Two Perspectives on Preferences and Structural Transformation

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Introduction

Introduction

Structure Transformation:

The reallocation of resources across the broad economic sectors:

agriculture, manufacturing, and services.

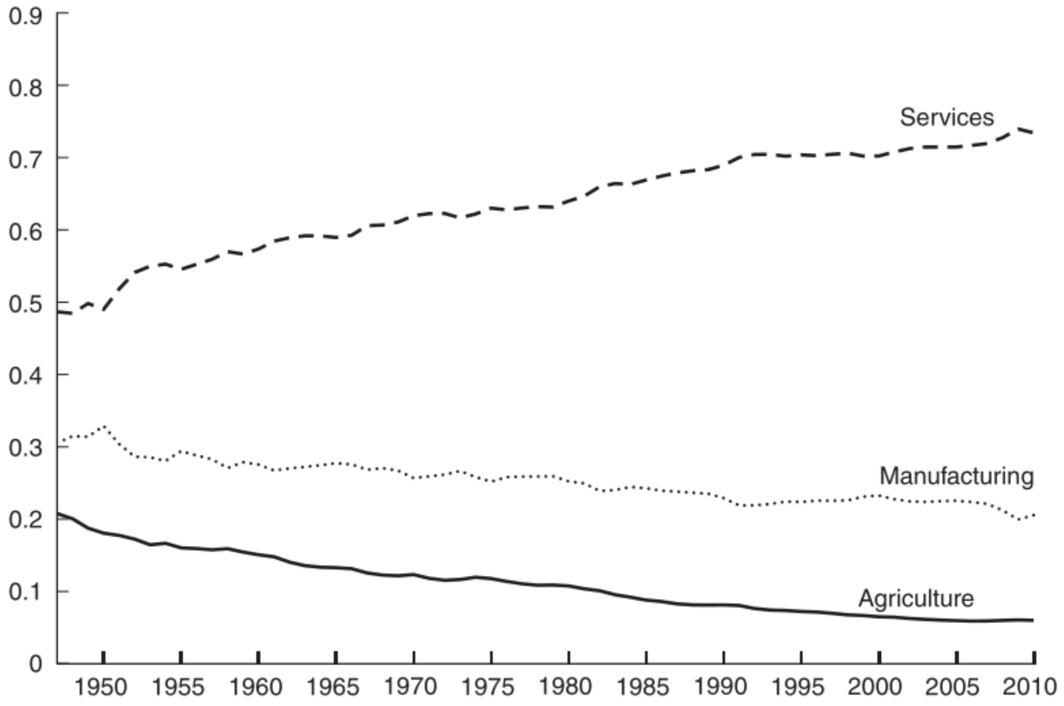


FIGURE 1. EXPENDITURE SHARES

Introduction

Driving forces of structure transformation?

Income

Relative Price

Introduction

Two approaches:

① Final Consumption Expenditure:

Manufacturing

② Consumption Value Added:

raw cotton——Agriculture

processing——Manufacturing

retailing——Services

Model

Model

Household Utility Function:

$$u(c_{at},\, c_{mt},\, c_{st}) = \left(\sum_{i=a,m,s} \underline{\omega_i^{\frac{1}{\sigma}}} \left(\underline{c_{it}} + \underline{\bar{c}_i} \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}},$$

Model

Static Optimization:

$$\max_{c_{at}, c_{mt}, c_{st}} u(c_{at}, c_{mt}, c_{st})$$

$$\text{s.t.} \sum_{i=a,m,s} p_{it} c_{it} = C_t.$$

Expenditure Share:

$$s_{it} \equiv \frac{p_{it} c_{it}}{C_t} = \frac{\omega_i p_{it}^{1-\sigma}}{\sum_{j=a,m,s} \omega_j p_{jt}^{1-\sigma}} \left(1 + \sum_{j=a,m,s} \frac{p_{jt} \overline{c}_j}{C_t}\right) - \frac{p_{it} \overline{c}_i}{C_t}.$$

Model

Empirical Work:

$$s_{it} \equiv \frac{p_{it}\, c_{it}}{C_t} = \frac{\omega_i\, p_{it}^{1-\sigma}}{\sum_{j=a,m,s} \omega_j\, p_{jt}^{1-\sigma}} \left(1 + \sum_{j=a,m,s} \frac{p_{jt}\, \bar{c}_j}{C_t}\right) - \frac{p_{it}\, \bar{c}_i}{C_t}.$$

Given: S_{it}, C_t, p_{it}

Estimate the parameters in the utility function

Model

Under final consumption approach: Stone-Geary specification

$$u(c_{at}, c_{mt}, c_{st}) = \omega_a \log(c_{at} + \overline{c}_a) + \omega_m \log(c_{mt}) + \omega_s \log(c_{st} + \overline{c}_s).$$

$\sigma = 1$

Under consumption value added approach: Leontief (homothetic CES) specification

$$u(c_{at}, c_{mt}, c_{st}) = \left(\sum_{i=a,m,s} \omega_i^{\frac{1}{\sigma}} c_{it}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}.$$

$\sigma < 1, \ \overline{c}_i = 0$

Final Consumption Expenditure

Method

Classify The Expenditures Into Three Sectors

Individual commodities

- Agriculture
- Manufacturing
- Services

Nonhomotheticty

Structure transformation——Share——

- Income $\overline{C}_i$
- Price σ

Structure

1.Implement the Final Consumption Expenditure Specification

--data

--the pattern of structural transformation

--select the parameters of the utility specification

2.Results with Final Consumption Expenditure

--three different specifications

3. Income versus Price Effects with Final Consumption Expenditure

--What factor plays a major role?

Model

Empirical Work:

$$s_{it} \equiv \frac{p_{it}\, c_{it}}{C_t} = \frac{\omega_i\, p_{it}^{1-\sigma}}{\sum_{j=a,m,s} \omega_j\, p_{jt}^{1-\sigma}} \left(1 + \sum_{j=a,m,s} \frac{p_{jt}\, \overline{c}_j}{C_t}\right) - \frac{p_{it}\, \overline{c}_i}{C_t}.$$

Given: S_{it}, C_t, p_{it}

Estimate the parameters in the utility function

Implement the Final Consumption Expenditure Specification

1.Data

Required data: 1.total consumption

2.expenditure shares

3.prices

final consumption expenditure

chain-weighted consumption quantities

chain-weighted prices

$$s_{it} \equiv \frac{p_{it}\, c_{it}}{C_t} = \frac{\omega_i\, p_{it}^{1-\sigma}}{\sum_{j=a,m,s} \omega_j\, p_{jt}^{1-\sigma}} \left(1 + \sum_{j=a,m,s} \frac{p_{jt}\, \overline{c}_j}{C_t}\right) - \frac{p_{it}\, \overline{c}_i}{C_t}.$$

Period:1947-2010

Resources: BEA(the Bureau of Economic Analysis)

Processing:

1.Assign the commodity to three sectors

2.Aggragate the chain-weighted quantities

Implement the Final Consumption Expenditure Specification

2.The pattern of structural transformation--Shares

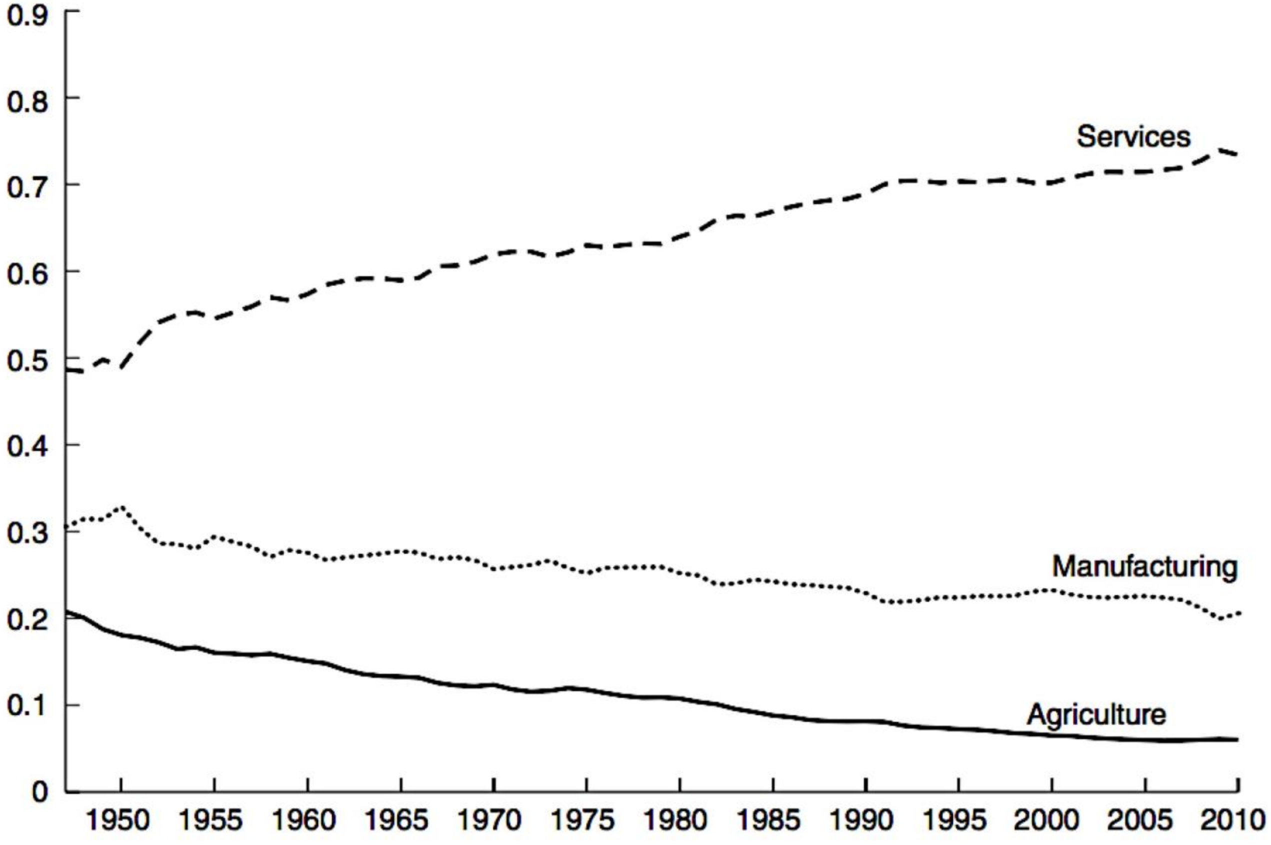


FIGURE 1. EXPENDITURE SHARES

Implement the Final Consumption Expenditure Specification

2.The pattern of structural transformation---Prices

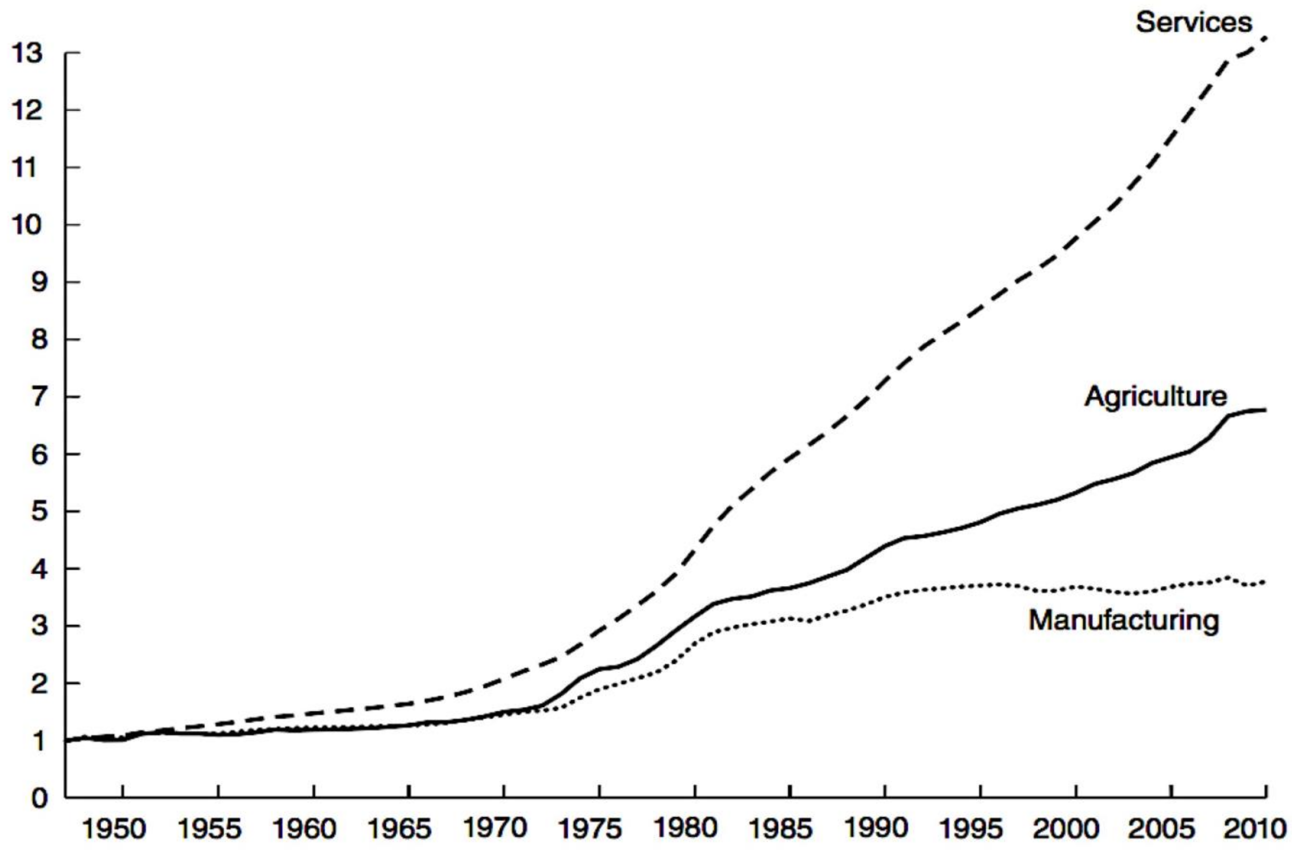


FIGURE 2. PRICE INDICES (1947 = 1)

Implement the Final Consumption Expenditure Specification

2.The pattern of structural transformation---Quantities

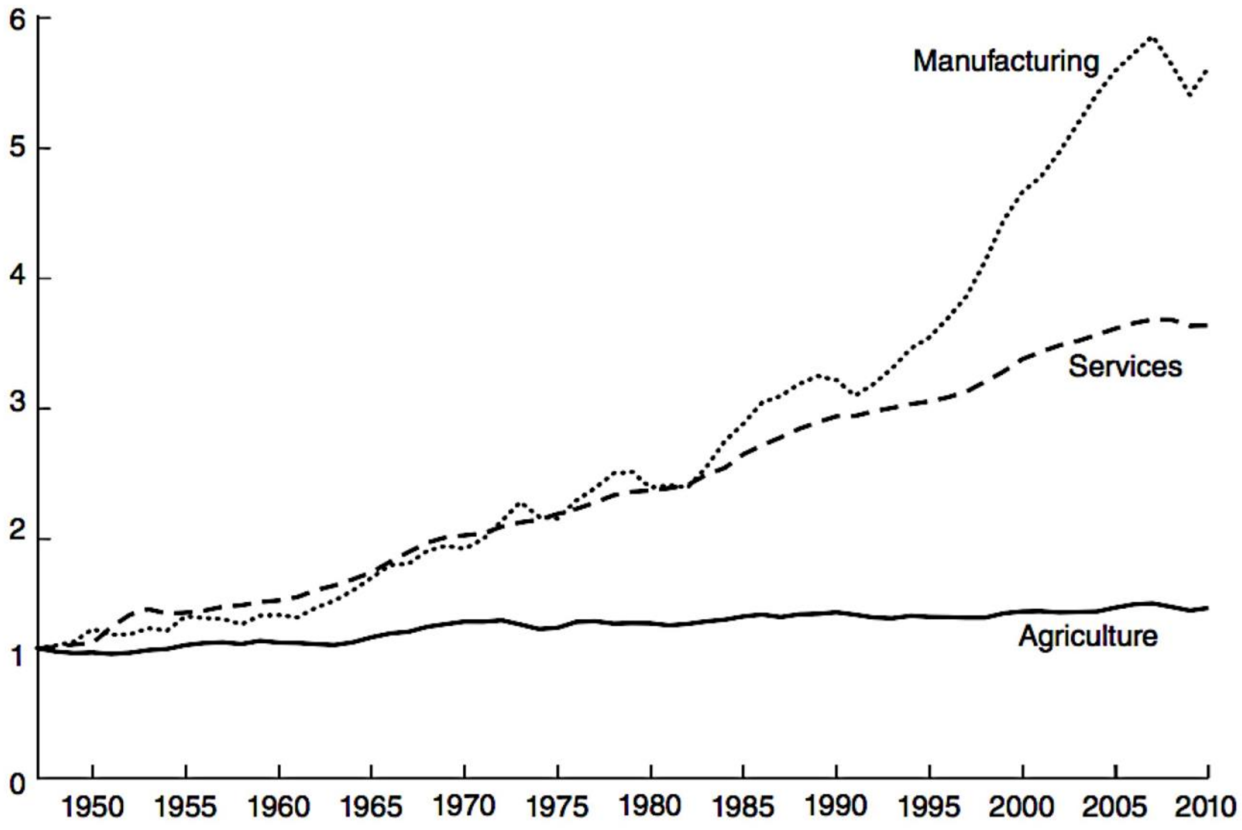


FIGURE 3. QUANTITY INDICES (2005 *chained dollars*, 1947 = 1)

Implement the Final Consumption Expenditure Specification

3. Select the parameters of the utility specification

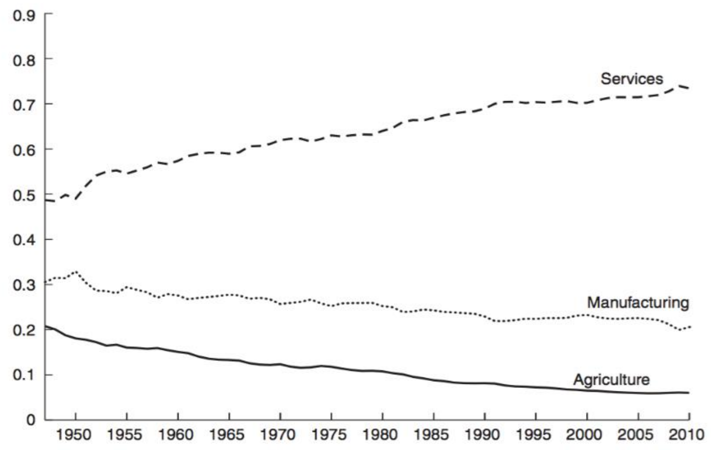
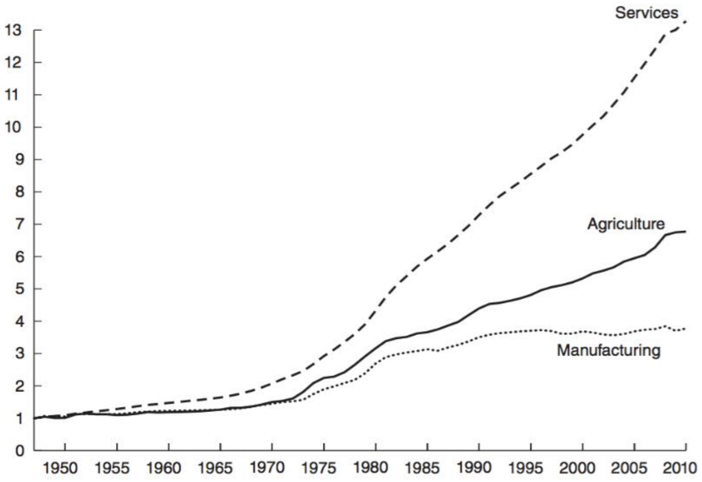


FIGURE 1. EXPENDITURE SHARES



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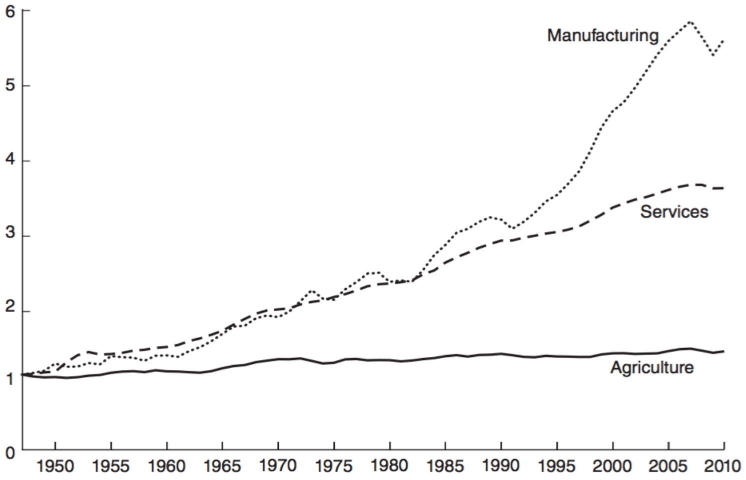

FIGURE 3. QUANTITY INDICES (2005 *chained dollars*, 1947 = 1)

1.For services and agriculture---$\bar{c}_a<0/\bar{c}_s>0$
2.For agriculture and manufacturing---$\sigma=1$

$$p_{at}\,\bar{c}_a + p_{st}\,\bar{c}_s = 0,$$

Results with Final Consumption Expenditure

1.Regression method

Iterated feasible generalized nonlinear least square estimation

2.Parameter

Transform the constrained parameter to unconstrained ones

$$\sigma = e^{b_0}, \quad \omega_a = \frac{1}{1 + e^{b_1} + e^{b_2}}, \quad \omega_m = \frac{e^{b_1}}{1 + e^{b_1} + e^{b_2}}, \quad \omega_m = \frac{e^{b_2}}{1 + e^{b_1} + e^{b_2}};$$

Results with Final Consumption Expenditure

TABLE 1—RESULTS WITH FINAL CONSUMPTION EXPENDITURE

	(1)	(2)	(3)
σ	0.85**	1	0.89**
	(0.06)	—	(0.02)
$\overline{c}_a$	−1,350.38**	−1,315.99**	
	(31.18)	(26.48)	
$\overline{c}_s$	11,237.40**	19,748.22**	
	(2,840.77)	(1,275.69)	
ω_a	0.02**	0.02**	0.11**
	(0.001)	(0.001)	(0.005)
ω_m	0.17**	0.15**	0.24**
	(0.01)	(0.004)	(0.03)
ω_s	0.81**	0.84**	0.65**
	(0.01)	(0.005)	(0.01)
$\chi^2(\overline{c}_a = 0, \overline{c}_s = 0)$	3,866.73**	4,065.33**	
AIC	−932.55	−931.35	−666.03
$RMS\ E_a$	0.004	0.004	0.040
$RMS\ E_m$	0.009	0.009	0.022
$RMS\ E_S$	0.010	0.011	0.061

Notes: χ^2 is the Wald Test Statistics for the hypothesis that $\overline{c}_a$ and $\overline{c}_s = 0$ are jointly zero. AIC is the Akaike information criterion, $RMS\ E_i$ is the root mean squared error for equation i. Robust standard errors in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Results with Final Consumption Expenditure

1.First specification(no restrictions)

$$u(c_{at}, c_{mt}, c_{st}) = \left(\sum_{i=a,m,s} \omega_i^{\frac{1}{\sigma}}(c_{it} + \overline{c}_i)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \quad \overline{c}_a < 0 \text{ and } \overline{c}_s > 0.$$

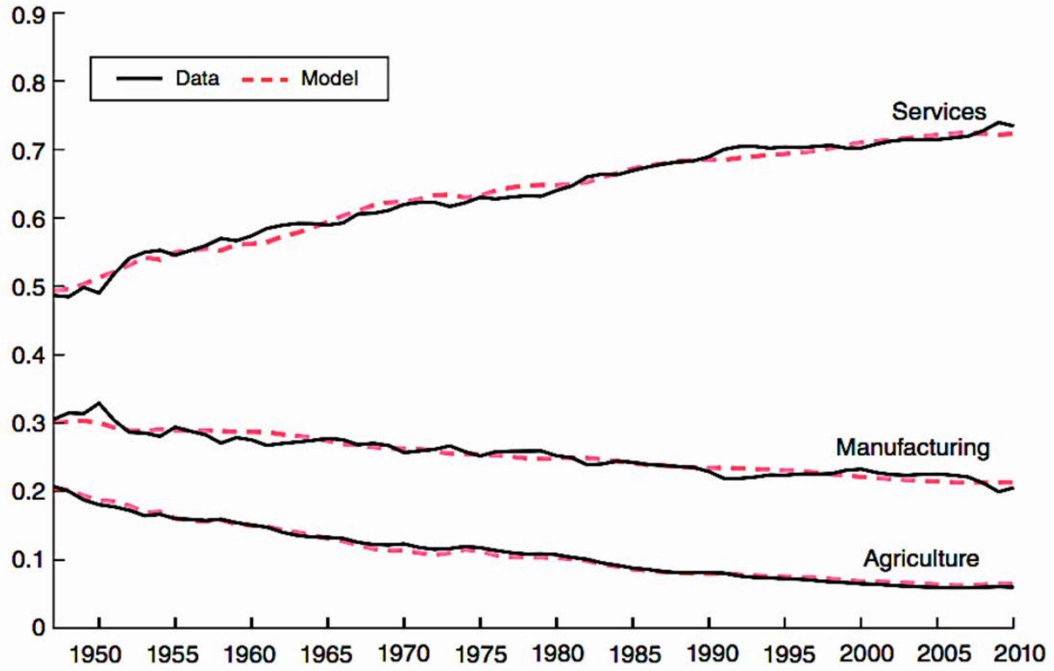

FIGURE 4. FIT OF COLUMN 1

TABLE 1—RESULTS WITH FINAL CONSUM

	(1)
σ	0.85**
	(0.06)
$\overline{c}_a$	−1,350.38**
	(31.18)
$\overline{c}_s$	11,237.40**
	(2,840.77)
ω_a	0.02**
	(0.001)
ω_m	0.17**
	(0.01)
ω_s	0.81**
	(0.01)
$\chi^2(\overline{c}_a = 0, \overline{c}_s = 0)$	3,866.73**
AIC	−932.55
$RMS\ E_a$	0.004
$RMS\ E_m$	0.009
$RMS\ E_S$	0.010

Results with Final Consumption Expenditure

2.Second specification(σ=1)

$$u(c_{at}, c_{mt}, c_{st}) = \omega_a \log(c_{at} + \overline{c}_a) + \omega_m \log(c_{mt}) + \omega_s \log(c_{st} + \overline{c}_s).$$

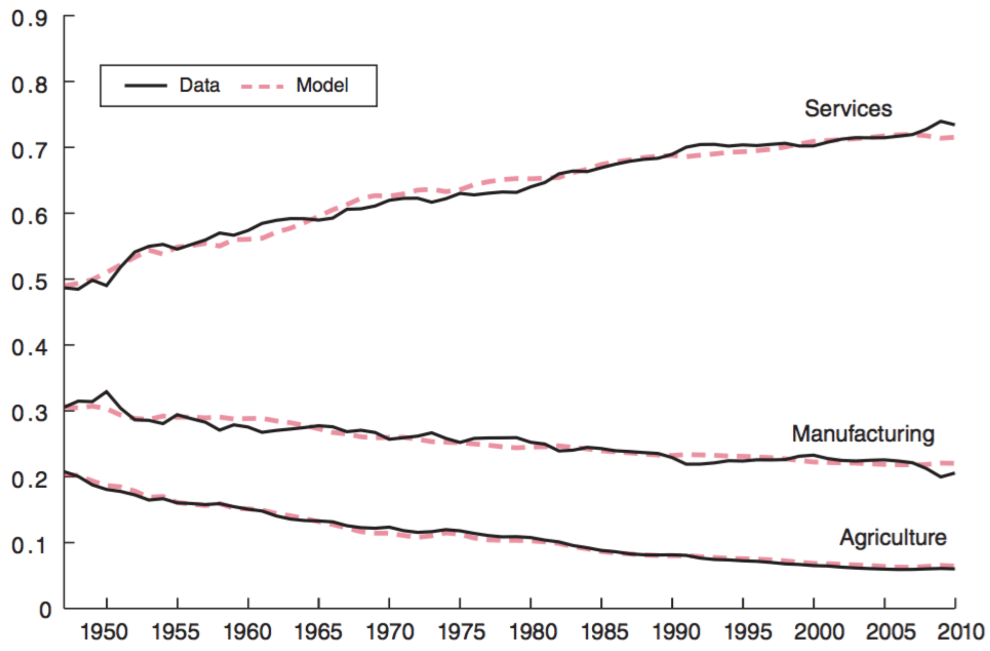

Figure 5. Fit of Column 2

Table 1—Results with Final Consumption Expenditure

	(1)	(2)	(3)
σ	0.85**	1	0.89**
	(0.06)	—	(0.02)
$\overline{c}_a$	−1,350.38**	−1,315.99**	
	(31.18)	(26.48)	
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AIC	−932.55	−931.35	−666.03
RMS E_a	0.004	0.004	0.040
RMS E_m	0.009	0.009	0.022
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Notes: χ^2 is the Wald Test Statistics for the hypothesis that $\overline{c}_a$ and $\overline{c}_s = 0$ are jointly zero. AIC is the Akaike information criterion, *RMS* E_i is the root mean squared error for equation i. Robust standard errors in parentheses.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Results with Final Consumption Expenditure

3.Other tests

$\bar{C}_s$=0

$\bar{C}_a$=0

TABLE 1—RESULTS WITH FINAL CONSUMPTION EXPENDITURE

	(1)	(2)	(3)
σ	0.85**	1	0.89**
	(0.06)	—	(0.02)
$\bar{c}_a$	−1,350.38**	−1,315.99**	
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Notes: χ^2 is the Wald Test Statistics for the hypothesis that $\bar{c}_a$ and $\bar{c}_s = 0$ are jointly zero. AIC is the Akaike information criterion, *RMS* E_i is the root mean squared error for equation *i*. Robust standard errors in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Income versus Price Effects

1.The size of the estimated terms

TABLE 2—NONHOMOTHETICITY TERMS RELATIVE TO FINAL CONSUMPTION EXPENDITURE FROM THE DATA

	1947	2010
$-p_a\bar{c}_a/C$	0.17	0.04
$p_s\bar{c}_s/C$	0.73	0.32
$-\bar{c}_a/c_a$	0.81	0.62
$\bar{c}_s/c_s$	1.49	0.43

Income effects could play an important role.

Income versus Price Effects

2.Counterfactual exploration (relative prices remain constant, income changes as dictated by the data)

The fit of the expenditure shares

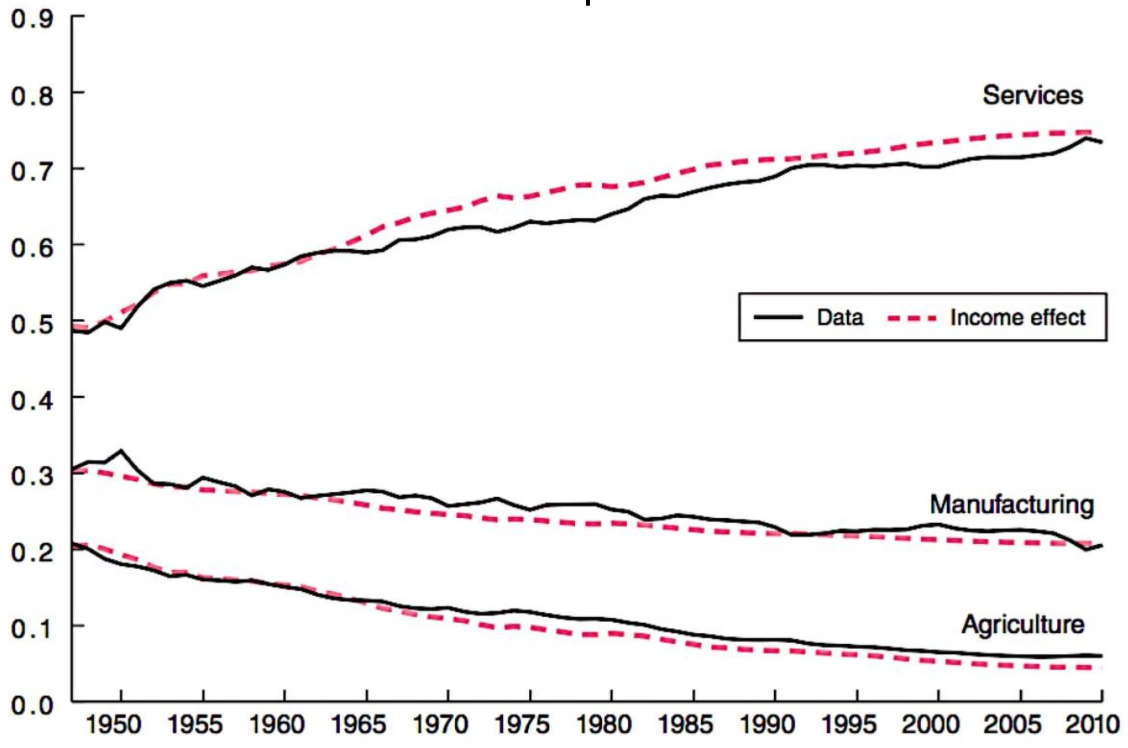

FIGURE 6. FIT OF COLUMN 1 WITH RELATIVE PRICES FIXED AT 1947 VALUES

Income Effect

Income Effect+Price Effect

Income versus Price Effects

2.Counterfactual exploration (income remain constant, relative prices change as dictated by the data)

The fit of the expenditure shares

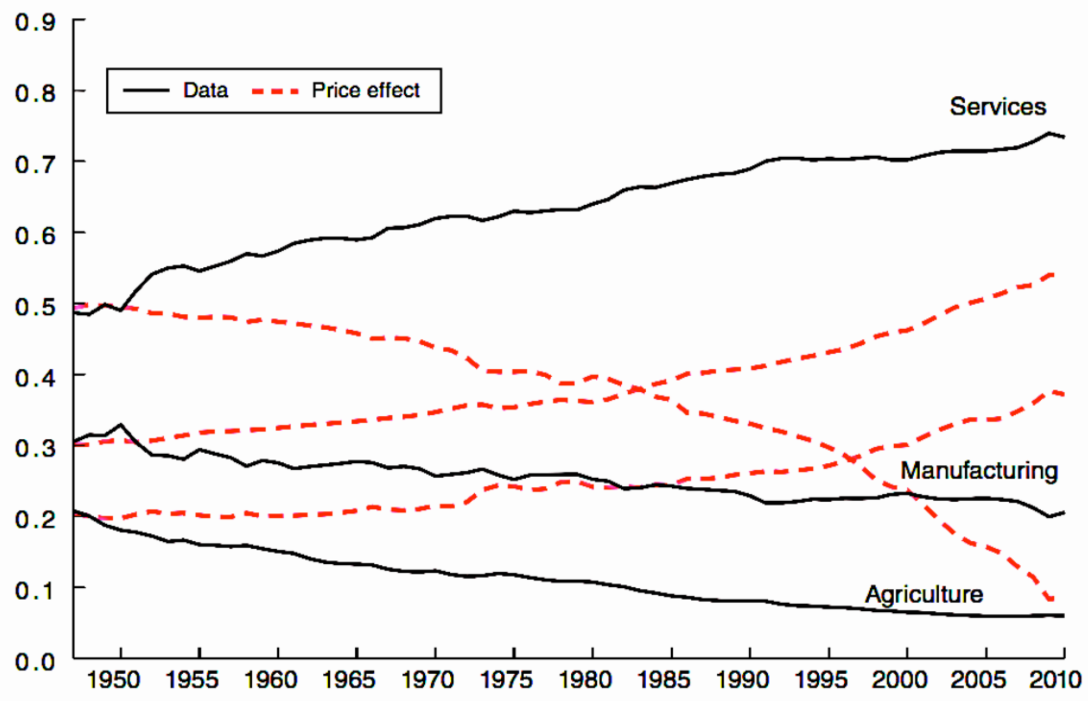

FIGURE 7. FIT OF COLUMN 1 WITH INCOME FIXED AT 1947 VALUES

Income versus Price Effects

3.To which extent a homothetic specification can fit the data

Third specification($\bar{C}_a$=0 $\bar{C}_s$=0)

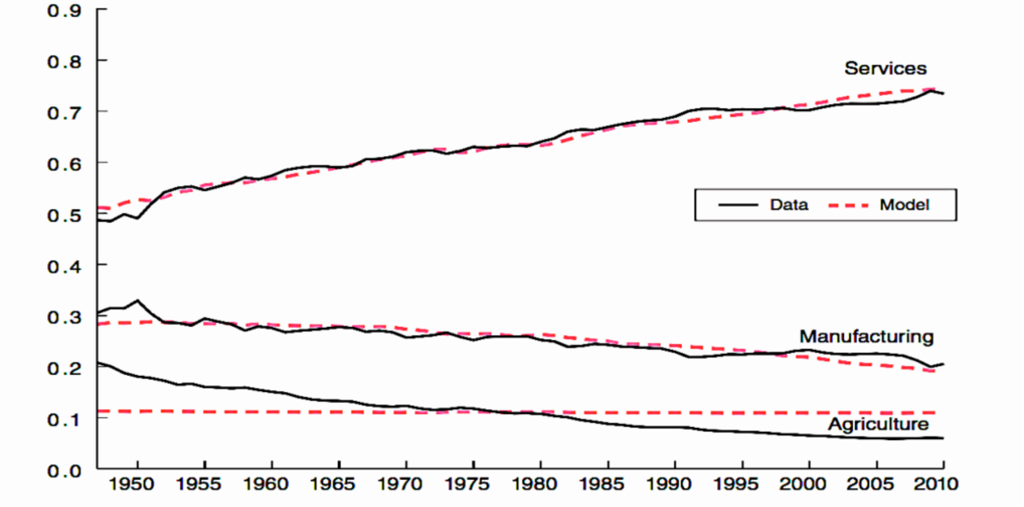

FIGURE 8. FIT OF HOMOTHETIC SPECIFICATION IN COLUMN 3

TABLE 1—RESULTS WITH FINAL CONSUMPTION EXPENDITURE

	(1)	(2)	(3)
σ	0.85**	1	0.89**
	(0.06)	—	(0.02)
$\bar{c}_a$	−1,350.38**	−1,315.99**	
	(31.18)	(26.48)	
$\bar{c}_s$	11,237.40**	19,748.22**	
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	(0.001)	(0.001)	(0.005)
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ω_s	0.81**	0.84**	0.65**
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$\chi^2(\bar{c}_a = 0, \bar{c}_s = 0)$	3,866.73**	4,065.33**	
AIC	−932.55	−931.35	−666.03
RMS E_a	0.004	0.004	0.040
RMS E_m	0.009	0.009	0.022
RMS E_S	0.010	0.011	0.061

Notes: χ^2 is the Wald Test Statistics for the hypothesis that $\bar{c}_a$ and $\bar{c}_s = 0$ are jointly zero. AIC is the Akaike information criterion, *RMS* E_i is the root mean squared error for equation i. Robust

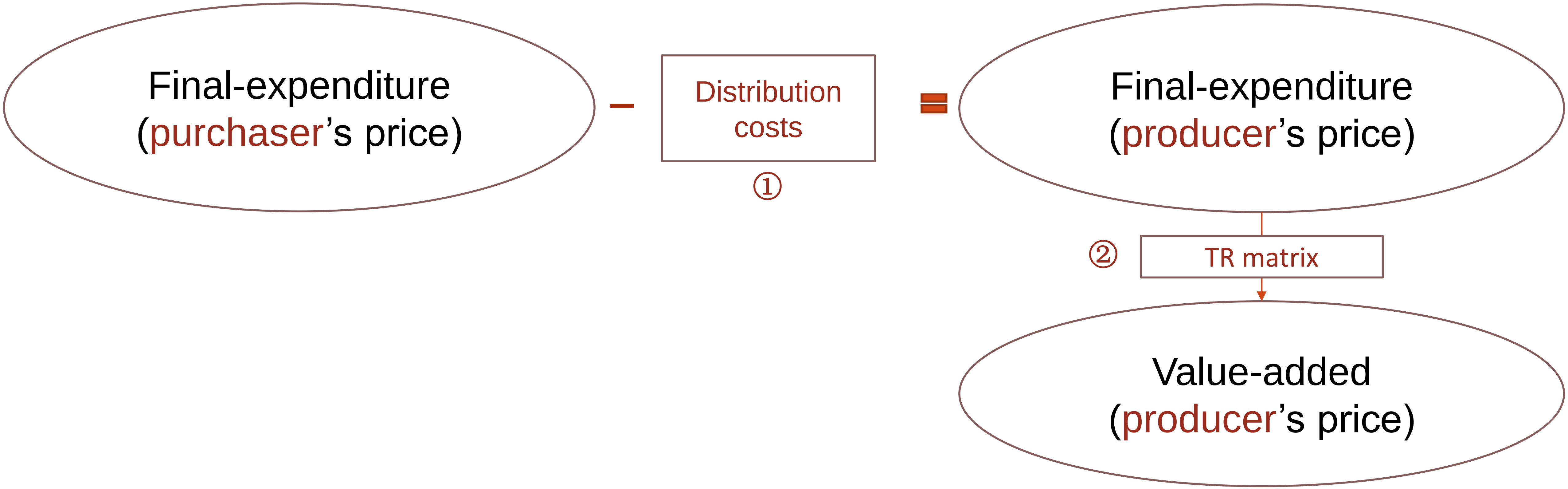
Nonhomotheticties could play an important role.

Consumption Value Added

A. Implementing the Consumption Value-added Specification

Constructing Relevant Data

- Constructing final expenditure in producer's prices



A. Implementing the Consumption Value-added Specification

Constructing the relevant data

- Linking consumption expenditure to value added

Intermediate
final

Before 1972 （n commodities , n industries）	After 1972（m commodities , n industries）
$\left.\begin{aligned} \mathbf{q} &= \mathbf{A}\mathbf{g} + \mathbf{e}, \\ \mathbf{q} &= \mathbf{g}. \end{aligned}\right\}$ $\mathbf{g} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{e}$ $\downarrow$ $\mathbf{R} \equiv (\mathbf{I} - \mathbf{A})^{-1}$ **q:** Commodities output **g**: Industry output	$\left.\begin{aligned} \mathbf{q} &= \mathbf{B}\mathbf{g} + \mathbf{e}, \\ \mathbf{g} &= \mathbf{W}\mathbf{q}. \end{aligned}\right\}$ $\mathbf{g} = \mathbf{W}(\mathbf{I} - \mathbf{B}\mathbf{W})^{-1}\mathbf{e}.$ $\downarrow$ $\mathbf{R} \equiv \mathbf{W}(\mathbf{I} - \mathbf{B}\mathbf{W})^{-1}$

③
Value-added

$\mathbf{va} = \langle \mathbf{v} \rangle \mathbf{R}\mathbf{e}$

②
Final-expenditure

Consumption value added

$\mathbf{c} = \langle \mathbf{v} \rangle \mathbf{R}\mathbf{e}_c$

Final consumption expenditure

A. Implementing the Consumption Value-added Specification

The pattern of structural transformation---shares

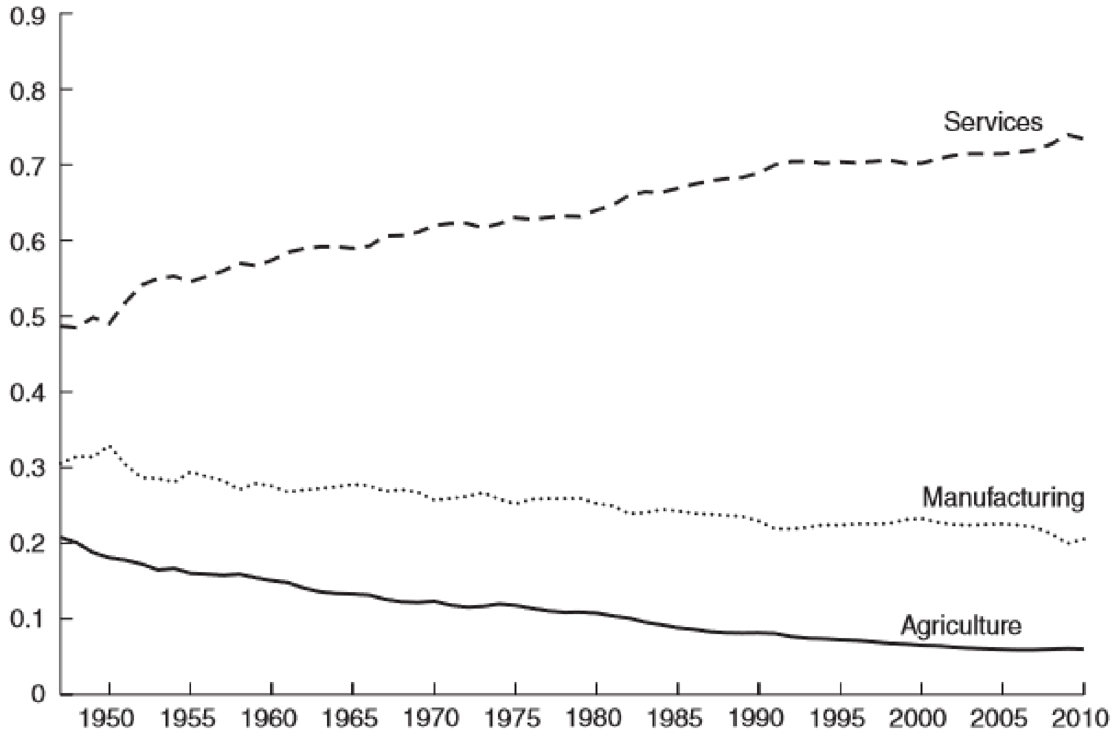


FIGURE 1. EXPENDITURE SHARES

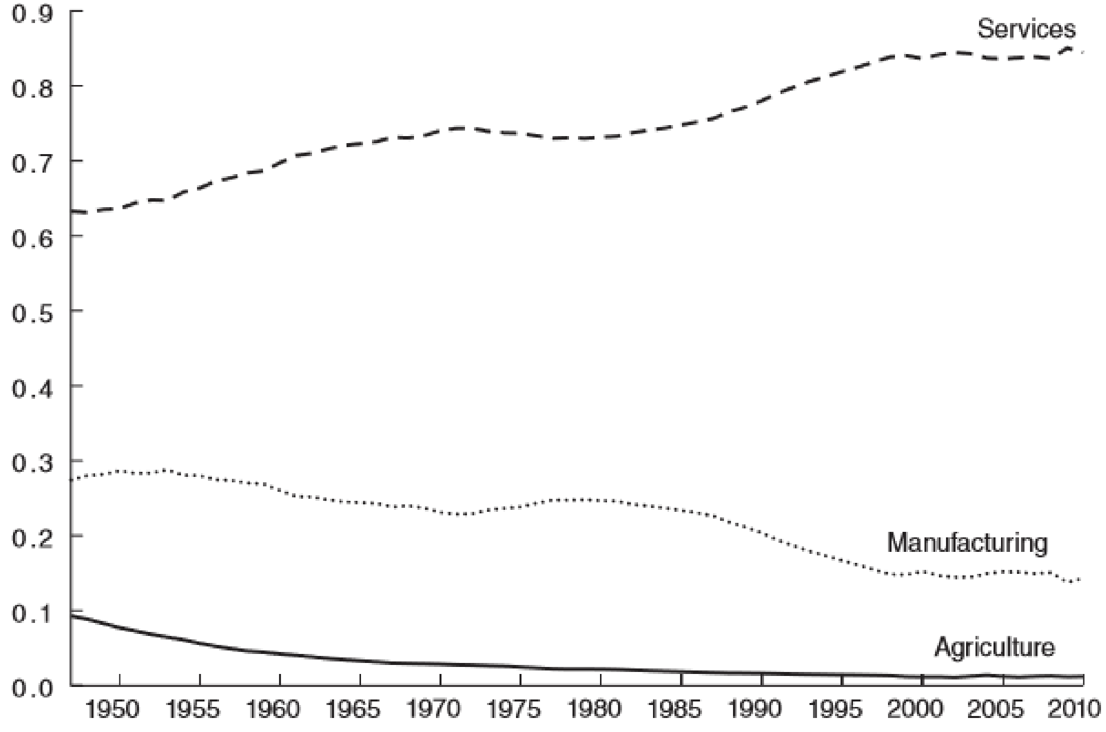


FIGURE 9. EXPENDITURE SHARES

Final consumption expenditure

Consumption value added

A. Implementing the Consumption Value-added Specification

The pattern of structural transformation---price

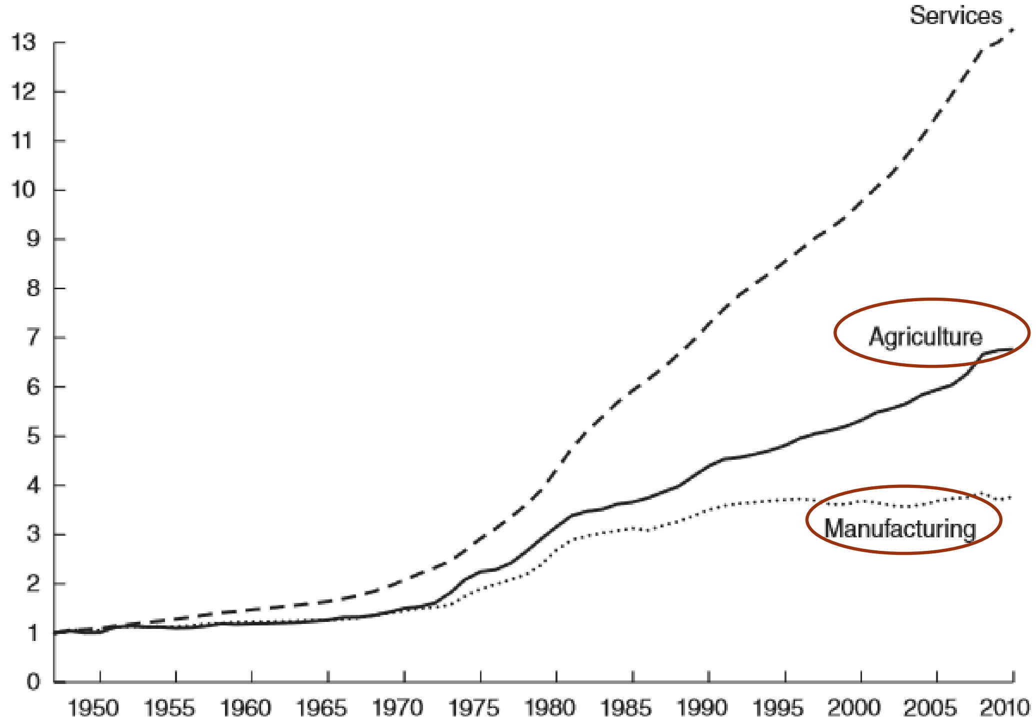


FIGURE 2. PRICE INDICES (1947 = 1)

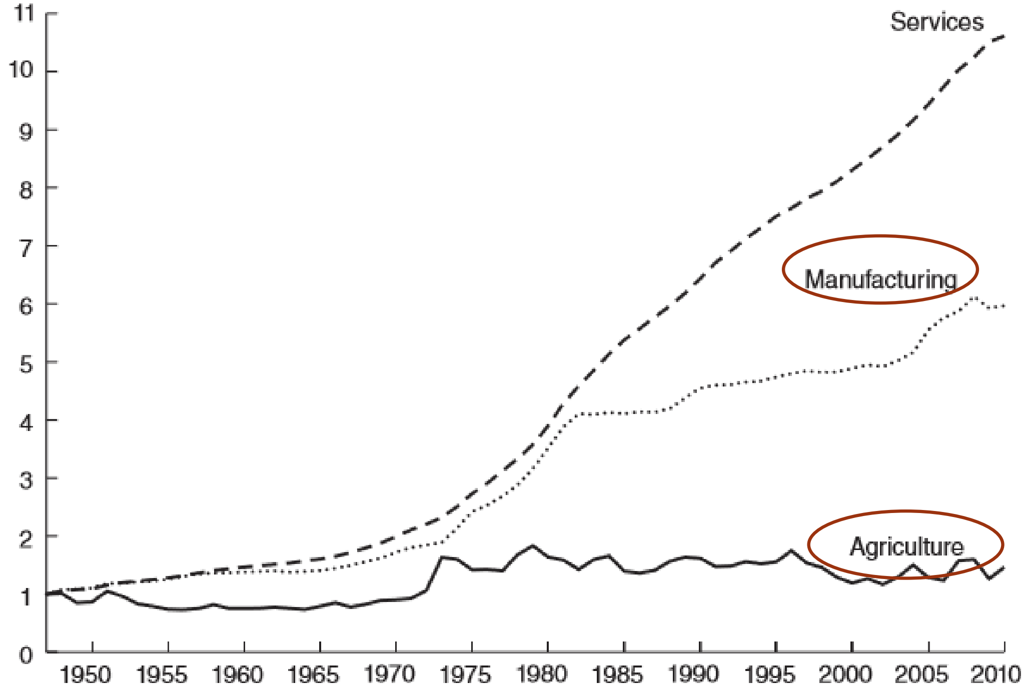


FIGURE 10. PRICE INDICES (1947 = 1)

Final consumption expenditure

Consumption value added

A. Implementing the Consumption Value-added Specification

The pattern of structural transformation---quantity

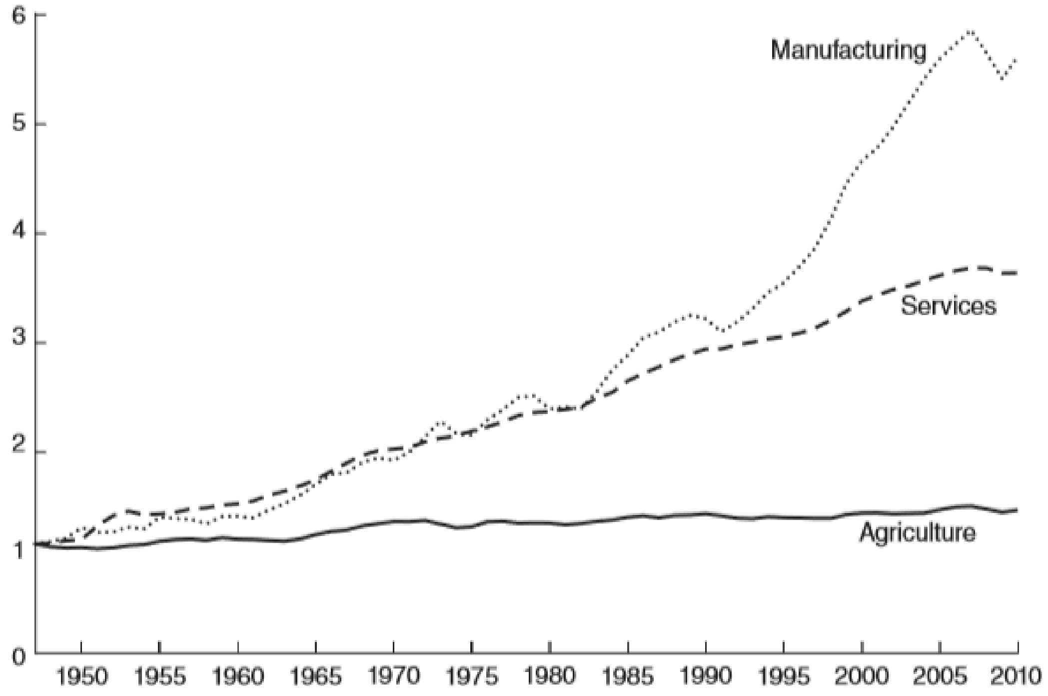


FIGURE 3. QUANTITY INDICES (2005 *chained dollars*, 1947 = 1)

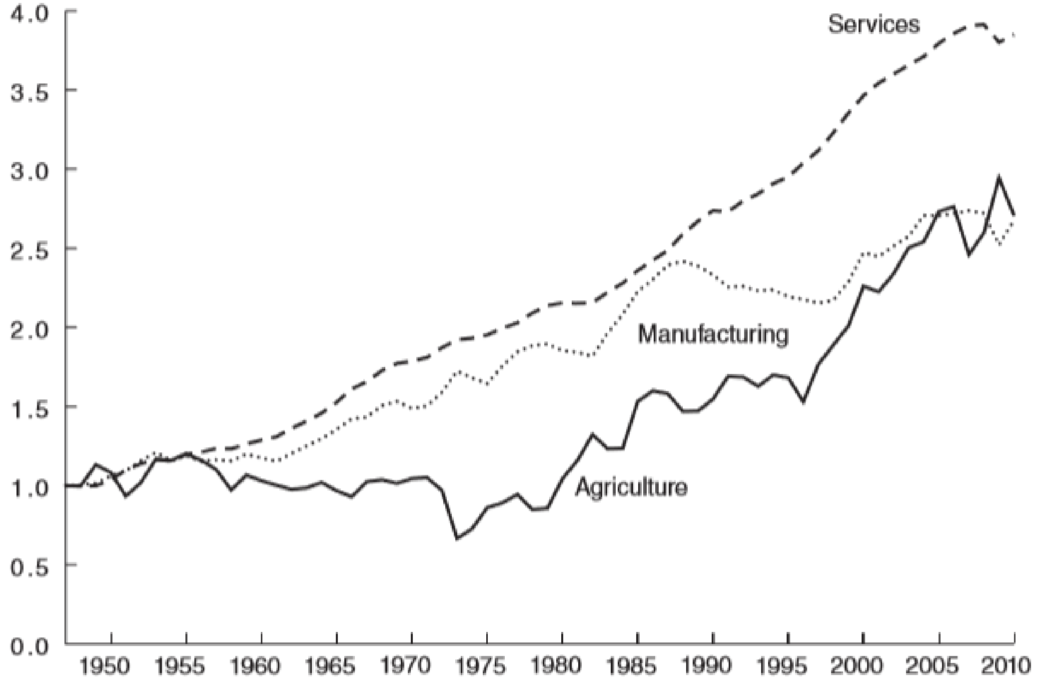


FIGURE 11. QUANTITY INDICES (2005 *chained dollars*, 1947 = 1)

Final consumption expenditure

Consumption value added

B. Results with Consumption Value Added

TABLE 3—RESULTS WITH CONSUMPTION VALUE ADDED

	(1)	(2)	(3)
σ	0.002	0	0
	(0.001)	—	—
$\overline{c}_a$	−138.68**	−138.88**	
	(4.57)	(16.04)	
$\overline{c}_s$	4,261.82**	4,268.06**	
	(223.78)	(439.93)	
ω_a	0.002**	0.002**	0.01**
	(0.0002)	(0.001)	(0.001)
ω_m	0.15**	0.15**	0.18**
	(0.002)	(0.004)	(0.002)
ω_s	0.85**	0.85**	0.81**
	(0.002)	(0.004)	(0.003)
$\chi^2(\overline{c}_a = 0, \overline{c}_s = 0)$	1,424.50**	216.30**	
AIC	−837.27	−875.36	−739.35
RMS E_a	0.005	0.005	0.010
RMS E_m	0.012	0.012	0.019
RMS E_S	0.011	0.011	0.024

Notes: χ^2 is the Wald Test Statistics for the hypothesis that $\overline{c}_a$ and $\overline{c}_s = 0$ are jointly zero. AIC is the Akaike information criterion; *RMS* E_i is the root mean squared error for equation i. Robust standard errors in parentheses.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

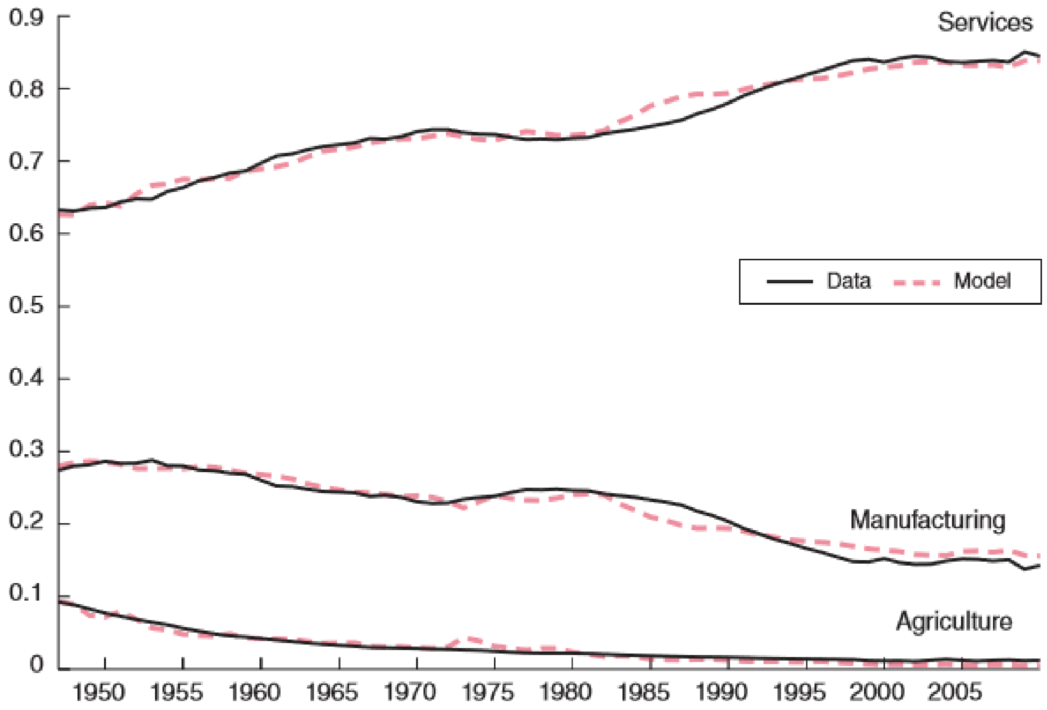


FIGURE 12. FIT OF COLUMN 2

$$u(c_{at}, c_{mt}, c_{st}) = \left(\sum_{i=a,m,s} \omega_i^{\frac{1}{\sigma}} c_{it}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}.$$

C. Income versus Price Effects with Consumption Value Added

TABLE 2—NONHOMOTHETICITY TERMS RELATIVE TO FINAL CONSUMPTION EXPENDITURE FROM THE DATA

	1947	2010
$-p_a\bar{c}_a/C$	0.17	0.04
$p_s\bar{c}_s/C$	0.73	0.32
$-\bar{c}_a/c_a$	0.81	0.62
$\bar{c}_s/c_s$	1.49	0.43

Final consumption expenditure

TABLE 4—NONHOMOTHETICITY TERMS RELATIVE TO FINAL CONSUMPTION FROM THE DATA

	1947	2010
$-p_a\bar{c}_a/C$	0.08	0.004
$p_s\bar{c}_s/C$	0.34	0.12
$-\bar{c}_a/c_a$	0.86	0.32
$\bar{c}_s/c_s$	0.53	0.14

Consumption value added

C. Income versus Price Effects with Consumption Value Added

Assess the importance of income and substitution effects

- Restriction: $\overline{c_a} = \overline{c_s} = 0$

$$u(c_{at}, c_{mt}, c_{st}) = \left(\sum_{i=a,m,s} \omega_i^{\frac{1}{\sigma}} c_{it}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}.$$

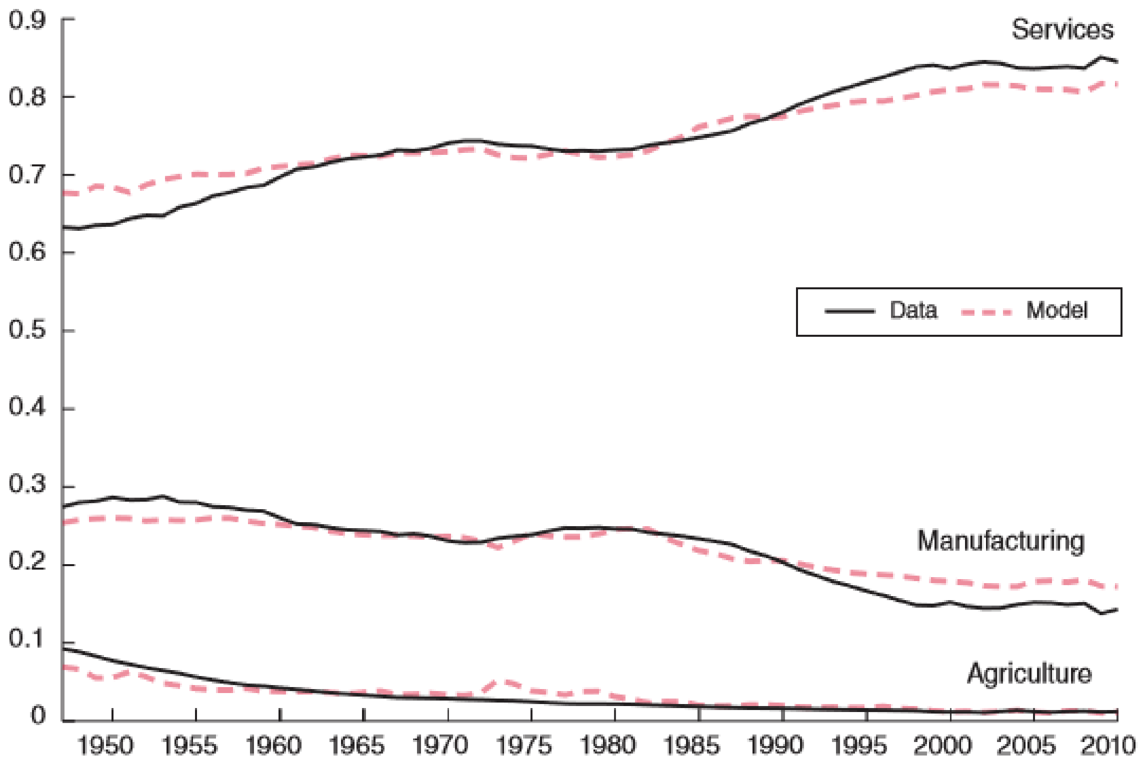


Figure 13. Fit of Homothetic Specification in Column 3

C. Income versus Price Effects with Consumption Value Added

- Counterfactual exercises (Fixed relative prices & Changing income)

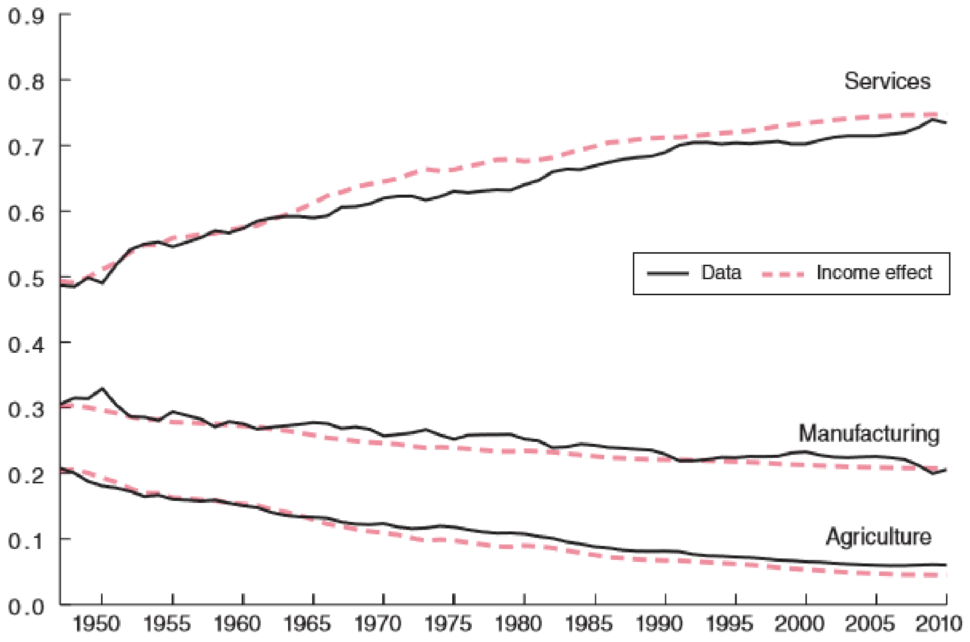


FIGURE 6. FIT OF COLUMN 1 WITH RELATIVE PRICES FIXED AT 1947 VALUES

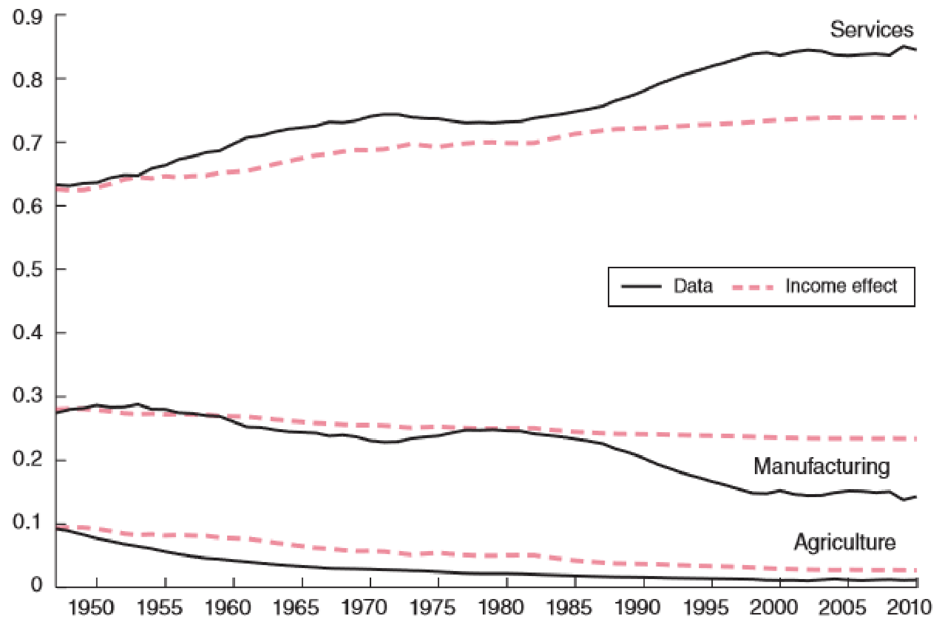


FIGURE 14. FIT OF COLUMN 2 WITH PRICES FIXED AT 1947 VALUE

Final consumption expenditure

Consumption value added

C. Income versus Price Effects with Consumption Value Added

- Counterfactual exercises (Fixed income & Changing relative price)

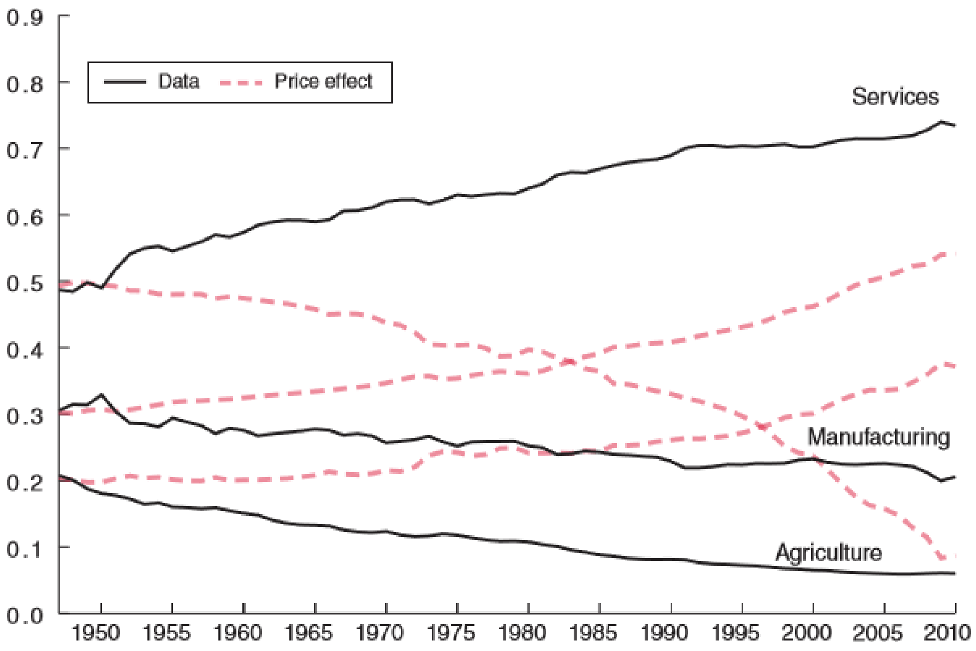


FIGURE 7. FIT OF COLUMN 1 WITH INCOME FIXED AT 1947 VALUES

Final consumption expenditure

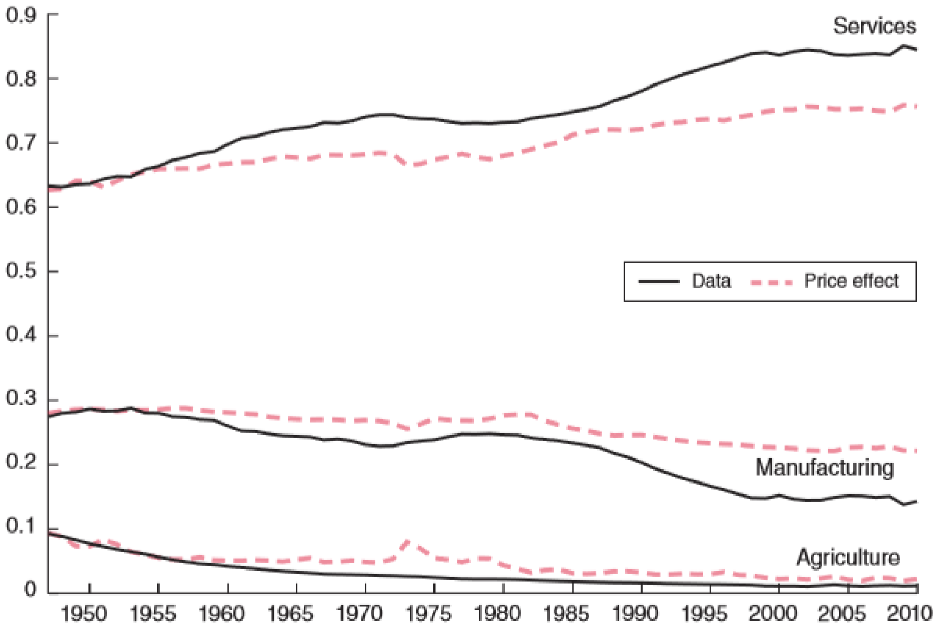


FIGURE 15. FIT OF COLUMN 2 WITH INCOME FIXED AT 1947 VALUE

Consumption value added

D. Summary

- One contribution:

A procedure to extract the consumption component from the total value added in each sector.

- One conclusion:

In the case of consumption value-added:

Income effects are less important and relative price effects are found to play a key role.

DISCUSSION

A. COMPARE THE RESULTS

B. ADDITIONAL MEASUREMENT ISSUES

A. Compare the results - intuition

- **The difference between final consumption expenditure specification and value-added specification**

- Take food from supermarkets and meals from restaurants for example.

- The substitutability in the final consumption expenditure is greater.

- The nonhomotheticities are less apparent in the consumption value-added specification.

A. Comparing the results – formal analysis

The CES production functional form:

$$c_{it}^{FE} = \left[\sum_{j\in\{a,m,s\}} \left(A_{it}\phi_{ji}\right)^{\frac{1}{\eta_i}} \left(c_{jit}^{VA}\right)^{\frac{\eta_i - 1}{\eta_i}}\right]^{\frac{\eta_i}{\eta_i - 1}}$$

c_{jit}^{VA} is the value added from sector j that is used as an intermediate input in the production of the final consumption good c_{it}^{FE}

A_{it} determines the TFP of producing final consumption of category i

ϕ_{ji} are relative weights with $\sum_j \phi_{ji} = 1$

$\eta_i > 0$ is the elasticity of substitution

A. Comparing the results – formal analysis

The static optimization problem:

$$\min_{c_{jit}^{VA}} c_{it}^{FE} = \left[\sum_{j \in \{a,m,s\}} \left(A_{it} \phi_{ji} \right)^{\frac{1}{\eta_i}} \left(c_{jit}^{VA} \right)^{\frac{\eta_i - 1}{\eta_i}} \right]^{\frac{\eta_i}{\eta_i - 1}}$$

s.t. $\sum_{j \in \{a,m,s\}} c_{jit}^{VA} p_{it}^{VA} = p_{it}^{FE} c_{it}^{FE}$

A. Comparing the results – formal analysis

$$c_{jit}^{VA} p_{jt}^{VA} = \frac{\phi_{ji}\left(p_{jt}^{VA}\right)^{1-\eta_i}}{\sum_{n\in\{a,m,s\}} \phi_{jn}(p_{nt}^{VA})^{1-\eta_i}} p_{it}^{FE} c_{it}^{FE} \quad (1)$$

Aggregating the demands for c_{jit}^{VA} to the demand for c_{jt}^{VA}

$$c_{jt}^{VA} p_{jt}^{VA} = \sum_{i\in\{a,m,s\}} \frac{\phi_{ji}\left(p_{jt}^{VA}\right)^{1-\eta_i}}{\sum_{n\in\{a,m,s\}} \phi_{jn}(p_{nt}^{VA})^{1-\eta_i}} p_{it}^{FE} c_{it}^{FE} \quad (2)$$

A. Comparing the results – formal analysis

$$P_t C_t = \sum_{\mathrm{i} \in \{a,m,s\}} p_{it}^{FE} c_{it}^{FE}$$

$$p_{it}^{FE} = \left[\sum_{n \in \{a,m,s\}} A_{it} \phi_{jn} (p_{nt}^{VA})^{1-\eta_i} \right]^{\frac{1}{\eta_i - 1}}$$

Where $\eta_i = 0$ and $\phi_{ji} = \phi_j \;\; \forall \mathrm{i} \in \{a, m, s\}$

A. Comparing the results – formal analysis

$$c_{jt}^{VA} p_{jt}^{VA} = \sum_{\mathrm{i} \in \{a,m,s\}} \frac{\phi_{ji} \left(p_{jt}^{VA}\right)^{1-\eta_i}}{\sum_{n \in \{a,m,s\}} \phi_{jn} (p_{nt}^{VA})^{1-\eta_i}} p_{it}^{FE} c_{it}^{FE} \quad (2)$$

$$c_{jt}^{VA} p_{jt}^{VA} = \frac{\phi_j p_{jt}^{VA}}{\sum_{n \in \{a,m,s\}} \phi_{\mathrm{n}} p_{nt}^{VA}} \sum_{\mathrm{i} \in \{a,m,s\}} p_{it}^{FE} c_{it}^{FE} = \frac{\phi_j p_{jt}^{VA}}{\sum_{n \in \{a,m,s\}} \phi_{\mathrm{n}} p_{nt}^{VA}} P_t C_t \quad (3)$$

A. Comparing the results – formal analysis

TABLE 5—RESULTS FOR THE ESTIMATION OF (7)

	Agriculture	Manufacturing	Services
η_i	0.19**	0.001	0.001
	(0.03)	(0.001)	(0.0003)
ϕ_{ai}	0.05**	0.02**	0.005**
	(0.002)	(0.001)	(0.0002)
ϕ_{mi}	0.33**	0.36**	0.09**
	(0.003)	(0.002)	(0.001)
ϕ_{si}	0.62**	0.62**	0.90**
	(0.005)	(0.002)	(0.001)
AIC	−657.99	−790.10	−896.63

Notes: AIC is the Akaike information criterion, $RMS\ E_i$ is the root mean squared error for equation i. Robust standard errors in parentheses.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

A. Comparing the results – formal analysis

$$p_{jt}^{VA} c_{jt}^{VA} = \Phi_{jt} \frac{\phi_j p_{jt}^{VA}}{\sum_{n\in\{a,m,s\}} \phi_\mathrm{n} p_{nt}^{VA}} P_t C_t \quad (4)$$

Where

$$\Phi_{jt} = \sum_{\mathrm{i}\in\{a,m,s\}} \left(\frac{\phi_{ij} p_{jt}^{VA}}{\phi_j p_{jt}^{VA}} \frac{\sum_{n\in\{a,m,s\}} \phi_\mathrm{n} p_{nt}^{VA}}{\sum_{n\in\{a,m,s\}} \phi_\mathrm{in} p_{nt}^{VA}} \right) \frac{p_{it}^{FE} c_{it}^{FE}}{P_t C_t}$$

A. Comparing the results – formal analysis

$$c_{jt}^{VA} p_{jt}^{VA} = \frac{\phi_j p_{jt}^{VA}}{\sum_{n\in\{a,m,s\}} \phi_{\mathrm{n}} p_{nt}^{VA}} \sum_{\mathrm{i}\in\{a,m,s\}} p_{it}^{FE} c_{it}^{FE} = \frac{\phi_j p_{jt}^{VA}}{\sum_{n\in\{a,m,s\}} \phi_{\mathrm{n}} p_{nt}^{VA}} P_t C_t \quad (3)$$

B. Additional measurement issues - government

TABLE 6—RESULTS FOR FINAL CONSUMPTION EXPENDITURE AND DIFFERENT SPECIFICATIONS OF GOVERNMENT EXPENDITURES

	$(c_{s\backslash g} + c_g) + \bar{c}_s$		$c_{s\backslash g} + (c_g + \bar{c}_s)$	
	(1)	(2)	(3)	(4)
σ	0.85**	1.00	0.80**	1.00
	(0.06)	—	(0.05)	—
$\bar{c}_a$	−1,350.38**	−1,315.99**	−1,360.93**	−1,314.89**
	(31.18)	(26.48)	(29.83)	(26.40)
$\bar{c}_s$	11,237.40**	19,748.22**	7,254.04**	14,685.83**
	(2,840.77)	(1,275.69)	(1,806.82)	(1,045.21)
ω_a	0.02**	0.02**	0.02**	0.02**
	(0.001)	(0.001)	(0.001)	(0.001)
ω_m	0.17**	0.15**	0.19**	0.16**
	(0.01)	(0.004)	(0.01)	(0.005)
ω_s	0.81**	0.84**	0.79**	0.82**
	(0.01)	(0.005)	(0.01)	(0.01)
Average c_g			5,283.67	5,283.67
AIC	−932.55	−931.35	−856.26	−853.56
$RMS\ E_a$	0.004	0.004	0.030	0.030
$RMS\ E_m$	0.009	0.009	0.066	0.066
$RMS\ E_s$	0.010	0.011	0.095	0.095

Notes: AIC is the Akaike information criterion; $RMS\ E_i$ is the root mean squared error for equation i. Robust standard errors in parentheses.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

B. Additional measurement issues - government

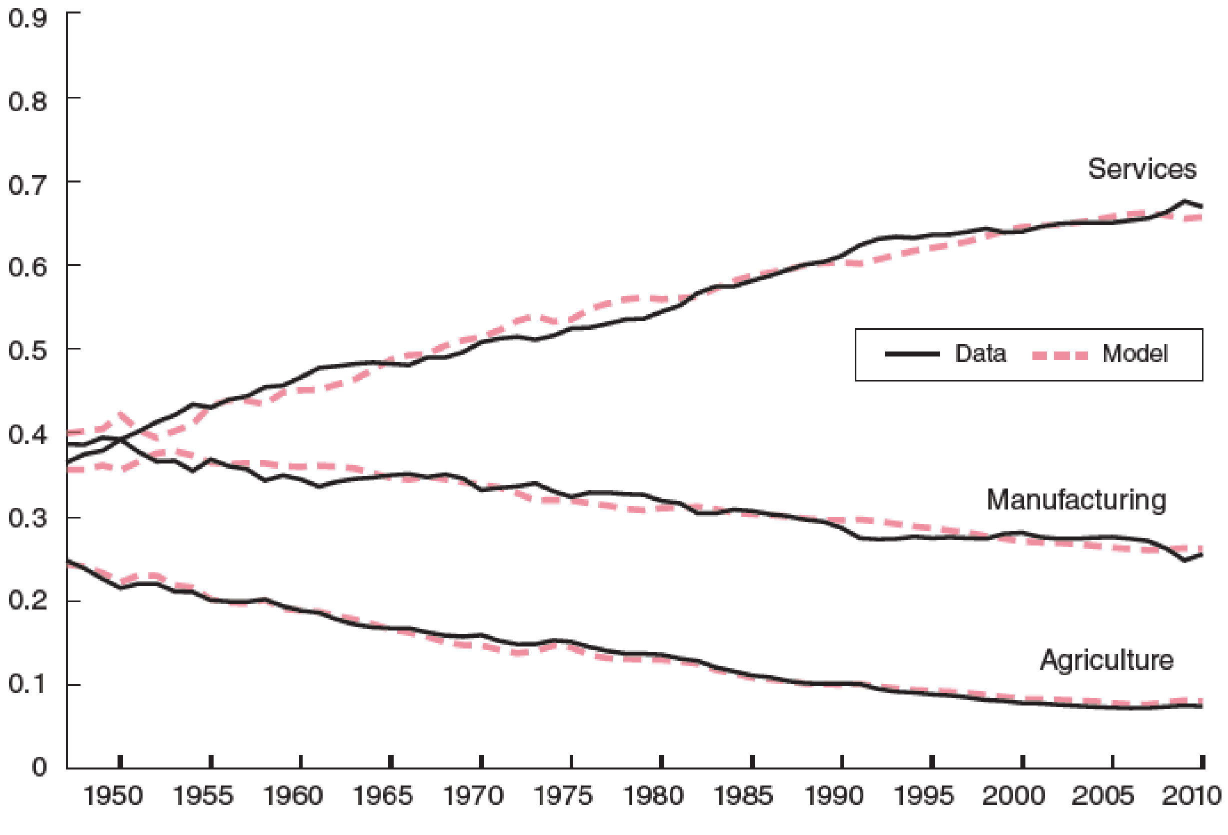


FIGURE 17. FIT OF COLUMN 3

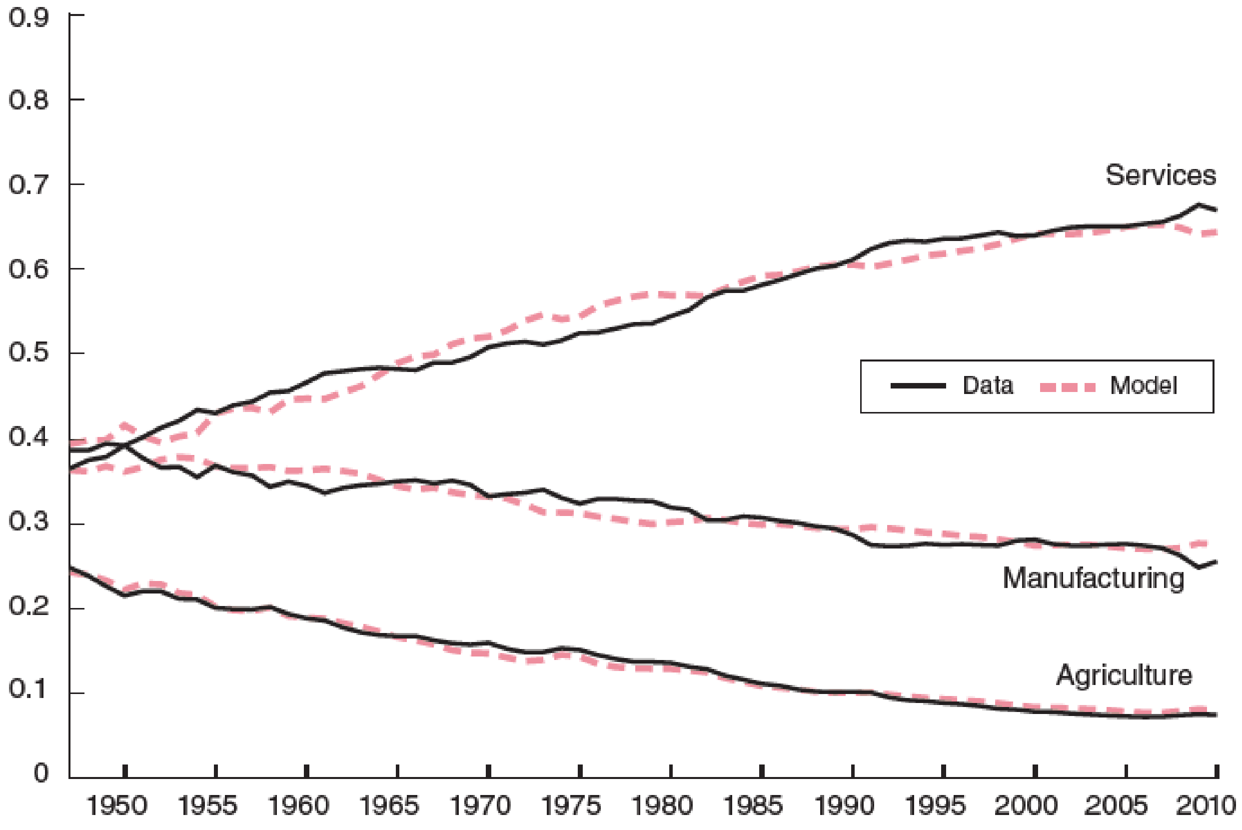


FIGURE 18. FIT OF COLUMN 4

B. Additional measurement issues - government

Table 7—Results for Consumption Value Added and Different Specifications of Government Expenditures

	$(c_{s\backslash g}+c_g)+\bar{c}_s$ (1)	$c_{s\backslash g}+(c_g+\bar{c}_s)$ (2)
σ	0.002	0.001
	(0.001)	(0.001)
$\bar{c}_a$	−138.68**	−140.53**
	(4.57)	(4.33)
$\bar{c}_s$	4,261.82**	5,712.68**
	(223.79)	(225.99)
ω_a	0.002**	0.001**
	(0.0002)	(0.0002)
ω_m	0.15**	0.14**
	(0.002)	(0.002)
ω_s	0.85**	0.86**
	(0.002)	(0.003)
Average c_{ag}		21.02
Average c_{mg}		516.95
Average c_{sg}		3,906.44
AIC	−873.27	−812.14
RMS E_a	0.005	0.008
RMS E_m	0.012	0.023
RMS E_s	0.011	0.026

Notes: AIC is the Akaike information criterion; *RMS* E_i is the root mean squared error for equation i. Robust standard errors in parentheses.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

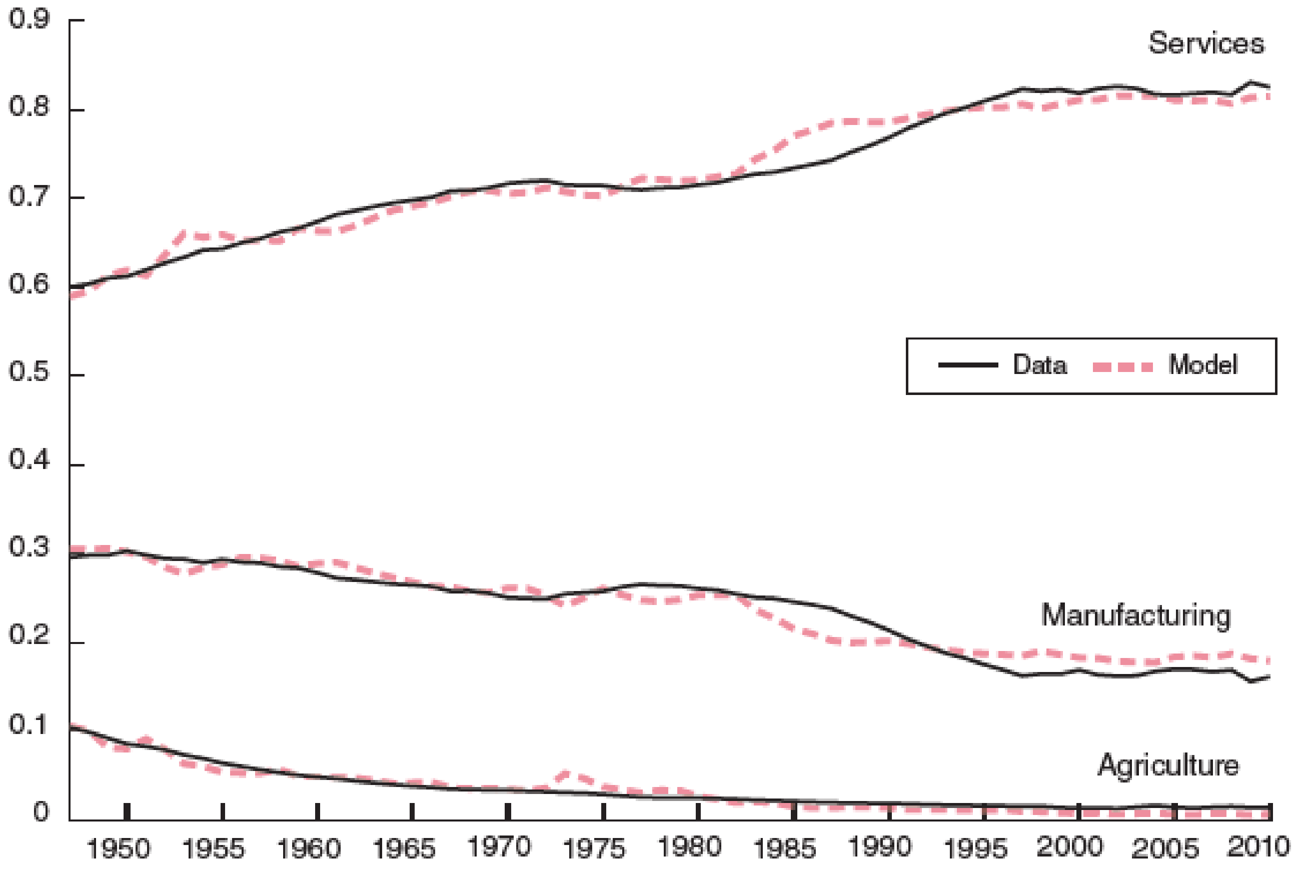


Figure 19. Consumption Value Added and Different Specifications of Government Expenditures: Fit of Column 2

B. Additional measurement issues – unmeasured quality improvements

- If the quality of a consumption category has improved, but this is not measured properly, then the reported price will be larger than the true price, and the reported quantity will be smaller.

- A key limitation of the official data used in our analysis is that effectively no corrections are made to allow for quality improvements in services.

- They provide some illustrative calculations based on the findings of the report by Boskin et al. (1996) on the extent of quality change bias in the CPI during the period 1965–1996。

B. Additional measurement issues – unmeasured quality improvements

TABLE 8—RESULTS FOR FINAL CONSUMPTION EXPENDITURES WITH QUALITY ADJUSTMENT

	Original	Quality adjusted
σ	0.85**	0.90**
	(0.06)	(0.06)
$\overline{c}_a$	−1,350.38**	−1,046.19**
	(31.18)	(31.05)
$\overline{c}_s$	11,237.40**	7,478.75**
	(2,840.77)	(1,403.05)
ω_a	0.02**	0.03**
	(0.001)	(0.001)
ω_m	0.17**	0.18**
	(0.01)	(0.01)
ω_s	0.81**	0.78**
	(0.01)	(0.01)
AIC	−932.55	−924.70
$RMS\ E_a$	0.004	0.005
$RMS\ E_m$	0.009	0.008
$RMS\ E_s$	0.010	0.010

Notes: AIC is the Akaike information criterion; $RMS\ E_i$ is the root mean squared error for equation i. Robust standard errors in parentheses.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

B. Additional measurement issues – home production

- Given that most home production takes the form of services, the parameter $\bar{c}_s$ captures both the presence of home production and a possible nonhomotheticity in the preferences for services.

- Even if only part of $\bar{c}_s$ represents home production, any variation in home production over time would induce variation in the value of $\bar{c}_s$ over time, whereas the empirical work has treated it as constant.

- They assume that $\bar{c}_s$ is time varying with $\bar{c}_{st} = exp(\gamma_t)\bar{c}_s$

CONCLUSION

MAIN FINDINGS

CONTRIBUTIONS

FUTURE EXTENSIONS

Conclusion

- **Main findings & Contributions**

- The first contribution is to clarify that the research requires one for each of two different methods of defining commodities in models.

- The second contribution of this paper is to supply the two answers. If one adopts the final consumption expenditure specification, a Stone-Geary utility function provides a good fit to the data. If instead one adopts the consumption value-added specification, then a homothetic Leontief utility provides a reasonable fit to the data.

- The third contribution is to shed light on how the two different specifications of preferences are connected via technology and the nature of input-output relationships.

Conclusion

- **Future extensions**

- It is of interest to extend this analysis to a larger set of countries, in particular to situations which feature a larger range of real incomes.

- This will be useful in assessing the extent to which one can account for the process of structural transformation with stable preferences.

Thank you!