FTA Revenue Estimating Conference

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Tampa, Florida

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How Much Is Enough?

Prevailing Revenue Volatility & State Rainy Day Funds

2009 - 2011


TwinCities.com
PIONEER PRESS
It doesn't have to be this way, Minnesota
By Kevin Goodno and Jay Kiedrowski
POSTED: 01/25/2009 12:01:00 AM CST
StarTribune
Editorial: How to manage a volatile state budget
Without change, deficits will persist, report says.
JANUARY 12, 2009
MINNPOST
Minnesota's rainy day fund is drained, and now we're in a budget storm
By Sharon Schmickle | 02/15/10
The New York Times
Minnesota Government Shuts in Budget Fight
By MONICA DAVEY JUNE 30, 2011
THE WALL STREET JOURNAL.
Fitch Cuts Minnesota From Triple-A
By KELLY NOLAN July 7, 2011
StarTribune
Minnesota's bond rating downgraded
By rachelsb | SEPTEMBER 23, 2011 — 7:58PM

2013 - 2015


MINNPOST

November forecast brings good news for Minnesota — but proceed with caution

By Christina Wessel | 12/06/13


StarTribune

No reason not to support a higher Minnesota budget reserve

The required level of cushion hasn't been updated since 2001, even as the general fund has grown by 59 percent.

By Richard Cohen | MARCH 10, 2014


StarTribune

A healthy budget reserve is state's shock absorber

"Give it back" sounds good — until revenues drop.

By Editorial Board Star Tribune | MARCH 28, 2014


StarTribune

Minnesota puts money in the bank, raising reserves to highest level ever

Blog post by Rachel E. Stassen-Berger | JULY 1, 2014


StarTribune

Keep building state's reserve fund

Economic news is good, but state revenues remain volatile.

By Editorial Board Star Tribune | JULY 16, 2014


MPRnews

S&P: Minnesota's fiscal picture brightening, top debt rating may return

MPR News Staff · Aug 5, 2015


StarTribune

Wyoming looks to Minnesota in setting its rainy-day fund

By Ricardo Lopez | SEPTEMBER 19, 2015

How Much Is Enough?

Prevailing Revenue Volatility & State Rainy Day Funds

- Most state governments (incl. Minnesota) use rainy day funds (RDFs) to cushion against fiscal stress caused by changing economic conditions and tax policy preferences.

- Yet public finance literature offers little guidance on the amount of RDF savings a state needs.

- Our method provides a comprehensive empirical method for estimating an appropriate size RDF based on prevailing cyclical volatility of a state's revenue system.

Key Motivations

We draw on the motivation that state RDFs are not a one-size-fits-all solution.

Instead:

- **Changing economic conditions and tax policy choices are unique among states.**
- **Growth, volatility, and diversity characteristics underlying state revenue streams are inherently different.**
- **Appropriate state RDF considerations require state-specific focus in a comprehensive and time-varying manner.**

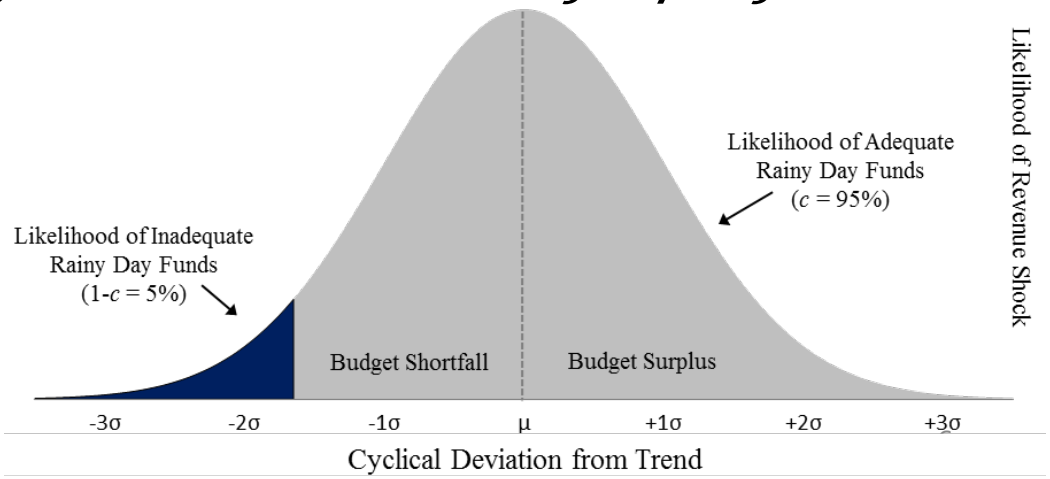
Conceptual Framework

We construct a normal probability density function of state general fund revenues.

- **Scale parameter σ is estimated using a time-varying portfolio formula. This integrates dynamic measures of composition, diversification, and volatility for detailed revenue components:**

$$\sigma_{P,t} = \sqrt{\sum_{i=1}^{N} \sum_{j=1}^{N} w_{i,t} \, w_{j,t} \, \rho_{ij,t} \, \sigma_{i,t} \, \sigma_{j,t}}$$

- **Systematic changes in portfolio σ are quantified in four steps.**



Outline

1. **Design**
   - **Empirical Considerations**
     - **Time Period**
     - **Measuring Techniques**
   - **Minnesota's Tax System**
     - **Description**
     - **Data Sources**
2. **Process & Results**
   - **Step 1: Detach Cyclical Deviation from Long-term Trend Growth Rate**
     Method: Hodrick-Prescott filter
   - **Step 2: Measure Time-Varying Cyclical Volatility.**
     Method: Integrated Generalized Autoregressive Conditional Heteroskedasticity (IGARCH) model
   - **Step 3: Measure Time-Varying Covariation between Components**
     Method: Integrated form of Dynamic Conditional Correlation (DCC) model
   - **Step 4: Quantify System-Wide Volatility Over Time**
     Method: Portfolio Standard Deviation Formula
3. **Compute Appropriate Size Rainy Day Fund**

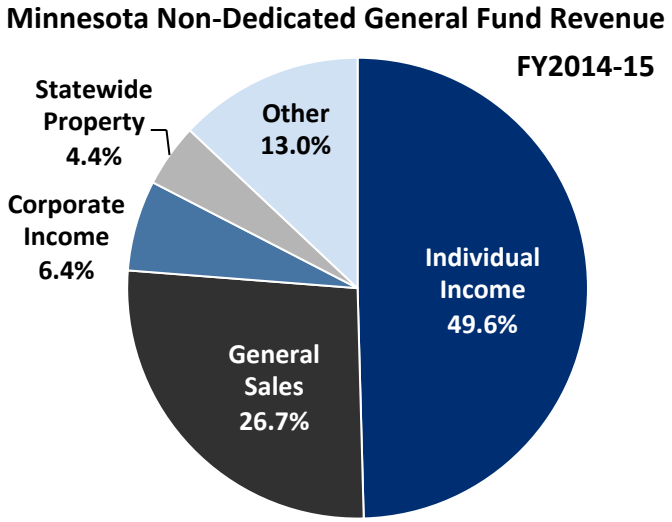
Design:
Empirical Considerations

- **Analyze 50-year period: 1963 to 2013**
- **Values are in nominal dollars**
  - **Most of the state's tax provisions are based on current dollar values of income, profits, and goods and services**
  - **Converted to growth rates using log-differences (stationary)**
- **Examine tax base (not revenues)**
  - **Difficult to obtain a series of state revenue data uninfluenced by changes to tax law over time**
  - **Key objective is to provide guidance on policy options available to mitigate major responses to most economic disturbances**
- **Use national data (not state)**
  - **Availability of detailed state-level economic data is limited**
  - **National data serve as an appropriate proxy for state activity**

Design:

Minnesota's Tax System (Description/Data Sources)

Major Sources of Revenue:



1. **Individual Income Tax**

   Analyze 6 different personal taxable income types (before deductions) from IRS's *Statistics of Income (SOI)*

   - Salaries and wages
   - Taxable interest
   - Ordinary dividends
   - Net capital gains
   - Business-related income
   - All other taxable income

2. **General Sales Tax**

   Analyze 5 purchase categories from the *National Income and Product Accounts (NIPAs)* of the Bureau of Economic Analysis (BEA)

   - Consumer spending on non-auto durable goods
   - Non-durable goods subject to tax
   - Investment and government consumption
   - Household operation services
   - Other services subject to tax

3. **Corporate Income Tax** - **Pre-tax domestic corporate profits from the BEA *NIPAs***

4. **Statewide Property Tax** - **Implicit price deflator for state and local government consumption expenditures and gross investment from the BEA *NIPAs***

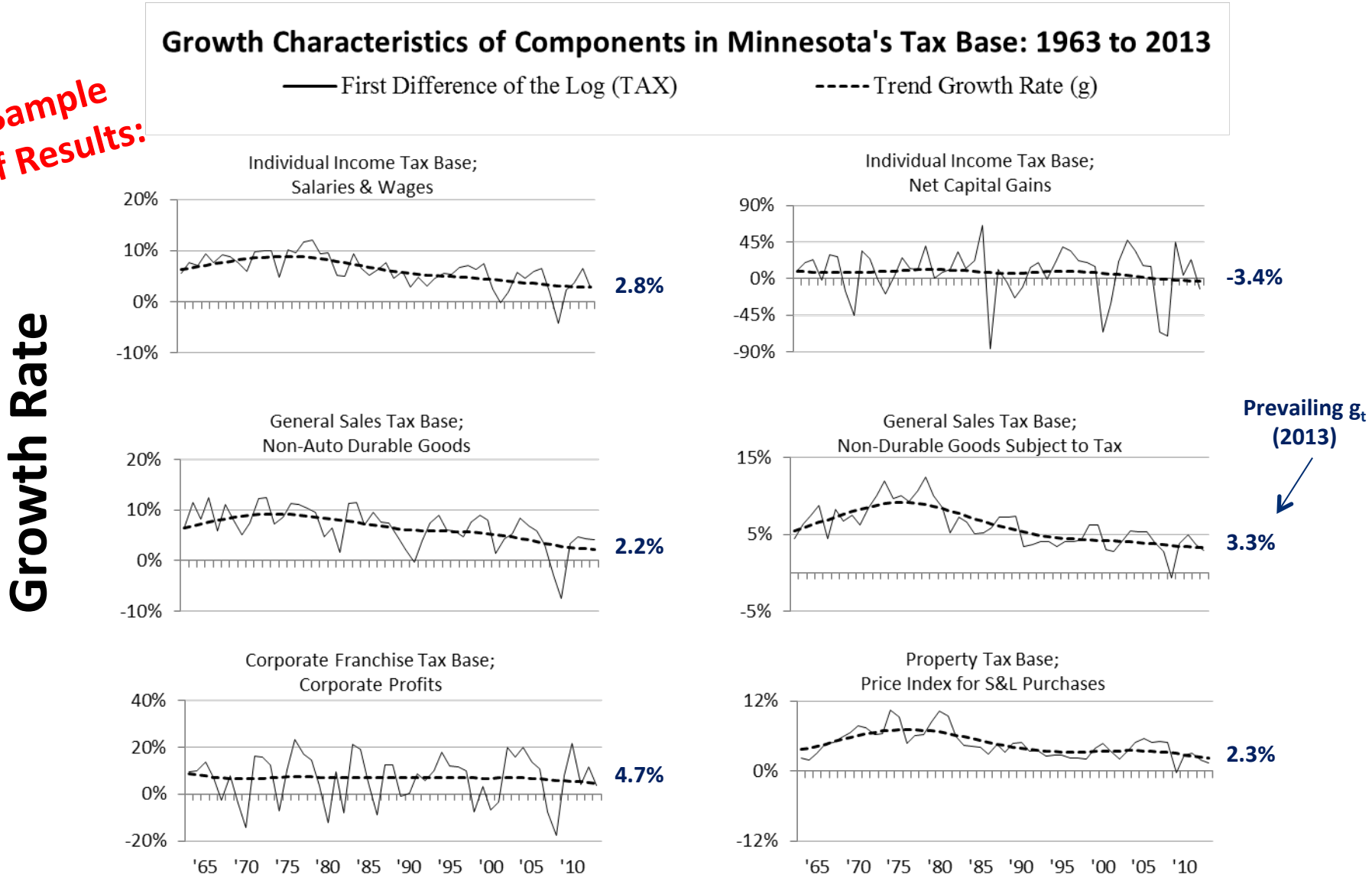
5. **Other Revenue & Tax Portfolio Shares – Derived from U.S. Census Bureau's State *Government Finance statistics* (adjusted for major changes in tax rates and bases).**

Empirical Strategy & Results

Step 1: Detach Cyclical Deviations from Long-Term Trend

Method: Hodrick-Prescott Filter

Sample of Results:

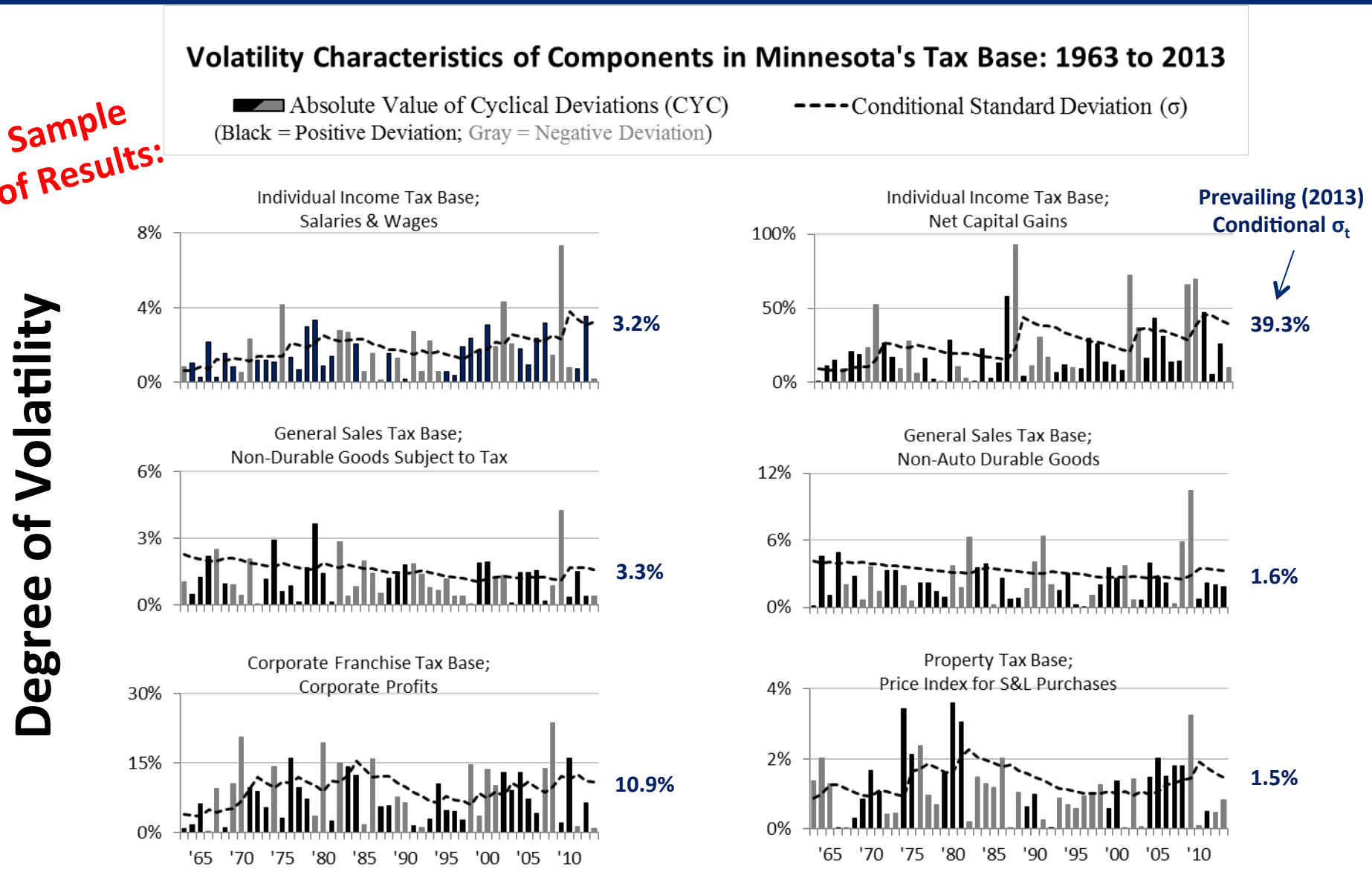


Empirical Strategy & Results

Step 2: Construct a Time-Varying Measure of Cyclical Volatility

Method: Integrated Generalized Autoregressive Conditional Heteroskedasticity (IGARCH) model

Sample of Results:

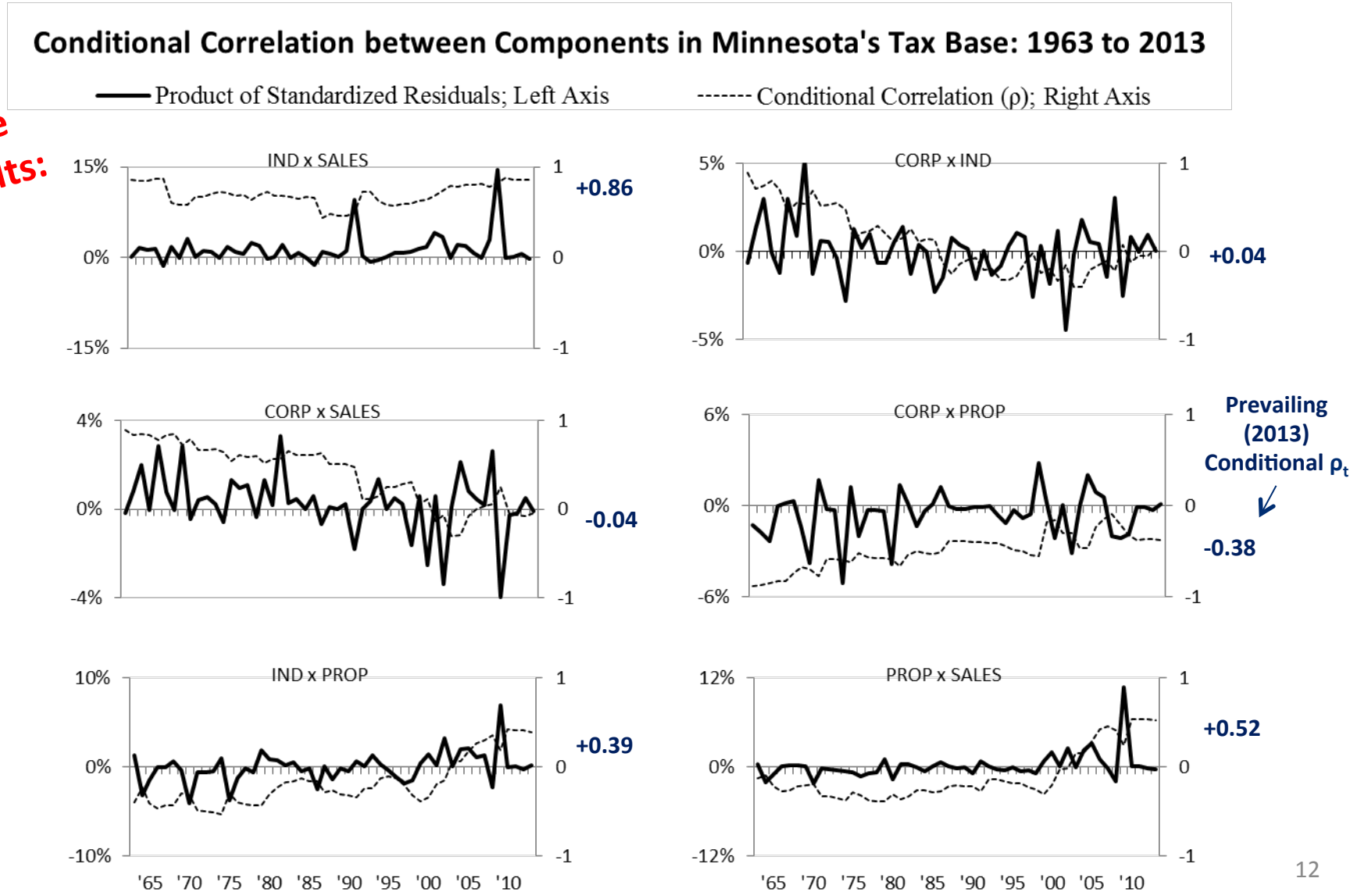


Empirical Strategy & Results

Step 3: Measure Time-Varying Covariation between Components

Method: Integrated form of Dynamic Conditional Correlation (INT-DCC) model

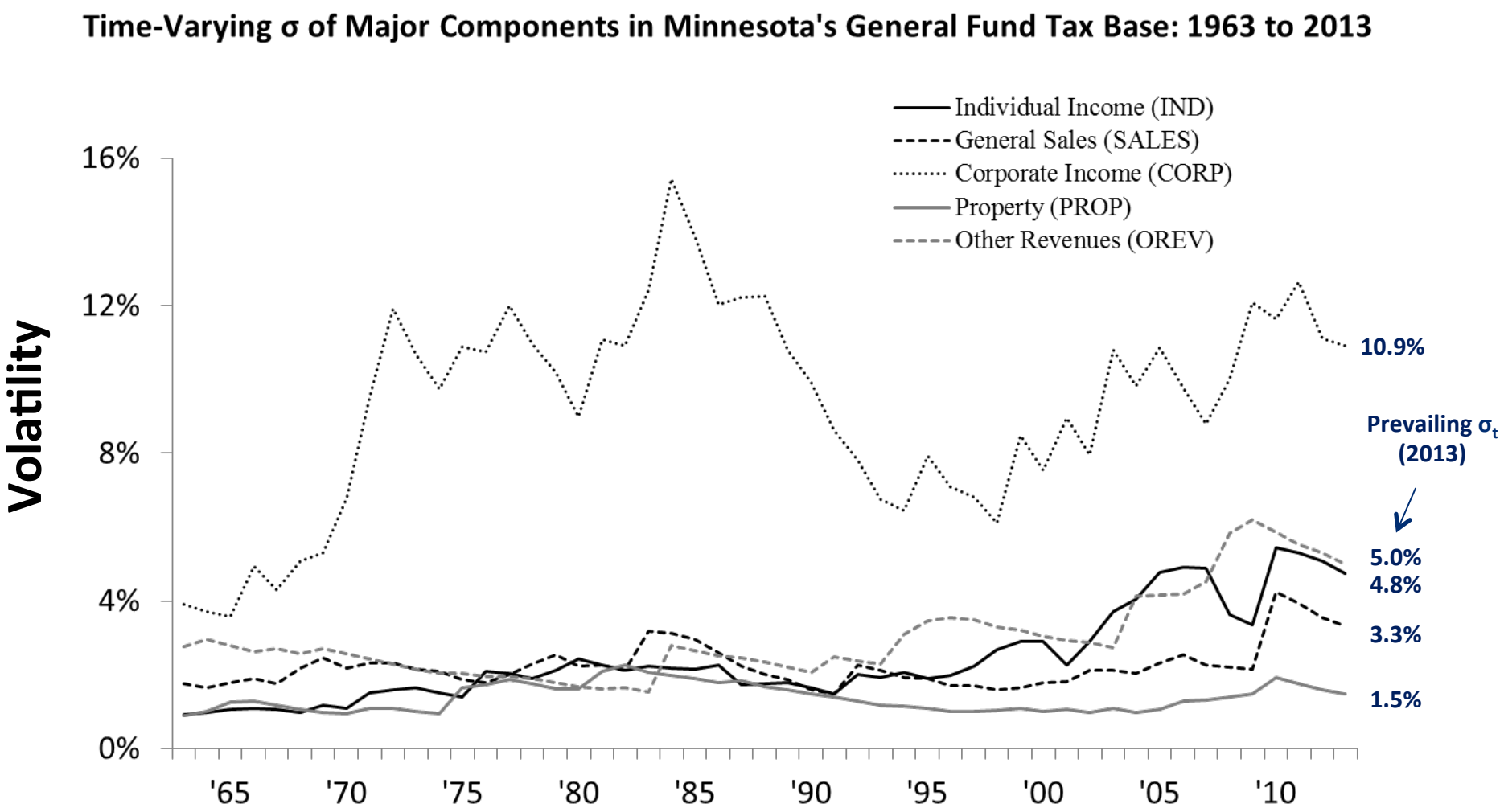
Sample of Results:



Empirical Strategy & Results

Step 4: Quantify System-Wide Volatility Over Time

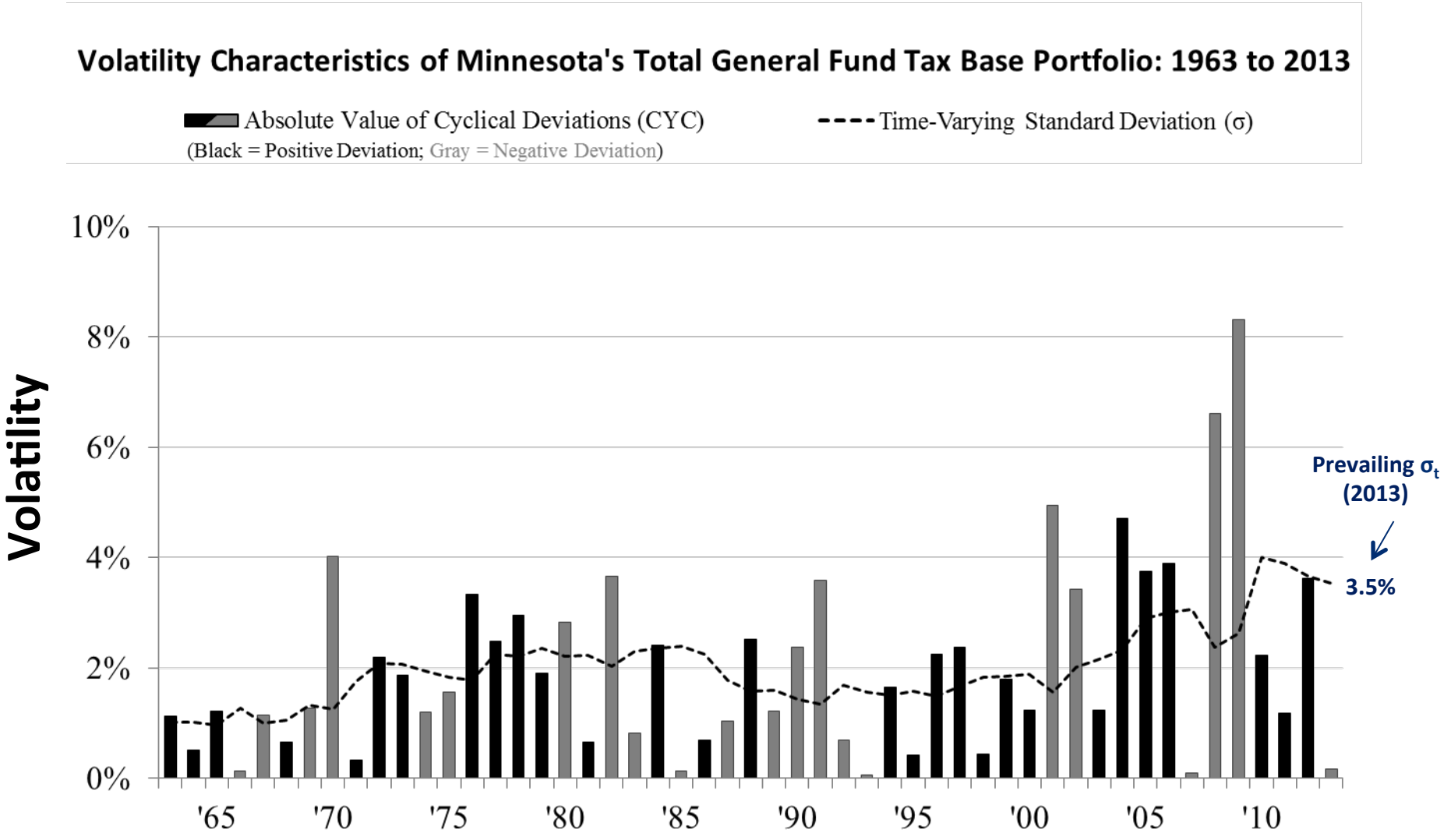
Method: Portfolio Standard Deviation Formula



Empirical Strategy & Results

Step 4: Quantify System-Wide Volatility Over Time

Method: Portfolio Standard Deviation Formula



* Calculated as the weighted sum of log differences less the weighted sum of trend growth rates.

Appropriate Size Rainy Day Fund?

Over time, an increasingly volatile tax base can have meaningful implications for long-term state budget planning.

To protect against the prevailing level of risk, an appropriate size RDF can be calculated:

1. **Convert estimated tax base volatility (σ = 3.5%) to revenue volatility (σ = 4.2%)**
   Reason: Progressivity in MN's individual income tax; elasticity w/ respect to tax base ≈ 1.27
2. **Choose confidence level: % of outcomes RDF protects against shock (e.g. 95%)**
3. **Multiply prevailing volatility measure by critical z-value (4.2%*1.645 = 6.9%)**
   Note: One-tailed critical z-value for 95% confidence level (normal distribution) = 1.645
4. **Scale for number of years: $\sigma\sqrt{years}$ (6.9% $\sqrt{2}$ = 9.8% of annual revenues)**
   two-year basis

   Note: MN budgets on a

Method demonstrates that a state RDF of *9.8% of annual revenues* will sufficiently protect against cyclical risk—w/ 95% confidence—during most recent two-year budget period

Summary

- Consider role of revenue volatility in context of state RDFs
- Estimate appropriate RDF size for Minnesota by constructing a normal pdf of unexpected shocks to state revenues:
  - Scale parameter estimated using a portfolio σ
  - Integrates measures of volatility, diversification, and composition
  - Examine detailed components of state's tax base
- Evaluate portfolio σ in the dynamic context of time (1963-2013):
  - Annual measures of portfolio σ are quantified in 4 steps, including IGARCH process
  - Consideration of state RDF size can then be based on prevailing conditions
- Results:
  - Minnesota's tax base has grown more volatile since the late 1990s.
  - Attributable to increasingly unstable components, such as wages, forms of individual investment income, and corporate income. The changing composition and less short-run diversification are also contributing factors.
  - State rainy day reserve of 9.8% of annual revenues would adequately protect against cyclical economic risk.

Thank You

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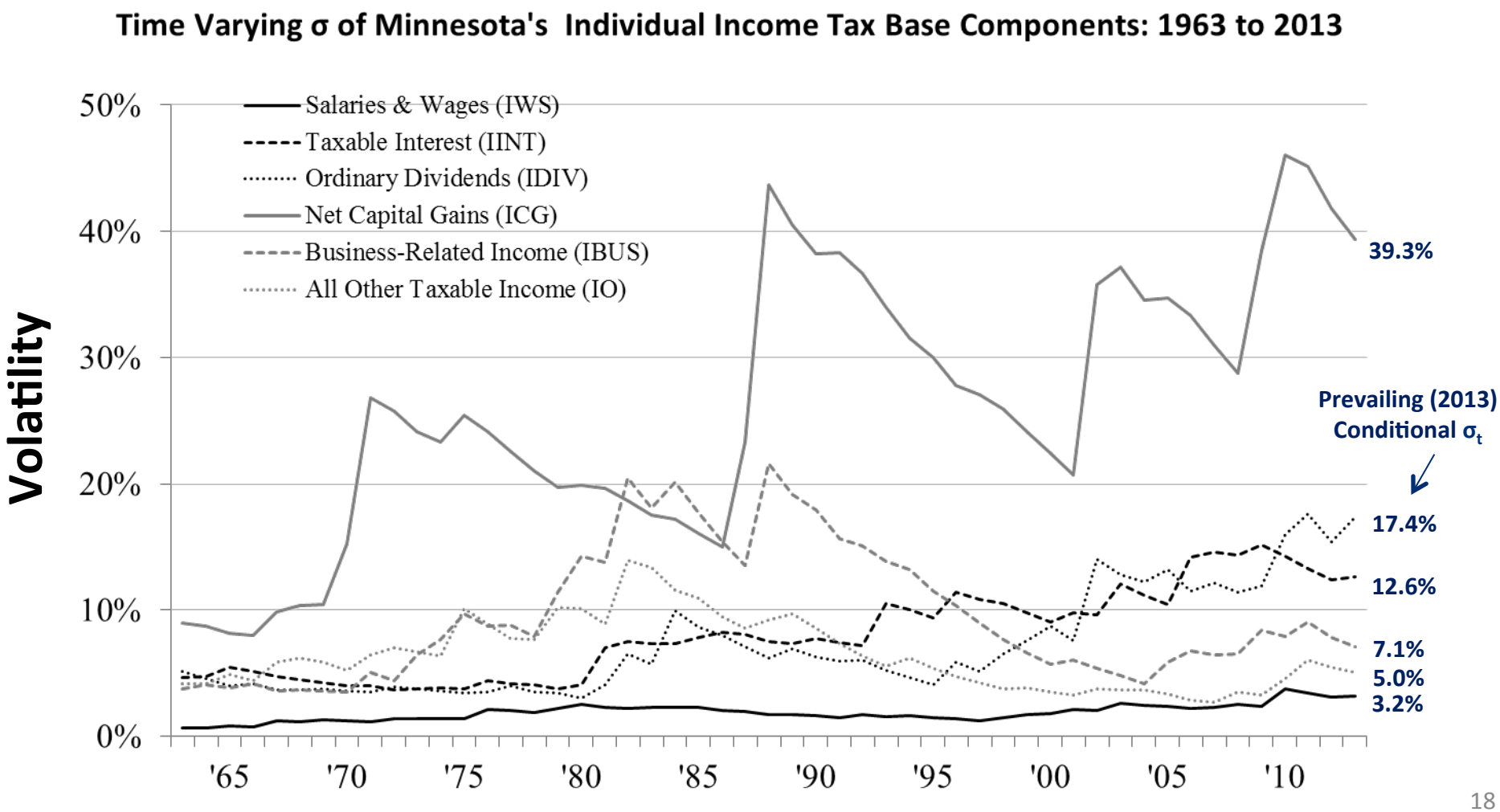
Supplemental Charts/Data



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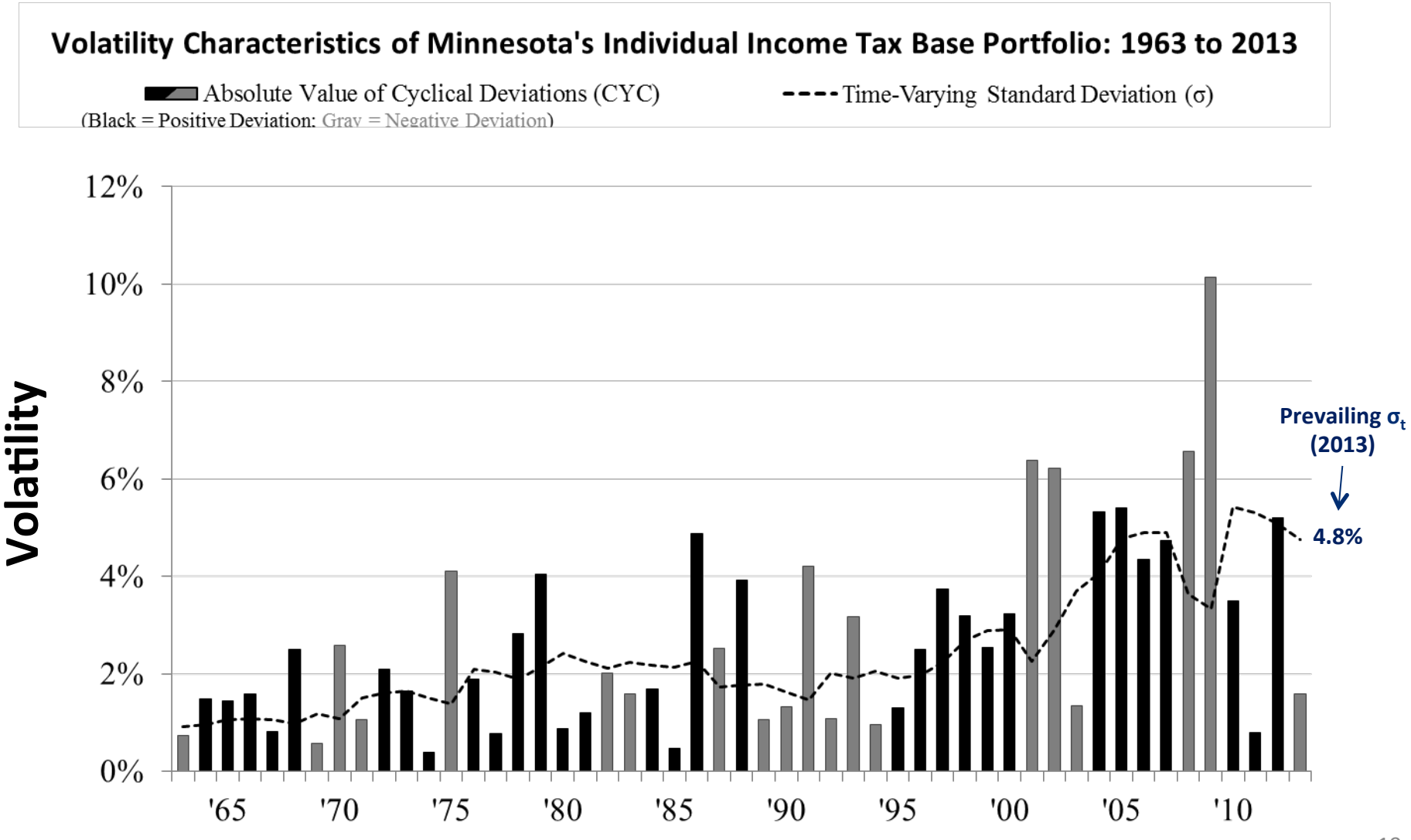

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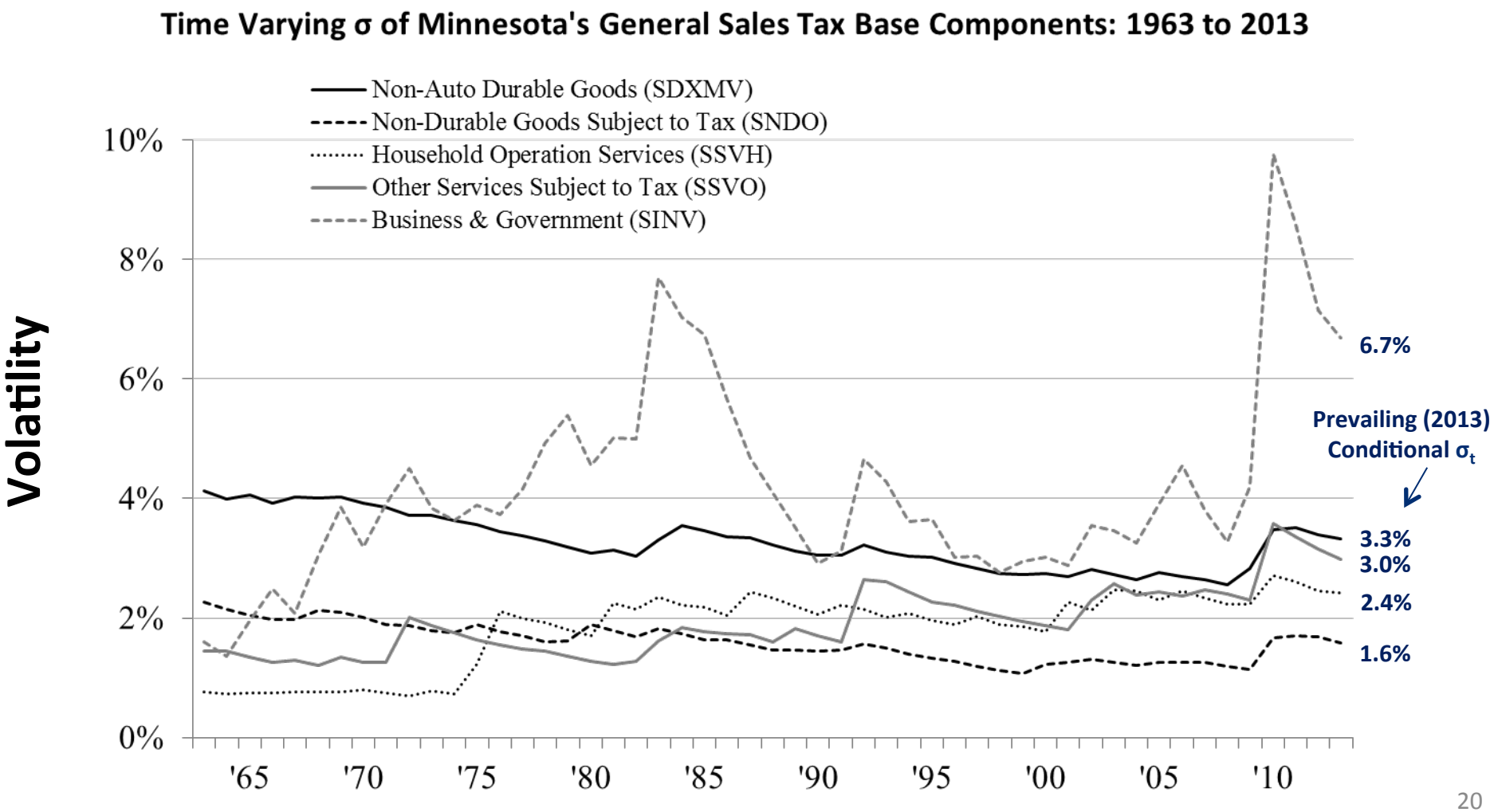

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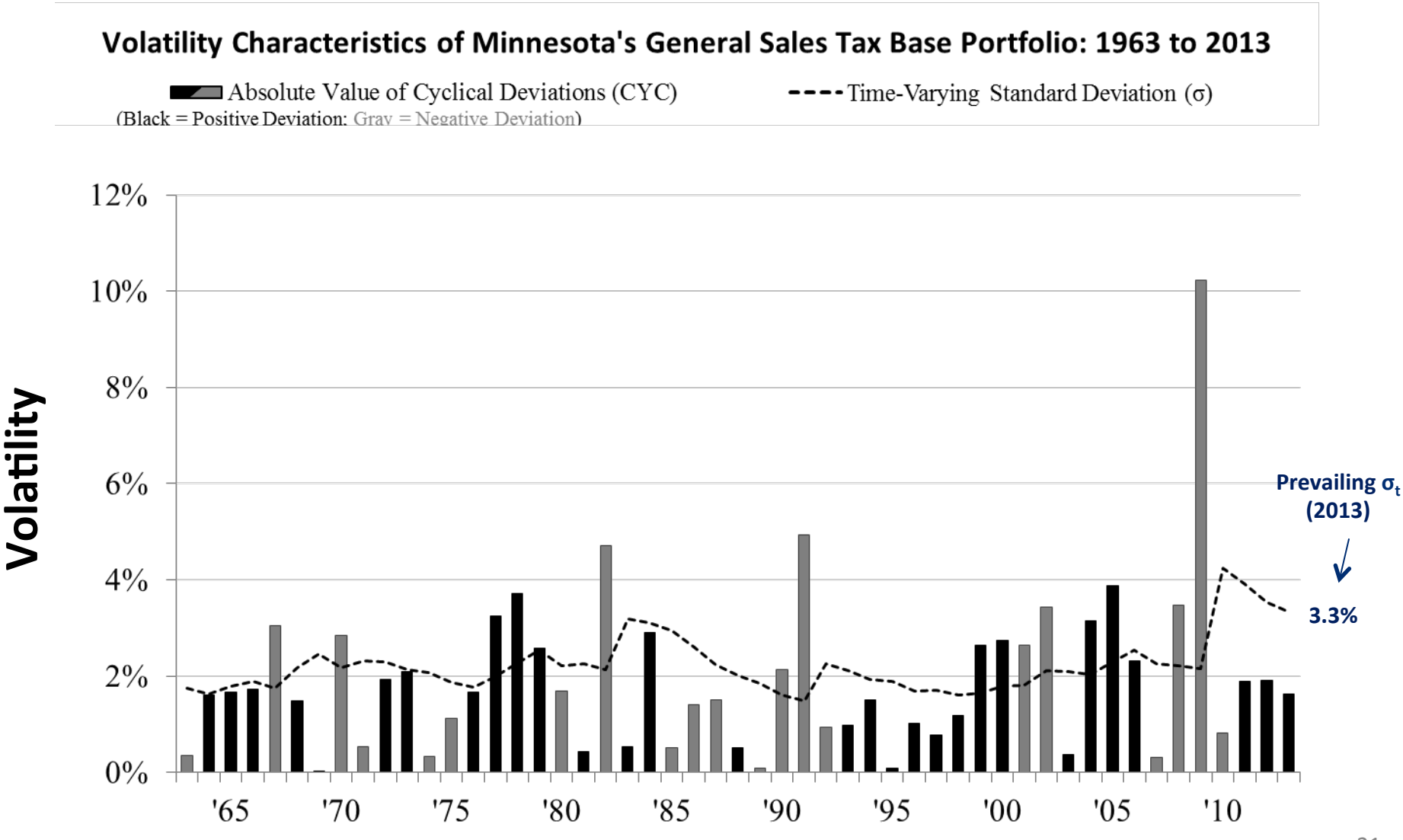

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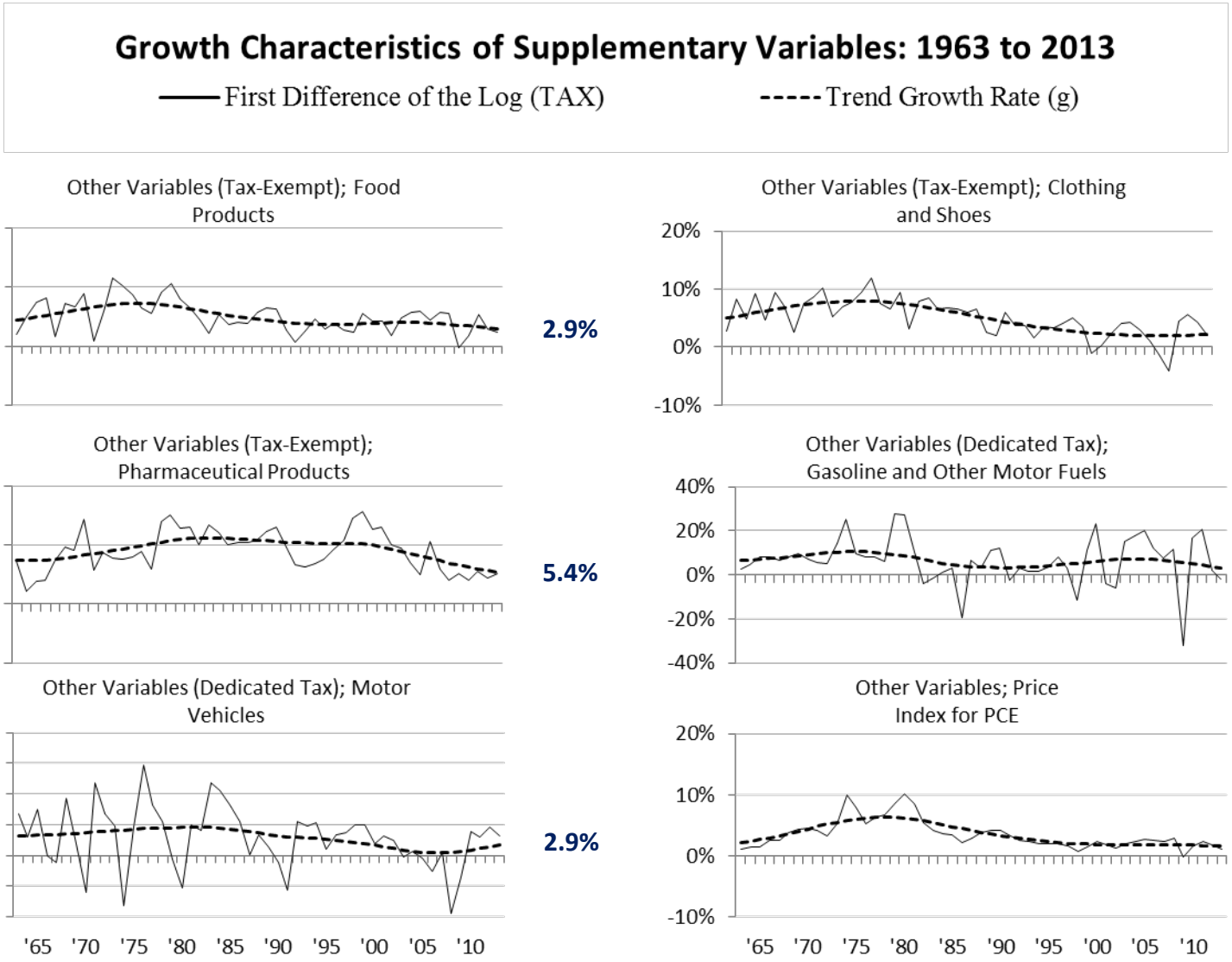

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