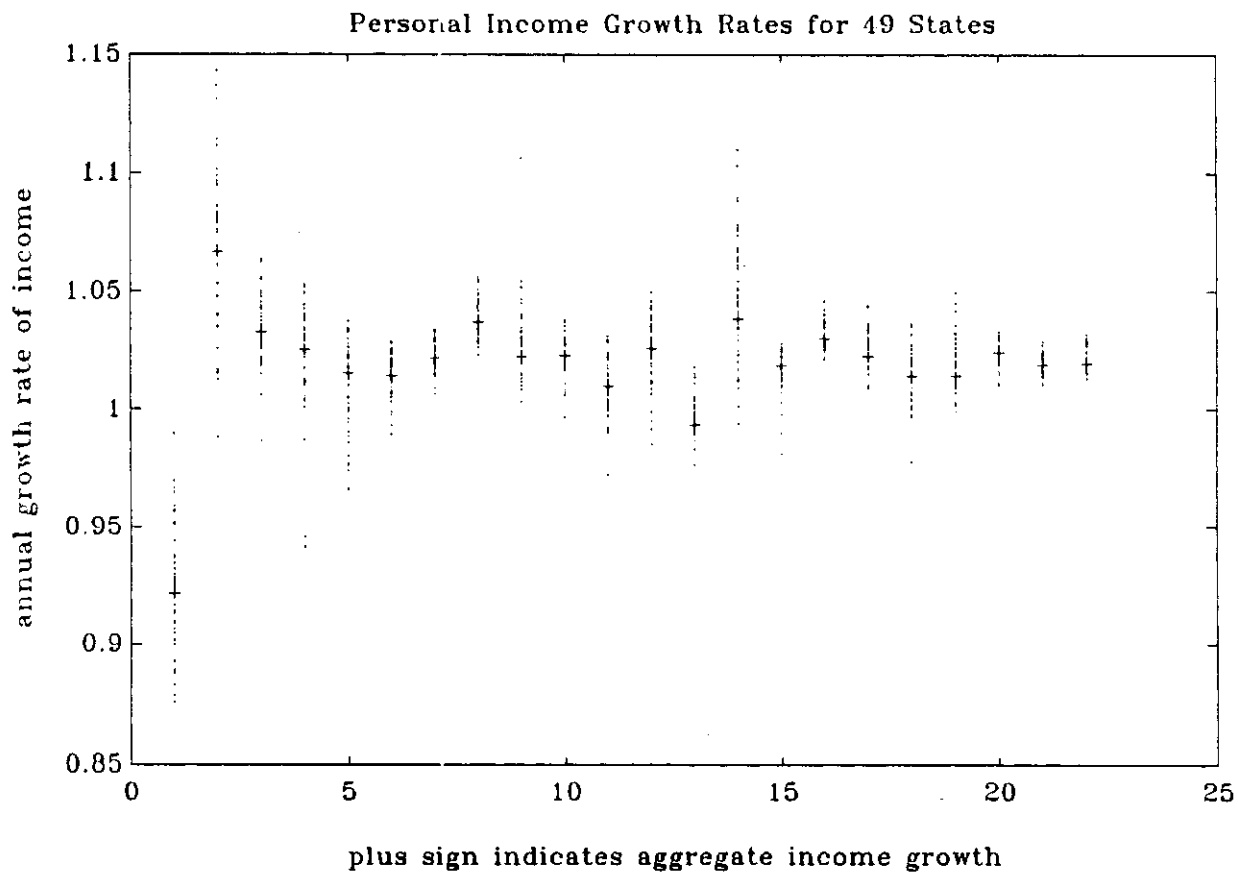
49 States Income Growth Rates By Year



49 States Income Growth Rates By Year



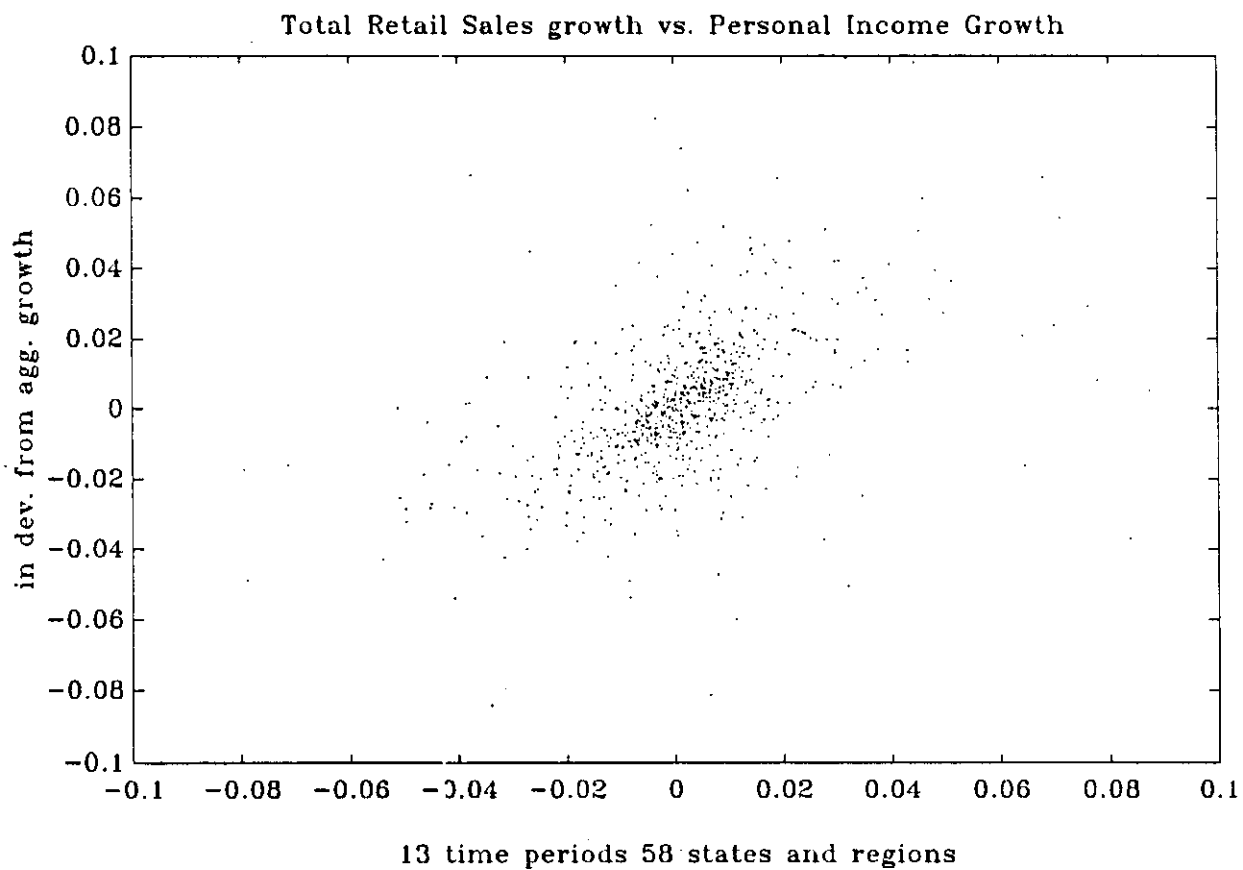
Plot 4:



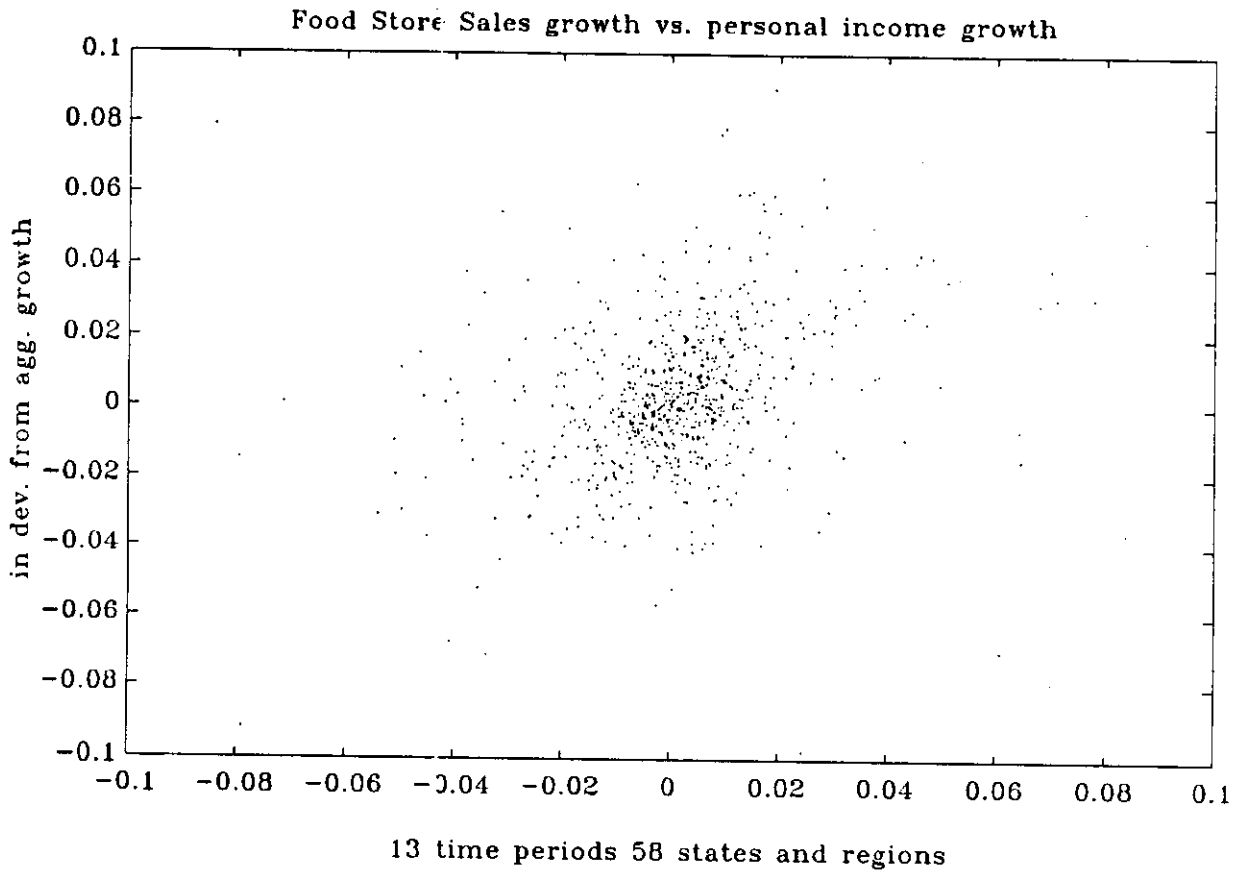
Date key for horizontal axis:

- (1) 1929-33, (2) 1933-35, (3) 1935-39, (4) 1948-52, (5) 1952-55, (6) 1955-59, (7) 1959-64,
(8) 1964-70, (9) 1970-74, (10) 1974-79, (11) 1979-84, (12) 1984-86,
(13) 1929-39, (14) 1939-48, (15) 1948-59, (16) 1959-70, (17) 1970-79, (18) 1979-86,
(19) 1929-43, (20) 1948-70, (21) 1970-86, (22) 1929-86

Plot 5:

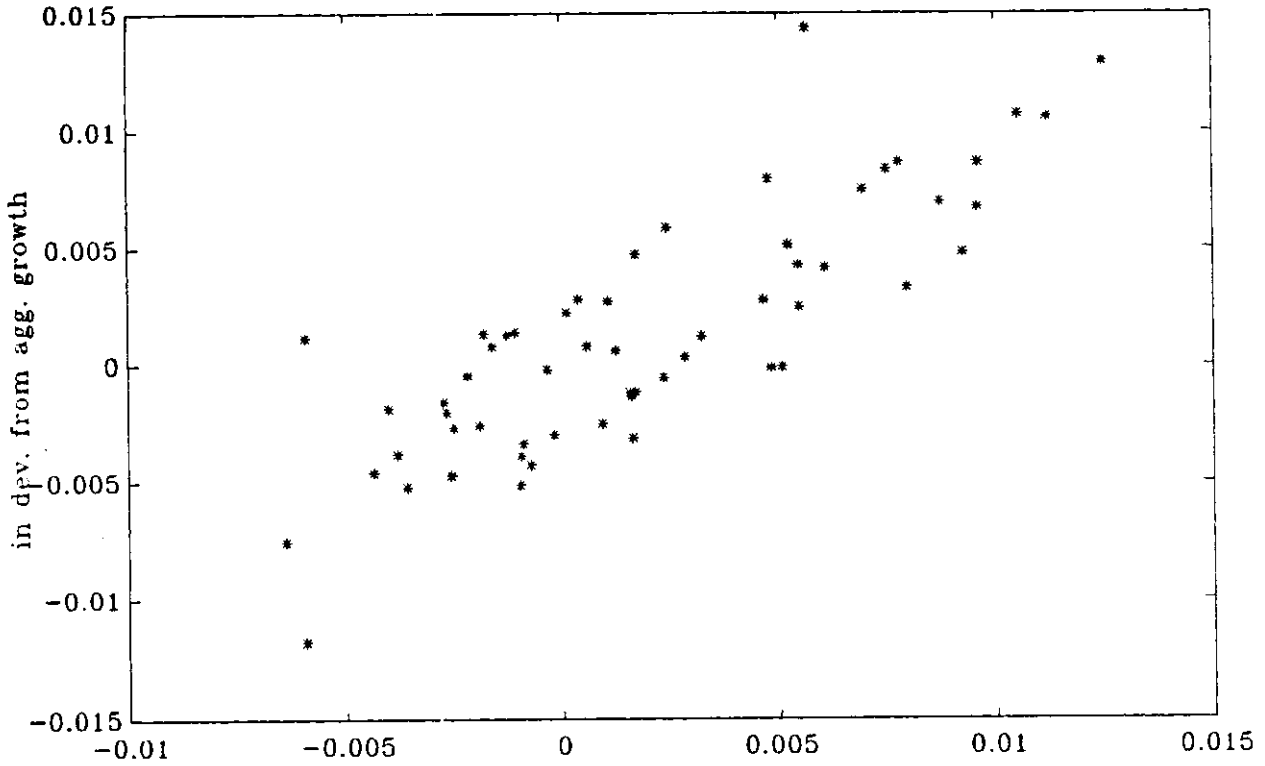


Plot 6:



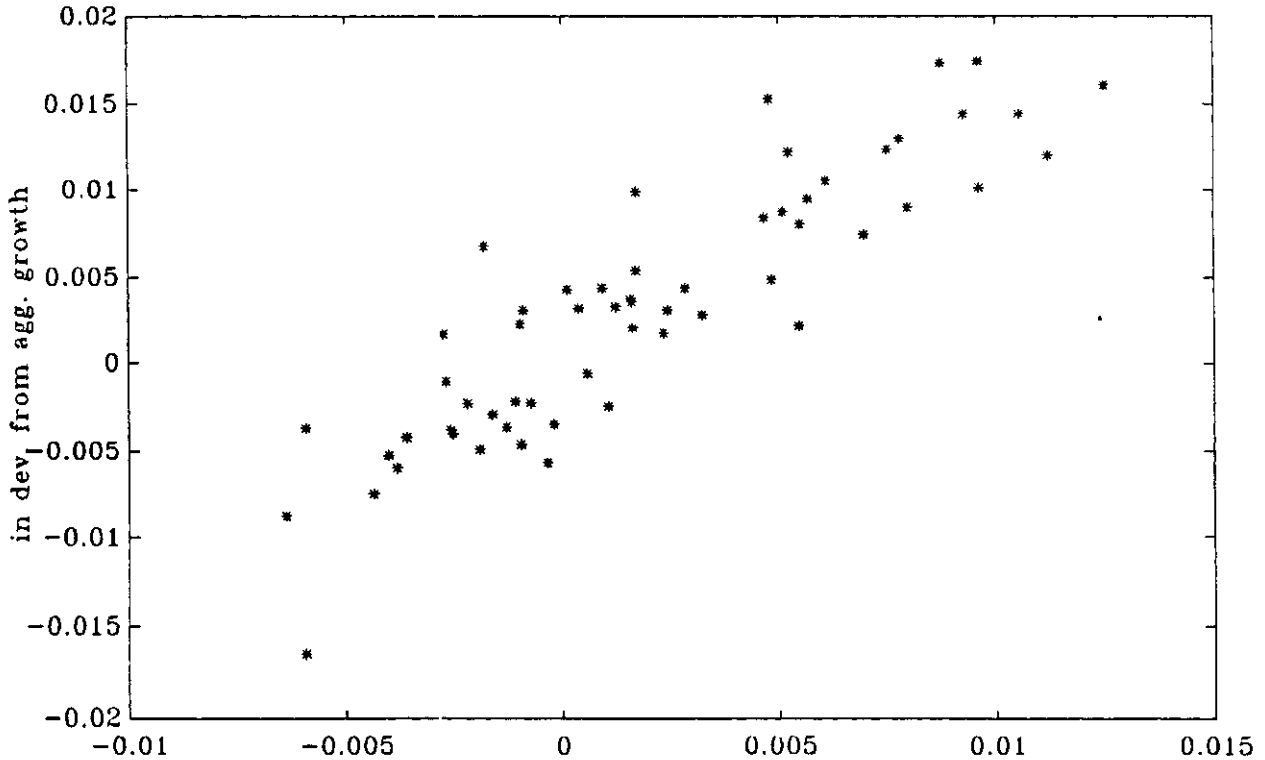
Plot 7:

Total Retail
~~Food Store~~ Sales growth vs. personal income growth



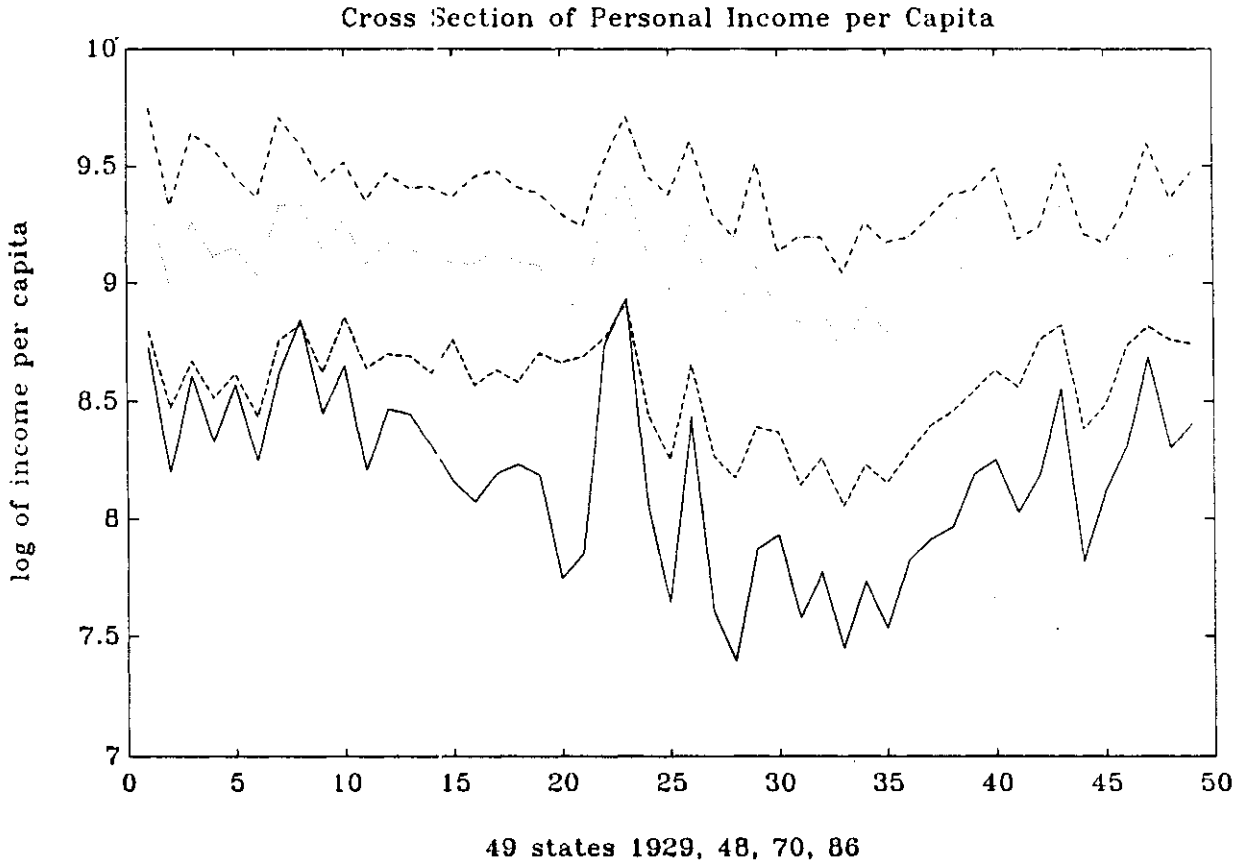
1929-1986 overall growth 58 states and regions

Food Store Sales growth vs. personal income growth



1929-1986 overall growth 58 states and regions

Plot 8:

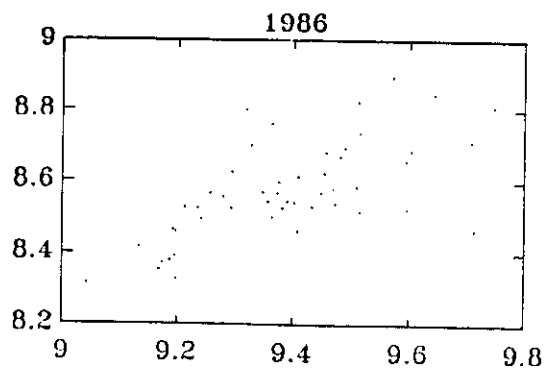
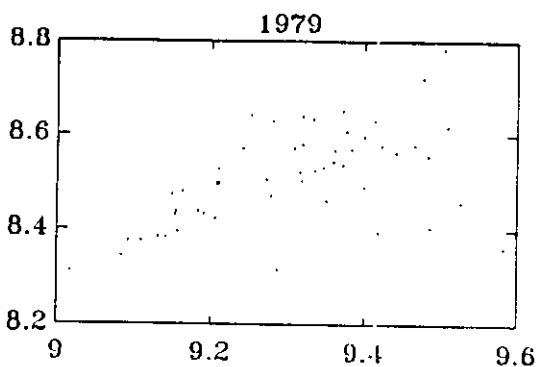
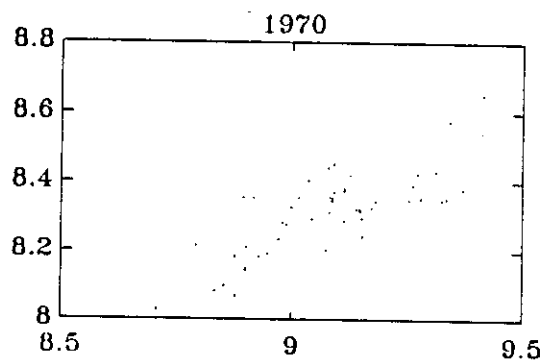
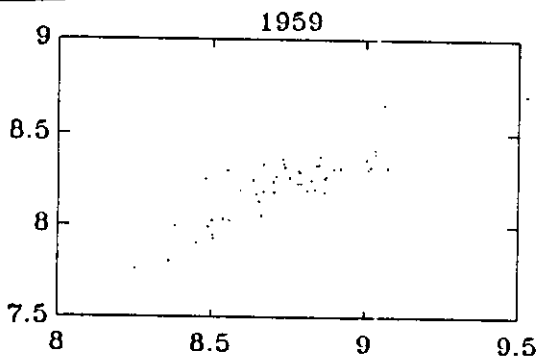
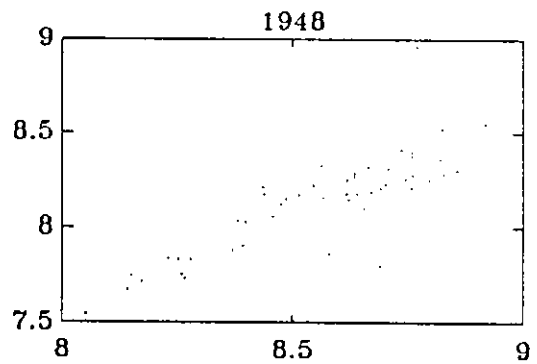
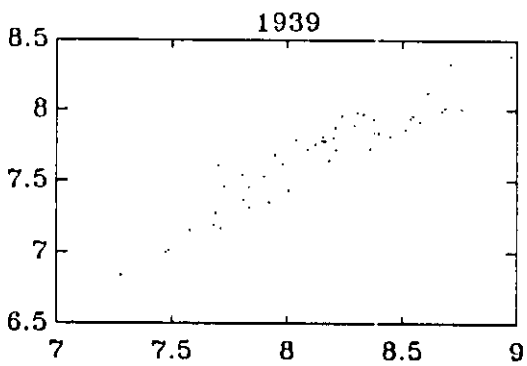
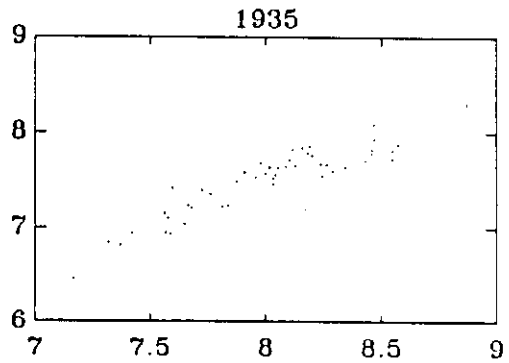
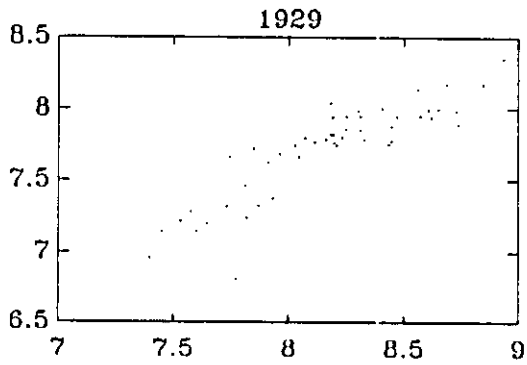


State Key:

- 1) CN, 2) ME, 3) MA, 4) NH, 5) RI, 6) VT, 7) NJ, 8) NY, 9) PA, 10) IL
11) IN, 12) MI, 13) OH, 14) WI, 15) IA, 16) KA, 17) MN, 18) MO, 19) NE, 20) ND
21) SD, 22) DE, 23) DC, 24) FL, 25) GA, 26) MD, 27) NC, 28) SC, 29) VA, 30) WV
31) AL, 32) KY, 33) MS, 34) TE, 35) AK, 36) LA, 37) OK, 38) TX, 39) AZ, 40) CO
41) ID, 42) MT, 43) NV, 44) NM, 45) UT, 46) WY, 47) CA, 48) OR, 49) WA

Plot 9:

Various Years' Cross Section of
Log Income vs. Log Total Retail Sales



Plot 10:
Various Years' Cross Section of
Log Income vs. Log Food Store Sales

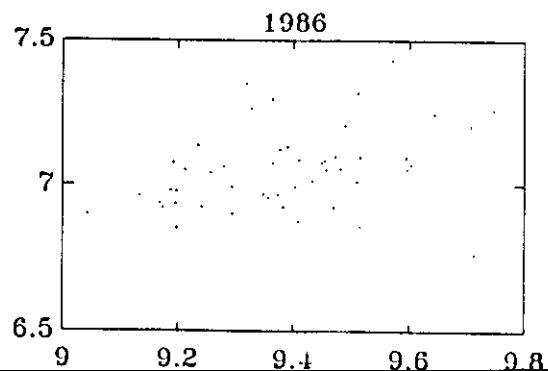
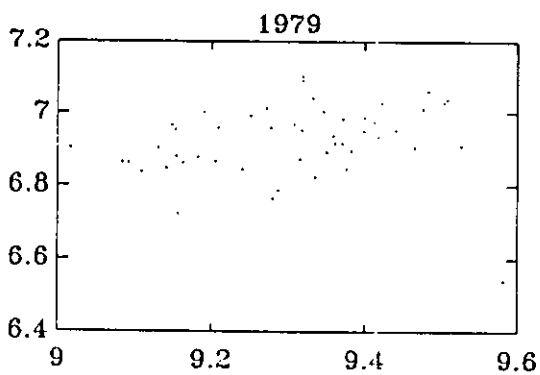
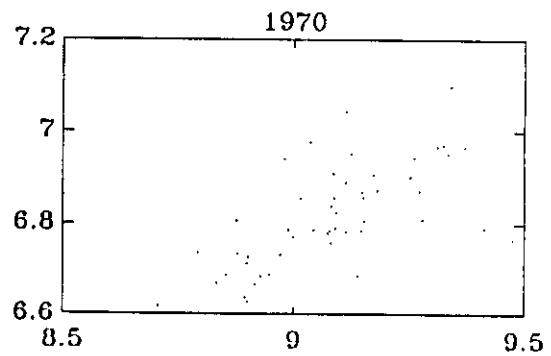
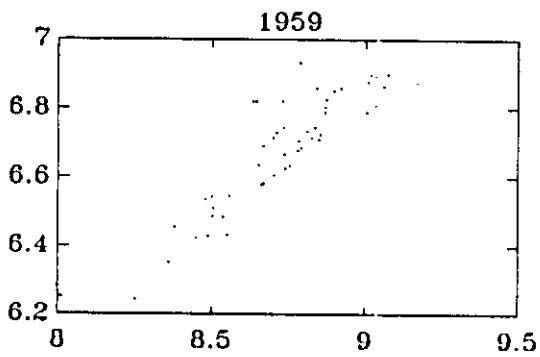
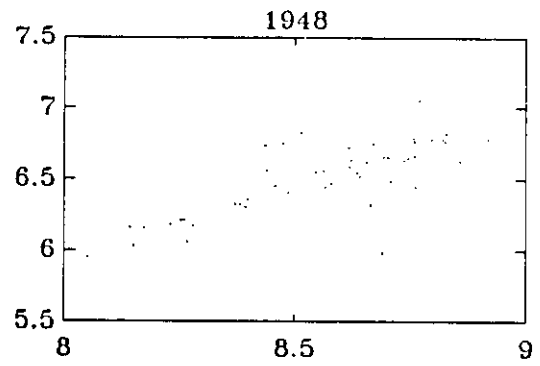
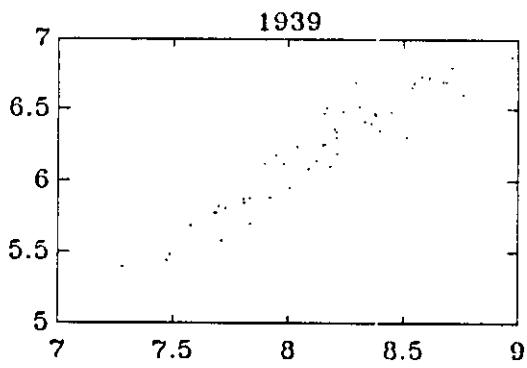
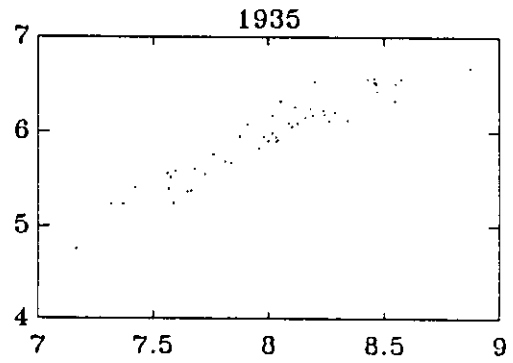
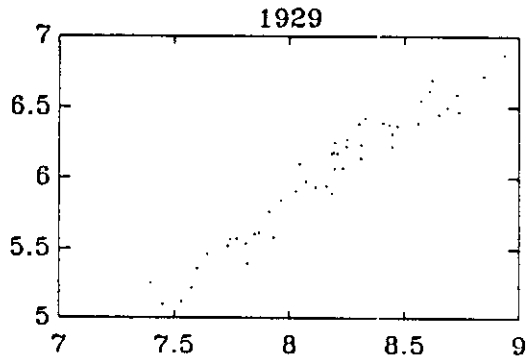


Table 1A:

**Results of Regressions of Total Retail Sales Growth
On Aggregate Total Sales Growth and Personal Income Growth
Short Term Growth Rates
standard errors are in parentheses**

Years	Δ Agg. Sales	Δ Income	Adj. R^2 & N
All years	.0117 (.0135)	.8099 (.0253)	.6177 & 637
1929-33	.4465 (.1063)	.6385 (.1172)	.3739 & 49
1933-35	.8671 (.1000)	.2652 (.0651)	.2450 & 49
1935-39	.5866 (.1399)	.6113 (.1846)	.1720 & 49
1948-52	1.4124 (.3339)	-.4026 (.1863)	.0710 & 49
1952-55	.2613 (.2667)	.6549 (.1538)	.2630 & 49
1955-59	3.5525 (.7448)	.5738 (.1169)	.3247 & 49
1959-64	-2.1730 (.7093)	.7604 (.1683)	.2879 & 49
1964-70	-2.2685 (.4888)	.8801 (.1238)	.5080 & 49
1970-74	1.3081 (.1911)	-.3792 (.2201)	.0394 & 49
1974-79	.1671 (.7434)	.3880 (.3282)	.0082 & 49
1979-84	-11.8388 (4.3242)	1.1581 (.1633)	.5068 & 49
1984-86	.2235 (.1685)	.9030 (.1658)	.3738 & 49

Table 1B:

Results of Regressions of Total Retail Sales Growth
 On Aggregate Total Sales Growth and Personal Income Growth
 Long Term Growth Rates
 standard errors are in parentheses

Years	Δ Agg. Sales	Δ Income	Adj. R^2 & N
1929-39	.0035 (.2928)	.9564 (.1992)	.3148 & 49
1939-48	.6389 (.1153)	.4564 (.0970)	.3058 & 49
1948-59	.8037 (.4456)	.0542 (.1990)	-.0197 & 49
1959-70	-2.7875 (.4197)	.9818 (.1051)	.6424 & 49
1970-79	.0015 (.2350)	.8838 (.1991)	.2803 & 49
1979-86	-.4895 (.3008)	1.1016 (.1455)	.5397 & 49
1929-48	.8394 (.1580)	.3396 (.1198)	.1280 & 49
1948-70	-.9844 (.6164)	.6786 (.2071)	.1687 & 49
1970-86	-.1340 (.3276)	.9628 (.2661)	.2012 & 49
1929-86	-.3154 (.1502)	.9022 (.0933)	.6585 & 49

Table 2A:

Results of Regressions of Food Store Sales Growth

On Aggregate Food Store Sales Growth and Personal Income Growth

Short Term Growth Rates

standard errors are in parentheses

Years	Δ Agg. Food Sales	Δ Income	Adj. R^2 & N
All years	-1.1813 (.1199)	.1704 (.0255)	.0640 & 637
1929-33	-2.4459 (.7126)	.4680 (.0894)	.3547 & 49
1933-35	1.1262 (.2713)	.2845 (.0737)	.2247 & 49
1935-39	1.6091 (.1649)	.1877 (.2608)	-.0101 & 49
1948-52	1.2025 (.1716)	-.2906 (.1407)	.0637 & 49
1952-55	.4100 (.7142)	.3131 (.2042)	.0274 & 49
1955-59	1.0693 (.2565)	.2464 (.1929)	.0130 & 49
1959-64	-0.7452 (.6409)	.7660 (.2489)	.1500 & 49
1964-70	-1.5592 (.5962)	.7931 (.1702)	.3015 & 49
1970-74	-6.7064 (13.4554)	-.0992 (.2063)	-.0163 & 49
1974-79	.7383 (.3997)	.2402 (.3367)	-.0103 & 49
1979-84	1.8020 (.4033)	.1567 (.2139)	-.0098 & 49
1984-86	.5174 (.2860)	.6338 (.2643)	.0900 & 49

Table 2B:**Results of Regressions of Food Store Sales Growth****On Aggregate Food Store Sales Growth and Personal Income Growth****Long Term Growth Rates**

standard errors are in parentheses

Years	Δ Agg. Food Sales	Δ Income	Adj. R^2 & N
1929-39	1.9038 (.1629)	.6163 (.2050)	.1434 & 49
1939-48	.3535 (.1602)	.4868 (.0827)	.4120 & 49
1948-59	1.1086 (.2096)	-.0446 (.1740)	-.0199 & 49
1959-70	-1.7777 (.4568)	.9610 (.1471)	.4649 & 49
1970-79	-.8286 (.4462)	.8247 (.1902)	.2705 & 49
1979-86	1.1087 (.2606)	.3788 (.1976)	.0528 & 49
1929-48	.4667 (.1310)	.8128 (.1042)	.5551 & 49
1948-70	.1145 (.3950)	.5368 (.2099)	.1035 & 49
1970-86	.4291 (.4165)	.4879 (.2494)	.0556 & 49
1929-86	-.8116 (.1662)	1.3919 (.1103)	.7673 & 49