Two Perspectives on Preferences and Structural Transformation

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Motivation

Structural Transformation (ST)

- **As economies develop, resources get reallocated across broad sectors**
  - Agriculture shrinks
  - Manufacturing first grows and then shrinks
  - Services grow

- **Recent literature: ST crucial for understanding important economic issues**
  - Cross–country differences in hours worked
  - Cross–country differences in aggregate productivity

Open Empirical Question

- **Which economic forces shape ST?**
- **We take a first step and ask: Which features of preferences shape ST?**

Which Features of Preferences Shape ST?

- **Income Effects**
  - As income changes, households reallocate consumption expenditures across sectors
  - Requires income elasticity different from one (nonhomothetic preferences)
  - Key channel in theoretical work on ST by Kongsamut–Rebelo–Xie (REStud, 2001)

- **(Relative) Price Effects**
  - As prices change, households reallocate consumption expenditures across sectors
  - Requires elasticity of substitution different from one (no log preferences)
  - Key channel in theoretical work on ST by Ngai–Pissarides (AER, 2007)

- **Different implications for how growth affects ST**
  - Income effects: Anything that causes growth causes ST
  - Price effects: Something on technology side needs to change relative prices

To Answer Our Question, We Can Take Two Perspectives On Data

1. Perspective: Final Consumption Expenditures (FE Perspective)

- **Assumes categories in utility function are final consumption goods**
- **Classifies final consumption expenditure into the three sectors**
- **Examples**
  - supermarket food: agriculture
  - clothing: manufacturing
  - restaurant meals: services

2. Perspective: Consumption Value Added (VA Perspective)

- **Assumes categories in utility are consumed value added**
- **Breaks final consumption expenditure into value added components**
- **Classifies value added components into the three sectors**
- **Example: Final consumption expenditure on cotton shirt**
  - value added from producing cotton: agriculture
  - value added from turning cotton into shirt: manufacturing
  - value added from delivering shirt: services

Not clear which perspective to take

- **Both are logically consistent**
- **We may have data for one of the two perspectives only**
  - Penn World Table: Final expenditure
  - Industry data sets: Value added

We take both perspective on US postwar data

Our Contribution

- **We estimate preferences for both perspectives**
- **We find that the resulting utility specifications have very different properties**
  - FE Perspective: Income effects dominant force behind ST
  - VA Perspective: Price effects dominant force behind ST
- **We explain where the differences come from**
  - Input–output relationships connect the two perspectives
  - They are two perspectives on *same* data

Estimation of Preferences

We Focus on the Following Class of Utility Functions

$$\sum_{t=0}^{\infty} \beta^t \left[\frac{u(c_{at}, c_{mt}, c_{st})^{1-\rho}}{1-\rho} + v(1-h_t) \right] \qquad \text{where}$$

$$u(c_{at}, c_{mt}, c_{st}) = \left[\omega_a^{\frac{1}{\sigma}} (c_{at} + \bar{c}_a)^{\frac{\sigma-1}{\sigma}} + \omega_m^{\frac{1}{\sigma}} c_{mt}^{\frac{\sigma-1}{\sigma}} + \omega_s^{\frac{1}{\sigma}} (c_{st} + \bar{c}_s)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

- **Kongsamut–Rebelo–Xie**
  - $\sigma = 1$, $\bar{c}_a < 0$, $\bar{c}_s > 0$ (Stone–Geary specification)
- **Ngai–Pissarides**
  - $\sigma < 1$, $\bar{c}_a = \bar{c}_s = 0$ (CES specification with more complementarity than log)

Minimum Distance Method

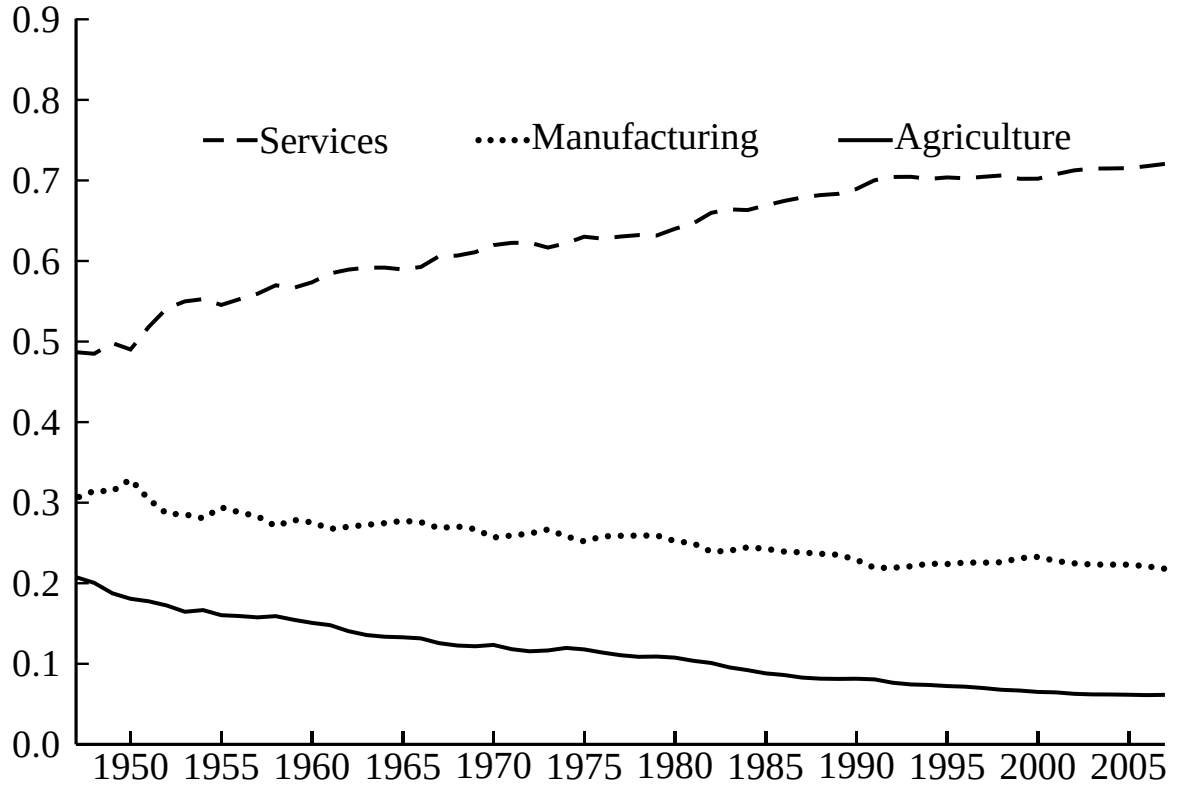
- **Solve period problem of choosing period consumption of the three goods, taking as given observed total period consumption expenditure and prices**

- **Choose utility parameters ($\omega_a, \omega_m, \omega_s, \bar{c}_a, \bar{c}_s, \sigma$) to minimize distance between implied expenditure shares in model and data**

FE Perspective

- **Use annual U.S. data 1947–2007 from the BEA**
- **Assign final consumption expenditure on commodities to the three sectors**
  - **Agriculture: Final expenditure on**
    - food/beverages
  - **Manufacturing: Final expenditure on**
    - durable goods
    - nondurable goods except food/beverages
  - **Services: Final expenditure on**
    - all other commodities

Expenditure Shares with FE Perspective



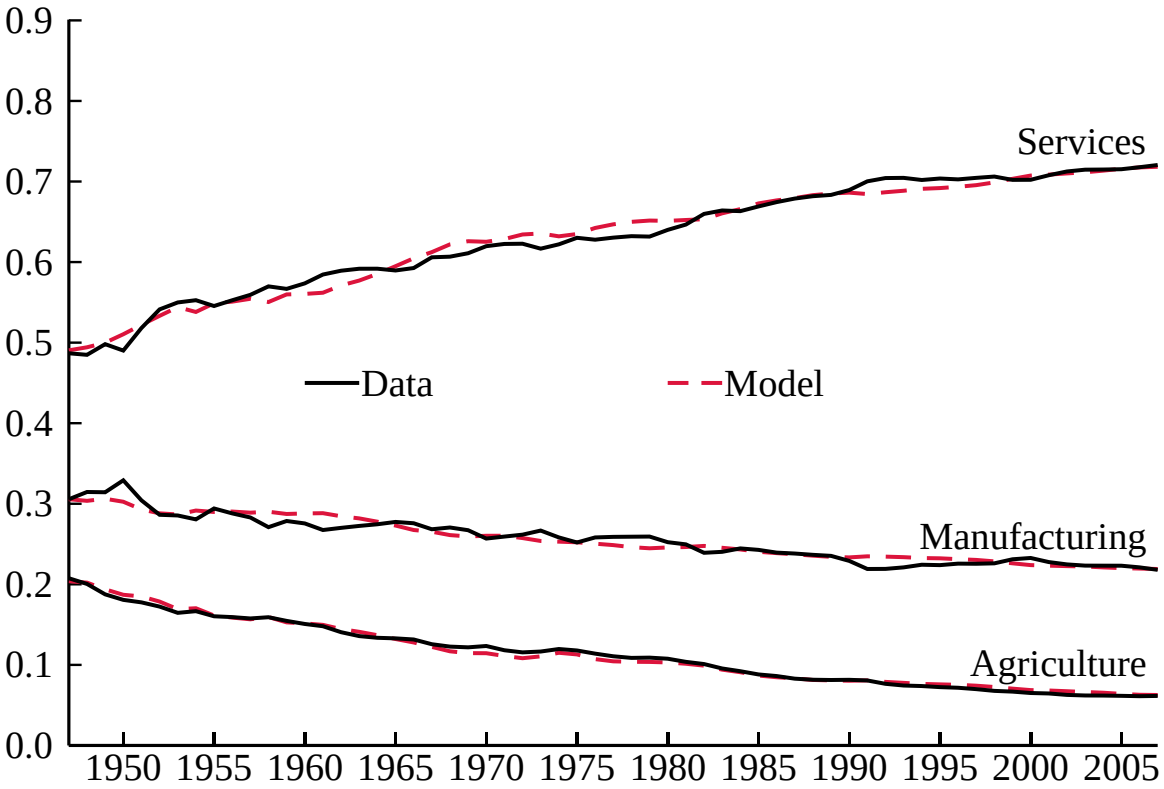
- **Expenditure share of services increased**
- **Expenditure shares of manufacturing and agriculture decreased**

Estimation Results with FE Perspective

σ	.81
$\bar{c}_a$	-1,208
$\bar{c}_s$	8,024

- **Close to Stone–Geary specification used by Kongsamut–Rebelo–Xie ($\sigma = 1$)**
- **Broadly consistent with results from literature on expenditure systems**

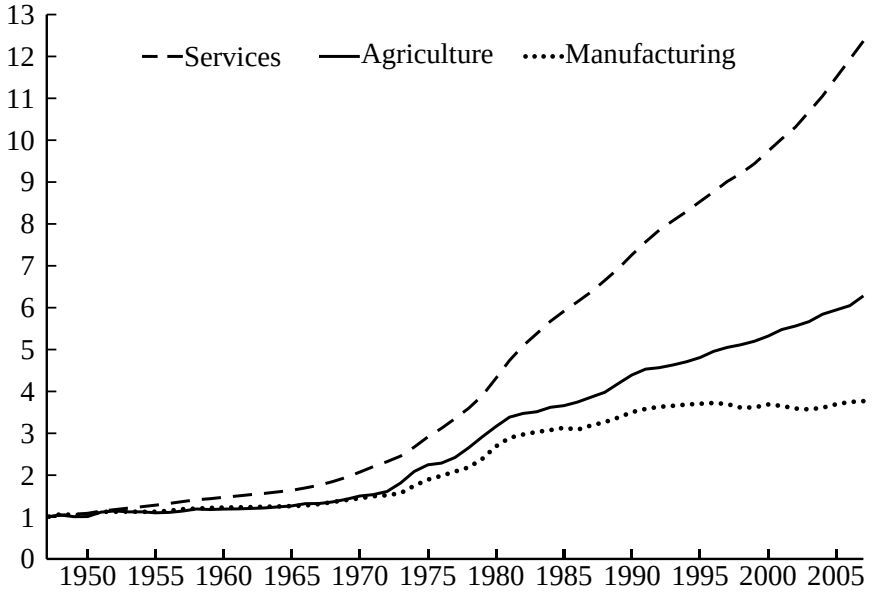
Fit of Expenditure Shares with FE Perspective



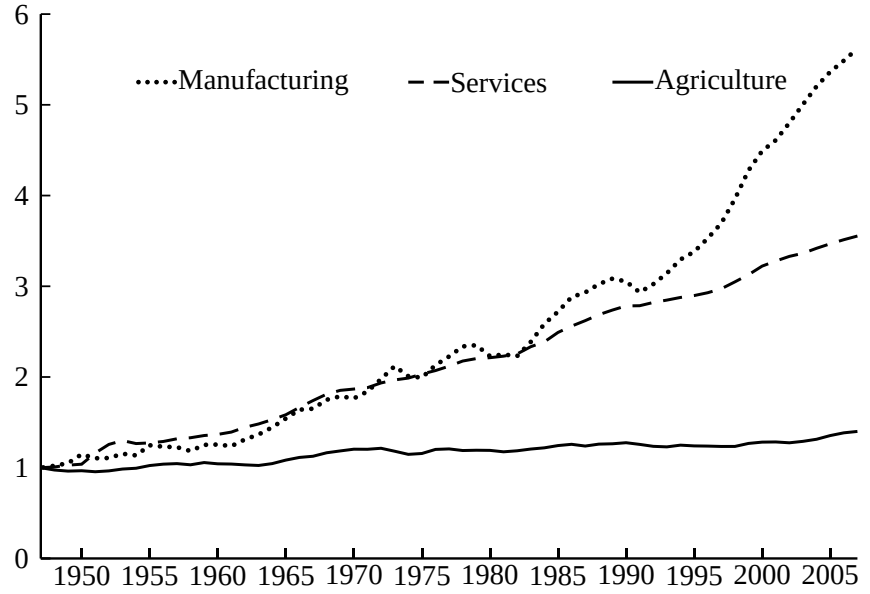
- **Note: Stone–Geary specification (σ restricted to one) has similar fit**

Intuition for Results With FE Perspective

Prices



Quantities



- p_{st}/p_{at} **and** c_{st}/c_{at} **increased: Need utility to be nonhomothetic**
- p_{st}/p_{mt} **increased and** c_{st}/c_{mt} **decreased: Need substitutability between goods**

Importance of Income versus Price Effects with FE Perspective

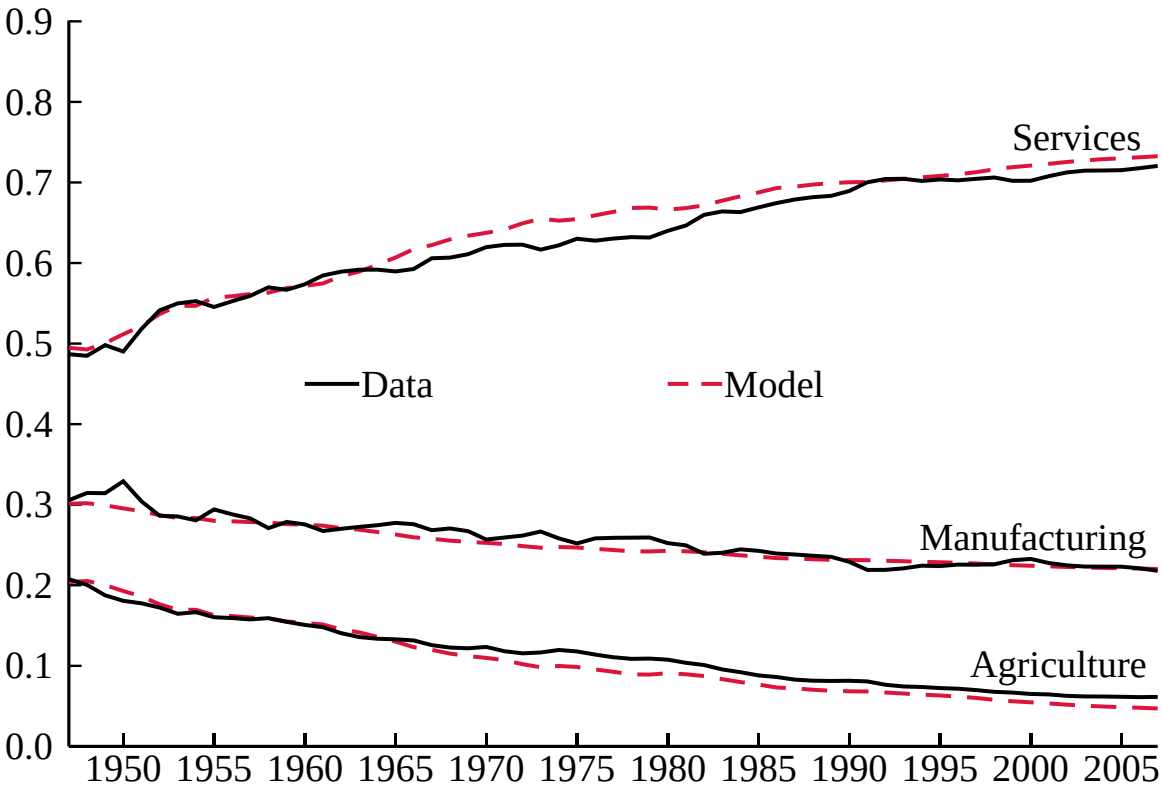
- **Values of $\bar{c}_i$ large relative to total consumption expenditure**

	1947	2007
$p_{at}(-\bar{c}_a)/C_t$	.17	.04
$p_{st}\bar{c}_s/C_t$	1.22	.51

- **Suggests that income effects dominant force**

- **To establish this we**
  - **fix relative prices at 1947 values**
  - **feed observed increase in total consumption expenditure into estimated utility**

Fit With Relative Prices Fixed at 1947 Values



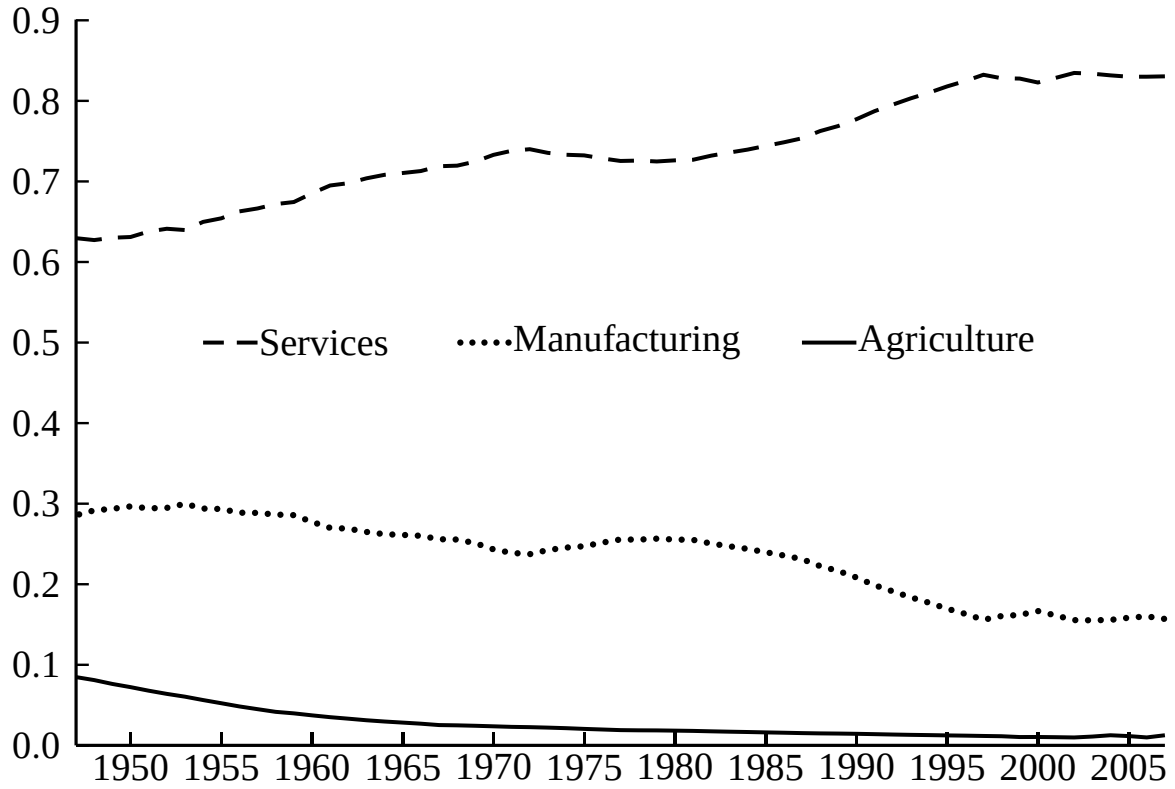
Summary of Results with FE Perspective

- **Specification close to Stone–Geary provides good fit**
- **Income effects dominant force behind ST**

VA Perspective

- **Use annual U.S. data 1947–2007 from the BEA**
- **Break final consumption expenditure into value added components**
- **Assign value added components to sectors**
  - **Agriculture: Consumed value added produced in**
    - farms
    - forestry, fishing, and related activities
  - **Manufacturing: Consumed value added produced in**
    - construction
    - manufacturing
    - mining
  - **Services: Consumed value added produced in**
    - all other industries

Expenditure Shares with VA Perspective



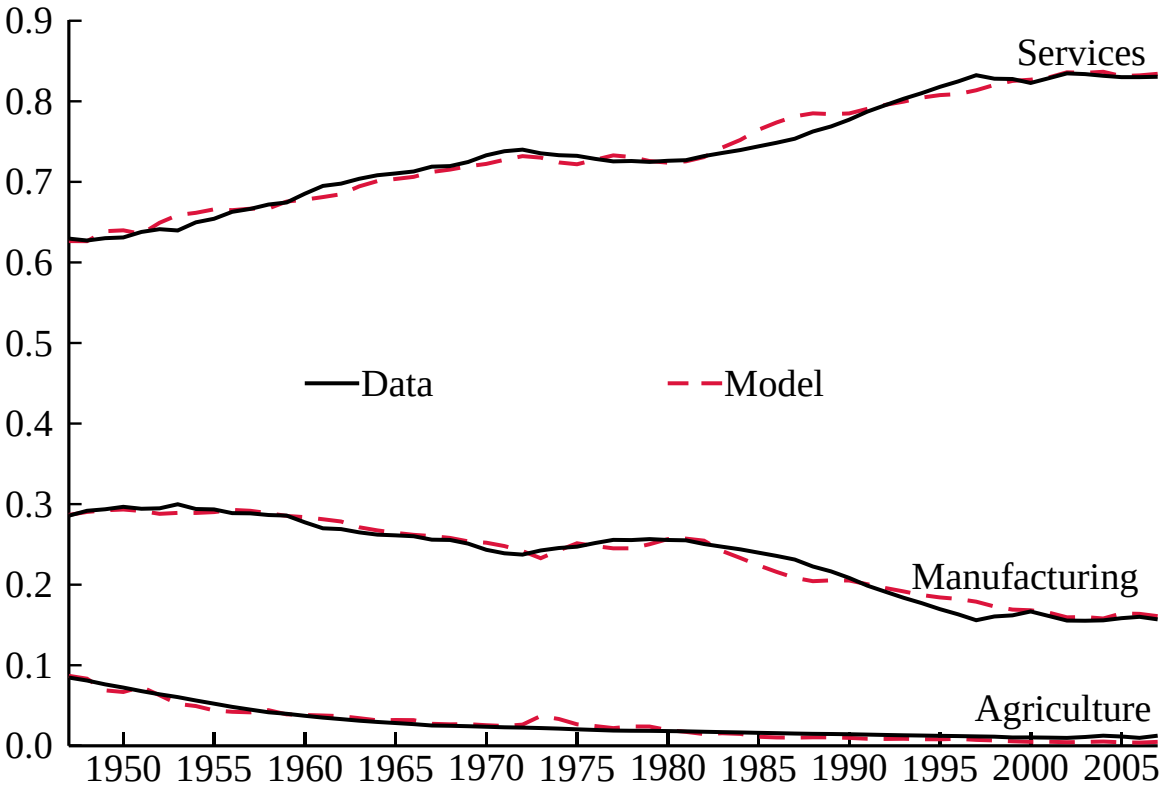
- **As before,**
  - **expenditure share of services increased**
  - **expenditure shares of manufacturing and agriculture decreased**

Results with VA Perspective

σ	0
$\overline{c}_a$	-136.3
$\overline{c}_s$	3,652

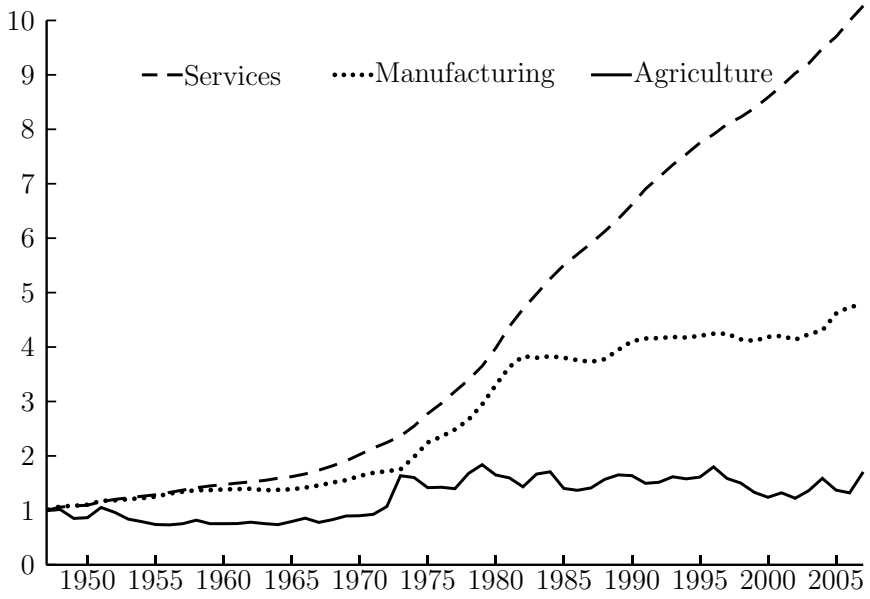
- **Little substitutability and smaller nonhomotheticity terms**
- **Broadly consistent with results of Buera–Kaboski (JEEA,2009)**

Fit of Expenditure Shares with VA Perspective

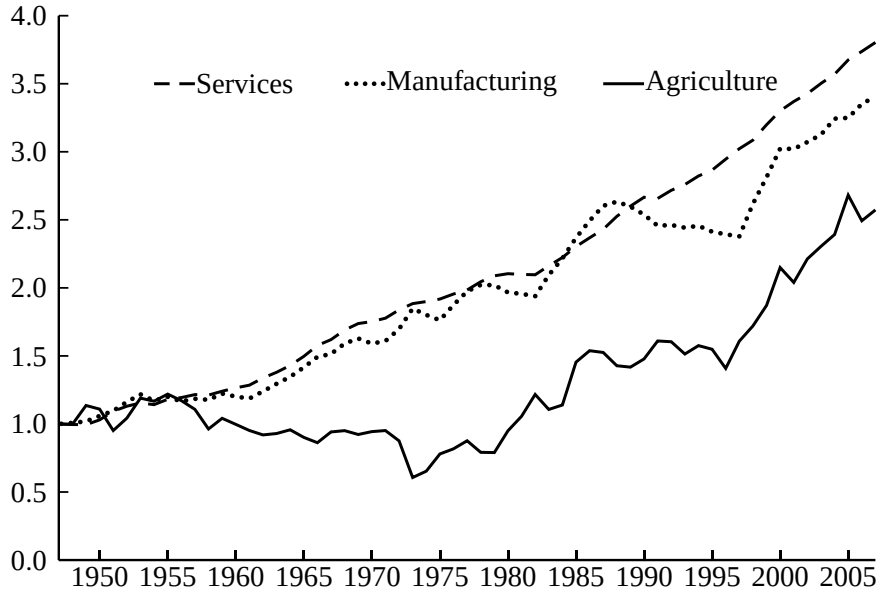


Intuition For Results With VA Perspective

Prices



Quantities

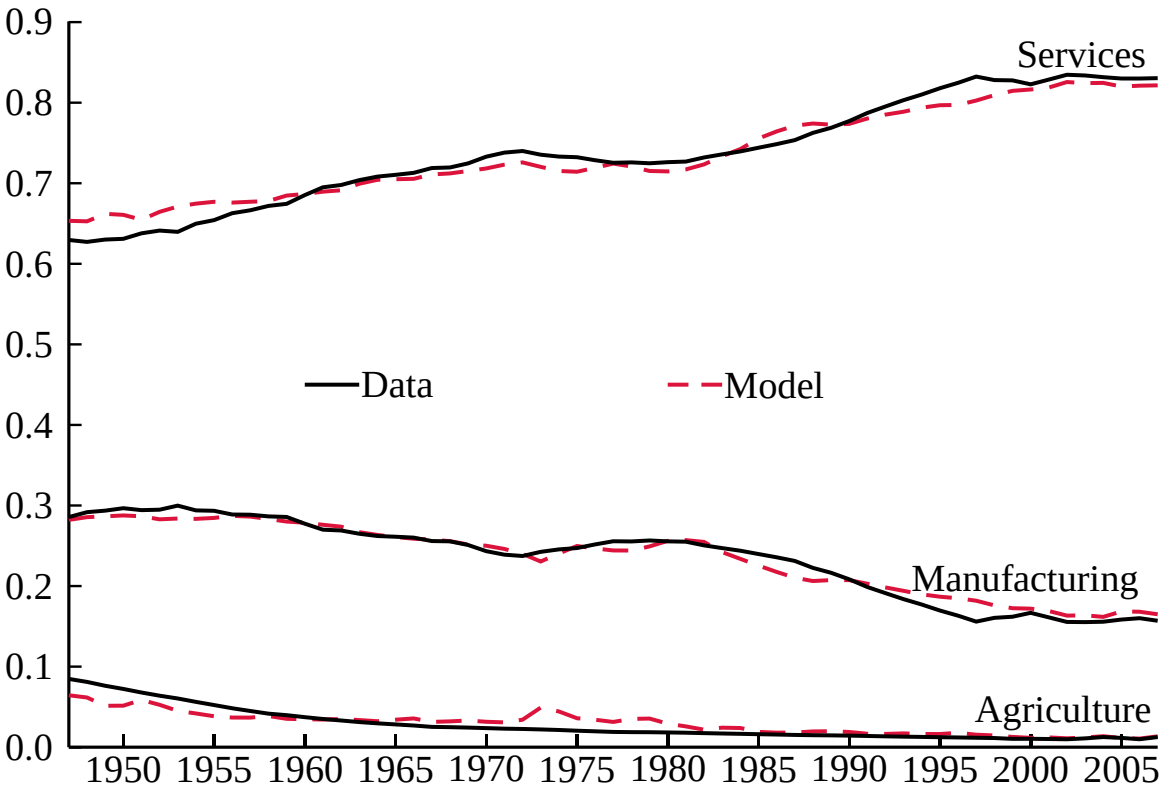


- p_{st}/p_{mt} **increased and** c_{st}/c_{mt} **stayed roughly constant: Need complementarity**
- p_{st}/p_{at} **and** c_{st}/c_{at} **increased before 1970 only: Need (smaller) nonhomotheticities**

Importance of Income versus Price Effects With VA Perspective

- **Smaller values of $\bar{c}_i$ suggest that now income effects are less important**
- **To establish that now price effects are dominant force, we estimate homothetic specification ($\bar{c}_a$, $\bar{c}_s$ restricted to zero)**
- **Result: $\sigma = 0$**
  - Leontief specification
  - Special case of CES used by Ngai–Pissarides

Fit of Expenditure Shares with Leontief Specification



- **Still, fit is pretty not bad!**

Summary of Results with VA Perspective

- **Leontief provides good fit (special case of specification of Ngai–Pissarides)**
- **Price effects dominant force behind ST**

Opposite Result from Before!

Why?

Intuition for Results

Focus on two consumption items

- **Food from supermarkets**
- **Meals from restaurants**

Importance of Price Effects

- **FE Perspective**
  - Food from supermarkets in agriculture
  - Meals from restaurants in services
  - Substitutability because both use intermediate input food
  - Price effects have some importance ($\sigma \approx 1$)

- **VA Perspective**
  - Both intermediate food inputs in agriculture
  - Removes substitutability
  - Price effects unimportant ($\sigma = 0$)

Importance of Income Effects

- **FE Perspective**
  - Food from supermarkets necessity ($\overline{c}_a < 0$)
  - Meals from restaurants luxury ($\overline{c}_s > 0$)
  - Income effects important
- **VA Perspective**
  - Necessary and luxury intermediate food inputs in agriculture
  - Reduces importance of income effects

Merits of the Two Perspectives

FE Perspective

- **Implementation of consumption side straightforward**
- **Need input–output tables to construct technology side**

VA Perspective

- **Need input–output tables to construct consumption side**
- **Implementation of technology side straightforward**

- **Preferences side easier with FE perspective**
- **Technology side easier with VA perspective**
- **But same complexity if one wants both sides**

Measurement Issues

Outsourcing of Services as Source of ST

- **Fuchs (1968): reallocation of resources may reflect outsourcing, as opposed to a fundamental shift of economic activity across sectors**
  - In–house janitorial services of a car manufacturer part of manufacturing
  - Purchased janitorial services part of services

- **Outsourcing not likely to be a big force behind ST**
  - Final consumption expenditure
    - Outsourcing not an issue
    - There still is ST, so not all ST result of outsourcing
  - Consumption value added
    - NAICS classifies at establishment level, so headquarters counted as services
    - Outsourced services part of business services
    - Business services account for 41% of rise in expenditure share of services

Decomposition of Increase in Expenditure Share of Services Consumption Value Added (accumulated 1947–2007)

Category	%
Finance, Insurance, Real Estate, Rental, and Leasing	48.8
Professional and Business Services	41.5
Health Care and Social Assistance	26.3
Information	8.3
Utilities	3.4
Educational Services	2.9
Government	1.0
Arts, Entertainment, Recreation, Accommodation, Food Services, and Other	−0.5
Trade and Transport	−31.7
	100

Badly Measured Government Services

- **Government services often "approximated" by corresponding wage bill**
- **To see how this affects estimates, we redid everything without government services**
  - This should lower ω_s and $\overline{c}_s$
  - Fortunately, it does not affect other parameter estimates much
    (with consumption value added, the estimates remain virtually unchanged)

Durable Goods

- **For owner–occupied houses, BEA distinguished consumption from purchases**
- **For all other durables, BEA sets consumption equal to purchases**
  - We have not attributed utility flow to stocks for these durables
  - Not serious problem here because we focus on longer term trends in aggregate data

Home Production

- **We have abstracted from home production**
- **Aguiar–Hurst (QJE, 2007) and Ramey–Francis (AERMacro, 2009): sharp drop in home production time**
- **This could**
  - led to substitution of market produced for home produced services
  - cause an upward bias in expenditure share of services in our data

Quality Improvements

- **Official data do not control for quality improvements**
- **Particularly relevant for services**
- **Nothing we can do about this other than mention it**

Conclusion

We have found

- **Utility specifications that account for changes in postwar U.S. expenditure shares**
- **That the specifications depend crucially on whether we formulate utility over**
  - **final consumption expenditures**
  - **consumption value added**

What next?

- **Ultimate goal is to estimate model of structural transformation**
- **Next steps**
  - **estimate sector technologies for each of the two specifications**
  - **extend analysis to other countries**

Defensive Slides

Re–estimating Utility Restricting $\sigma = 1$:

Stone–Geary Specification of Kongsamut–Rebelo–Xie

	Unrestricted	**Restricted**
σ	.81	**1**
$\overline{c}_a$	-1,208	-1,182
$\overline{c}_s$	8,024	15,999
ω_m	.18	.15
ω_s	.80	.83
Loss	.105	.112

Fit of Expenditure Shares with Stone–Geary Specification