The demand for skills: accounting for technology, trade and final consumption in employment

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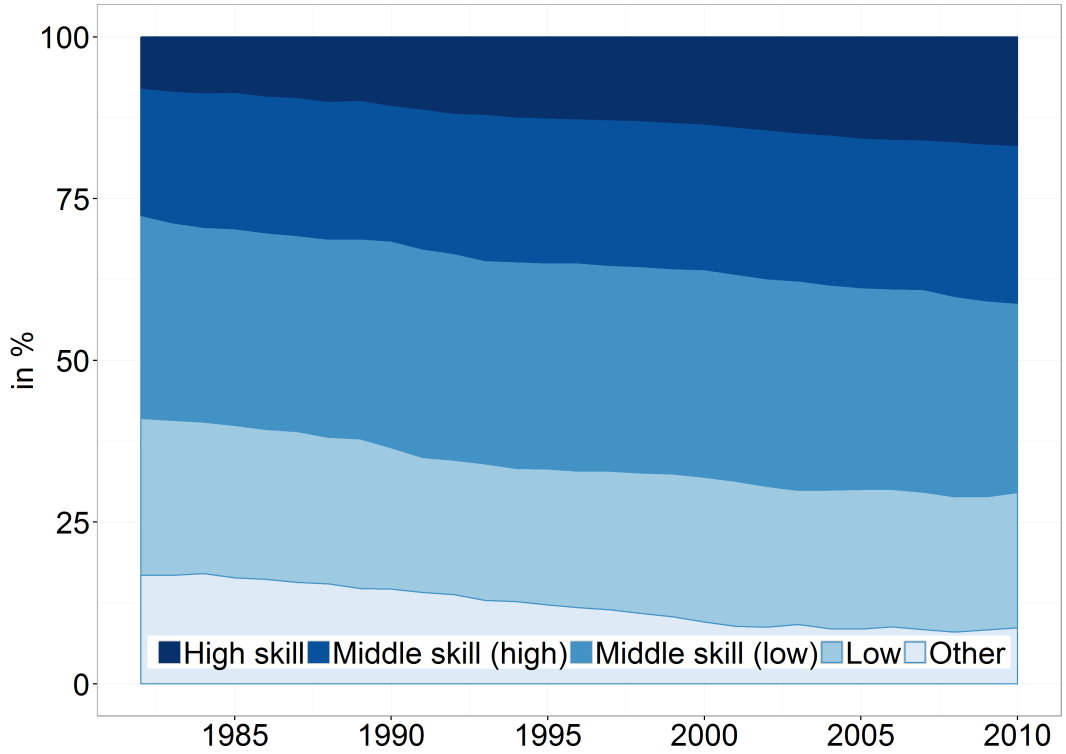
Plan

Stylized facts



Source: Insee, LFS

- An increasing share of skilled jobs in France since 1982
- In a context of productivity gains, trade openness increase (esp. in the 90s) and consumption gradual shift from goods to service

Literature

Distinguished effects by skill level?

- Technology: routinization hypothesis
  (Autor, Levy and Murnane, 2003; Goos and Manning, 2007)
- External trade: comparative advantages, jobs offshorability
  (Blinder, 2009)
- Final consumption: Engel curves
  (Autor and Dorn, 2013; Goos and Manning, 2007)
- All 3 channels altogether: Input-Output analysis
  (Gregory, Zissimos and Greenhalgh, 2001; Los, Timmer and de Vries, 2014)

Our approach

Limits related to the accounting decomposition:

- We capture only first round/partial equilibrium effects
- We cannot reveal underlying causal links between employment and its determinants in the long-run
- We cannot single out effects of relative prices from changes in preference in consumption, import/domestic products

$\Rightarrow$ Results to be interpreted in terms of short-term effects

$\Rightarrow$ We isolate an income effect in final consumption (see positive long-term effect of technology)

Our main results

- Technology is the main determinant of skill-biased changes in employment.
- An important positive contribution of final consumption is linked to the development of services.
- Trade has a small but nonetheless positive contribution to employment regardless of the skill level.

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Data

- Input-Output data (Insee national accounts)
  - Availability: 1980-2010, for 48 products
  - Work on these data: in current prices and previous year prices (using specific deflator for consumption, investment...) and using ESA 2010 concepts from 2010 up to 1980
- Labour Force Survey (Insee)
  - Employment by skill and sector: from 1982 to 2010 (in headcounts)
  - Work on these data: treat for changes in occupation and sector classifications (NAP-NAF-NAF Rev. 1-NAF Rev. 2 & PCS); convert sectors to concept of industry and then 38 products; treat for breaks in collection process

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$\Rightarrow$ Final database: 1982-2010; 38 products, 9 skill groups

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Input-Output Analysis Framework

From production required to address final demand...

$$P + M = IC + FD \quad \Rightarrow \quad \begin{cases} P = IC^d + FD^d \\ M = IC^m + FD^m \end{cases}$$

Technological coefficients $IC = \mathbf{A}P$
Domestic share, ex: $FD^d = \mathbf{S}^{FD}FD$

... to labour content of final demand

$$P = (I - \mathbf{S}^{IC}\mathbf{A})^{-1}(\mathbf{S}^{FD}FD) = \mathbf{R}(\mathbf{S}^{FD}FD)$$
$$VA = MP$$
$$N = \mathbf{TMR}(\mathbf{S}^{FD}FD)$$

$M = diag((I - {}^t\mathbf{A})\mathbf{1})$
T: matrix of skill-use coefficients

$\mathbf{TMRS}^{FD}$ is the labour content of FD

Employment changes decomposition

$$\Delta N_{t,\tau} = \underbrace{\mathbf{T}_t\mathbf{M}_t\mathbf{R}_t\mathbf{S}_\tau^{FC}\Delta FC}_{\text{Changes in Final Domestic Consumption}} + \underbrace{\mathbf{T}_t\mathbf{M}_t\mathbf{R}_t(\Delta\mathbf{S}^{FDD}FDD_t + \Delta(\mathbf{S}^X X)) + \mathbf{T}_t\mathbf{M}_t\mathbf{R}_t\Delta\mathbf{S}^{IC}\mathbf{A}_t P_\tau}_{\text{Changes in exports and imports}} + \underbrace{\mathbf{T}_t\mathbf{M}_t\mathbf{R}_t\mathbf{S}_\tau^{IC}\Delta\mathbf{A}P_\tau + \mathbf{T}_t\mathbf{M}_t\mathbf{R}_t\mathbf{S}_\tau^{GFCF}\Delta GFCF + \mathbf{T}_t\Delta\mathbf{M}P_\tau + \Delta\mathbf{TM}_\tau P_\tau}_{\text{Changes in technology}}$$

Additionally we decompose consumption into a consumption basket structure, socio-demographics, purchasing power and savings ratio:

$$FC_{val} = P^{tot} \quad \frac{FC_{val}}{FC_{val}^{tot}} \quad cu \quad PP^{GDI/cu} \quad \frac{FC_{val}^{tot}}{GDI}$$

Employment changes decomposition ●●

ΔN = vector of employment change for each skill level in each production
Treatment of the issue of the n! decompositions: average all potential decompositions

Is GFCF demand or technology ?

Changes in GFCF = changes in future production factors
Considered as technology

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CTB to employment growth by skill level

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Jobs creation	0.6	3.4	1.4	0.4	0.1	-1.7
CTB-Final consumption	1.2	1.3	1.3	1.2	1.3	0.9
CTB-Trade	0.3	0.3	0.3	0.4	0.3	0.4
CTB-Technology	-0.9	1.7	-0.3	-1.2	-1.5	-3.0

Source: Insee, LFS and national accounts; authors' calculations.

Note: The first row of the table represents the average annual growth rate of total employment and employment by skill level. The remaining rows represent the average annual contributions that sum to the employment growth rate.

- Technological skill-bias
- Important contribution of final consumption
- Trade effects > 0 regardless of the skill level

CTB to employment growth by skill level

Breakdown of final consumption effects

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Final consumption effects	1.2	1.3	1.3	1.2	1.3	0.9
Consumption structure	-0.1	0.1	0.0	-0.1	-0.2	-0.3
Purchasing power	0.4	0.4	0.4	0.4	0.5	0.6
Sociodemographic effects	0.3	0.2	0.2	0.3	0.3	0.4
Household saving	0.0	0.0	0.0	0.0	0.0	0.1
Gov. consumption	0.5	0.6	0.7	0.5	0.6	0.2

Source: Insee, LFS and national accounts; authors' calculations.

Note: The first row represents the average annual contribution of final consumption to employment growth also displayed in the previous table. It is equal to the sum of the remaining rows.

- Main CTB: household income and government consumption
- Changes in the consumption structure are slightly skill-biased

CTB to employment growth by skill level ●●●○

Breakdown of trade effects

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Trade effects	0.3	0.3	0.3	0.4	0.3	0.4
CTB-Exports	0.7	0.7	0.7	0.8	0.7	0.8
CTB-Offshore outsourcing	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3
CTB-Imports final products	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1

Source: Insee, LFS and national accounts; authors' calculations.

- Trade effect always > 0
- CTB exports > CTB imports + CTB offshoring

CTB to employment growth by skill level

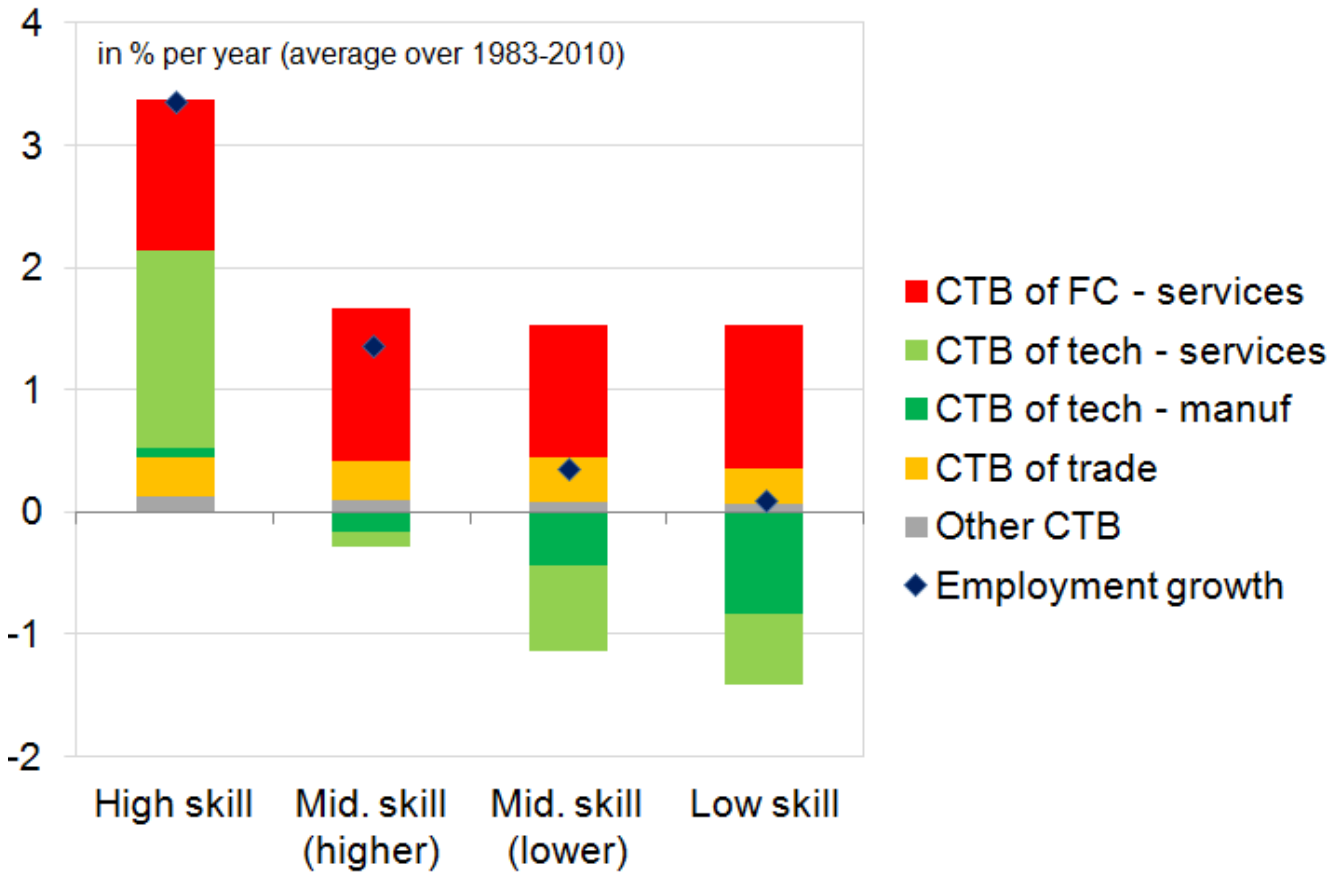
Breakdown of technology effects

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Technology effects	-0.9	1.7	-0.3	-1.2	-1.5	-3
CTB-Direct labour saving	-1.2	1.4	-0.4	-1.5	-1.5	-3.2
CTB-IC effects	-0.1	-0.1	-0.1	0.0	-0.2	0.0
CTB-GFCF effects	0.3	0.5	0.3	0.3	0.2	0.2

Source: Insee, LFS and national accounts; authors' calculations.

- Technology change is largely labour-saving
- Especially for lowest-skilled jobs
- Technology effect > 0 only for high-skilled jobs
- Small skill-bias from GFCF

CTB to employment growth by skill and product



Source: Insee, LFS and national accounts; authors' calculations.

Development in services account for a substantial part of employment growth, regardless of the skill level.

CTB to employment growth by skill and product ●●

- High skill employment growth: +3.4%
  - CTB FC: pub. admin. (+0.5 pp); business serv. (incl. R&D; +0.2)
  - CTB tech: business serv. (+0.6); pub. admin. (+0.4); ICT (+0.3)
- Low skill employment growth: +0.1%
  - CTB FC: pub. admin. (+0.6 pp)
  - CTB tech: low-technology manufacturing (-0.6); trade (-0.3)

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Conclusion

What are the contributions of trade, technology and final consumption on employment?
How can we explain skill-bias changes in French employment?

- Structural decomposition analysis using Input-Output data
- Definition of skill levels based on occupations
- Main skill-bias determinant: technology
- Important contribution of final consumption explained by the development of services
- Trade effect: small, but positive regardless of the skill level

Thank you for your attention!

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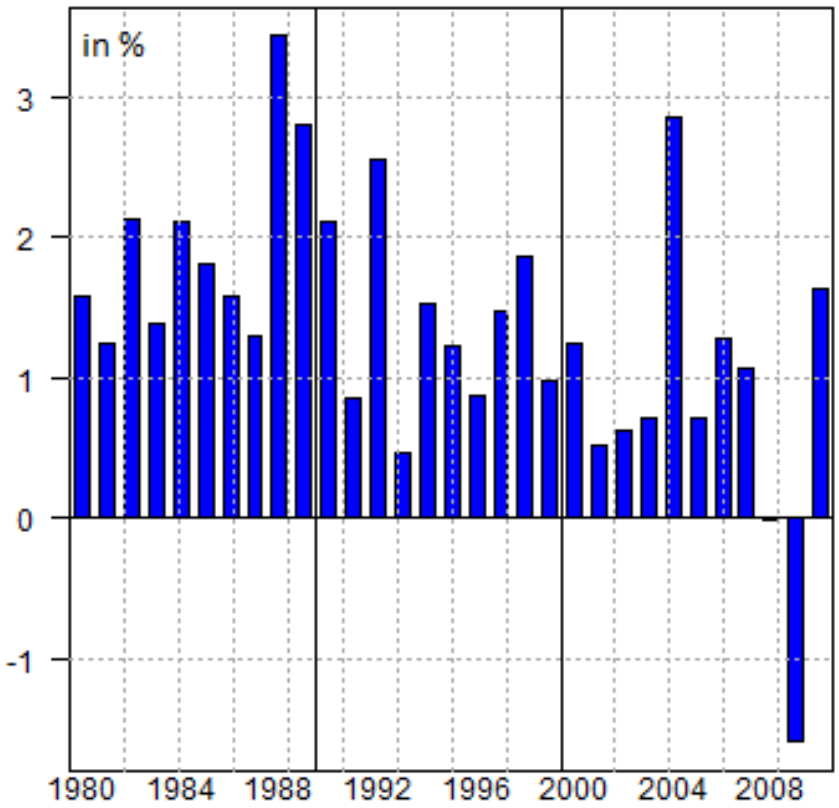
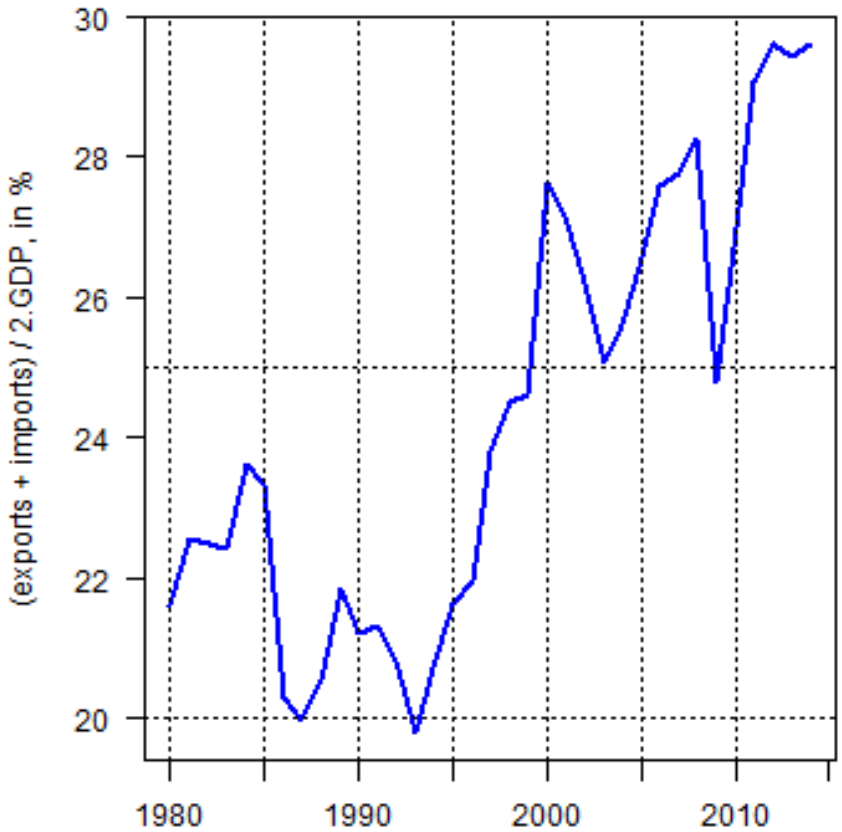
Link to Insee working paper

Appendix

Stylized facts ●○

In a context of labour productivity gains, increasing openness...

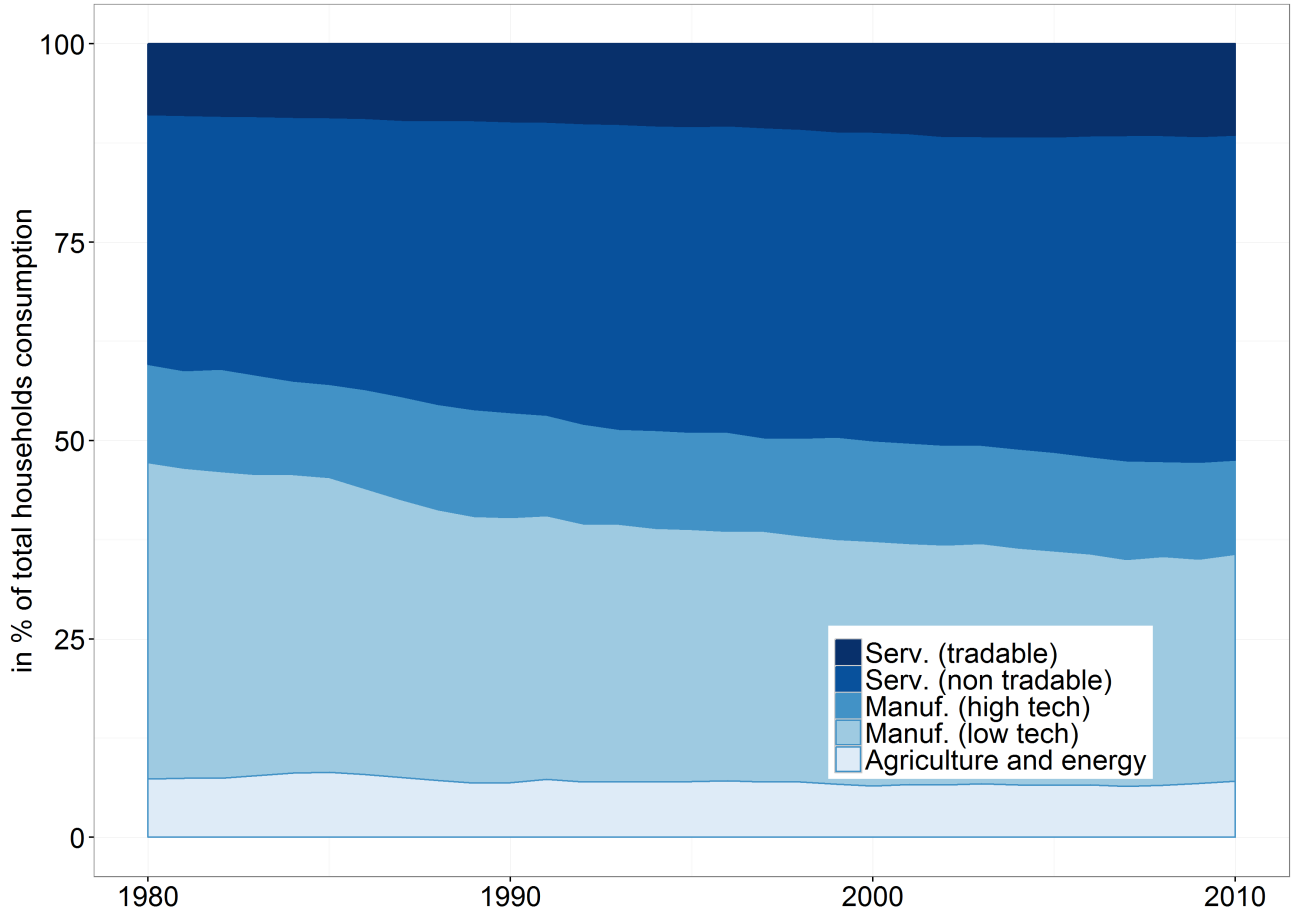




Source: Insee, national accounts

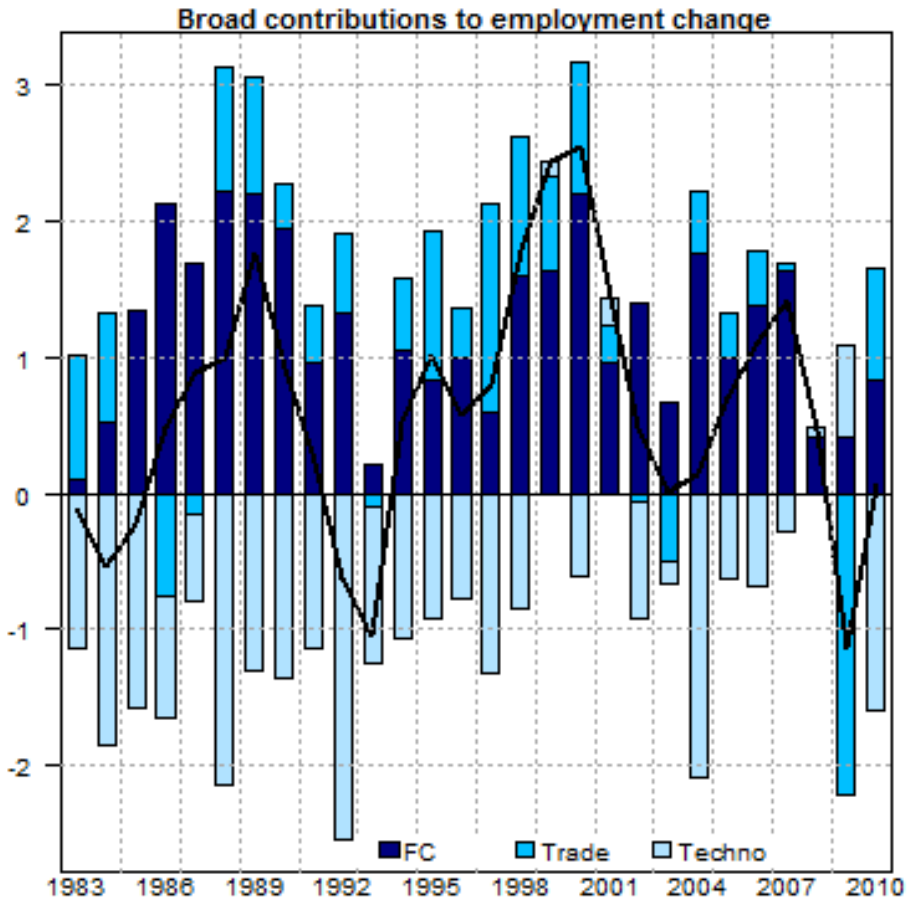
Stylized facts ●●

... and preferences of consumers for services



Source: Insee, national accounts

CTB to employment growth over 1983-2010



Source: Insee, LFS and national accounts; authors' calculations.

Product aggregation

Aggregated sector	Description	Average contribution (in % per year)			
		FC	Exports	Imports	Tech.
Manuf. High Tech.	CE - Chemicals	0.4	2.8	-2.1	-3.2
	CF - Pharmaceuticals	3.3	4.0	-2.5	-4.5
	C3- Electrical equip.	2.4	8.2	-6.1	-9.8
	CL - Transport equip.	-0.1	2.2	-1.2	-3.3
Manuf. Low Tech.	C1 - Food & drink	0.9	0.7	-0.5	-1.5
	CB - Textile & leather	-0.3	0.7	-4	-2.5
	CC - Wood & paper	0.8	1.2	-0.8	-2.8
	C2 - Coke & refined petroleum	0.7	1.0	-1.2	-2.8
	CG - Rubber & plastic	0.5	1.6	-1.3	-2.2
	CH - Metals	0	1.4	-1.3	-1.8
	CM - Other manuf.	0.1	1.4	-0.9	-1.8
Serv. non Tradable	FZ - Construction	0.2	0.1	0.0	-0.2
	IZ - Accomodation & food serv.	1.2	0.2	-0.1	0.6
	KZ - Finance	2.2	0.5	-0.1	-2.1
	LZ - Real estate	2.0	0.2	-0.1	-0.7
	OQ - Public adm.	7.1	0.1	-0.1	-1.7
	RU - Other serv.	6.0	0.7	-0.2	2.2
Serv. Tradable	GZ - Trade	1.4	1.0	-0.2	-1.5
	HZ - Transportation	1.1	1.1	-0.4	-1.2
	JZ - Info. & comm.	6.4	1.9	-0.8	-2.3
	MN - Business serv.	3.5	3.7	-1.7	3.8
Other	AZ - Agriculture	0.9	0.9	-0.6	-4.3
	DE - Energy & utilities	3.3	2.7	-3.7	-4.7

Skill levels based on occupation classification

- "high-skill" = Managers (includes liberal professions)
- "intermediate-skill (higher)" = Intermediate occupations (professionals and technicians)
- "intermediate-skill (lower)" = Skilled service and sales workers; Skilled machine operators and elementary occupations
- "low-skill" = Unskilled service and sales workers; Unskilled machine operators and elementary occupations;
- "others" = Farmers; Craft and related trades workers and chief executives; Other (Military contingents, unknown)

Price effects in the IOT

Insee's methodology is applied to the SUT in order to build the IOT both in current prices and prices of the previous years.
Prices are mostly inherited from the SUT.
Some issues are due to the ventilations in the SUT-IOT conversion:

A use current price ponderations to distribute PYP

B use PYP ponderations to distribute PYP

A implies a specific price common to the ventilated components (CIFFOB, transportation margins)
B implies that the relative price of the ventilated components reflects that of the weight structure (eg. VAT on IC by industries, imported/domestic)

$n!$ possible breakdowns