Dissecting the Impact of Imports from Low-Wage Countries on Inflation[1]

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June 24, 2020

[1]The views expressed in this paper do not necessarily reflect the opinion of the BdF or the Eurosystem

Motivation

- Low inflation in developed economies (av. FR 1991-2016 = 1.3%).
- Large increase of imports from low-wage countries (in particular China) in developed countries. In France during 1994-2014:
  - Share of LWC in consumer good imports increased from 26% to 43%
  - Share in total consumption passed from 2.4% to 6.9%

Policy makers' hunch: globalization is (partly) responsible for low inflation

"Falling import prices partly explain the subdued performance of core inflation, too. This is because imported consumer products account for around 15% of industrial goods in the euro area" (ECB President Mario Draghi, 2017) Decomposition

Research Question: By how much did imports from LWC contribute to the dynamics of consumer prices and welfare in France?

Our approach:

- Develop an inflation decomposition that is linear in pure-price and taste shift terms
- We apply it to quantify different "channels":

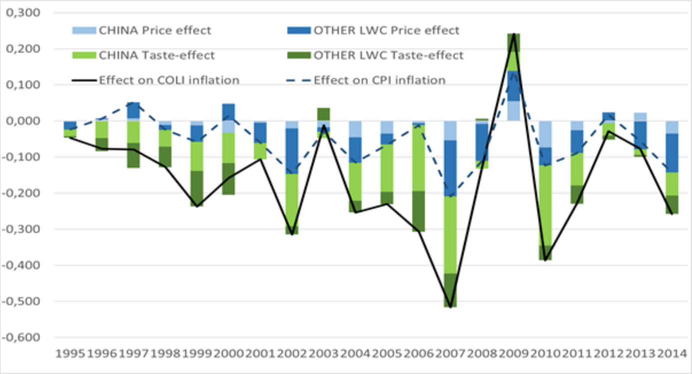
1. *Composition*: Substitution in favour of LWC-goods and away from domestic goods (holding price constant).
2. *Imported Inflation*:
   - Changes in the share of LWCs in total imports (holding price constant)
   - Differential inflation rates between LWC and HWC
3. *Competition*: domestic producer prices' reaction to import competition.

Preview of the Results

Did imports from LWCs lower French cost-of-living inflation ?

- **Yes, by** -0.17 **pp per year on average** over 1994-2014:
  - Substitution toward LWC goods: -0.05 pp
  - Reduction in imported inflation: -0.06 pp
  - Reduction in local producer prices: -0.06 pp
- China accounts for $\approx -0.10pp$
- Households pay €1000 less for consumption in 2014 wrt to 1994
- Impact on *measured* CPI inflation $\approx -0.05pp$ per year on average
- Allowing for higher elasticities of substitution reduces impact on *cost-of-living* inflation to $-0.13pp$ per year on average.

Effect of Imports from LWC on French Inflation



Comparison with the literature

- Econometric evidence on the "China" shock with US data: Bai & Stumpner (2019), Jaravel & Sager (2019), Amiti et al (2018).
- Broda and Weinstein (2010), Redding and Weinstein (2020, 2018): macro/micro CES price indices

Contributions of our work:

- We quantify the **overall effect** of the large surge in imports from LWCs based on detailed **country-level import price indices**
- We quantify the **effect on CPI versus cost-of-living index**
  - We show how to compute the decomposition using widely available trade and consumption data
- We **focus on year-on-year changes** (long run effect difficult to interpret with endogenous monetary policy)

Outline of the talk

1. Inflation decomposition
2. Data Construction
3. Quantification
4. Conclusion

1. Inflation Decomposition
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Product-level Inflation Decomposition

- A representative consumer derives utility from the consumption of N goods in quantity Q_i: $U(Q_1, ...Q_i, ...Q_N)$
  - N includes tradable and non-tradable goods
  - Good i varieties are indexed by j and differentiated by country of origin, including France.

- Utility for good i:

$$Q_{it} = \left[\sum_{j \in \Omega_i^J} \omega_{ijt}^{\frac{1}{\theta}} Q_{ijt}^{\frac{\theta}{\theta-1}} \right]^{\frac{\theta-1}{\theta}}$$

with $\theta \geqslant 1$ and Ω^{J_i} the set of available varieties of i (fixed over time).

- ω_{ijt} : variety-specific taste parameter, allowed to vary over time.

Product-level Inflation Decomposition

- Benchmark: Cobb-Douglas utility ($\theta \to 1$) with a fixed set of varieties Ω^{J_i}.

$$Q_{it} = \prod_{j \in \Omega_i^J} Q_{ijt}^{\omega_{ijt}}$$

with $\sum_{j \in \Omega_i^J} \omega_{ijt} = 1$

- Taste shocks assumed to reflect relative preferences across varieties (Redding and Weinstein, 2020).
- ω_{ijt} = expenditure share of variety j.

Product-level Inflation Decomposition

- Price index of good i: $P_{it} = \prod_{j \in \Omega_i^J} P_{ijt}^{\omega_{ijt}}$

- Collecting foreign varieties and using logs:

$$p_{it}^T = (1 - \eta_{it}) p_{it}^D + \eta_{it} p_{it}^F$$

  - p^F and p^D are price indices of foreign and domestic varieties.
  - $\eta_{it} = \sum_{j \in \Omega_i^F} \omega_{ijt}$ expenditure share of foreign varieties

- Decompose **inflation** into **pure-price** and **taste-shift** components arising from imports:

$$\pi_{it} = \pi_{it}^D + \eta_{it} \left(\pi_{it}^F - \pi_{it}^D \right) + \frac{d\eta_{it}}{dt} \left(p_{it}^F - p_{it}^D \right).$$

Imports from LWC and inflation for tradable good *i*

Further decompose import origins into LWC and HWC.
We obtain:

$$
\begin{aligned}
\pi_{it}^{T} = {} & \underbrace{\frac{\partial \eta_{it}}{\partial t}\gamma_{it}\left(p_{it}^{LWC} - p_{it}^{D}\right)}_{\text{Substitution}} \\
& + \underbrace{\eta_{it}\left[\frac{\partial \gamma_{it}}{\partial t}(p_{it}^{LWC} - p_{it}^{HWC}) + \gamma_{it}\left(\pi_{it}^{LWC} - \pi_{it}^{HWC}\right)\right]}_{\text{Imported Inflation}} \\
& + \underbrace{(1-\eta_{it})\pi_{it}^{D}}_{\text{Competition}} + \underbrace{\eta_{it}\pi_{it}^{HWC} + (1-\gamma_{it})\frac{\partial \eta_{it}}{\partial t}\left(p_{it}^{HWC} - p_{it}^{D}\right)}_{\text{indirect contribution of LWC}}
\end{aligned} \tag{1}
$$

Cost-of-living (COLI) versus "pure price" indices

- CPIs are "Fixed Basket of Goods (FBG)" indices
  - Cost of a basket in t divided by the cost of the *same basket* in t_0.
  - "Pure price" indices: hold structure and quality constant.
- Typically Laspeyres base-weighted chained indices
  - Weights fixed from $t-1$ to t but updated every year
  - Closer to COLIs derived from Cobb-Douglas utility functions..
  - ... but abstracting from taste shifts: $\omega_{ijt-1} = \omega_{ijt}$
- FBG inflation:

$$\pi_{it}^{FBG} = \pi_{it}^{D} + \eta_t \left(\pi_{it}^{F} - \pi_{it}^{D}\right) \tag{2}$$

- CPI "substitution bias" approximated by:

$$\pi_{it}^{T} - \pi_{it}^{CBG} = \frac{\partial \eta_t}{\partial t} \left(p_t^{F} - p_t^{D}\right) \tag{3}$$

Example

Imports from LWC to inflation for good i: price and taste-shift effects

Re-express contribution of LWC imports to inflation into *pure-price* and *taste-shift* terms:

$$
\begin{aligned}
&\pi_{it} = \\
&\underbrace{(1-\eta_{it})\pi_{it}^{D} + \eta_{it}\gamma_{it}\left(\pi_{it}^{LWC} - \pi_{it}^{HWC}\right)}_{\text{pure price}} + \\
&\underbrace{\frac{d\eta_{it}}{dt}\gamma_{it}\left(p_{it}^{LWC} - p_{it}^{D}\right) + \eta_{it}\frac{d\gamma_{it}}{dt}(p_{it}^{LWC} - p_{it}^{HWC})}_{\text{taste shift}} \\
&+\text{contribution of HWCs}
\end{aligned}
\tag{4}
$$

Aggregation to Macro Inflation

- Aggregate effect = weighted average of product-level contributions
- No need to specify upper-level elasticity of substitution (i.e. across goods).

$$\pi_t = \sum_{i}^{I} \omega_{i,t-1} \pi_{it} = \sum_{i=0}^{T} \omega_{i,t-1} \pi_{it}^{T} + \sum_{i=n+1}^{NT} \omega_{i,t-1} \pi_{it}^{NT}$$

We obtain macro level versions of (1) and (4) by defining weights

- β_t the expenditure share on tradables
- η_t the expenditure share on foreign goods
- γ_t the expenditure share of LWC goods on total imports

Imports from LWC and inflation

$$\pi_t = \underbrace{\beta_t \frac{\partial \eta_t}{\partial t} \gamma_t \left(p_t^{LWC} - p_t^{D} \right)}_{\text{Substitution Channel}}$$
$$+ \underbrace{\beta_t \eta_t \left[\frac{\partial \gamma_t}{\partial t} (p_t^{LWC} - p_t^{HWC}) + \gamma_t \left(\pi_t^{LWC} - \pi_t^{HWC} \right) \right]}_{\text{Imported Inflation Channel}}$$
$$+ \underbrace{\beta_t (1 - \eta_t) \pi_t^{D}}_{\text{Competition Channel}} + \Lambda_t$$

Details of Λ_t

1. Inflation decomposition
2. Data Construction
3. Quantification
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Empirical exercise

- We match trade, production, and consumption data for 1994-2014
- We provide measures of the different components of the contribution to inflation of imports from LWC:
  - Consumption shares: $(\beta_t, \eta_t, \gamma_t)$ and their evolution $\left(\frac{\partial \beta_t}{\partial t}, \frac{\partial \eta_t}{\partial t}, \frac{\partial \gamma_t}{\partial t}\right)$
  - Price-level levels: $\left(p_t^D, p_t^{LHC}, p_t^{LWC}\right)$
  - Inflation rates : $\left(\pi_t^D, \pi_t^{HWC} \pi_t^{LWC}\right)$
- We estimate the impact of import penetration on domestic prices π_t^D using exports shocks in LWCs as sources of exogenous variation

Main dataset: Customs' import and export data

- Quasi-exhaustive administrative database collected by the French Customs for 1994-2014.
- Values (in euros) and quantities of imports and exports by country of origin and product at the CN8 level ($\approx$ 14,000 products)
- We construct import and export unit values at the CN8 level
- We exploit the detailed nature of the data to build import price indices by product-origin

Consumption Data

- Aggregate consumption values at the level 4 of COICOP from INSEE ($\approx$ 150 products).

Production Data

- Producer Price Indices from INSEE at the 4-digit CPA level
- Domestic production from PRODCOM Data
- Labor and intermediate input costs at NACE 2-digit level from OECD-STAN

Matching Trade, Consumption and CPI data

- We concord the CN8 classification to the COICOP classification
- We restrict to CN8 codes that match to COICOP to identify consumer goods ▸ details
- We calculate the share of imports in consumption for COICOP products
  - We add VAT rates + uniform retail distribution margin rate

Country groups

- 5 different country categories according to their GDP per capita (Bernard, Jensen and Schott [2006], Auer and Fischer [2010] and Auer et al. [2013]) details
  - 3 main groups:
    - High-wage countries (above 75% of French GDP pc): EU countries, US, Can., Jap...
    - Intermediate group of LWC (btw 25% and 75% of French GDPpc): South America, Eastern European countries, South East Asia...
    - LWC (less than 25% of the French GDPpc): China, India, Vietnam and most of African countries
  - 2 separate groups for:
    - China
    - New EU member states (NEUMS)

Import Price Indices p_t^F

g=country group, i=product(CN 8-digit level), c=country

- At date 0.

$$P_{gi,0}^F = \prod_{c \in g} P_{ic,0}^{\gamma_{ic,0}}$$

- At date t, aggregation by groups of country:

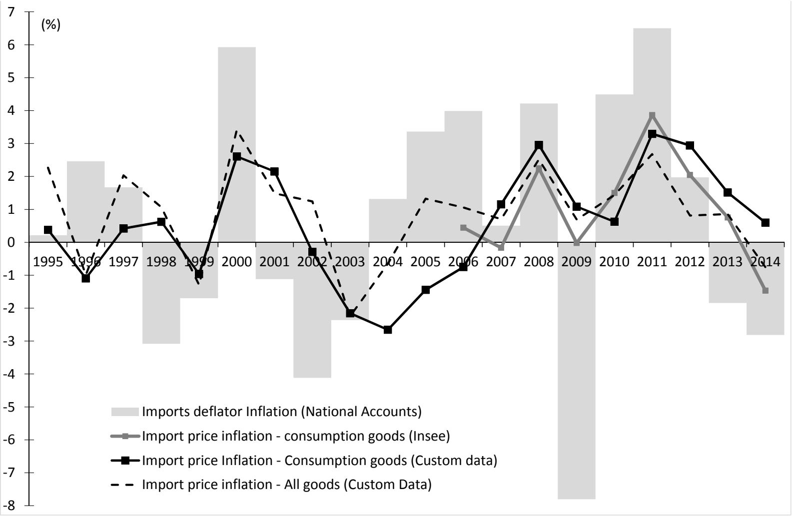
$$\pi_{gi,t}^F = \frac{\prod_{c \in g} P_{ic,t}^{\gamma_{ic,t-1}}}{\prod_{c \in g} P_{ic,t-1}^{\gamma_{ic,t-1}}}$$

Then: $P_{gi,t}^F = P_{gi,t-1}^F \pi_{gi,t}^F$

- At date t, import price level for product i:
$P_{i,t}^F = \prod_g {P_{gi,t}^F}^{\gamma_{gi,t}}$ and $\pi_{i,t}^F = ln\left(P_{i,t}^F\right) - ln\left(P_{i,t-1}^F\right)$

Aggregate import price inflation: $\pi_t^F = \sum_i \gamma_{i,t} \pi_{i,t}^F$

Figure: Import Price Inflation - A Comparison



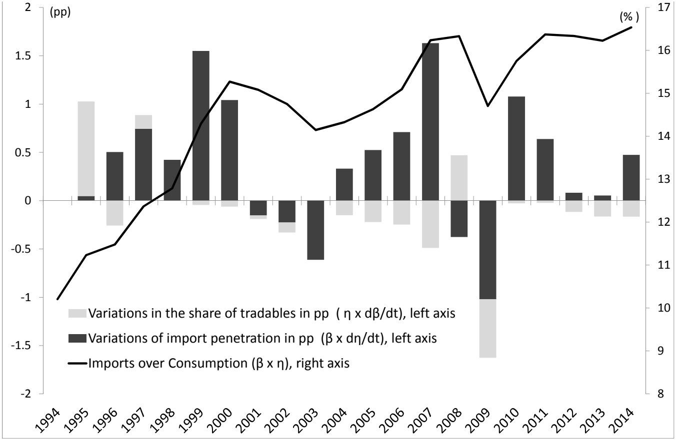
Substitution Channel

$$\beta_t \frac{\partial \eta_{it}}{\partial t} \gamma_{it} \left(p_{it}^{LWC} - p_{it}^{D} \right)$$

- β_t the expenditure share on tradables
- $\frac{\partial \eta_{it}}{\partial t}$ change in the expenditure share on foreign goods
- γ_t the expenditure share of LWC goods on total imports

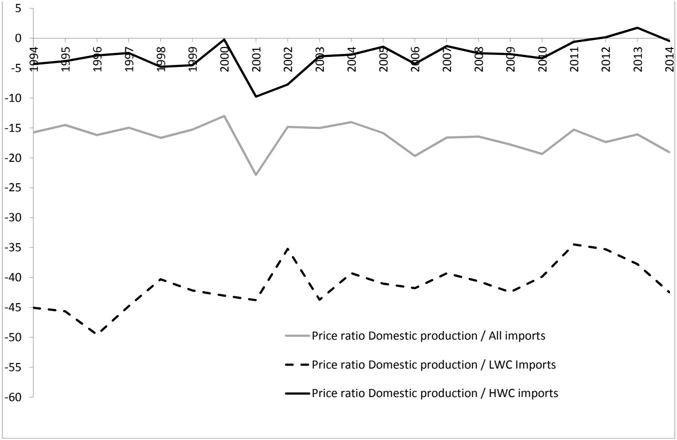
Substitution towards LWC goods: $\beta_t \frac{\partial \eta_t}{\partial t} \gamma_t \left(p_t^{LWC} - p_t^D\right)$

Figure: Import Penetration in CPI Consumption - Total and by Country Groups



Price differential: $\beta_t \frac{\partial \eta_t}{\partial t} \gamma_t \left(p_t^{LWC} - p_t^{D}\right)$

Figure: Price of Domest. Produced Goods vs. Imported (Consumption) Goods



Substitution Channel: Total Effect

- Substitution Channel:

$$\underbrace{\beta_t \frac{\partial \eta_t}{\partial t} \gamma_t}_{0.46\times 0.8\times 0.31} \underbrace{\left(p_t^{LWC} - p_t^{D}\right)}_{-0.41}$$

$$\Rightarrow \text{Channel 1} = -0.05pp$$

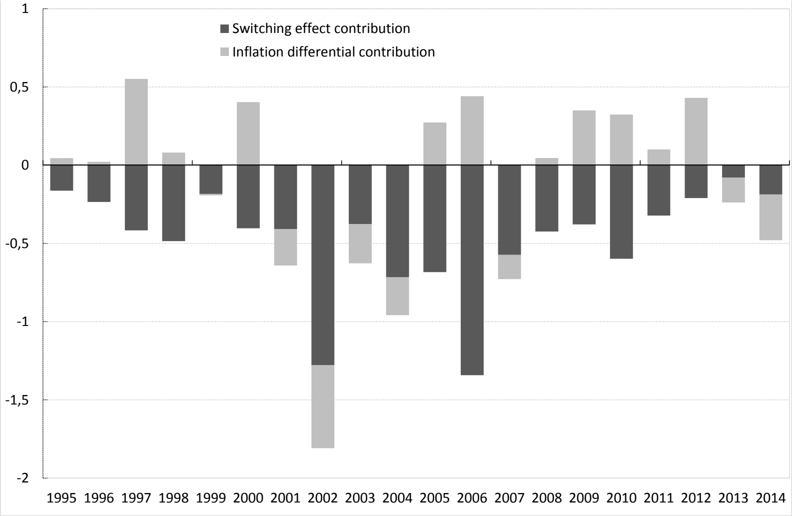
- Remark: Important heterogeneity across products. Clothing, Furnishing and Communication account for a bulk of the effect.
- China accounts for -0.03 pp in the total effect

Contribution of LWCs to Imported Inflation

$$\beta_t \eta_t \left[\underbrace{\frac{\partial \gamma_t}{\partial t} (p_t^{LWC} - p_t^{HWC})}_{\text{Substitution effects}} + \underbrace{\gamma_t \left(\pi_t^{LWC} - \pi_t^{HWC} \right)}_{\text{Inflation differential}} \right]$$

- Substitution effects: substitute HWC goods for LWC goods
- Inflation differential effects: differences in evolution of import prices

Figure: Contribution to Import Price Inflation: Substitution vs Inflation Differential Effects



Total Effect of the *Imported Inflation* channel

- Imported Inflation Channel:

$$\underbrace{\beta_t \eta_t}_{0.14} \left[\underbrace{\frac{\partial \gamma_t}{\partial t}(p_t^{LWC} - p_t^{HWC})}_{-0.47} + \underbrace{\gamma_t \left(\pi_t^{LWC} - \pi_t^{HWC} \right)}_{+0.06} \right]$$

$\Rightarrow$ Channel 2$=$ $-0.06pp$

- with China $= -0.05$ pp

Competition channel

$$\beta_t(1-\eta_t)\pi_t^D$$

- We estimate the impact of changes in LWC import penetration on changes in domestic producer prices:

$$\pi_{i,t}^D = \Psi \Delta S_{i,t}^{LWC} + \kappa \Delta labcost_{i,t} + \eta \Delta inputcost_{i,t} + \lambda_t + \nu_i + \epsilon_{i,t}$$

- See underlying model with strategic complementarities ▸ here

- We instrument $\Delta S_{i,t}^{LWC}$ with labor share in sector i $\times \Delta X_t^{LWC}$: where ΔX_t^{LWC} is the yearly change in the value of exports of LWCs excluding France (Autor et al (2013) and Auer et al (2016))

Table: Results of first-stage estimation

	All goods		Consumption goods		High Import penetration	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Export LWC × Labour share	0.236***		0.175*		0.205**	
	(0.055)		(0.092)		(0.097)	
Δ Export China × Labour share		0.135***		0.113**		0.179***
		(0.034)		(0.052)		(0.059)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Product dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.10	0.05	0.08	0.06	0.13	0.08
Nb products	154	154	52	52	81	81
Nb observations	1,981	1,982	699	699	980	980

Impact of LWCs on French Producer Inflation

Table: Impact of LWC Imports on French Producer Price Inflation

	All goods		Consumption goods		High Import penetration	
	OLS	IV	OLS	IV	OLS	IV
Δ share - LWC	0.134*	-1.208**	0.198*	-0.803	0.102	-1.656
	(0.063)	(0.615)	(0.103)	(1.283)	(0.086)	(1.312)
Δ Interm. Input costs	0.226***	0.249***	0.095**	0.100*	0.245***	0.340***
	(0.041)	(0.044)	(0.048)	(0.051)	(0.058)	(0.103)
Δ Labour costs	-0.052	0.025	-0.069	0.004	-0.043	0.145
	(0.044)	(0.054)	(0.080)	(0.077)	(0.068)	(0.140)
R^2	0.11	0.03	0.14	0.06	0.11	0.06
Nb products	154	154	52	52	81	81
Nb observations	1,986	1,981	699	699	984	981

See first stage

Effects through the *Competition Channel*

- Competition Channel:

$$\underbrace{\beta_t}_{0.46}\underbrace{(1-\eta_t)}_{0.68}\underbrace{\frac{\partial \pi_t^D}{\partial S_t^{LWC}}}_{-1.21}\underbrace{\frac{\partial S_t^{LWC}}{\partial t}}_{0.17}$$

$\Rightarrow$ Channel 3 -0.06 pp

- China effect $= -0.02$ pp

Discussion of the results: total effect

- The share of imports from LWCs in consumption increased from 2.4% to 6.9%.
- Contributed negatively to CPI inflation by 0.17pp by year on average:

$$\underbrace{0.05}_{\text{substitution}} + \underbrace{0.06}_{\text{imported inflation}} + \underbrace{0.06}_{\text{competition}} \simeq 0.17$$

- 2 thirds of the effect due to expenditure switching into LWC goods and away from domestic and HWC goods.

Discussion of the results: composition vs price effects

Alternative decomposition: "pure price" and composition effects

$$\pi_t^T = \underbrace{(-0.06 - 0.06)}_{\text{Composition effect}} + \underbrace{(-0.06 + 0.01)}_{\text{CBG Inflation effect}} = 0.17$$

Pure inflation effects : -0.05 pp per year on average

CES preferences

- Consider general under CES preferences: $\theta > 1$.
- For simplicity we pull France and other HWCs together. We obtain (1st order approx):

$$\pi_t^{CES} = \underbrace{\pi_t^R + \gamma_t^L \left(\pi_t^L - \pi_t^R\right)}_{\text{pure price}} + \underbrace{\frac{1}{1-\theta}\left[\left(\frac{P_t^L}{P_t}\right)^{1-\theta} - \left(\frac{P_t^R}{P_t}\right)^{1-\theta}\right]\frac{d\alpha_t^L}{dt}}_{\text{taste shift}}$$

- Reminder, under Cobb-Douglas:

$$\pi_t^{CB} = \underbrace{\pi_t^R + \gamma_t^L \left(\pi_t^L - \pi_t^R\right)}_{\text{pure price}} + \underbrace{\left[\log P_t^L - \log P_t^R\right]\frac{d\alpha_t^L}{dt}}_{\text{taste shift}}$$

- **Difference** given only by the **taste-shift term**.

CES preferences

- Under Cobb-Douglas, taste parameter α_{ijt} show up as expenditure shares (thus observable):

$$\alpha_{ijt} = \frac{P_{ijt} Q_{ijt}}{P_{it} Q_{it}} = \frac{v_{ijt}}{v_{it}} = S_{ijt}$$

- Under CES:

$$S_{jt} = \alpha_{jt} \left(\frac{P_{jt}}{P_t} \right)^{1-\theta}$$

rearranging

$$\alpha_t^L = \frac{\left(\frac{P_t^L}{P_t^R}\right)^{\theta-1} \frac{S_t^L}{1-S_t^L}}{1 + \left(\frac{P_t^L}{P_t^R}\right)^{\theta-1} \frac{S_t^L}{1-S_t^L}} \tag{5}$$

$\rightarrow$ Taste parameter α_t^L can be recovered from **observed prices and expenditure shares** for any **given elasticity of substitution**.

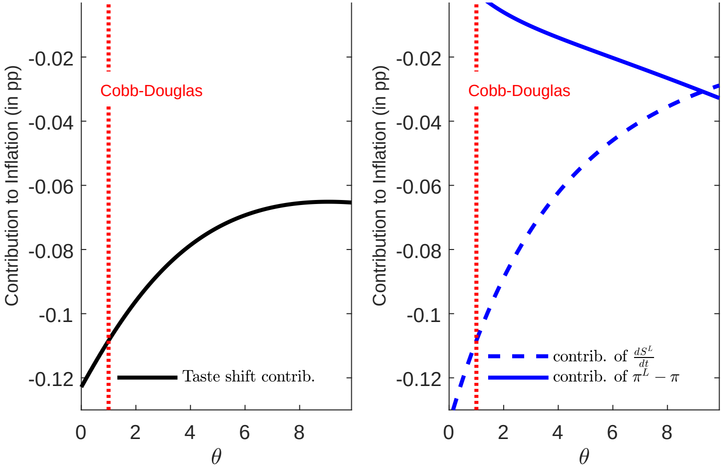
CES preferences

- How are implied taste shifts related to θ ?

$$\frac{d\alpha_t^L}{dt} = \frac{dS_t^L}{dt}\left(\frac{P_t^L}{P_t}\right)^{\theta-1} + (\theta-1)S_t^L\left(\frac{P_t^L}{P_t}\right)^{\theta-1}(\pi_t^L - \pi_t) \qquad (6)$$

- For given prices and expenditure shares, $\frac{d\alpha_t^L}{dt}$ is decreasing in θ.
- True analytically for the first term, and explored numerically for the entire expression

Figure: Contribution of Taste Shifts



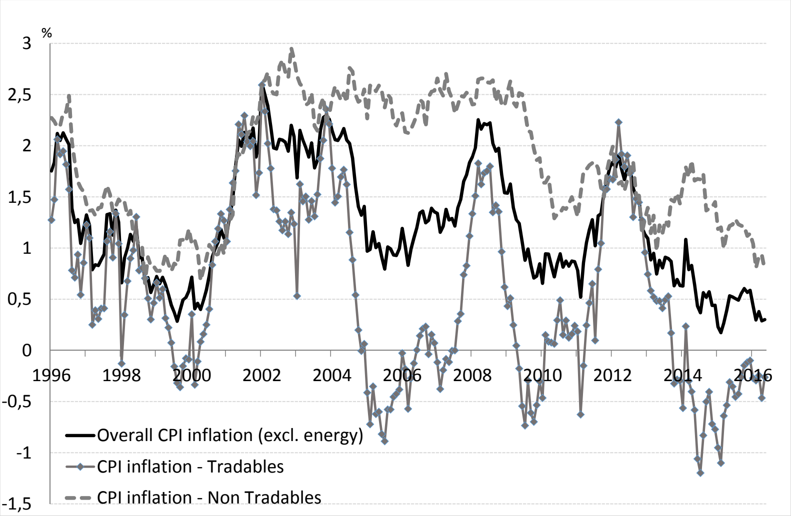
Concluding Remarks

- LWC contributed negatively to consumer prices in France by 0.17pp by year on average over 1994-2014
  - China accounts for two thirds of the overall effect
- "Substitution" effects (-0.12 pp) and "pure price" effects (-0.05 pp).
  - "Substitution" effects likely to be a lower bound to welfare effects under CES.
  - "Pure price" effects lower bound due to intermediate input trade not accounted for.
- Households pay €1000 less for consumption in 2014 wrt to 1994
- Future research:
  - Micro study with firm-level producer prices

Thank you for your attention!

Appendix

Decomposition of French CPI inflation: Tradable vs Non-Tradables



Indirect effects

$$\Lambda_t = \beta_t \left[\eta_t \pi_t^{HWC} + (1-\gamma_t) \frac{\partial \eta_t}{\partial t} \left(p_t^{HWC} - p_t^{D} \right) \right] + (1-\beta_t) \pi_t^{NT} + \frac{\partial \beta_t}{\partial t} (p_t^{T} - p_t^{NT})$$

Back

Definition of the sample: identification of consumer goods

We proceed as follows

1. We concord CN8 into 6-digit CPA codes ($\approx$ 3,000 products) using concordance tables from RAMON, the EU Statistical Website
2. We concord CPA codes to COICOP categories using concordance tables from RAMON, the EU Statistical Website
3. We improve on both concordances by performing keyword searches
4. We drop all those CN8 without a mapping into COICOP

Examples

- CN8 61112010, "Babies' garments and clothing accessories, knitted or crocheted: Gloves, mittens and mitts", maps into COICOP 03.1.2, "Garments"
- CN8 28121011, "Chlorides and chloride oxides" has no counterpart in COICOP

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Table: List of Countries by Country Categories

Group of countries	
High-Wage countries	GDP per capita above 75% of France's: EU countries, US, Canada, UK, Japan,South Korea, Australia, New Zealand, Israel...
Low wage countries	GDP per capita between 25% and 75% of France's
- New EU member states	
	Bulgaria, Croatia, Cyprus, Czech, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia
- Other Low wage countries	
	Turkey, Brazil, Mexico, Malaysia, Russia, Argentina,...
Very Low wage countries	GDP per capita below 25% of France's
- China (including Hong-Kong)	
- Other Very low wage countries	
	India, Thailand, Tunisia, Morocco, Indonesia, Philippines, Vietnam, Egypt, Pakistan, Ukraine,...

Table: Contribution of LWC Imports to Import Price Inflation: Comparison

Country	Period	Impact of LWC on import inflation	Source
France	95-05	-0.44 pp	This study
Austria	95-05	-0.66 pp	Glatzer et al. 2006
Finland	96-05	-1 pp	BoFinland 2006
Portugal	98-06	-0.2 pp	Cardoso et al.2006
Sweden	96-04	-1 to -2 pp	Bank of Sweden 2005
United States	93-02	-0.8 to -1 pp	Kamin Marazzi 2006
France	00-05	-1 pp	This study
United Kingdom	00-05	-0.7 pp	Mac Coille 2008

Note: this table reports estimates of the contribution of LWC to import prices in different countries. These estimates are obtained using a very similar methodology presented in section 4.2. Differences in methodologies may come from the definitions of country categories and also from the level of product disaggregation. Results presented for France are calculated over two different periods (1995-2005) and (2000-2005).

Channel 1: Heterogeneity across products

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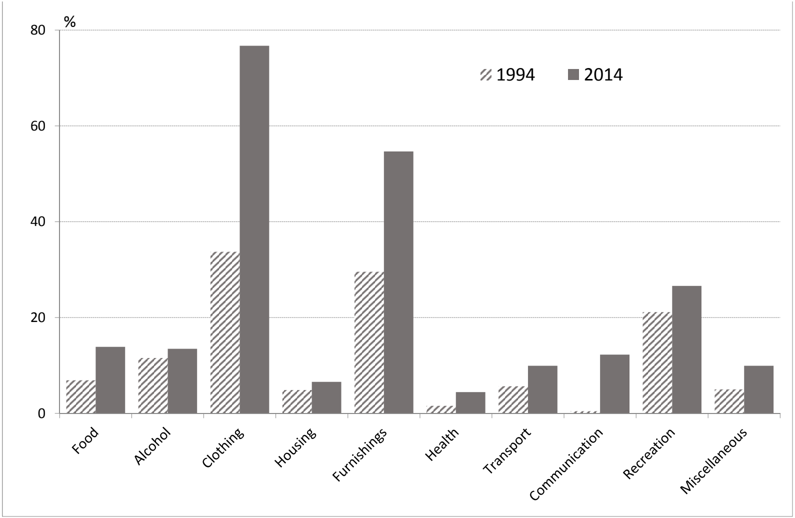


Figure: Import Market Share by Country Category

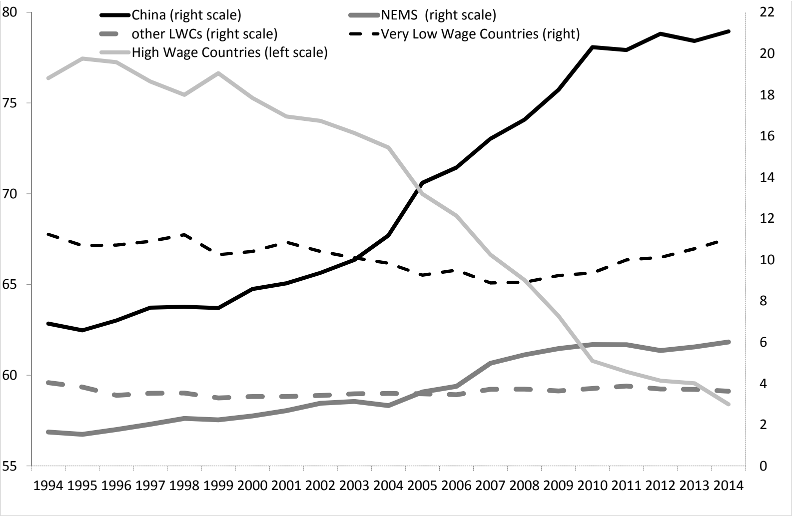
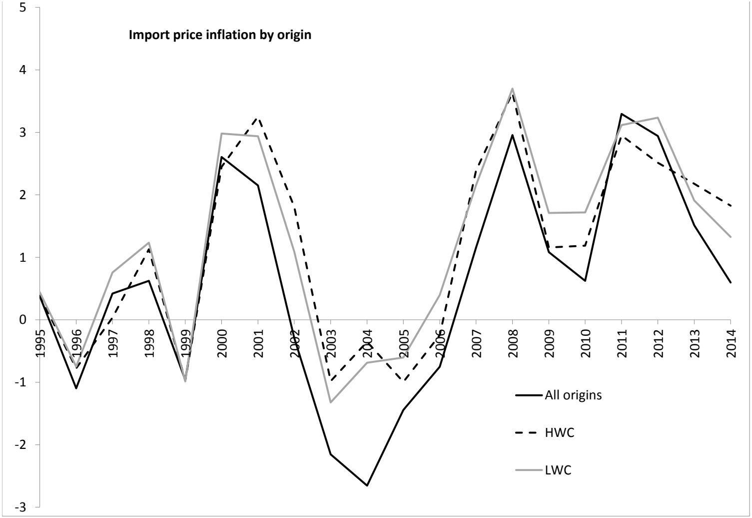


Figure: Import Price Inflation Differential: High-wage vs. Low-wage Countries



Sketch of the Model for Channel 3

Competition effect through Variable Markups

- Firm j within a given industry i.
- $P_t(j,i) = \mathcal{M}_t(j,i) mc_t(j,i)$ where $\mathcal{M}_t(j,i)$ depends on price elast. of demand
  - Price elasticity of demand of competitors
  - In equilibrium : this information is summarized in firm's market share $S_t(j,i) \Rightarrow \mathcal{M}_t(j,i) = \mathcal{M}(S_t(j,i))$

$\Rightarrow \Delta \log(P_t(j,i)) \simeq \Gamma_t(j,i) \Delta \log(S_t(j,i)) + \Delta \log(mc_t(j,i))$ back

Sketch of the Model for Channel 3

Foreign Competition

- 3 firms: $j \in \{d, LWC, HWC\}$.
- Within each sector i: $S_t(d) = 1 - (S_t(HWC) + S_t(LWC))$.
- Theoretical Prediction:

$$\Delta \log(P_t(d)) =$$
$$\Psi_t^{LWC} \Delta \log(S_t(LWC)) + \Psi_t^{HWC} \Delta \log(S_t(HWC)) + \Delta \log(mc_t(d))$$

back

Pure Price index versus Constant Utility index

Table: Two price indices with and without composition effect

year	FR P	FR Q	FR ξ	CN P	CN Q	CN ξ	CPI $\sum_j \xi^j_{-1} \frac{P^j}{P^j_{-1}}$	CUI $\frac{\sum_j \xi^j P^j}{\sum_j \xi^j_{-1} P^j_{-1}}$
$t-1$	10	10	1		0	0		
t	10	7	$\frac{70}{100}$	5	6	$\frac{30}{70}$	1	$\frac{0.7*10+0.3*5}{1*10}$
$t+1$	10	2	$\frac{20}{80}$	5	12	$\frac{60}{80}$	$0.7\frac{10}{10}+0.3\frac{5}{5}$	$\frac{0.25*10+0.75*5}{0.7*10+0.3*5}$
$t+2$	10	1	$\frac{10}{100}$	5	18	$\frac{90}{100}$	$0.25\frac{10}{10}+0.75\frac{5}{5}$	$\frac{0.1*10+0.9*5}{0.25*10+0.75*5}$

back

Pure Price index versus Constant Utility index

Table: Two price indices with and without composition effect

year	FR			CN			CPI inf	CUI inf
	P	Q	ξ	P	Q	ξ	$\sum_j \xi^j_{-1} \frac{P^j}{P^j_{-1}}$	$\frac{\sum_j \xi^j P^j}{\sum_j \xi^j_{-1} P^j_{-1}}$
$t-1$	10	10	1		0	0		
t	10	7	$\frac{70}{100}$	5	6	$\frac{30}{70}$	0%	−15%
$t+1$	10	2	$\frac{20}{80}$	5	12	$\frac{60}{80}$	0%	−11%
$t+2$	10	1	$\frac{10}{100}$	5	18	$\frac{90}{100}$	0%	−12%

back

Imports from LWC to inflation for good i: price and composition effects

Combining expressions and rearranging terms

$$\begin{aligned}\pi_{it}^{T} = & \underbrace{(1-\eta_{i,t-1})\pi_{it}^{D} + \eta_{i,t-1}\gamma_{i,t-1}\left(\pi_{it}^{LWC} - \pi_{it}^{HWC}\right)}_{\text{CBG Inflation effect}} \\ & + \underbrace{\frac{\partial \eta_{i,t-1}}{\partial t}\gamma_{it}\left(p_{it}^{LWC} - p_{it}^{D}\right) + \eta_{it}\frac{\partial \gamma_{it}}{\partial t}(p_{it}^{LWC} - p_{it}^{HWC})}_{\text{Composition effect}}\end{aligned} \tag{7}$$

back

Derivation of inflation decomposition

- Consider a general CES Utility Function $U(C) = A \sum_1^N \alpha_i^{\frac{1}{\theta}} C_i^{\frac{\theta-1}{\theta}}$.
- Assume N and α_i constant.

Leontief

- $\theta \to 0$: $U(X_i) = \min_i \left\{ \frac{X_i}{\alpha_i} \right\}$
- $X_i = \frac{\alpha_i R}{\sum_i P_i \alpha_i} = \alpha_i Y$, $P = \sum_i \alpha_i P_i$
- Differencing P wrt time: $\pi_t = \sum_i \xi_{i,t-1} \pi_{i,t}$, with $\xi_{i,t-1} = \frac{X_{i,t-1} P_{i,t-1}}{Y_{t-1} P_{t-1}}$

Cobb-Douglas

- $\theta \to 1$: $U(X_i) = \prod_i X_i^{\alpha_i}$
- $X_i = \alpha_i \left(\frac{P_i}{P}\right)^{-1} Y$, $P = \prod_i P_i^{\alpha_i}$
- log-differencing P wrt time
  $\pi_t = \sum_i \alpha_i \pi_{i,t}$ with $\alpha_i = \frac{X_{i,t}P_{i,t}}{Y_t P_t} = \frac{X_{i,t-1}P_{i,t-1}}{Y_{t-1}P_{t-1}}$

CES

- $\theta \to 1$: $U(X_i) = \prod_i X_i^{\alpha_i}$
- $X_i = \alpha_i \left(\frac{P_i}{P}\right)^{-\theta} Y$, $P = \left[\sum_i \alpha_i P_i^{1-\theta}\right]^{\frac{1}{1-\theta}}$
- Taking a first order Taylor approximation (around $t-1$):

$$\hat{P}_t = \sum_i \xi_{i,t-1}\hat{P}_{i,t} \text{ with } \xi_{i,t-1} = \frac{X_{i,t-1}P_{i,t-1}}{Y_{t-1}P_{t-1}} = \alpha_{i,t-1}\left(\frac{P_{i,t-1}}{P_{t-1}}\right)^{1-\theta}$$
$$\Rightarrow \pi_t = \sum_i \xi_{i,t-1}\pi_{i,t} \tag{8}$$

back