A Multisector Perspective on Wage Stagnation

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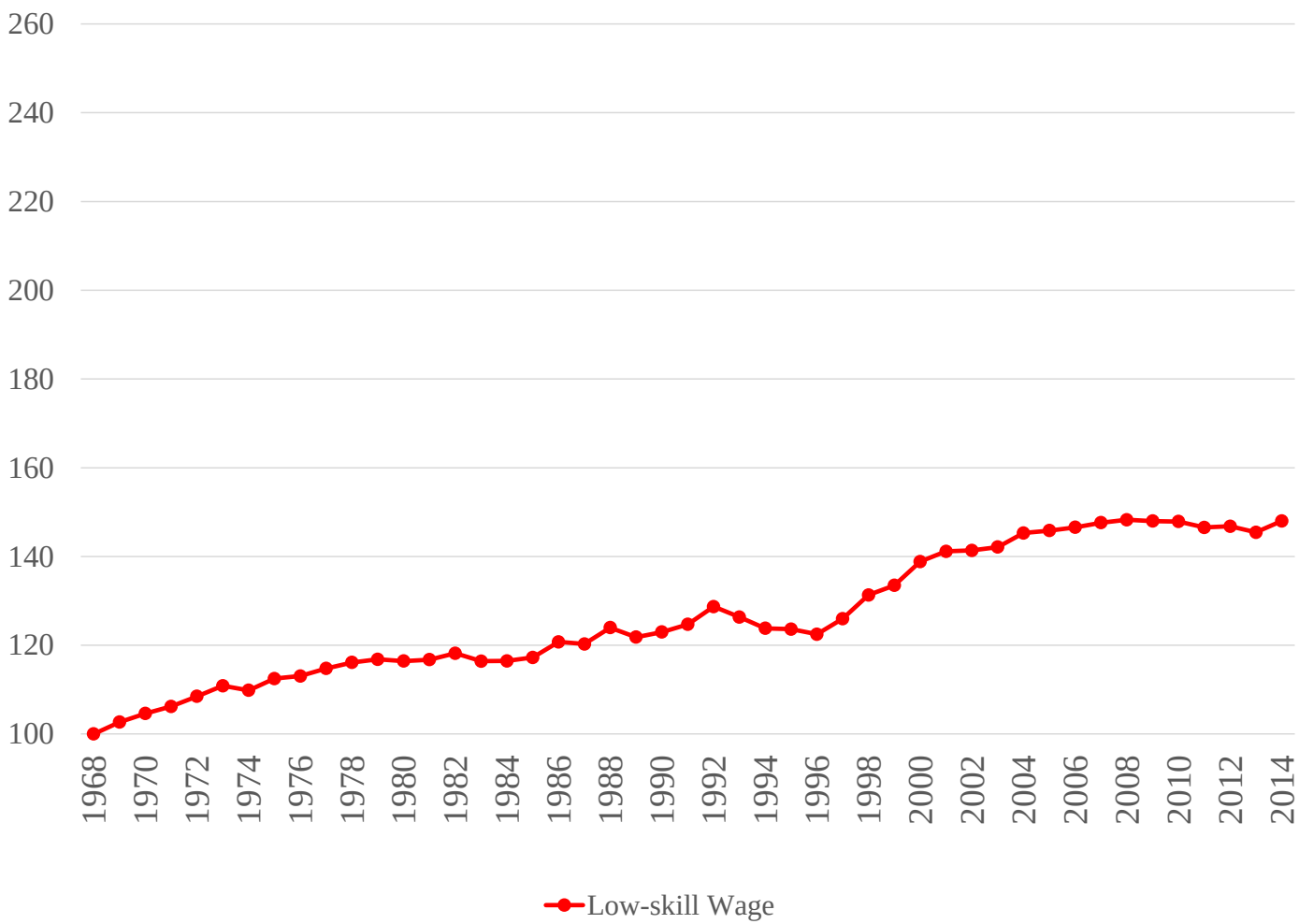
Real Wage of Non-college Workers



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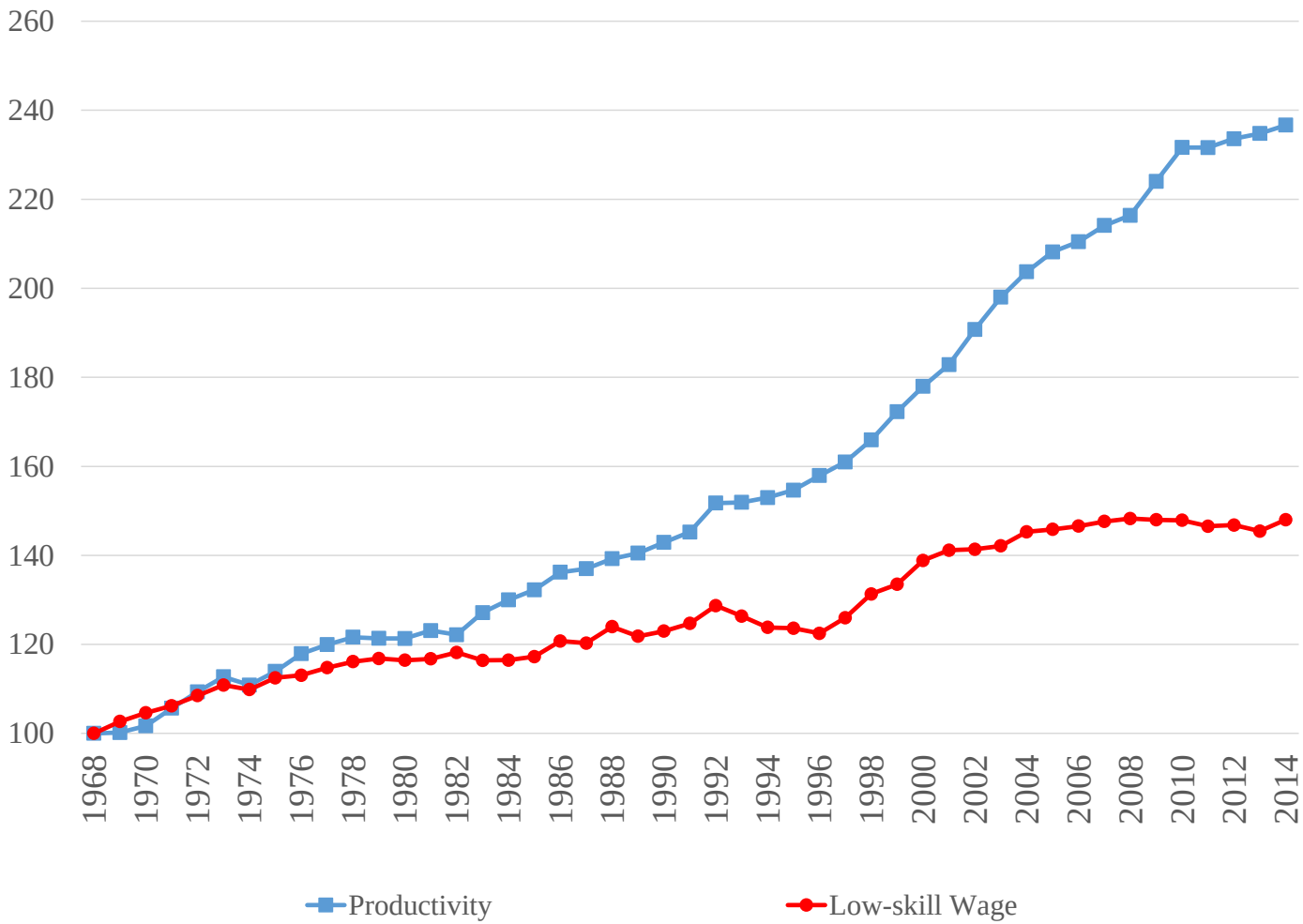
The share of non-college worker is 86% in 1968, 62% in 2014

Productivity and Low-skill Wage



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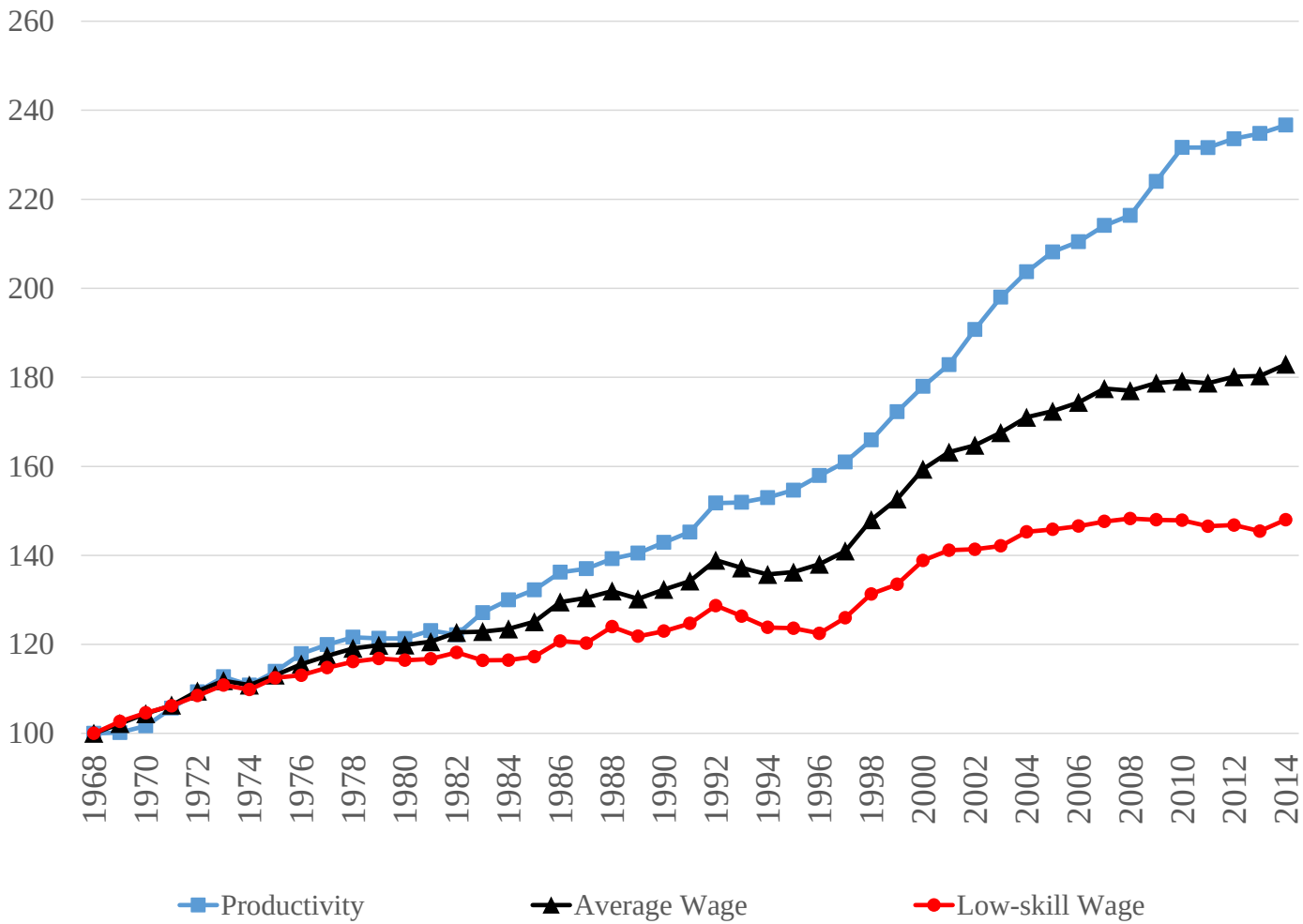
Productivity, Average and Low-skill Wage



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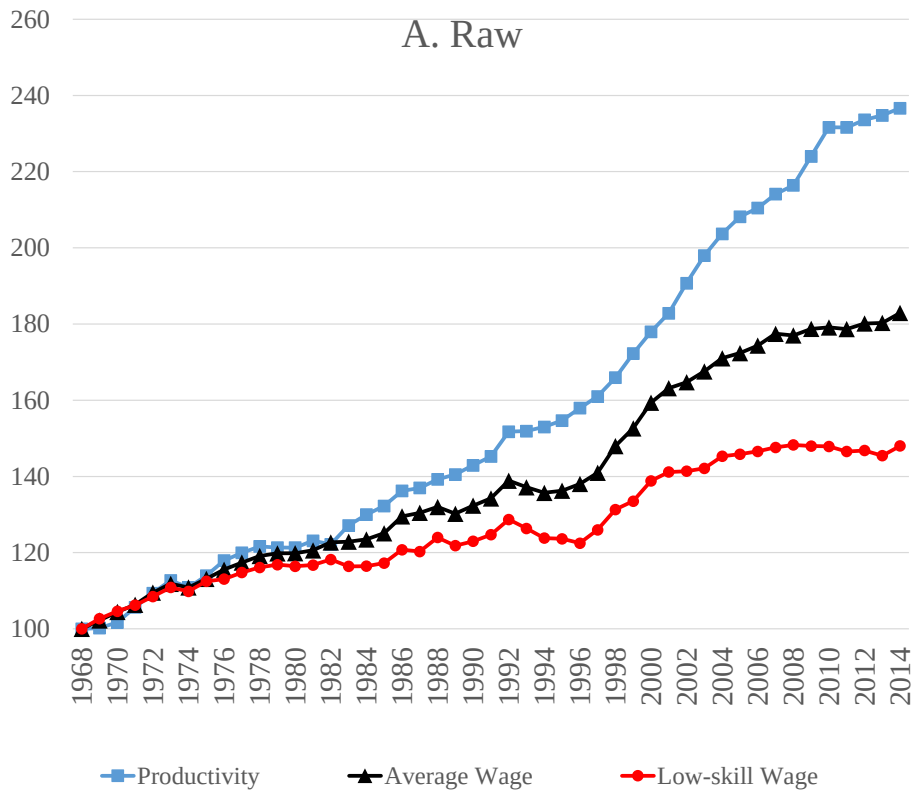
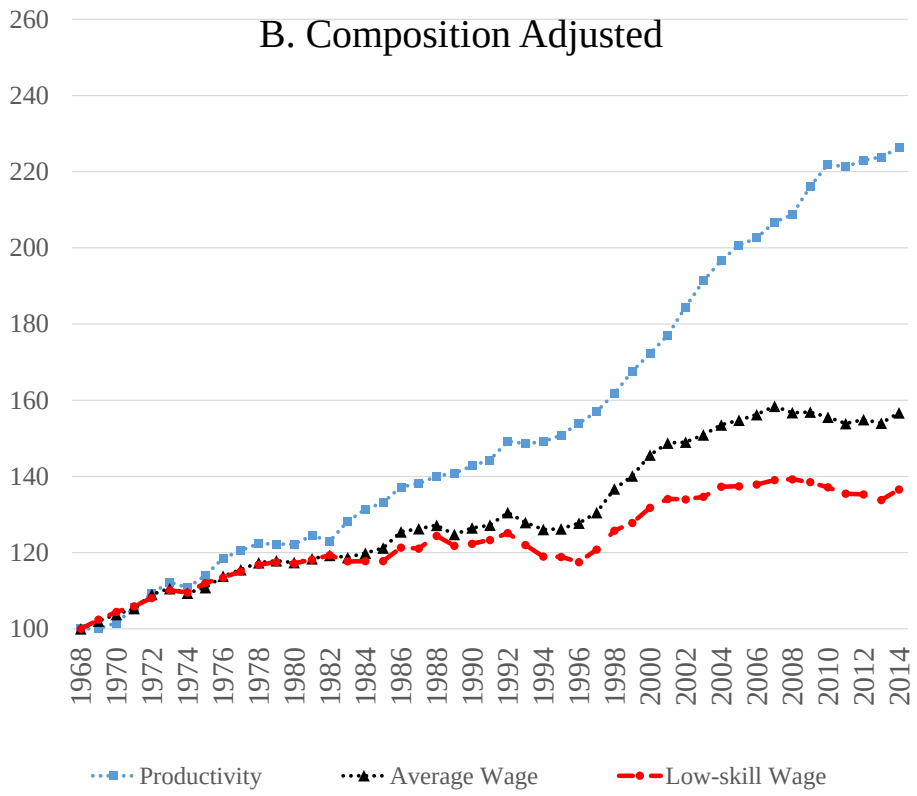
Low-Skill Wage and Aggregate Labour Productivity





Percentage changes from 1968. Wage is deflated by PCE. The share of low-skill (non-college) worker is 86% in 1968, 62% in 2014. Composition adjusted wages are calculated as the fixed-weighted mean of 120 demographic groups based on 6 age, 2 gender, 2 race and 5 education categories, where the fixed weights are groups' long-run employment shares.

Source: BLS and CPS. CPI

Objective of the Paper

- To understand **the slow growth in the low-skill real wage** together with **rising wage inequality** and **wage-productivity divergence**
- They are interrelated but one do not necessarily imply the other
- This paper makes two contributions
  - Empirical decomposition of low-skill wage stagnation and relate it to the other two facts
  - Provide a new explanation for the low-skill wage stagnation together with the other two facts. Show it is quantitatively important

Accounting for Growth in Low-skill Wage

- Accounting identity:

  Total value-added of the economy = the sum of total factor payments

- Low-skill wage and labour productivity divergence are driven by:
  1. Rising relative cost of living (30%)
  2. Rising wage inequality (50%)
  3. Falling labour income share (20%)

- They imply low-skill wage stagnation despite strong growth in productivity

A Multisector Perspective of Wage Stagnation

- Stagnation in marginal product of low-skill workers?
- Focusing on the aggregate MPL masks the underlying causes
- Economy consists of many sectors

  Labour mobility$\rightarrow$ **similar trends in sectoral nominal wages**

  Trends in relative prices $\rightarrow$ **differential trends in sectoral MPL**
- Wage stagnation can result from a reallocation of workers from sectors with growing MPL into the stagnant one
- Why does this reallocation happen?

  Why only low-skill wage is stagnant?

  Why is there wage-productivity divergence?

The Idea

- Simple observation: low-skill workers cannot easily substitute away from consuming services that requires high-skill labour (e.g. health care) and these services are getting more expensive over time
- Key elements
  - Uneven productivity growth across sectors
  - Different input intensities across sectors
  - Complementarity across sectors
- The mechanism: low-skill workers are concentrated in sector with faster productivity growth but do not benefit as much because their output are getting cheaper over time and are complement to high-skill labour

Mechanisms at Work

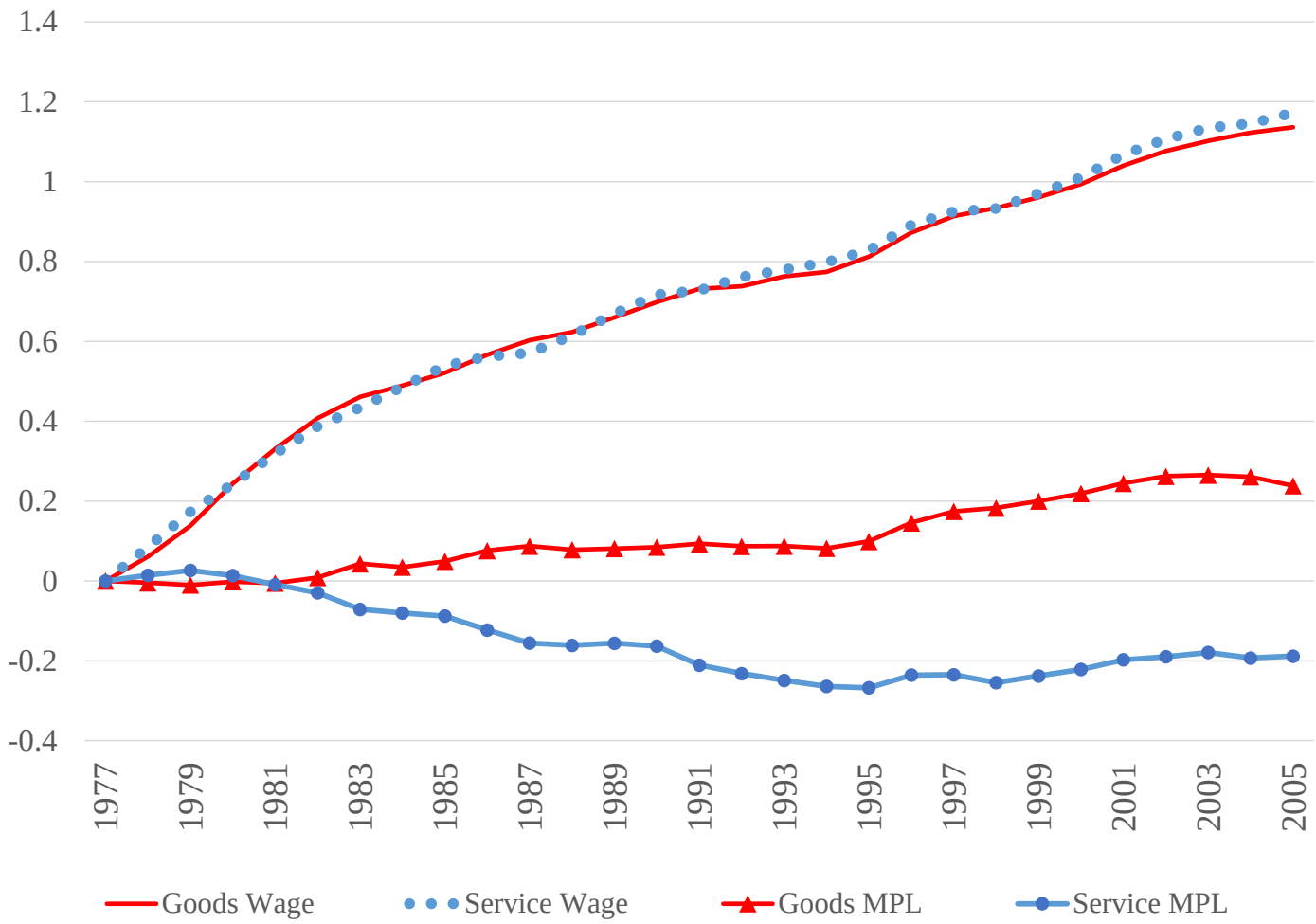
- Faster productivity growth in goods $\rightarrow$ higher relative price of services
  $+$ consumption complementarity $\rightarrow$ labour reallocates to services
  $+$ services has lower weight on low-skill $\rightarrow$ larger wage inequality
- Higher relative cost of living and larger wage inequality
  $\rightarrow$ **Divergence in low-skill wage and productivity**
- Rising relative price of services $\rightarrow$ slower growth in MPL in services $+$
  Labour reallocation towards services and growing wage inequality
  $\rightarrow$ **low-skill wage stagnation**

Basic Stylized Facts for a Two-sector Economy

- EU KLEMS data (1977-2005), classify the economy into two sectors according to the importance of high-skill workers.
- High-skill service sector: Finance, insurance and business services, Health and Education
  - 61% high-skill worker share in labour income; 28% share in total income
- Goods sector: All remaining sectors
  - 27% high-skill worker share in labour income; 16% share in total income
- Labour reallocates towards the service sector with rising relative price and slower productivity growth.
- Similar nominal wages growth but different growth for the marginal product of low-skill labour across sectors

Prices and value-added | Productivity growth | High-skill labour income share

Low-skill nominal wages and MPL (Logs, 1977=0)



CPS nominal wage, adjusted for age, education, gender, race and occupation

MPL is the nominal wage divided by KLEMS value-added price

Accounting for growth in low-skill wage

Accounting Identity

The total labour income:

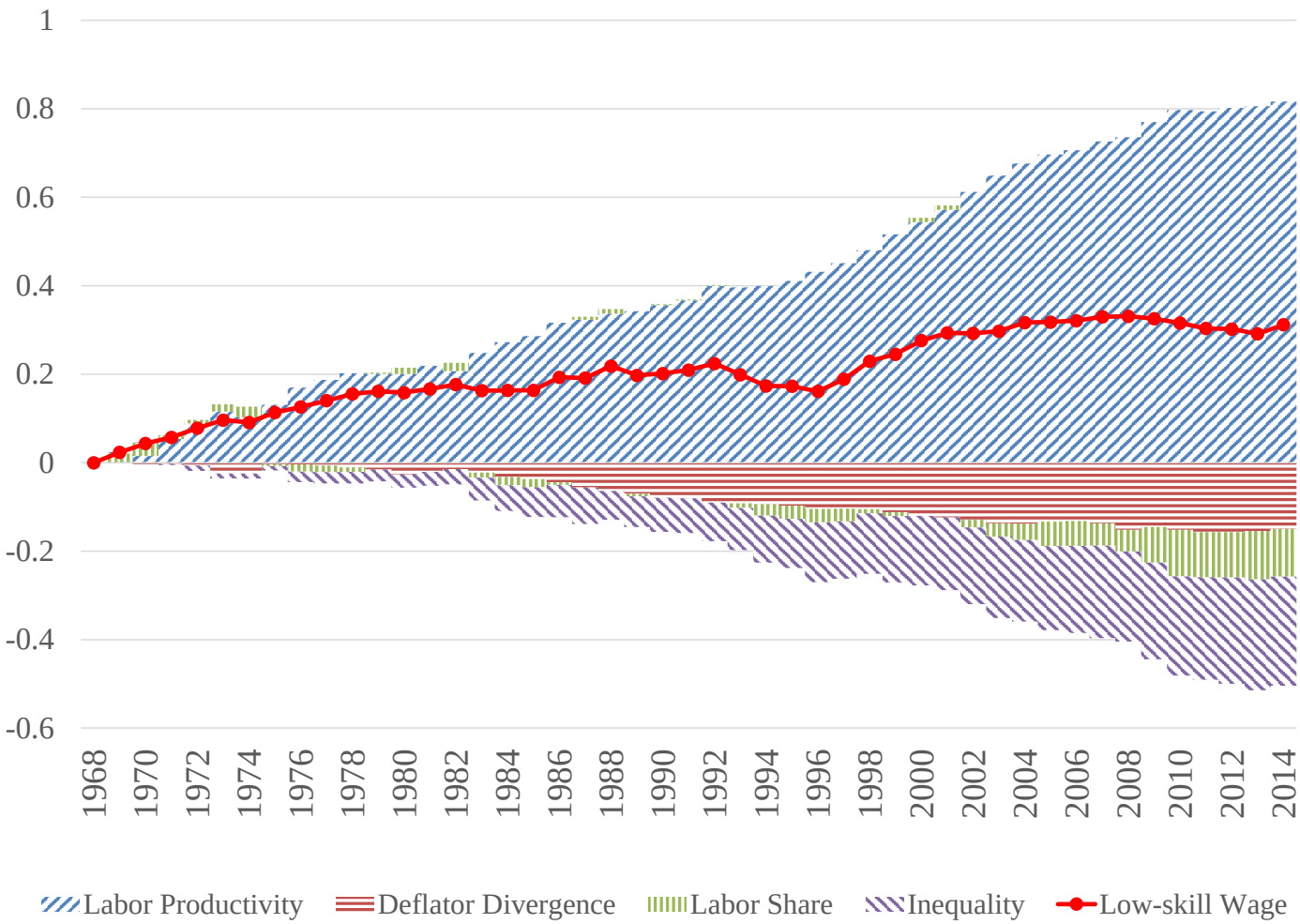
$$\beta \sum_j p_j Y_j = \sum_i w_i M_i \Longrightarrow \beta y = w; \quad y = \frac{\sum_j p_j Y_j}{M}, w = \frac{\sum_i w_i M_i}{M}$$

The ratio of labour productivity and wage:

$$\underbrace{\frac{y/P_Y}{w_I/P_C}}_{\textit{Real}} = \underbrace{\left(\frac{y}{w_I}\right)}_{\textit{Nominal}} \underbrace{\left(\frac{P_C}{P_Y}\right)}_{\textit{Deflator}}; \qquad \underbrace{\frac{y}{w_I}}_{} = \underbrace{\left(\frac{w}{w_I}\right)}_{\textit{Inequality}} \underbrace{\left(\frac{1}{\beta}\right)}_{\textit{Labour Share}}$$

- p_j and Y_j is the price and real value-added of sector j
- w_i and M_i are the wage and market hours by labour input i,
- β is the labour income share, M is total market hours
- P_C is the price of the consumption and P_Y is the aggregate output price

Decomposition of Low-Skill Wage Growth, Logs, 1968=0



Negative forces: relative cost of living, wage inequality and labour income shares

Decomposition of Divergence

- The real divergence is driven by three factors:

$$\underbrace{\frac{y/P_Y}{w_l/P_C}}_{\textit{Real Divergence}} = \underbrace{\left(\frac{y}{w_l}\right)}_{\textit{Nominal Divergence}} \underbrace{\left(\frac{P_C}{P_Y}\right)}_{\textit{Deflator}}, \quad \underbrace{\frac{y}{w_l} = \left(\frac{w}{w_l}\right)}_{\textit{Inequality}} \underbrace{\left(\frac{1}{\beta}\right)}_{\textit{Labour Share}}$$

1. Rising relative cost of living (consumption price relative to output price)
2. Rising wage inequality (average wage relative to low-skill wage)
3. Falling labour income share

- The first contributes directly to the real divergence while the last two factors contribute through nominal divergence

Decomposition of Real Divergence

	(1) Real Divergence	(2) Deflator	(3) Nominal Divergence	(4) Inequality	(5) Labour Share
			A. % Change		
1968-1980	4.3	2.7	1.5	3.0	1.5
1980-1990	11.9	5.4	6.2	4.9	-1.2
1990-2000	12.0	4.2	7.4	8.3	.8
2000-2014	26.7	3.0	23.1	9.4	-11.1
1968-2014	65.6	16.1	42.6	28.0	-10.2
			B. % Contribution to Real Divergence		
1968-1980	100	63.5	36.5		
1980-1990	100	46.5	53.5		
1990-2000	100	36.5	63.5		
2000-2014	100	12.4	87.6		
1968-2014	100	29.7	70.3		

Decomposition of Nominal Divergence

	(1) Real Divergence	(2) Deflator	(3) Nominal Divergence	(4) Inequality	(5) Labour Share
			A. % Change		
1968-1980	4.3	2.7	1.5	3.0	1.5
1980-1990	11.9	5.4	6.2	4.9	-1.2
1990-2000	12.0	4.2	7.4	8.3	.8
2000-2014	26.7	3.0	23.1	9.4	-11.1
1968-2014	65.6	16.1	42.6	28.0	-10.2
			C. % Contribution to Nominal Divergence		
1968-1980	-	-	100.0	194.8	-94.8
1980-1990	-	-	100.0	79.6	20.4
1990-2000	-	-	100.0	111.0	-11.0
2000-2014	-	-	100.0	43.2	56.8
1968-2014	-	-	100.0	69.6	30.4

Model

A Two-sector Economy with Two Skills and Capital

- Two sectors: high-skill service and goods.
- Production uses high-skill labour, low-skill labour and capital.
- The goods sector produces consumption goods and capital.
- Key ingredients
  1. **Uneven productivity growth**: faster productivity growth in the goods sector and investment-specific technical change
  2. **Different input intensities**: low-skill workers are used more intensively in the goods sector
  3. **Complementarity**: Goods and services gross complements. High-skill labour and capital are gross complements

Household

- Fraction α_i of household i, endowed with e_i efficiency unit of labour
- Household i maximize utility by choosing consumption of high-skill services and goods, c_{ij}, $j = s, g$:

$$U_i = \ln \left[\psi c_{ig}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\psi) c_{is}^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

subject to the budget constraint:

$$p_l c_{il} + p_h c_{ih} = W_i = w_i M_i / \alpha_i,$$

- W_i is total income, M_i is total market hours, and $w_i = e_i q_i$ is hourly wage, q_i is the price of labour per efficiency unit

Production

- The production function for sector $j = g, s$ is:

$$
\begin{aligned}
Y_j &= A_j F_j \left(G_j \left(H_j, K_j \right), L_j \right) \\
F_j \left(G_j \left(H_j, K_j \right), L_j \right) &= \left[\xi_j L_j^{\frac{\eta-1}{\eta}} + \left(1 - \xi_j \right) \left[G_j \left(H_j, K_j \right) \right]^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \\
G_j \left(H_j, K_j \right) &= \left[\kappa_j K_j^{\frac{\rho-1}{\rho}} + \left(1 - \kappa_j \right) H_j^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}}
\end{aligned}
$$

- Parameter ξ_j captures the importance of low-skill labour
- H_j and L_j are the efficiency unit of high- and low-skill labour
- One unit of Y_g can be converted into $1/\phi$ units of capital
- Capital fully depreciates

Market Clearing Conditions

- Labour market clearing conditions

$$H_s + H_g = H = e_H M_H; \quad L_s + L_g = L = e_L M_L$$

- Goods market clearing conditions

$$Y_s = C_s; \quad Y_g = C_g + \phi K$$

- The capital market clearing condition

$$K = \sum_j K_j$$

- The relative supply of efficiency labour is:

$$\zeta \equiv \frac{H}{L} = e\mu; \quad e \equiv \frac{e_H}{e_L}; \quad \mu \equiv \frac{\mu_H}{\mu_L} = \frac{M_H}{M_L};$$

- The relative wage is:

$$\pi \equiv \frac{w_H}{w_L} = eq; \quad q \equiv \frac{q_H}{q_L}$$

Assumption (I)

$$A1: \frac{\gamma_g}{\gamma_s} > 1 > \gamma_\phi,$$

- TFP growth in the goods sector is faster than the high-skill service sector, $\gamma_g > \gamma_s$
- ϕ can be interpreted as the price of capital relative to goods in a three-sector model. Due to investment-specific technical change (Greenwood, Herowitz and Krusell, 1997), the price of capital is falling relative to goods, $\gamma_\phi < 1$
  - In a three sector model where capital and goods sector have the same production function except TFP index $\phi = \frac{A_g}{A_k}$

Assumptions (II)

- The weight on low-skill worker is higher in the goods sector compared to the high-skill service sector:

$$A2: \quad \xi_g > \xi_s$$

- Consumption and production complementarity

$$A3: \quad \eta > 1 > \rho, \varepsilon$$

  - $\varepsilon < 1$: consumption complementarity
  - $\rho < 1$: capital-skill complementarity
  - $\rho < 1 < \eta$: capital is a poor substitute to high-skill worker but a good substitute to low-skill worker.

Equilibrium

Firm's Optimal Decision: High-Skill Worker vs Capital

Intensity of high-skill to capital

- Equating MRTS to relative prices

$$\frac{H_j}{K_j} = (\chi \delta_j)^{-\rho}; \qquad \delta_j \equiv \frac{\kappa_j}{1-\kappa_j}, \quad \chi \equiv \frac{q_H}{p_K}$$

- Define $\tilde{I}_j$ as the high-skill income relative to total income that goes to high-skill and capital:

$$\tilde{I}_j \equiv \frac{q_H H_j}{q_K K_j + q_H H_j} = \frac{1}{1 + \chi^{\rho-1} \delta_j{}^{\rho}};$$

- Due to the capital-skill complementarity, a fall in the price of capital relative to high-skill (χ) implies a rise in $\tilde{I}_j$ in all sectors

Firm's Optimal Decision: High- vs Low-Skill Workers

Intensity of high-skill to low-skill labour

- Equating MRTS to relative prices

$$\frac{H_j}{L_j} = \left(\frac{\sigma_j}{q}\right)^{\eta} (1-\kappa_j)^{\frac{\rho(\eta-1)}{(\rho-1)}} \tilde{I}_j^{\frac{\eta-\rho}{1-\rho}}; \quad \sigma_j \equiv \frac{1-\xi_j}{\xi_j},$$

- Let J_j be the income share of the low-skill:

$$J_j \equiv \frac{q_L L_j}{q_K K_j + q_H H_j + q_L L_j} = \frac{1}{1 + q^{1-\eta}\sigma_j^{\eta}\left[\tilde{I}_j (1-\kappa_j)^{-\rho}\right]^{\frac{\eta-1}{1-\rho}}},$$

- Let I_j be the income share of high-skill:

$$I_j \equiv \frac{q_H H_j}{q_K K_j + q_H H_j + q_L L_j} = [1 - J_j]\, \tilde{I}_j$$

Household's Maximization: Demand for High-Skill Services

- Equalizing MRS to relative prices implies the household $i's$ relative demand:

$$\frac{c_{ih}}{c_{il}} = \left(\frac{p_l}{p_h}\left(\frac{1-\psi}{\psi}\right)\right)^{\varepsilon}$$

- Relative expenditure

$$x \equiv \frac{p_h c_{ih}}{p_l c_{il}} = \left(\frac{p_h}{p_l}\right)^{1-\varepsilon}\left(\frac{1-\psi}{\psi}\right)^{\varepsilon}$$

- Aggregate relative demand (due to homothetic preference):

$$\frac{C_h}{C_l} = \left(\frac{p_l}{p_h}\left(\frac{1-\psi}{\psi}\right)\right)^{\varepsilon}$$

Equilibrium Prices

- Input prices are equal to the value of their marginal products:

$$q_l = \xi_j^{\frac{\eta}{\eta-1}} p_j A_j \left[J_j\right]^{\frac{1}{1-\eta}}, \quad q_h = q q_l, \quad q_k = \frac{q_H}{\chi}$$

- Given ϕ is the price of capital relative to goods, so $\phi = q_k / p_g$,

$$\chi = q \frac{A_g}{\phi} \left(J_g \xi_g{}^{-\eta}\right)^{\frac{1}{1-\eta}}$$

- Express q explicitly as an increasing function of χ

$$q = \chi \left[\left(\frac{\phi}{A_g} \right)^{\eta-1} \xi_g^{-\eta} - \sigma_g^{\eta} \left[\left(\chi^{1-\rho} + \delta_g^{\rho} \right) (1-\kappa_g)^{\rho} \right]^{\frac{1-\eta}{1-\rho}} \right]^{\frac{1}{\eta-1}},$$

- Relative price across sectors

$$\frac{p_s}{p_g} = \left(\frac{A_g}{A_s} \right) \left(\frac{\xi_g}{\xi_s} \right)^{\frac{\eta}{\eta-1}} \left(\frac{J_s}{J_g} \right)^{\frac{1}{\eta-1}}$$

Equilibrium Allocation: Supply of high-skill in services

Supply equation for h_s:

$$S\left(\chi; \frac{\phi}{A_g}, \zeta\right) \equiv \frac{1-\left(\sigma_g/q\right)^{\eta}\left(1-\kappa_g\right)^{\frac{\rho(\eta-1)}{\rho-1}}\tilde{I}_g^{\frac{\eta-\rho}{1-\rho}}/\zeta}{1-\left(\sigma_g/\sigma_s\right)^{\eta}\left(\frac{1-\kappa_s}{1-\kappa_g}\right)^{\frac{\rho(\eta-1)}{1-\rho}}\left(\frac{\tilde{I}_s}{\tilde{I}_g}\right)^{\frac{\eta-\rho}{\rho-1}}}$$

- Derived only using market clearing conditions

$$h_s = \frac{L_g/H_g - L/H}{L_g/H_g - L_s/H_s}$$

- An increase in the relative supply of high-skill efficiency labour ζ shifts up the supply

Equilibrium Allocation: Demand for high-skill in services

Demand equation for h_s:

$$D\left(\chi; \hat{A}_{gs}, \frac{\phi}{A_g}\right) \equiv \left[1 + \frac{l_g}{l_s}\left(\frac{1 - x_s\beta_s}{x_s\beta_g}\right)\right]^{-1}$$

- $x_s = x/(1+x)$ is the expenditure share of services, where x is:

$$x = \left(\frac{p_s}{p_g}\right)^{1-\varepsilon}\left(\frac{1-\psi}{\psi}\right)^{\varepsilon} = \hat{A}_{gs}^{1-\varepsilon}\left(\frac{\xi_s^{-\eta} J_s}{\xi_g^{-\eta} J_g}\right)^{\frac{1-\varepsilon}{\eta-1}}; \hat{A}_{gs} \equiv \frac{A_g}{A_s}\left(\frac{1-\psi}{\psi}\right)^{\frac{\varepsilon}{1-\varepsilon}}$$

- The expenditure share of service x_s summarizes the effect of relative productivity on demand through its effect on relative prices
- Rise in $\hat{A}_{gs}$ shifts up the demand

Value-added Shares

- Define the value-added shares of sector j as

$$v_j(\chi, q) \equiv \frac{p_j Y_j}{\sum_j p_j Y_j}$$

- Can be expressed as a function of relative income shares and input allocation

$$v_s(\chi, q) = \left[1 + \left(\frac{J_s}{J_g}\right)\left(\frac{L - L_s}{L_s}\right)\right]^{-1}$$

- Given h_s is solved, MRTS condition implies a value for L_s/L, thus a value for the value-added shares v_s.

Endogenous Skill-Biased Demand Shifts

$$Y_j = \tilde{A}_j \left[\lambda_j H_j^{\frac{\eta-1}{\eta}} + (1-\lambda_j) L_j^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

$$\tilde{A}_j \equiv A_j \left(\xi_j + (1-\xi_j) \left(\frac{1-\kappa_j}{\tilde{I}_j} \right)^{\left(\frac{\rho}{\rho-1}\right)\left(\frac{\eta-1}{\eta}\right)} \right), \quad \lambda_j \equiv \frac{(1-\xi_j) \left(\frac{1-\kappa_j}{\tilde{I}_j} \right)^{\left(\frac{\rho}{\rho-1}\right)\left(\frac{\eta-1}{\eta}\right)}}{\xi_j + (1-\xi_j) \left(\frac{1-\kappa_j}{\tilde{I}_j} \right)^{\left(\frac{\rho}{\rho-1}\right)\left(\frac{\eta-1}{\eta}\right)}}$$

- **Between-sector:** expansion of services implies higher aggregate λ when $\lambda_s > \lambda_g$.
- **Within-sector:** rise in $\tilde{I}_j$ implies higher λ_j in both sectors.

- Both imply higher wage inequality thus contribute to wage-productivity divergence, but different effects on the level of low-skill wage growth
  - The between-sector SBDS implies a shifts from high $(1-\lambda_g)$ to low $(1-\lambda_s)$ contribute to a slow growth in low-skill wage
  - The within-sector SBDS reduces $(1-\lambda_j)$ but this effect is offset by the implied rise in effective productivity $\tilde{A}_j$

Other Skill-Biased Demand Shifts

- Changes in κ_j and ξ_j can also affect λ_j, for example
  - Automation: some tasks performed by low-skill are replaced by machine, e.g., Acemoglu and Autor (2011)
  - Skill-biased organizational change increases the importance of human capital, e.g. Caroli and van Reenen (2001):
- Both can contribute to rise in wage inequality, thus contribute to wage-productivity convergence
- But only fall in ξ_j can contribute to low-skill wage stagnation.

Skill-biased demand shifts

- All four sources of skill-biased demand shifts can contribute to a rise in wage inequality, thus contribute to wage and productivity divergence
- Among them, only the between-sector SBDS and exogenous SBDS through fall in ξ_j can contribute to low-skill wage stagnation
  - The between-sector SBDS induces a shifts from the goods sector with high $(1-\lambda_g)$ to the service sector with low $(1-\lambda_s)$, so it reduces the aggregate $(1-\lambda)$ contribute to a slow growth in low-skill wage. Similar effect from direct fall in ξ_j
  - The within-sector SBDS, through rising $\tilde{I}_j$, reduces $(1-\lambda_j)$ in both sectors but this effect is offset by the implied rise in the effective productivity $\tilde{A}_j$. Similar effect for κ_j.

Wage and Productivity Divergence in the Model

$$\frac{y/P_Y}{w_l/P_C} = \left(\frac{(\pi-1)\mu_H + 1}{\beta}\right)\frac{P_C}{P_Y}; \quad \beta = \beta_g v_g + \beta_s v_s,$$

Three sources of real divergence in the model

- The two sources for nominal divergence:
  - Aggregate labour share β through sectoral labour shares
  - Inequality through skill premium π and relative supply of high-skill μ_H
- The relative cost of living P_C/P_Y through the relative price of services

Relative Price of Consumption

- Consumption price index:

$$P_C = \left[\omega^{\varepsilon} p_g^{1-\varepsilon} + (1-\omega)^{\varepsilon} p_s^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}}$$

- Its growth rate:

$$\hat{P}_C \approx x_g \hat{p}_g + x_s \hat{p}_s$$

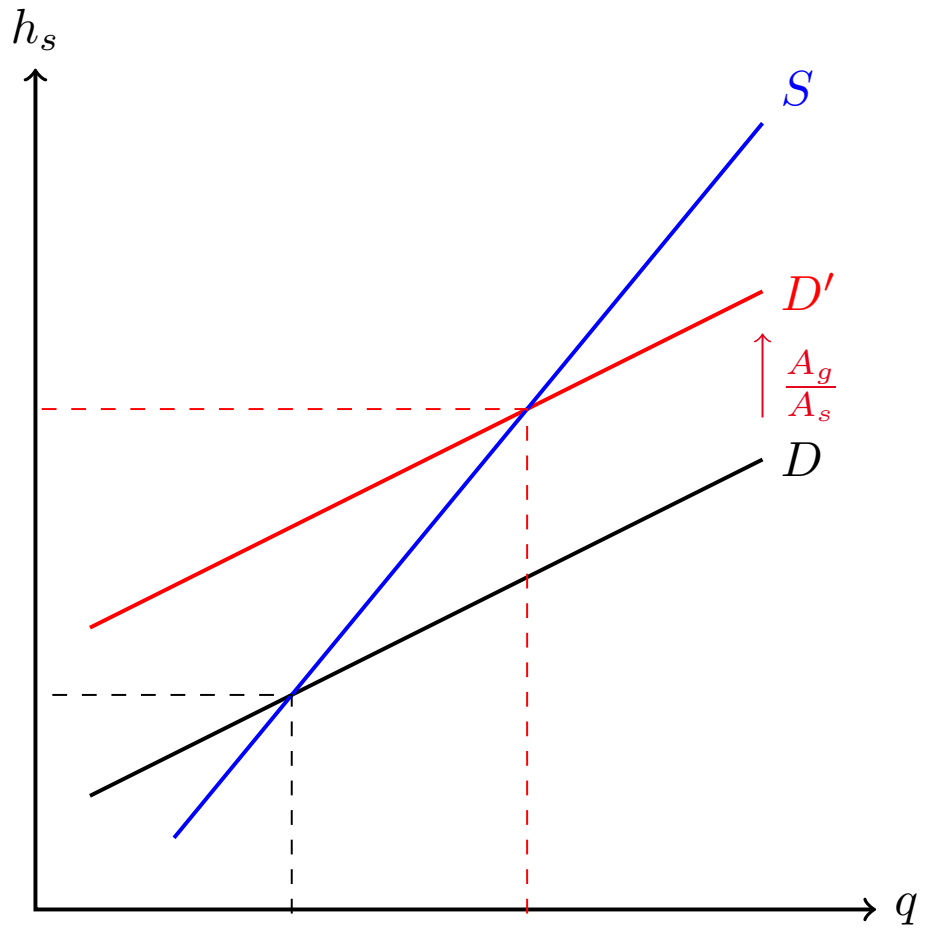
- Growth rate of output price index:

$$\hat{P}_Y \approx v_g \hat{p}_g + v_s \hat{p}_s$$

- Growth of consumption price relative to output price:

$$\hat{P}_C - \hat{P}_Y \approx (x_s - v_s)(\hat{p}_s - \hat{p}_g)$$

Rise in the Relative Productivity of the Goods Sector, $\kappa_j = 0$



Given $\varepsilon < 1, \xi_s < \xi_g$, a rise in A_g/A_s shifts up the demand curve, resulting in higher wage inequality and higher hour shares in services.

Low-skill wage stagnation

- When low-skill workers are used more intensively in the goods sector ($\zeta_g > \zeta_s$), and there is consumption complementarity ($\varepsilon < 1$) , faster productivity growth in the goods sector contributes to low-skill wage stagnation.
  - Baumol cost disease for all: when production function are identical except for the TFP index ($\zeta_s = \zeta_g$), faster productivity growth in the goods sector has the same effect on real wages of all workers.
  - When $\varepsilon = 1$, faster productivity growth in the low-skill sector has no effect on the low-skill real wage.

Quantitative Results

Data Target

- EU KLEMS Growth and Productivity Accounts for 1977-2005
- Classify the economy into two sectors according to the importance of high-skill workers
  - High-skill service sector: Finance, insurance and business services, Health and Education
  - Goods sector: all remaining sectors

Data used for calibration

	Level							Growth (% p.a.)		
	J	J_g	J_s	I	I_g	I_s	π	$\frac{y}{p_g}$	ϕ	$\frac{p_s}{p_g}$
1980	0.48	0.51	0.34	0.18	0.13	0.40	1.5	-	-	-
2003	0.35	0.38	0.26	0.30	0.20	0.52	2.0	1.9	-1.2	2.1

1978-1982 average for 1980, 2001-2005 average for 2003.

Baseline Parameters

A. Parameters from the literature

Parameters	Values	Source
ρ	0.67	Krussel et al. (2000)
η	1.4	Katz and Murphy (1992)
ε	0.2	Buera et al. (2018)

B. Calibrated parameters

Parameters	1980	2003	Growth (% p.a.)	Target
γ_ϕ			-1.2	$\frac{p_k}{p_g}$ at -1.2%
γ_g			0.8	$\frac{p_Y y}{p_g}$ at 1.9%
γ_{gs}			2.2	$\frac{p_s}{p_g}$ at 2.1%
ξ_g	0.39	0.32	-0.8	Sectoral income share.
ξ_s	0.32	0.27	-0.7	Sectoral income share.
κ_g	0.66	0.64	-0.1	Sectoral income share.
κ_s	0.18	0.15	-0.9	Sectoral income share.
ζ	0.45	0.76	2.4	$\frac{I}{Jq}$ Aggregate income ratio

Results on the Divergence

Model's Prediction of Divergence, Cumulative Percent Growth, 1980-2003

		Real	Nominal			Deflator	
		$(y/w_l)(P_C/P_Y)$	y/w_l	w/w_l	β	P_C/P_Y	p_s/p_g
(1)	Data	36	21	18	-2.1	12	61
(2)	Model	27	19	13	-4.9	6.3	m
	Counterfactual (keeping all else constant at 1980)						
(3)	$A_g/A_s \uparrow, \phi \downarrow$	17	8.2	14	5.3	8.4	95
(3a)	$A_g/A_s \uparrow$	12	4.1	7.4	3.1	7.2	78
(3b)	$\phi \downarrow$	9	7	10	3	1.7	17
(4)	$\xi_j \downarrow, \kappa_j \downarrow$	20	21	15	-4.9	-0.4	-3.8
(4a)	$\xi_j \downarrow$	21	21	13	-6.5	0.1	0.7
(4b)	$\kappa_j \downarrow$	3.0	2.8	5.4	2.6	0.2	1.9
(5)	$\zeta \uparrow$	-7	-5.7	-10	-4.5	-0.9	-7.7

Key variables Income shares

Results on the Divergence

- The full model accounts for 75% of the real divergence
- **Endogenous SBDS** $(A_g/A_s, \phi)$ account for 47%
  - 70% of the rise in relative cost of living
  - 78% of the rise in wage inequality but fail on labour share
- **Exogenous SBDS** (κ_j, ξ_j) account for 56%
  - fail on the relative cost of living
  - all changes in wage inequality and labour share
- **Supply** (ζ) implies convergence
  - contribute to the decline in labour share
  - fail on relative cost of living and wage inequality

Results on Low-skill Wage Stagnation

Productivity and Wages, Cumulative Percent Growth, 1980-2003

		$\frac{y/w_l}{P_C/P_Y}$	y/P_Y	w_l/P_C	y/w_l	y/p_g	w_l/p_g	w_l/p_s
(1)	Data	36	40	3	21	56	29	-20
(2)	Model	27	40	11	19	m	31	-19
	Counterfactual (keeping all else constant at 1980)							
(3)	$A_g/A_s \uparrow, \phi \downarrow$	18	27	7.9	8.4	50	39	-29
(3a)	$\boldsymbol{A_g/A_s \uparrow}$	**12**	**13**	**1.3**	**4.1**	**30**	**25**	**-30**
(3b)	$\phi \downarrow$	9	47	35	7.0	52	42	21
(4)	$\xi_j \downarrow, \kappa_j \downarrow$	20	22	1.7	21	21	0.5	4.5
(4a)	$\boldsymbol{\xi_j \downarrow}$	**21**	**22**	**0.8**	**21**	**22**	**1.0**	**0.3**
(4b)	$\kappa_j \downarrow$	3.0	30	27	2.8	31	27	23
(5)	$\zeta \uparrow$	-7	39	49	-5.7	37	45	57

Results on low-skill wage stagnation

- As expected, all four types of SBDS contribute to wage-productivity divergence but only the between-sector SBDS and the fall in ξ_j can contribute to low-skill wage stagnation
- But they have very different predictions on the sectoral marginal product of low-skill labour (measured as w_l / p_j)

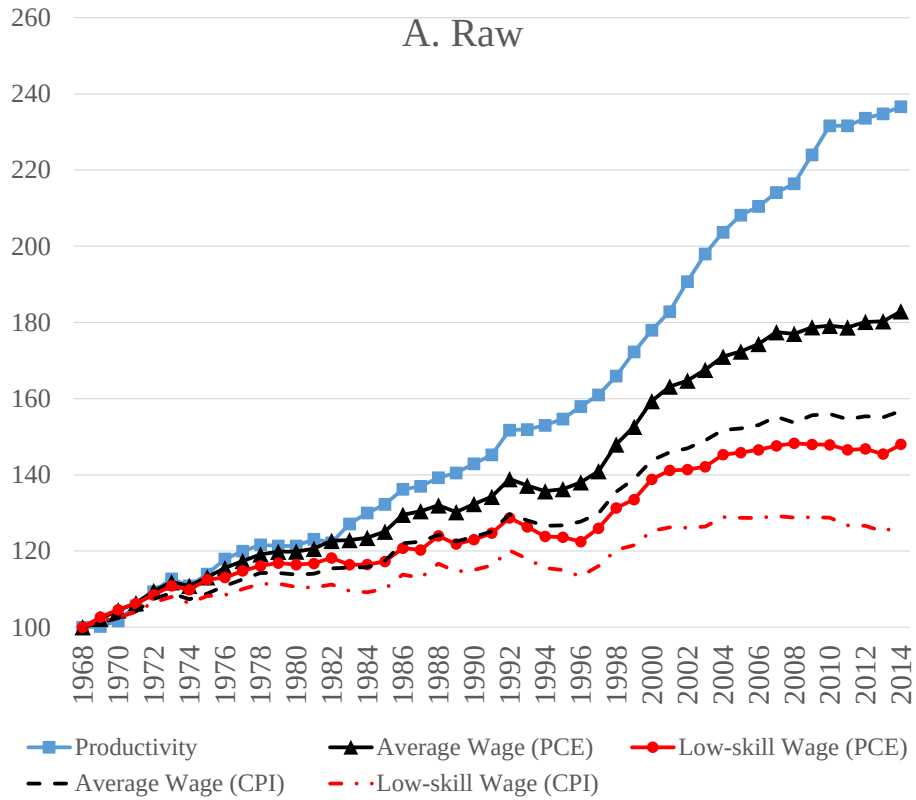
  In the data, it rises by 29% in the goods sector and fall by 20% in the service sector
  - The between-sector SBDS in row(3a): predicts a rise in relative price of services, a rise in the marginal product of low-skill in goods sector (25%) and a fall in the service sector (-30%)
  - The fall in ξ_j in row (4a): predicts zero growth in marginal product of low-skill labour in both sectors, missing the differential trends observed in the data

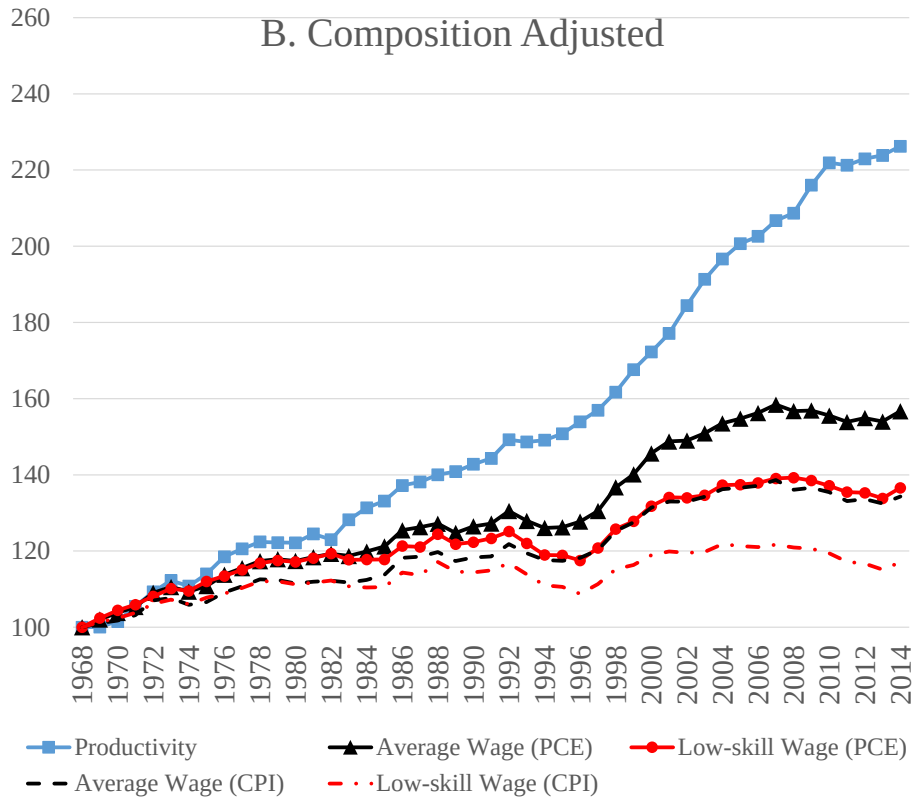
Summary of the Results

- Empirical findings:
  - Divergence in low-skill wage and productivity are due to rising relative cost of living (30%), growing wage inequality (50%) and falling labour income share (20%).
  - Sectoral reallocation is important for low-skill wage stagnation: differential trends in marginal product of low-skill labour across sectors
- Build a multisector model that delivers the results by predicting rising relative price of services and labour reallocation towards services:
  - Rising in the relative cost of living and growing wage inequality
  - differential trend in marginal product of low-skill labour
- Other factors are needed to account for the decline in labour share and the remaining increase in wage inequality.
- Increase in the relative supply of high-skill can reverse the low-skill wage stagnation and the divergence.

Appendix Slides

Low-Skill Wage and Aggregate Labour Productivity
CPI vs PCE





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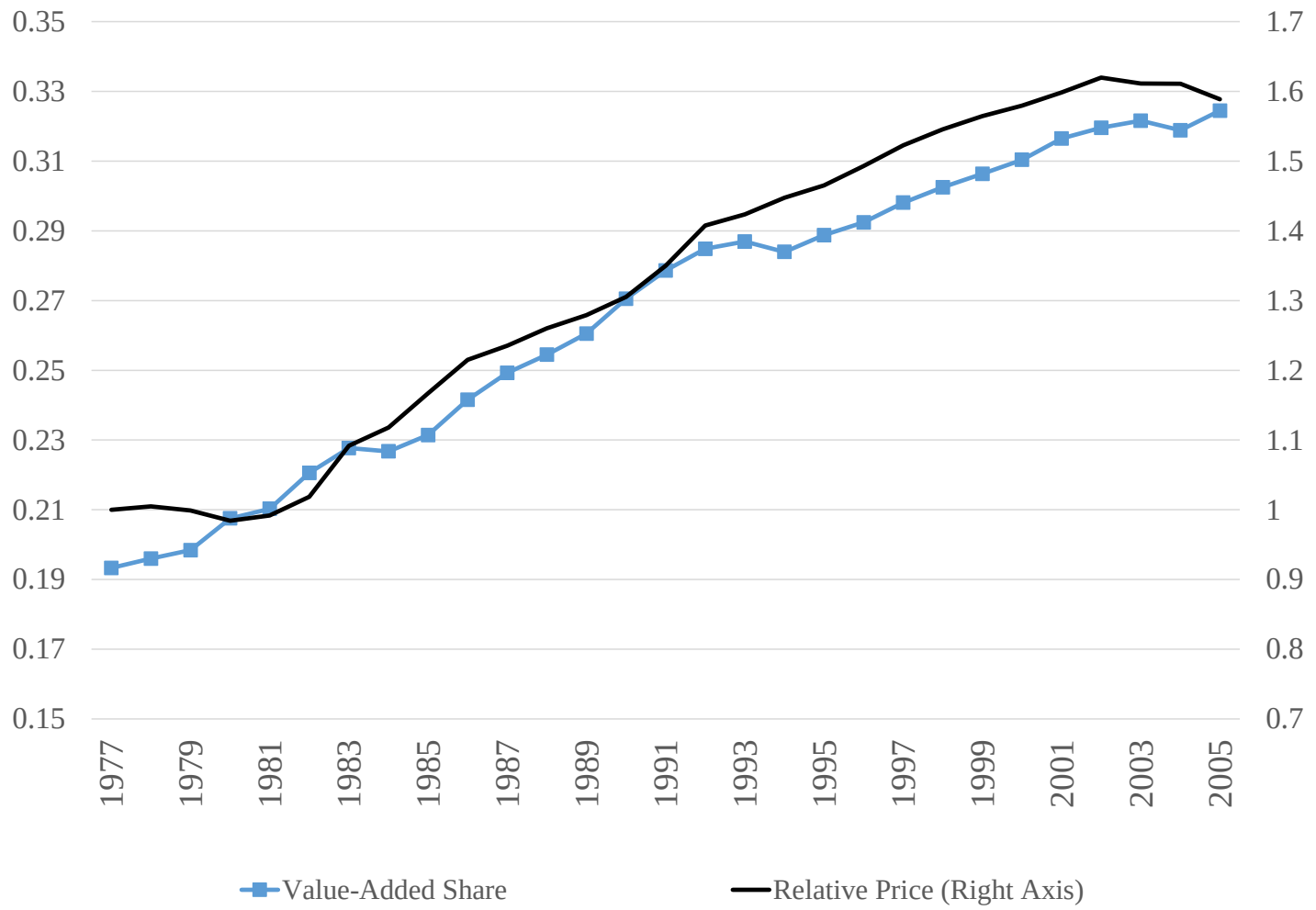
Value-Added Share and Relative Price of High-skill Services

EU KLEMS



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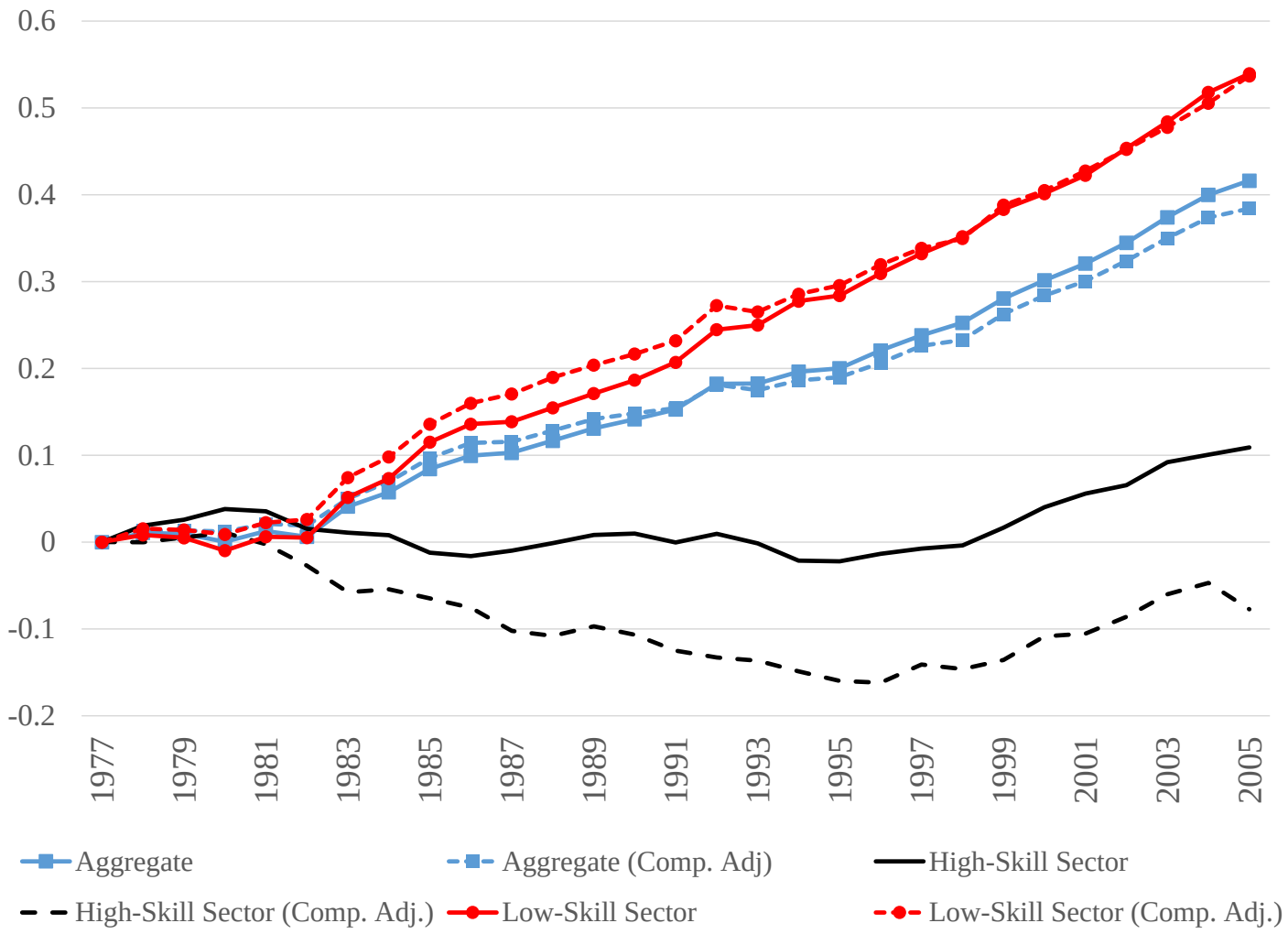
Aggregate and Sectoral Labour productivity

Logs, EU KLEMS



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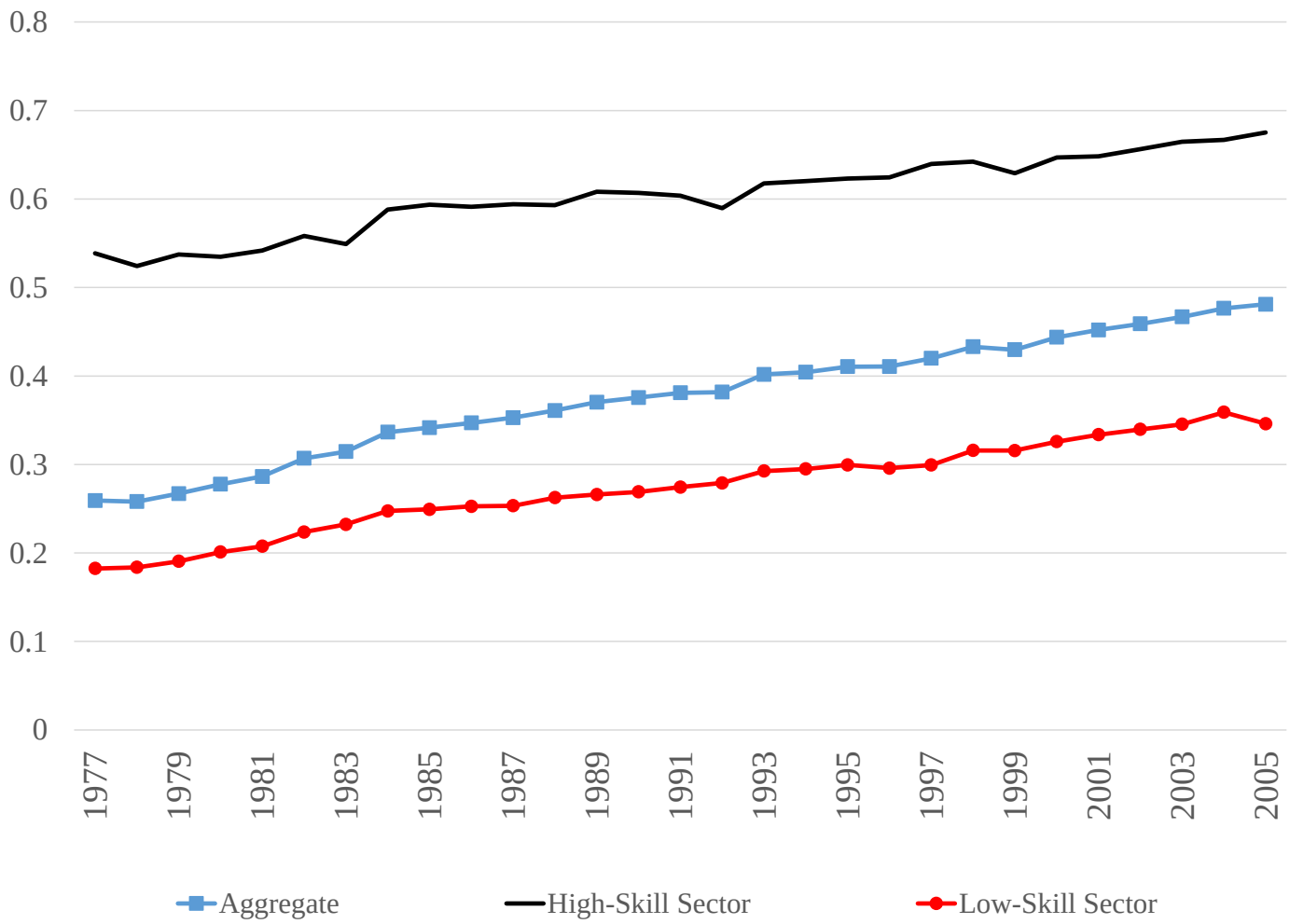
Share of High-skill Worker in Labour Income

EU KLEMS



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Actual and predicted values for key variables

		π	v_s	β_g	β_s	β
	Data 1980	1.5	0.21	0.64	0.74	0.66
(1)	Data 2003	2.0	0.32	0.59	0.78	0.65
	Model 1980	m	m	m	m	m
(2)	Model 2003	1.8	0.25	0.58	0.77	0.63
Counterfactual (keeping all else constant at 1980)						
(3)	$A_g/A_s \uparrow, \phi \downarrow$	2.3	0.30	0.66	0.79	0.70
(3a)	$A_g/A_s \uparrow$	1.9	0.29	0.65	0.76	0.68
(3b)	$\phi \downarrow$	2.1	0.23	0.65	0.78	0.68
(4)	$\xi_j \downarrow, \kappa_j \downarrow$	2.3	0.19	0.60	0.77	0.63
(4a)	$\xi_j \downarrow$	2.2	0.19	0.59	0.74	0.62
(4b)	$\kappa_j \downarrow$	1.9	0.21	0.65	0.78	0.68
(5)	$\zeta \uparrow$	1.0	0.19	0.61	0.72	0.63

The model predicts labour productivity growth rate almost perfectly (Model: 1.9% in the goods sector and -0.3% in the service sector; Data: 2% and -0.3%) Back

Actual and predicted values for income shares

		$\tilde{l}_g$	$\tilde{l}_s$	J_g	J_s	l_g	l_s
	Data 1980	0.26	0.60	0.51	0.34	0.13	0.40
(1)	Data 2003	0.32	0.70	0.38	0.26	0.20	0.52
	Model 1980	m	m	m	m	m	m
(2)	Model 2003	0.32	0.70	0.38	0.26	0.20	0.52
	Counterfactual (keeping all else constant at 1980)						
(3)	$A_g/A_s \uparrow, \phi \downarrow$	0.33	0.68	0.48	0.34	0.17	0.44
(3a)	$A_g/A_s \uparrow$	0.30	0.64	0.50	0.35	0.15	0.42
(3b)	$\phi \downarrow$	0.33	0.68	0.48	0.34	0.17	0.45
(4)	$\xi_j \downarrow, \kappa_j \downarrow$	0.30	0.67	0.42	0.28	0.18	0.48
(4a)	$\xi_j \downarrow$	0.30	0.67	0.50	0.33	0.15	0.45
(4b)	$\kappa_j \downarrow$	0.30	0.67	0.50	0.33	0.15	0.45
(5)	$\zeta \uparrow$	0.26	0.60	0.47	0.30	0.14	0.42

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