Sources of Moderation in the Volatility of GDP

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Measuring the Nation's Economy.

BEA
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Introduction

- Marked smoothing of real GDP growth—the Great Moderation—in mid-1980s
- BEA data—split up by industry or by state—allow a closer look
- Conventional stories…
  - Sector-specific real growth rates became less volatile
  - Activity shifted from bumpy to smooth sectors
  - Source data and estimation methods improved
- …are inadequate:
  - Variances *increased* after 1984 in nearly half the industries and over a quarter of states
  - Net declines in *covariances* among industries matter far more: some six-sevenths of the overall decline. (Same story for covs among states.)
  - Variance of real GDI growth smoothed out, too, in step with variance of real GDP growth

Illustration and Motivation

- For example, the variance of annual growth rates of real value-added by Motor Vehicle mfg fell by 346 percentage points after 1984. We take two perspectives:

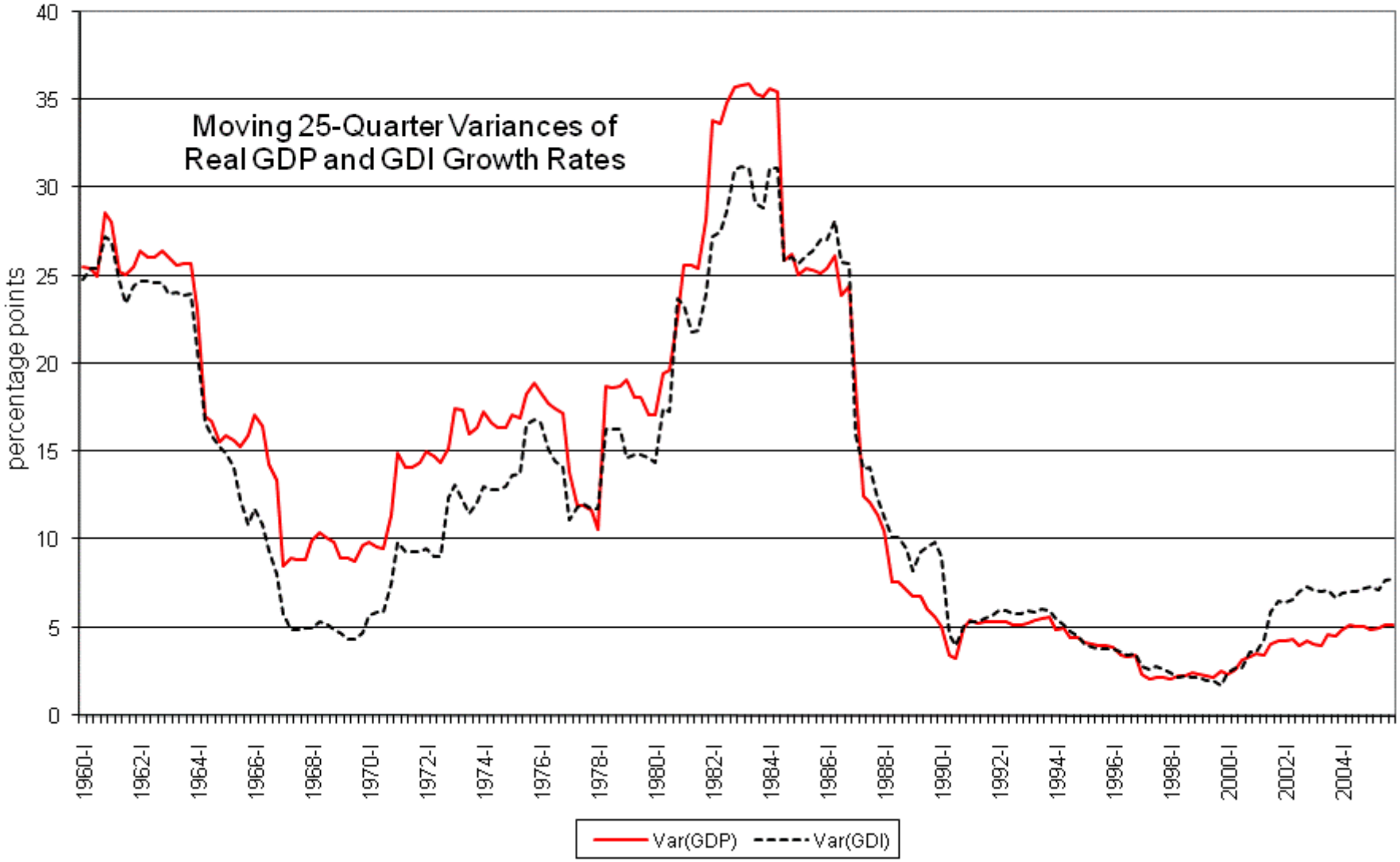
- Nationally, the decline in M.V. variance, correctly weighted, contributed directly to the decline in the GDP variance
- M.V. growth also co-varies with other industries (e.g., suppliers, production outsourcing)—which may augment or offset the direct effect in the GDP change-in-variance calculation

- From the industry perspective, the decline in M.V. variance encompasses the direct effects of M.V. output growth in each state, as well as the covariances of M.V. output growth among different states (e.g., coordination among dispersed plants)

Data Used

- Annual growth rates of real GDP, disaggregated across national-level industries, and disaggregated across states.
- Annual growth rates of real value added for each industry, disaggregated across states.
- Constant-dollar—fixed-weight computation.
- National-level real annual estimates:
  - …by SIC for 1977-97 (63 industries)
  - …by NAICS for 1997-2006 (64 industries)
- Hard to link SIC and NAICS industries before 1997

Income and Expenditure Data Tell the Same Story



Decomposition of National-Level Variance of Real GDP Growth

- among industries…

$$Var(Y_{78-84}) = \sum_{i=1}^{63} w_i^2 \, Var(X^i_{78-84}) + 2\sum_{i=1}^{62}\sum_{j=i+1}^{63} w_i w_j \, Cov(X^i_{78-84}, X^j_{78-84})$$

- or among states…

$$Var(Y_{78-84}) = \sum_{r=1}^{51} w_r^2 \, Var(X^r_{78-84}) + 2\sum_{r=1}^{50}\sum_{s=r+1}^{51} w_r w_s \, Cov(X^r_{78-84}, X^s_{78-84})$$

- Y = annual growth rate of constant-$ GDP
- X^i,X^j = annual growth rates of Real Value-Added by industry i or j
- X^r,X^s = annual growth rates of Real GSP in state r or s
- w_i=fixed weight for industry i …= $RVA^i/(\sum_j RVA^j)$ averaged over 1977-97
- w_r=fixed weight for state r …= $RGSP^r/(\sum_s RGSP^s)$ averaged over 1977-97
- Vars computed over 1978-84 and over 1985-97; Covs are mass residual
- ΔVariance = difference between 85-97 and 78-84 computations

Decomposition of National-Level Variance of Industry i's RVA Growth

- among states…

$$Var(X^{i}_{78-84}) = \sum_{r=1}^{51} w^{2}_{i,r}\, Var(X^{i,r}_{78-84}) + 2\sum_{r=1}^{50}\sum_{s=r+1}^{51} w_{i,r} w_{i,s}\, Cov(X^{i,r}_{78-84}, X^{i,s}_{78-84})$$

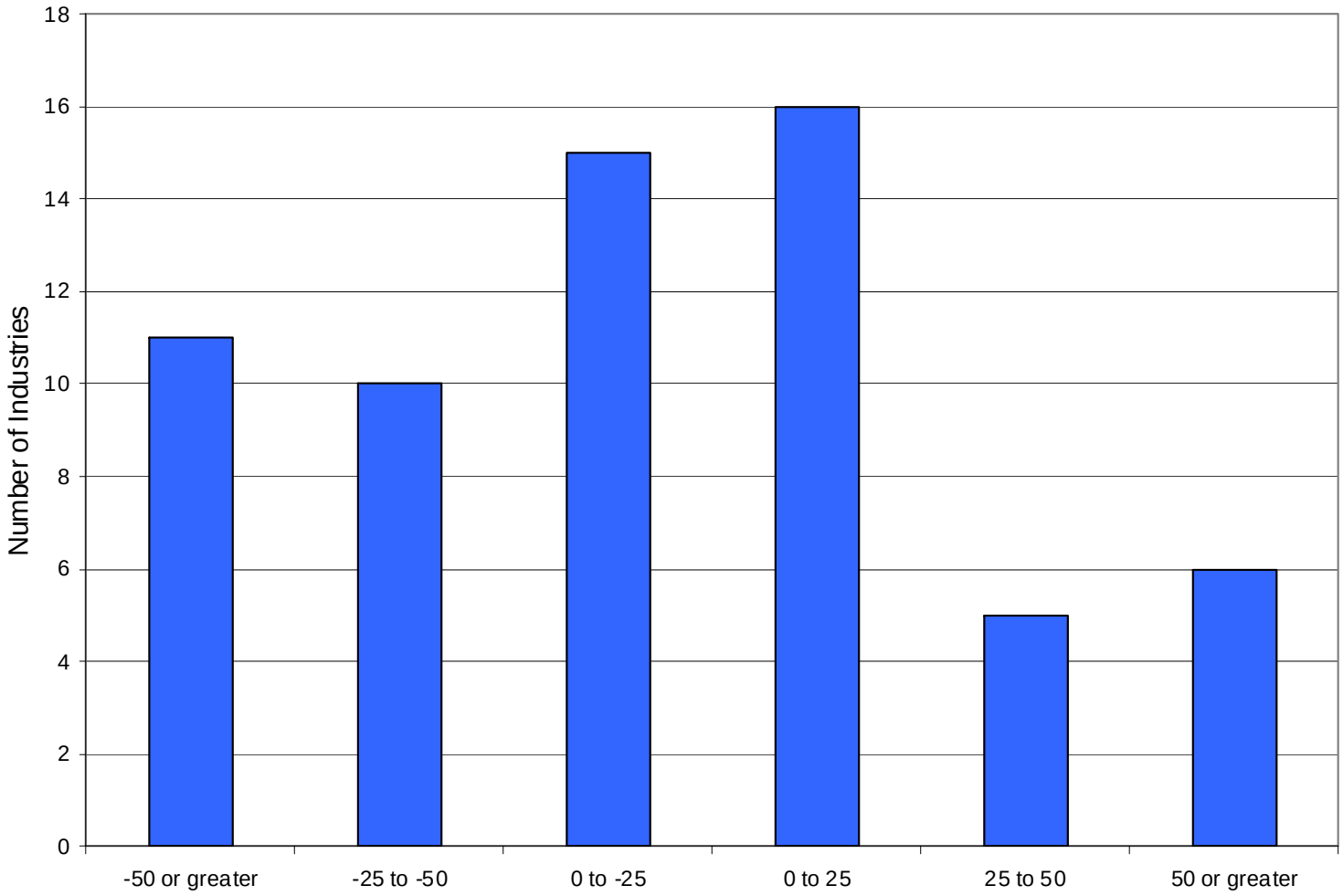
- X^{i} = annual growth rates of Real Value-Added by industry i
- $X^{i,r}$, $X^{i,s}$ = annual growth rates of RVA by industry i *in state r or s*
- $w_{i,r}$=fixed weight for industry i *in state r*

  … = $RVA^{i,r}/(\sum_{s} RVA^{i,s})$ averaged over 1977-97
- Compatibility of weights:

  $\sum_{s} RVA^{i,s} = RVA^{i}$, so $w_{i,r} \times w_{i}$ = RVA by industry i in state r as a share of Real GDP
- Vars computed over 1978-84 and over 1985-97; Covs are mass residual
- ΔVariance = difference between 85-97 and 78-84 computations

- Critical to keep straight Vars and Covs from different levels.

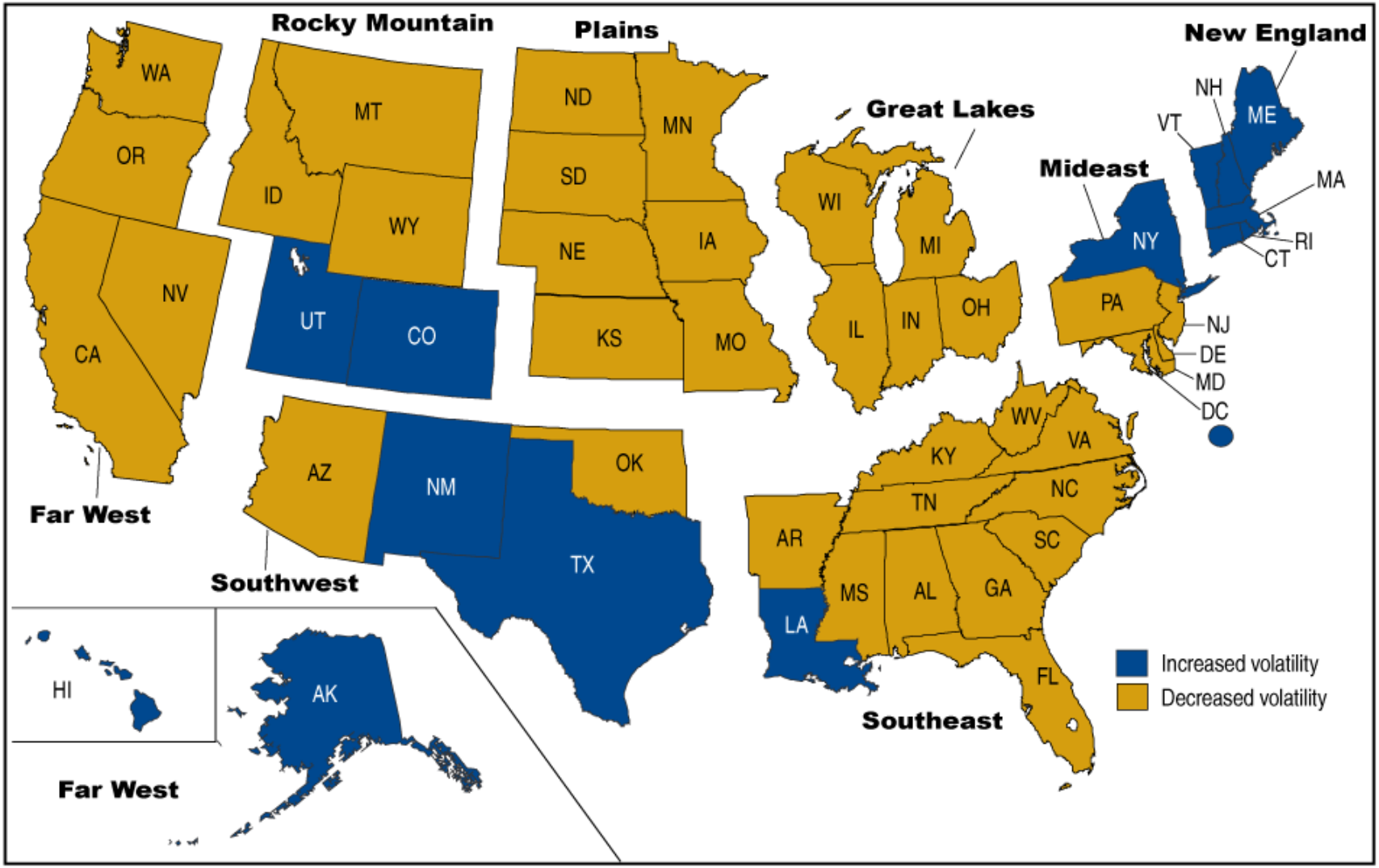
Distribution of Percentage Changes in Industries' Own-Variances (National Level, 1978-84 to 1985-97)



Effects of Industry Groups' Variances on Aggregate Variance (No Covariances, National Perspective)

	Share 1978-84	Δ Share to 1985-97	Variance 1978-84	Δ Variance to 1985-97	Effect of Δ in Shares & Variances
Agriculture, forestry and fishing	0.0107	0.0021	364.09	-274.49	-0.03
Mining	0.0225	-0.0023	67.97	-45.30	-0.03
Construction	0.0552	-0.0056	84.91	-68.50	-0.22
Durable goods manufacturing	0.0688	0.0038	57.96	-36.21	-0.16
Nondurable goods smanufacturing	0.0869	-0.0051	17.93	-9.42	-0.08
Transportation	0.0273	0.0019	24.19	-18.18	-0.01
Communications	0.0189	0.0022	21.05	-13.20	0.00
Electric, gas, and sanitary services	0.0255	-0.0006	14.73	1.97	0.00
Wholesale trade	0.0465	0.0085	14.41	2.75	0.02
Retail trade	0.0725	0.0050	19.69	-8.05	-0.03
Finance, insurance, and real estate	0.1977	-0.0024	2.68	-1.03	-0.04
Services	0.2002	0.0163	4.90	-1.92	-0.06
Government	0.1671	-0.0236	0.68	0.07	0.00
Addenda:				Column sum:	-0.64
Non-goods	0.4697	0.0174	3.31	-1.88	-0.39
Non-goods plus W+R trade	0.5887	0.0309	3.87	-2.46	-0.80
Motor vehicles	0.0139	-0.0020	471.40	-346.16	-0.07
Aggregate GDP			7.75	-5.40	

States with Increased GDP-by-State Variances; 1985 - 97 versus 1978 - 84



U.S. Bureau of Economic Analysis

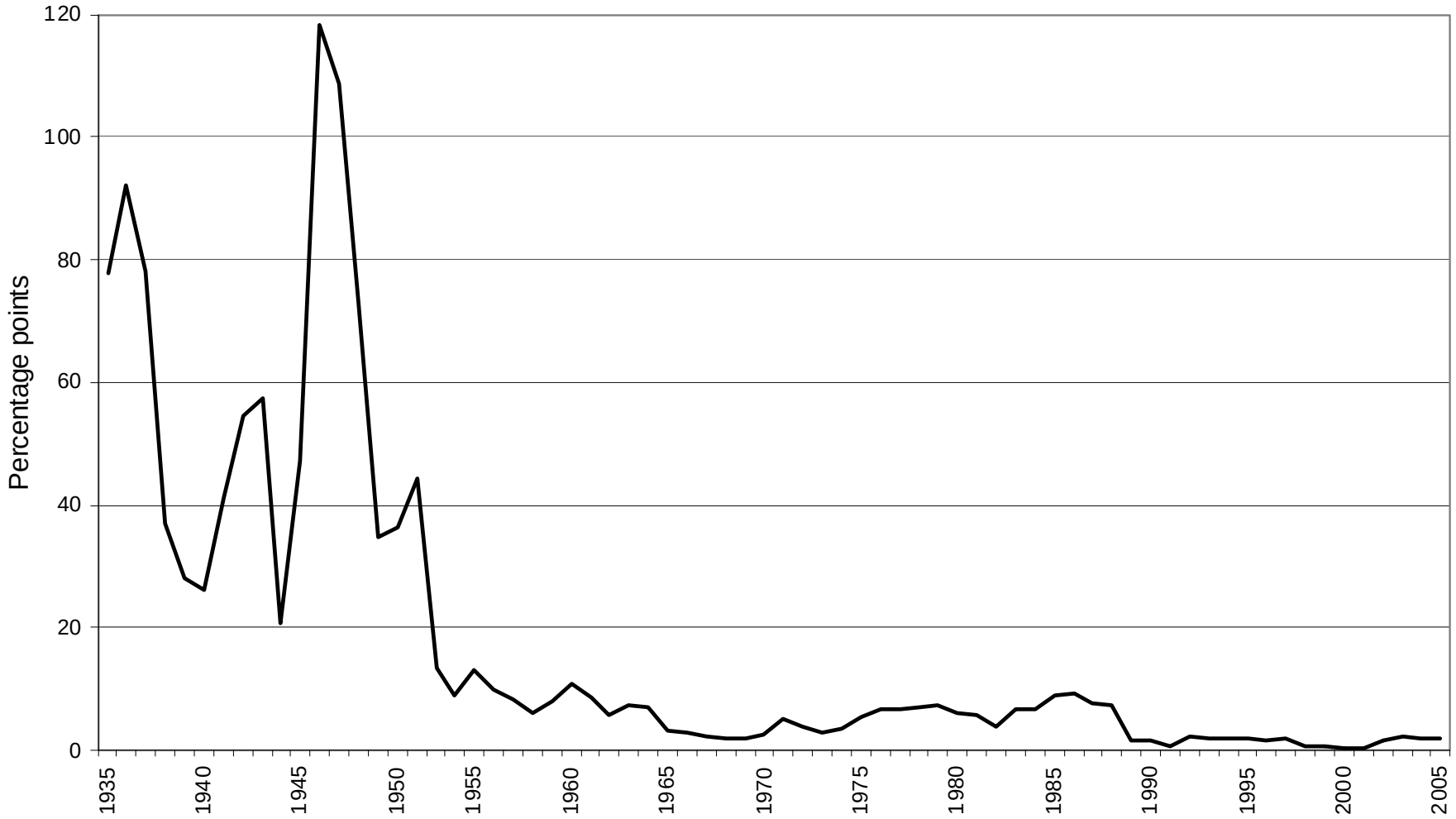
1978-84 to 1985-97 Changes in Selected Industries' National-Level Variances: Decomposed by States

(SIC) Industry	1978-84 Nationwide Variance	Change in Nationwide Variance to 1985-97	Change in Square-weighted Sum of State-Level Own Variances	Change in State-Level Covariance effects
Farms	543	-377	-15	-361
Nonmetalic minerals, except fuels	232	-191	-8	-183
Construction	85	-69	-69	1
Industrial machinery and equipment	69	4	2	2
Electronic and other electric equipment	57	19	10	9
Motor vehicles and equipment	471	-346	-459	113
Instruments and related products	21	197	55	143
Apparel and other textile products	34	-28	-1	-27
Chemicals and allied products	40	-16	4	-20
Petroleum and coal products	1558	-1148	-76	-1072
Communications	21	41	2	40
Wholesale trade	14	-4	0	-4
Retail trade	20	-8	0	-8
Depository institutions	4	31	8	23
Nondepository institutions	15	454	-1414	1868
Business services	17	18	1	17
Health services	3	2	0	2
Federal civilian (government)	5	-1	0	-1

Summary Decomposition of Changes in Variance of Real GDP Growth, by Industries and by States (Percentage Points)

	National Variance Δ	Change in Square-weighted Sum of Own Vars.	Change in All Covariances (residual)
GDP Growth, broken down by…	-5.4		
Industry groups …(*n* = 13)	-5.4	-0.7	-4.7
BEA Regions …(*n* = 8)	-5.4	-0.8	-4.5
Industries …(*n* = 63)	-5.4	-0.1	-5.2
States …(*n* = 51)	-5.4	-0.1	-5.2

Moving 6-Year Variance of Real GDP Growth Rates…*Way Back*



Summary

- Reduction in aggregate variance cannot be explained by different source data or estimating methods for GDP versus GDI
- Squared weights on own-variance terms greatly lessen industries' (or states') direct contributions to the decline in overall variance
- Relatedly, shifts toward less volatile industries not a big factor
- Covariance effects dominate decompositions of national-level variance changes across industries or states; and are generally important in decompositions of industry-level variance changes across states
- "Broad Brush" mechanisms—e.g., more fluid labor markets, better inventory control, lower price volatility—not ruled out.