

STATE GDP DEFLATOR AND STATE PI

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STATE GDP DEFLATOR AND STATE PI

I. PRICE AND QUANTITY INDICES

II. STATE GDP

III. STATE PI

I. PRICE AND QUANTITY INDICES

PRICE AND QUANTITY INDICES

- **Price Index-** A price index expresses the cost of a market basket of goods relative to its cost in some “base” period, which is simply the year used as a basis of comparison. [Baumol and Blinder (2010), p. 127]

- ❖ **Quantity index-**A Quantity index, particularly used for GDP by State, are Fisher indices calculated using a formula consisting of combinations of prices and quantities for the same year, and indices of relative prices for two adjacent years [U.S. BEA (2006), p. 41]

TABLE 1: Price and Quantity Indices

INDEX	<p align="center">PRICE INDEX</p> <p> Holds the Quantity constant and allows the price to vary.</p>	<p align="center">QUANTITY INDEX</p> <p> Holds the price constant and allows the quantity to vary</p>
Laspeyres	$\mathbf{LPI} = \frac{\Sigma(P_t \times Q_0)}{\Sigma(P_0 \times Q_0)}$ <p>Where: P_0 = Price in the base period Q_0 = Quantity purchased in the base period P_t = Price in the current period.</p>	$\mathbf{LQI} = \frac{(\Sigma P_0 \times Q_t)}{\Sigma(P_0 \times Q_0)}$ <p>Where: P_0 = Price in the base period Q_0 = Quantity purchased in the base period Q_t = Quantity purchased in the current period.</p>
Paasche	$\mathbf{PPI} = \frac{\Sigma(P_t \times Q_t)}{\Sigma(P_0 \times Q_t)}$ <p>Where: P_0 = Price in the previous period Q_t = Quantity purchased in the current period P_t = Price in the current period.</p>	$\mathbf{PQI} = \frac{\Sigma(P_t \times Q_t)}{\Sigma(P_t \times Q_0)}$ <p>Where: Q_0 = Quantity purchased in the previous period Q_t = Quantity purchased in the current period P_t = Price in the current period.</p>
Fisher's Ideal Index	$\sqrt{\mathbf{LPI} \times \mathbf{PPI}}$	$\sqrt{\mathbf{LQI} \times \mathbf{PQI}}$

PRICE AND QUANTITY INDICES

❖ **NOMINAL vs. REAL, or CONSTANT-DOLLAR GDP**

- Nominal GDP rises when prices rise, *even if there is no increase in actual production.*
- For example, if hamburgers cost \$2.00 this year but cost only \$1.50 last year, then 100 hamburgers will contribute \$200 to this year's nominal GDP, whereas they contributed only \$150 to last year's nominal GDP.
- But one hundred hamburgers are still 100 hamburgers—*output has not grown.* [Baumol and Blinder (2010), p. 88]

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

❖ ***CPI-U vs. the GDP Price Index*** [U.S. BLS, *Comparing the Consumer Price Index with the gross domestic product price index and gross domestic product implicit price deflator*, MLR (March 2016)]

- The GDP Price Index, like the CPI, measures price change for consumer goods and services, but the GDP Price Index also measures price change for goods and services purchased by businesses, governments, and foreigners.
- However, unlike the CPI, the GDP Price Index does not measure price change for imports.

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

❖ *CPI-U vs. the GDP Price Index* (Continued)

- Although the GDP Price Index and the CPI both measure changes in the prices of goods and services purchased by consumers, the GDP relies on the *Personal Consumption Expenditures (PCE) Price Index* as its measure of change in consumer prices.
- Table 2 compares the CPI and the PCE Price Index.

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

Table 2: Comparing The CPI and The PCE Price Index

PCE Price Index	CPI
Produced by BEA using BLS price indexes and other data sources.	Produced by BLS using surveys of consumer prices and other data sources.
Reflects the price of expenditures made by households, including those made on behalf of households.	Reflects the price of out-of-pocket expenditures made by consumers.
Composition of expenditures changes from quarter to quarter.	Composition of the market basket remains fixed (updated every two years).
Derived using a chained Fisher index formula.	Derived using a Laspeyres-type index formula.
Weights are derived from business surveys.	Weights are derived from household surveys.

SOURCE: Moyer, Brian C., U.S. BEA, *Comparing Price Measures—The CPI and the PCE Price Index* (March 13-14, 2006) NABE Conference

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

❖ *The Implicit Price Deflator* [U.S. BLS (March 2016), p. 5]

- The *GDP Implicit Price Deflator* deflates the current nominal-dollar value of GDP by the chained-dollar value of GDP.
- The chained-dollar value is derived by updating a base-period dollar value amount by the change in the *GDP Quantity Index*, which in turn is derived with the use of a Fisher ideal index formula that aggregates from component GDP quantity indices.

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

❖ *Deriving The Implicit Price Deflator* (ibid)

- Once the component quantity indices are calculated, the GDP Quantity Index can be derived and the *GDP Implicit Price Deflator is then calculated by dividing Nominal GDP by Real GDP.*
- The change in the GDP Implicit Price Deflator is roughly equal to the change in the GDP Price Index.
- In fact, the GDP Implicit Price Deflator has risen at a systematically lower annual rate than the CPI-U over time (2% for the GDP Price Index and Implicit Price Deflator, vs. 2.4% for the CPI-U).

Comparing the CPI with the GDP Price Index and Implicit Price Deflator

❖ *Deriving Real GDP and The Implicit Price Deflator*

TABLE 3: Deriving Real GDP and The Implicit Price Deflator

Year	CTGDP	CTQIndex	Qindx/100	Real GDP = Base Yr X Q	IPD = GDP/RGDP
2009	226,076	100.00	1.0000	226,076	100.00
2010	230,357	100.95	1.0095	228,212	100.94
2011	232,271	100.20	1.0020	226,535	102.53
2012	238,322	100.45	1.0045	227,084	104.95
2013	242,417	100.06	1.0006	226,209	107.16
2014	250,764	101.26	1.0126	228,927	109.54

SOURCE: U.S. BEA and Author's calculations

II. STATE GDP

STATE GDP: Three Sides of GDP

(Based on Coyle, 2014; Table 1, p. 26)

❖ Three sides to GDP: **OUTPUT = INCOME = SPENDING**

OUTPUT (Production, or Value Added)

Gross Output (Gross Sales -- Δ Inventories)

---- Intermediate Inputs

= VALUE ADDED

INCOME (By Type)

Compensation

+ Rental Income

+ Profits + Proprietors' Income

+ (Taxes on Production + Imports) – Subsidies

+ Interest + Miscellaneous Payments

+ Depreciation

= TOTAL DOMESTIC INCOME EARNED

FINAL DEMAND (Expenditures)

Consumer Spending (Households)

+ Investment in Plant, Equip., Software (Business)

+ Government Purchases (Goods and Services)

+ Net Exports (=Exports – Imports)

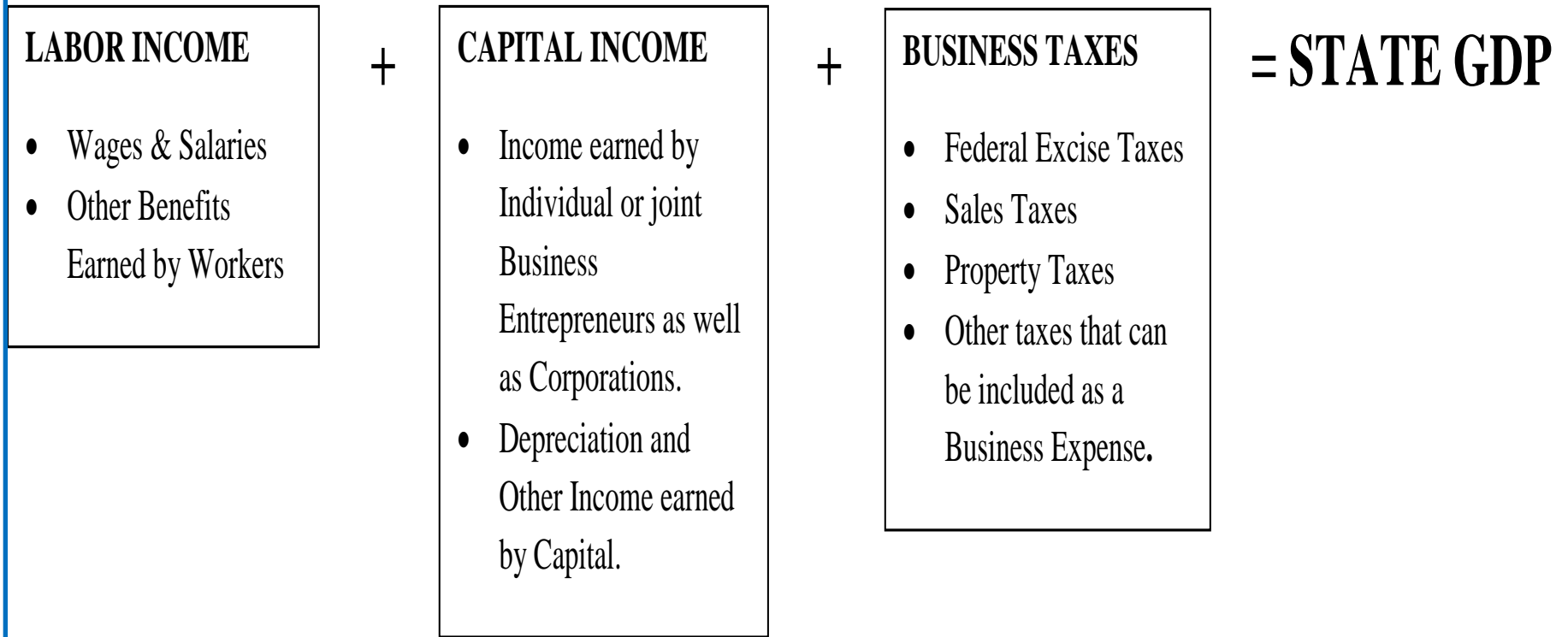
= FINAL SALES OF DOMESTIC PRODUCT

STATE GDP

❖ **Measuring GDP by State** [U.S. BEA, *Gross Domestic Product by State Estimation Methodology* (2006), p. ii]

- GDP by State cannot be measured by adding the number of goods and services produced by the states' economies because GDP by state consists of a variety of goods and services.
- The GDP by state dollar value is necessarily measured by either the amount of expenditures on it, or by the amount of incomes earned by the factors of production in producing it.
- GDP by state, like Gross Domestic Income (GDI) for the nation, *is measured as the factor incomes earned and the costs of production.* This is illustrated in Figure 1.

FIGURE 1: Components of State GDP



STATE GDP

❖ **Real GDP by State and Chain-Weighted Quantity Indices**

[U.S. BEA, *Gross Domestic Product by State Estimation Methodology* (2006), p. 15]

- The U.S. BEA prepares chain-type quantity indices, by industry, for the nation, *but state-level information on prices by industry is not available, so estimates of Real State GDP are derived by applying national-level industry Implicit Price Deflators* to the Current-Dollar State GDP estimates for the detailed industries.
- Real State GDP for the aggregate industries (such as Total Services, Manufacturing, etc.) is derived by using the same chain-type index formula that is used in the national accounts.

STATE GDP

- To the extent that a state's output is produced and sold in national markets at relatively uniform prices (or sold locally at national prices), Real State GDP captures the relative differences in the mix of goods and services that states produce.
- However, Real State GDP *does not capture state-to-state differences in the prices of goods and services that are produced and sold locally* (i.e., Non-Tradable Goods).

STATE GDP

❖ State GDP

- **Gross Operating Surplus (GOS)**. Value derived as a residual for most industries and is equal to:

$$\text{GOS} = \text{Total Industry Output} - [\text{Total Intermediate Inputs} + \text{Compensation of Employees} + (\text{Taxes on Production} - \text{Subsidies})]$$
http://www.bea.gov/glossary/glossary_g.htm

- **The Value Added** of an industry = GDP-by-Industry. It is the contribution of a private industry or government sector to overall GDP http://www.bea.gov/faq/index.cfm?faq_id=184

STATE GDP

❖ **STATE GDP: State and local government** [U.S. BEA (2006), pp. 13-14]

- *Gross Operating Surplus* (GOS) includes:

GOS = Consumption of Fixed Capital (CFC) + Proprietors' Income + Corporate Profits + Nontax Payments + Business Current Transfer Payments (net).

- The GOS estimates for State and Local Government consist of the surplus/deficit of 16 state and local government enterprises.
- The CFC for these enterprises, and state and local general government CFC.

STATE GDP

❖ STATE GDP: State and local government

- In general, state and local government revenues less expenditures, for each enterprise and state, from the Census Bureau are used to distribute to the states the national surplus or deficit of each state and local government enterprise.

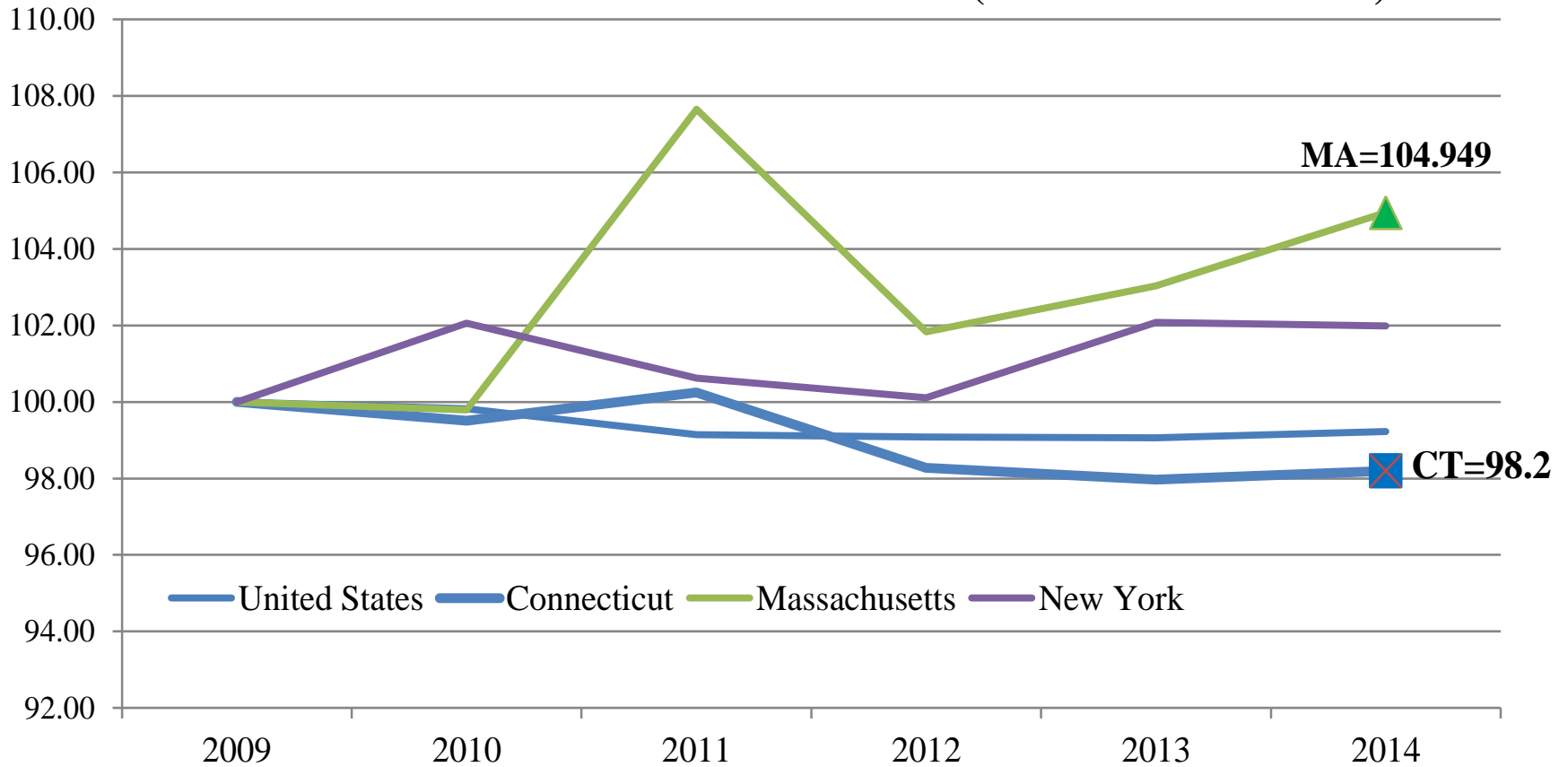
STATE GDP

❖ **STATE GDP: State and local government**

- The CFC for state and local government (general government and government enterprises) is distributed to the states based on each state's share of state and local government employment.
- Finally, the components estimated above for state and local government—the surplus or deficit of state and local government enterprises, the CFC for state and local government enterprises, and the CFC for state and local general government—are summed yielding the GOS for state and local government.

STATE GDP

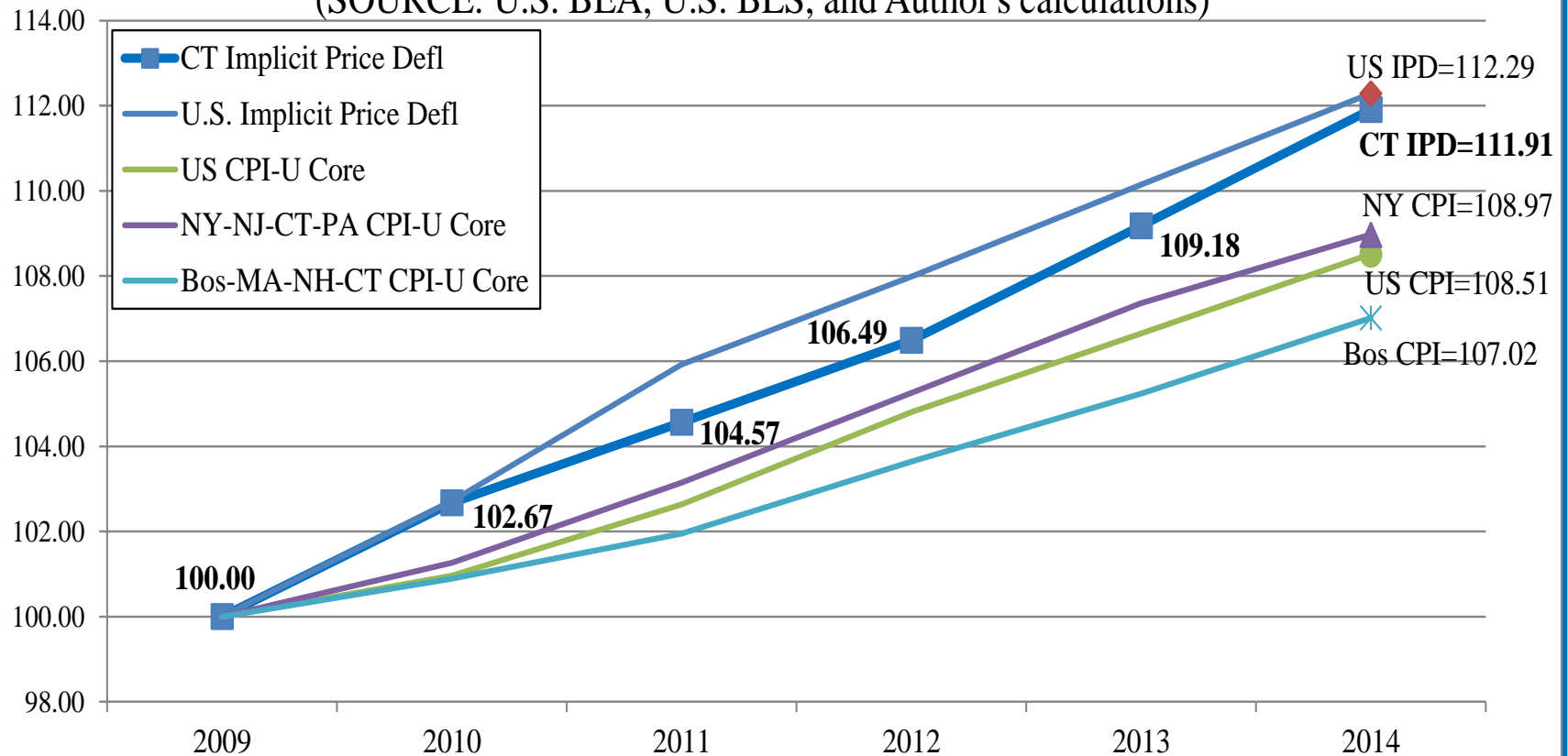
GRAPH 1A: Quantity Indices for U.S., CT, NY, and MA State/Local Gov.: 2009-2014 (SOURCE: U.S. BEA)



STATE GDP

GRAPH 1B: Alternative Price Indices for Measuring CT State/Local Gov. Inflation: 2009-2014

(SOURCE: U.S. BEA, U.S. BLS, and Author's calculations)



III. STATE PI

STATE PI

❖ STATE PI vs. STATE GDP

TABLE 4: The Relation of State GDP and State and PI, 2003

	State GDP	State PI
Compensation of Employees	6,268.70	6,271.50
Taxes on Production and Imports	798.1	-----
LESS: Subsidies	46.7	-----
Gross Operating Surplus (GOS)	3,903.80	-----
- Proprietors' Income	-----	839.1
EQUALS: Earnings by Place of Work	-----	7,110.60
LESS: Contributions for Government Social Insurance	-----	771.5
PLUS: Adjustment for Residence	-----	-1.2
PLUS: Dividends, interest, and rent		1,475.40
PLUS: Personal current transfer receipts		1,335.30
TOTAL	10,923.80	9,148.70

SOURCE: U.S. BEA, Gross Domestic Product by State Estimation Methodology (2006),

STATE PI

- ❖ **STATE PI** [Popov and Weiner, *Assessing Alternative Measures of State Income* (July 30, 2008), New England Public Policy Center]
 - To best capture ability to pay, an income measure should ideally reflect all types of income that generate revenue for the state government.
 - Personal Income (PI) excludes certain items that are important sources of revenue, while including others that may be less feasible revenue sources.
 - A SIMPLE FIX: Two relatively simple adjustments—the addition of *Realized Capital Gains*, and *an adjustment to reflect labor earnings by geographic source rather than state of residence*—can correct for some of these problems, providing a more comprehensive, albeit still imperfect, measure of income.

STATE PI

❖ STATE PI (ibid)

- Alternatives to the U.S. Bureau of Economic Analysis's (BEA) measures of income do exist.
- They include:
 - The Internal Revenue Service's (IRS) Adjusted Gross Income (AGI)
 - The U.S. Census Bureau's Money Income
- These tend to carry even greater limitations than BEA's PI in either completeness or availability.

STATE PI

❖ STATE PI (ibid)

- On the other hand, two production-based measures—the BEA’s *State GDP* (see Part II of this presentation), and the U.S. Treasury Department’s *Total Taxable Resources* (TTR)—are worth considering as proxies for a state’s ability to pay.
- However, they have limitations related to their comprehensiveness, transparency, and availability.

STATE PI

❖ STATE PI (ibid)

- Perhaps the most widely used practical measure of income is the U.S. BEA's State Personal Income (PI).
- State PI is defined as the “income received by persons from participation in production, from government and business transfer payments, and from government interest.

STATE PI

❖ STATE PI (ibid)

- The composition and derivation of Connecticut State PI for 2015 is presented in Tables 5A and 5B.
- The State PI data are timely—each quarter the BEA derives personal income from administrative data for purposes of national and regional income accounting—and are freely and publicly available on the agency’s website. The latest quarterly data are available for 2015Q4 and the latest annual data is for 2015.
- PI also has the benefit of being relatively transparent: it can easily be broken down into subcomponents (see Graphs 5A and 5B), that can be assessed for their feasibility as a revenue source for state governments.

STATE PI

TABLE 5A: Connecticut State PI-2015

BY PLACE OF RESIDENCE	
Personal income (thousands of dollars)	240,519,358
DERIVATION OF PI	
Earnings by Place of Work	160,485,814
LESS: Contributions for Government Social Insurance	16,365,177
Employee and Self-Employed Contributions for Government Social Insurance	8,789,060
Employer Contributions for Government Social Insurance	7,576,118
PLUS: Adjustment for Residence	14,917,605
EQUALS: Net earnings by Place of Residence	159,038,241
PLUS: Dividends, Interest, and Rent	50,089,251
PLUS: Personal Current Transfer Receipts	31,391,866
PI PLACE OF RESIDENCE	240,519,358

SOURCE: U.S. BEA, Table SA5N

TABLE 5B: Connecticut Earnings by Place of Work-2015

DERIVATION OF EARNINGS BY PLACE OF WORK	
Wages and Salaries	111,425,449
Supplements to wages and salaries	25,586,190
Employer Contributions for Employee Pension and Insurance Funds	18,010,073
Employer Contributions for Government Social Insurance	7,576,118
Proprietors' Income	23,474,174
Farm Proprietors' Income	20,277
Nonfarm Proprietors' Income	23,453,897
EARNINGS BY PLACE OF WORK	160,485,813

SOURCE: U.S. BEA, Table SA5N

STATE PI

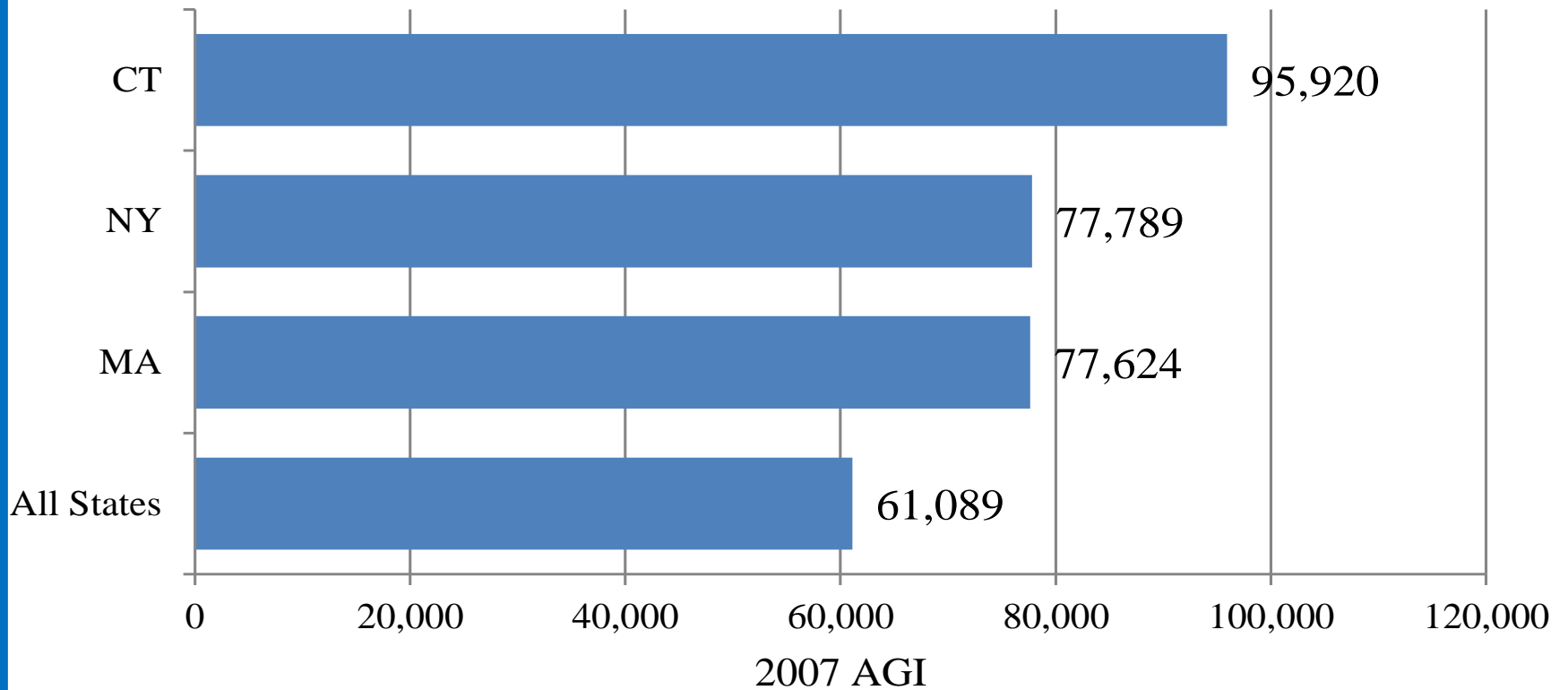
❖ STATE PI (ibid)

- Despite these advantages, there are several things to keep in mind when using personal income to represent a state's ability to fund programs.

- Specifically, PI:
 - excludes Capital Gains Income;
 - captures Labor Income of state residents regardless of where they earn it, rather than capturing *all labor income earned in the state*;
 - excludes Corporate Profits;
 - captures contributions to pension funds rather than disbursements;
 - includes certain types of non-cash income.

STATE PI

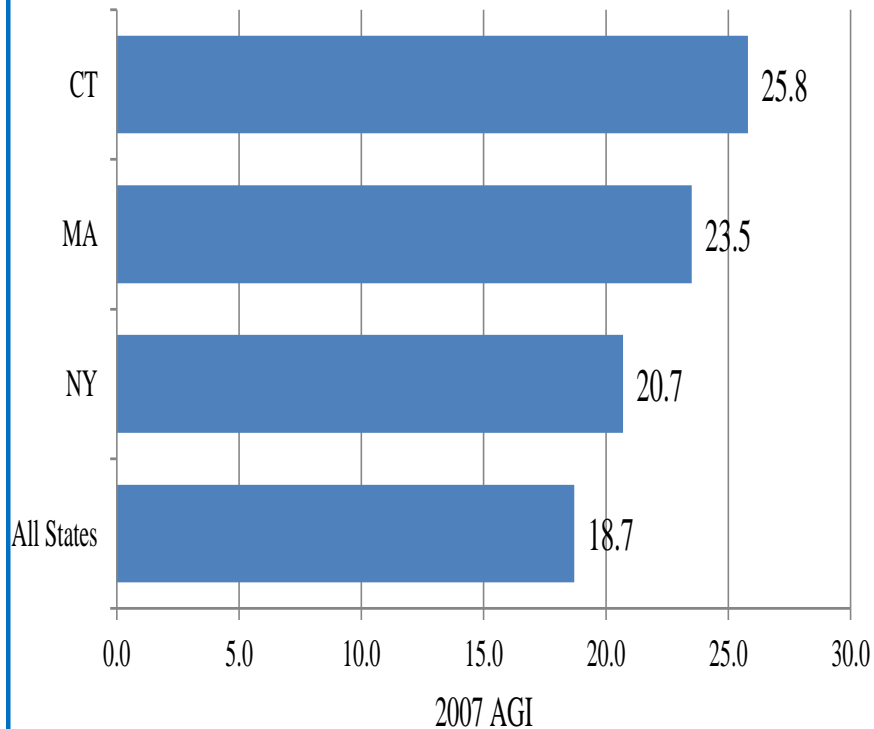
GRAPH 2: AGI for 2007-CT, NY, MA, and All States



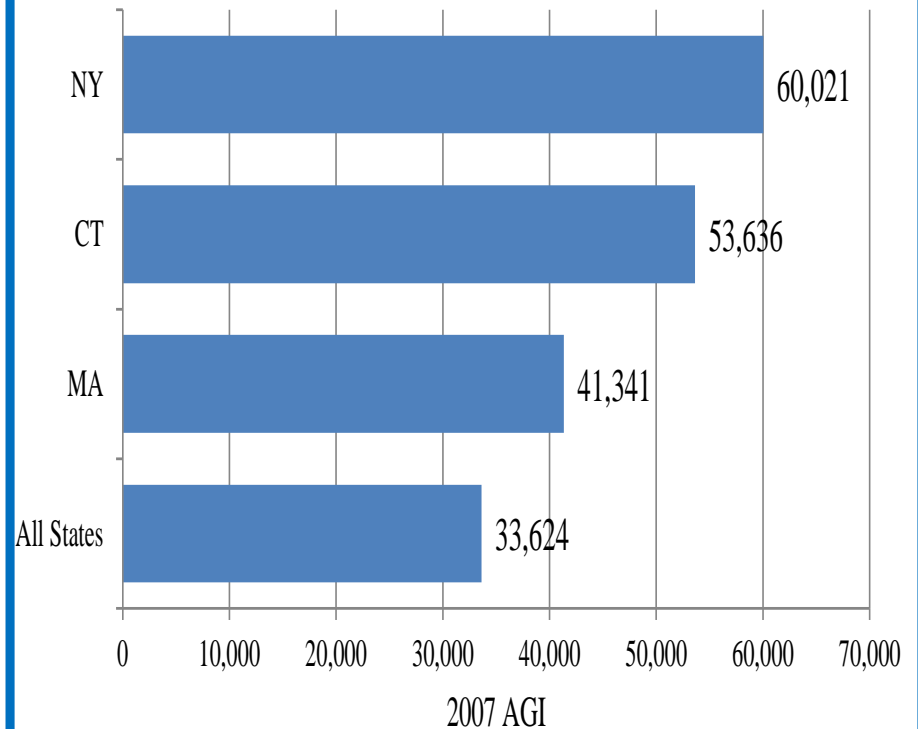
SOURCE: Figure E, IRS, Statistics of Income Bulletin | Spring 2011, p. 177

STATE PI

GRAPH 3A: % Returns with Net Capital Gains for 2007-CT, NY, MA, and All States



GRAPH 3B: Ave Net Capital Gain for 2007-CT, NY, MA, and All States



SOURCE: Figure C, IRS, Statistics of Income Bulletin | Spring 2011, p. 176

SOURCE: Figure C, IRS, Statistics of Income Bulletin | Spring 2011, p. 176

Table 6: Summary of Selected Income Measures

Income Measure	Personal Income (PI)	Adjusted Gross Income (AGI)	CPS* Money Income (MI)
Government agency	Bureau of Economic Analysis (BEA)	Internal Revenue Service (IRS)	U.S. Census Bureau
Are state-level data available?	Yes	Yes	Yes (Median HH Income only)
Most recent year state data available	Annual, 2015; Quarterly 2015Q4	2014	2014
Are selected components included?			
Wages and Salaries	Yes	Yes	Yes
Proprietors' Income	Yes	Yes	Yes
Dividends, Interest, and Rent	Yes	Yes (Taxable only)	Yes
Employer Pension/Insurance Contributions	Yes	No	No
Pension/Retirement Income Distributions	No	Yes	Yes
Government Cash Transfers	Yes	Some	Yes
Government Non-Cash Transfers	Yes	No	No
Interpersonal Cash Transfers	No	Some	Yes
Imputed Rental Income	Yes	No	No
Realized Net Capital Gains	No	Yes	No
Unrealized Capital Gains	No	No	No
Corporate Profits	No	No	No

SOURCE: Table 1 Popov and Weiner (June 30, 2008)

*Current Population Survey

STATE PI

❖ STATE PI (ibid)

- Additional income measures include:
 - The Congressional Budget Office's (CBO) Comprehensive Household Income (CHI)
 - The Joint Committee on Taxation's (JCT) Income Concept
 - The U.S. Treasury Department's Family Economic Income (FEI)
- However, there is no state-level data available for these income measures.