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

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Abstract

Using micro data on import values and quantities by product and countries of origin, we quantify the effect of imports of consumption-goods from low-wage countries (LWCs) on inflation in France from 1994 to 2014. Imports of varieties produced in LWCs affect the cost-of-living price index through pure-price and taste-shift variations (which, conditional on prices, drive expenditure shares). The pure-price effect includes both the contribution of imported inflation (given the share of imports in consumption) and the pro-competitive effect on domestic prices. The taste-shift effect cannot be directly observed but is recovered from actual expenditure shares and relative prices. We derive an expression of inflation that allows us to disentangle the impact of imports of consumption goods from LWCs on cost-of-living versus CPI inflation – the latter abstracting for composition effects. Overall, we estimate that imports from LWCs lowered CPI inflation by 0.05 pp per year on average, and had a much larger effect on cost-of-living inflation (between 0.13 to 0.17 pp per year depending on the preferences specification).

JEL codes: E31, F62
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1 Introduction

During the past decades consumers in developed economies continuously switched expenditures towards goods produced in low-wage countries (LWCs). In France, the share of LWCs in total imports of consumer goods increased from 26% in 1994 to over 43% in 2014. The weight of goods imported from LWCs as a percentage of total consumption tripled, passing from 2.4% to 6.9%. How did this change in the structure of consumption affect inflation and welfare?

In this paper, we quantify the effect of imports of consumption goods from LWCs on French inflation and consumer welfare over the period 1994-2014. Our results show that imports from LWCs lowered Consumer Price Index (CPI) inflation by 0.05 *pp* per year on average, and had a much larger effect on welfare-relevant cost-of-living (COLI) inflation, estimated to lie between -0.13 and -0.17 *pp* per year depending on the assumption about consumer preferences.

We first show how to measure the impact of imports on inflation and welfare using increasingly available trade data and publicly-available consumption expenditures data. We obtain our quantification from a theory-derived methodology to construct macro-level price indices from product-level import price indices and consumption expenditures. Starting from a general homothetic CES utility function for a representative consumer, we derive a simple expression for price dynamics of individual products that can be decomposed linearly into a "pure price" term, holding constant the composition of the consumption basket, and a "taste-shift" term, representing changes in relative consumption shares across varieties which, for given price levels, arise from shifts in the relative preferences over different varieties. Such product-level inflation rates aggregate-up to the level of sectors and then to the total economy, providing us with micro-founded measures of macro inflation that make apparent the contribution of imports through price and preferences' changes.

We then estimate empirically the contribution of these two terms on inflation. We use quasi-exhaustive firm-level data from the French Customs with information on quantities and values of imports by product and country of origin, from which we construct detailed import price indices based on unit values. We define a product variety as a combination of a product (at 8-digit level of the CN classification) and a country of origin. The use of detailed product-level data by origin country is key for our empirical exercise since it allows us to obtain measures of differences in price *levels*. We create a concordance table to assign each of the imported products to a consumption category in the French CPI, for which data on the value of consumption expenditures is publicly available.

We measure the overall effect of LWCs imports on inflation by quantifying separately the two effects of LWCs imports ("pure price" and "taste-shift" effects).

Pure price effects transit first via the contribution of LWCs import prices to the overall import inflation rate. Our estimates of imported inflation from LWCs show it was slightly higher than imported inflation from High-wage countries (HWCs), resulting in an overall positive but small impact of imports from LWCs on CPI inflation (+0.01 pp). Second, raising imports from LWCs affects the price-setting behavior of domestic firms, thus affecting domestic inflation indirectly (Chen et al. [2009]). This effect, labeled the *competition*, accounted for a reduction of inflation by 0.06 pp per year on average. We estimate it using data on domestic producer price indices and adopting a shift-share instrumental variable approach that uses exports from LWCs to the rest of the world to measure exogenous export supply shocks in these countries (Auer and Fischer [2010]; Autor et al. [2013]). Overall, the pure price effects have reduced CPI inflation by about 0.05 pp per year over the sample period.

Taste shift effects depend on the assumed form of the utility function of the representative consumer, contrary to *pure price* effects, which we show are the same independent of the value of the elasticity of substitution (i.e. be it Leontieff, Cobb-Douglas or general CES). To provide a quantification of the contribution of *taste shift* deriving from imports from LWCs, we start with the case of Cobb-Douglas preferences, which assumes that the elasticity of substitution is equal to one. The advantage of this approach is that it allows us to compute taste-shifts directly from data on prices and values, without relying on estimated values for the elasticities of substitution across varieties. We consider two types of taste shifts. First, we analyse changes in tastes within imports, with goods from LWCs replacing imports from HWCs. We estimate that such changes in the import basket reduced import inflation by about 0.5 pp and French CPI inflation by 0.07 pp per year on average. Second, we consider taste shifts leading French consumers to switch their expenditures of goods produced domestically towards goods imported from LWCs. Our estimations suggest that such substitution reduced French inflation by 0.05 pp per year on average. Overall, taste-shift effects reduced CPI inflation by about 0.12 pp per year over the sample period.

The sum of *taste-shift* effects and *pure-price* effects gives an overall effect of -0.17 pp per year on inflation. China, whose share in French consumption grew from 0.7% to 3.5% over the sample period, contributed to about half of the total.

Our methodological approach provides insights on how these effects are captured by official statistics. In particular, the estimation of the pure-price effect corresponds to the impact of imports from LWCs on CPI inflation, since CPI inflation as measured by National Statistical Offices is a pure-price index that holds the consumption basket constant (whereas composition effects arising from changes in relative preferences across goods are essential to cost-of-living measures). The taste-shift term has a different form depending on the elasticity of substitution. Measuring the contribution of taste-shifts under Cobb-Douglas preferences is straightforward because taste-shifts directly map into observable variety-level expenditure shares. However, in the general CES setup with higher-than-unity elasticity of substitution, taste-shifts are not directly observable but can be recovered from expenditure shares and relative prices, for any given value of the elasticity of substitution. We show in our case that a higher elasticity of substitution substantially reduces our estimates of this effect: when the elasticity of substitution ranges from 4 to 6, the contribution of LWCs to French inflation through taste-shifts is about one-third lower than in the Cobb-Douglas case. Overall, we calculate that the contribution of taste shifts to cost-of-living inflation is between -0.12 (in the Cobb-Douglas case) and about -0.08 pp for more standard values of elasticity of substitution (e.g. about 4).

Our approach encompasses micro and macro questions in one integrated framework, therefore contributing to literatures that evolve separately. On the one hand, there has been increasing interest in the recent macroeconomic literature on the link between globalization and inflation. Several mechanisms have been advanced (see e.g. Rogoff [2003] for an early survey), with one of them being that imports, especially from low-wage countries, were an important factor in determining the low levels of inflation observed in developed economies. However, empirical evidence is scarce, and statements on the role of imports on inflation have been rather conjectural.[1] We quantify the impact of imports from LWCs and show that, by construction,

[1]See for instance a statement from ECB president Mario Draghi: "*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*" Draghi [2017]. Baldwin [2022] labels this the "Globalisation of Inflation

the CPI does not take into account up to two thirds of the total effect. Our paper complements early work by Auer and Fischer [2010] and Auer et al. [2013], who estimated pro-competitive effects of import penetration from nine low-wage countries in the US and Europe respectively. We present a thorough analysis that includes pro-competitive effects as part of the total effect, and we show that composition effects played a larger role. We also present a flexible methodology to quantify the impact of imports on macro inflation that is easy to implement with increasingly available data.

Our approach is related to, and complement, recent works on price index measurement by Redding and Weinstein [2018] and Redding and Weinstein [2020] by developing a macro price index based on theoretically consistent aggregation of price indices of individual goods, and by showing how to apply the decomposition using available data on trade and domestic expenditures. Using detailed scanner data on prices and quantities for food products, Braun and Lein [2021] apply their decomposition in the context of the Swiss Franc 2015 devaluation, and they provide a quantification of biases in official statistics. We analyse the impact of the continuous increase in imports from LWCs during the long term and provide a quantification of how this affected the French CPI and compare it to a cost-of-living index.

We also contribute to the extensive literature on the welfare gains from trade that followed upon the seminal contribution of Arkolakis et al. [2012]. While a very large amount of work has been devoted to understanding the labor market impact of imports from LWCs, and in particular, China, little is known so far about prices and welfare, which are key variables in virtually all trade models. Recent contributions include evidence on the impact of the "China shock" on prices using sector-level data (Amiti et al. [2020]) and US scanner data (Bai and Stumpner [2019]) or CPI data (Jaravel and Sager [2018]). Such works focus on pro-competitive effects and do not provide estimates of overall macroeconomic effect. Berlingieri et al. [2016] find that trade EU agreements increased consumer welfare by 0.24%, with stronger effects for high-income countries. Like these works, our focus is on the direct impact of imports of consumption goods on French prices.[2] We contribute to this literature by shedding light on the

Hypothesis" and discusses how it relates to the role of imports of services.

[2]Our paper also relates to a previous literature studying the impact of import penetration on other price indices, either *import prices* or *producer prices*. A first group of works focuses on the evolution of *import prices* (Kamin et al. [2006] for the United States, Glatzer et al. [2006] for Austria, Mac Coille [2008] and Nickell [2005] for the United Kingdom, Pain et al. [2008] for the Euro Area and the United States). The general conclusion is

relative magnitudes of the different mechanisms through which imports of consumption goods from LWCs affected prices in a developed country, for a period in which these imports surged. One key result of our paper is that substitution effects matter the most.

The rest of the paper is organized as follows. Section 2 presents the data sources, and documents some key stylised facts on LWCs import prices and quantities. Section 3 provides a simple analytical framework that develops an expression for the impact of imports from LWCs on inflation. Section 4 presents the results of the quantification of imports from LWCs on inflation and discusses the aggregate effect of imports from LWCs on French CPI and Cost-of-living inflation.

2 Prices and expenditure shares by origin in French Imports

In this section, we present our data sources and document three stylized facts about the evolution of French imports that provide the motivation for the quantification developed in the rest of the paper.

2.1 Data

Our empirical analysis combines detailed administrative trade data with publicly available data for household consumption spanning the 1994-2014 period. We now briefly introduce the data sources and refer to sections A).1 and A).2 of the Appendix for details.

Product-country level imports and exports We obtain trade data from a quasi-exhaustive administrative file collected by the French Customs Office. It provides the yearly values (in euros) and quantities of imports (by country of origin and product) and exports (by country of destination and product) for all trading firms over the period 1994-2014. Trade flows are classified at the CN 8-digit level (Combined Nomenclature of the EU). We use the customs data to construct import and export unit values and calculate the share of imports on consumption by product and country.

that the rapid increase in LWCs imports depressed import prices in these countries because of the lower prices of imported goods. Interestingly, the magnitude of the effects reported by these works is very close to what we find.

Household consumption expenditures We also use the yearly value of household consumption provided by INSEE at the 3-digit level of the COICOP classification (51 products) which is used to build the official Consumer Price Index. Values of household consumption will allow us to measure the share of imported goods in households'consumption and thus the share of expenditures devoted to imported goods in the CPI. Our aim is to quantify the contribution of imports to the evolution of French consumer prices. We thus restrict our analysis to imports of consumption goods and we define the set of consumption goods as those goods included in the French CPI. We base this procedure on a concordance table between CN8 codes and COICOP classification that we construct as explained in Section A).1.

Main variables: expenditures shares and prices Matching the trade data with the expenditure data allow us to construct expenditure shares of imports by country. In particular, as it will become explicit in he theory section, we need to compute the share of imports from a country category in total imports of a specific good, the share of imports in a COICOP sector, the share of tradable goods in total consumption, the share of imports in tradable goods.

The trade data allow us to proxy product-level prices with unit values. We calculate unit values at the product(CN8)-country level, the most disaggregated available, in order to minimize measurement errors arising from heterogeneity at lower levels of disaggregation (still more disaggregated than the six-digit level at which the literature tends to focus). For each variety, we define: $P_{ijt} = v_{ijt}/Q_{ijt}$. Given the lack of available data on the price levels of domestically-produced goods, we proxy domestic prices with French export unit values, as in Emlinger and Fontagné [2013]. We compute export unit values similar to the case of imports.[3]

From individual unit values, we construct price indices by origin country group, which we then aggregate to obtain a macro price index of imported inflation. To check for external validity, Figure A in Appendix compares the evolution of our aggregate import price inflation with that of the official indices for 1995-2014. We obtain a correlation coefficient of 0.73 between our index and the official monthly import price index for the manufacturing industry, constructed

[3]Importantly, we compare prices by origin at the CN8 level and we assume that the definition of products is sufficiently precise so that varieties within each category i share the same "observed" quality. Hence we compare prices of goods that are observationally equivalent. Another dimension of quality is the *subjective* quality, as perceived by the consumer. Even though two goods have the same observable characteristics, the *perceived* quality refers to the relative preference/taste of consumers for each variety.

by the French National Statistical Institute (INSEE) from survey data collected in individual firms (the series start in 2005)[4]

Finally, to estimate the effect of imports from LWCs on domestic inflation, we use Producer Price Indices (PPI) of domestic production at the 4-digit level of the French NAF Rev 2 classification from INSEE (NAF Rev 2 is identical to the NACE Rev 2 classification of activities).

2.2 Stylised Facts

Fact 1: Imports of consumer goods surged

The share of imports in total consumption surged during the period under analysis. In 1994, 10% of consumption expenditures was devoted to goods produced abroad, while that figure rose to close to 17% in 2014, a total 6.3% increase as shown in the solid curve of Figure 1 (left scale).

The bars in Figure 1 provide the year-on-year variations in both the share of tradables in overall consumption (light grey bars) and the share of imported goods among total consumption of tradables (black bars). The share of tradables in total consumption diminished continuously, starting from 49% in 1994 to 43% in 2014, reflecting the structural switch towards services that has been documented for most advanced economies – see e.g. Galesi and Rachedi [2019] and references therein. Therefore, and interestingly, the increase in the importance of imports in consumption comes exclusively from a shift in expenditure within tradables, favoring imported goods away from domestic ones (the dark bars are positive in most years with the exception of 2001-2003 and during the global financial crises of 2008-2009) that was large enough to result in an overall higher share of imports in total consumption.

[Insert Figure 1 here]

Fact 2: Imports from low-wage countries explain the bulk of the import surge

The surge in imports was characterized by a marked increase in the share of goods originating in low-wage countries. We follow Bernard et al. [2006] and Auer and Fischer [2010] and group countries according to their GDP per capita relative to that of France: "High-wage countries"

[4]We also obtain a high correlation, of 0.55, with the import deflator from the National Accounts, in spite of the fact that such index covers a wider range, including manufacturing, services and extractive industries (the latter increasing the volatility of import inflation).

are those with GDPpc higher than 75% of the French GDPpc, "Low-wage countries (LWCs)" are those for which the GDPpc lies between 25% and 75% of the French GDPpc, "Very low-wage countries (VLWCs)" includes countries with GDPpc lower than 25% of France's. We look separately at the cases of China and the New European Union member states (NEUMS), grouping countries that joined the EU after 2004.[5] GDPpc ratios are averaged over 1994-2014 and the composition of groups is fixed over time. Table A in the Appendix reports a detailed list of countries by category.

Figure 2 plots the share of each country group in total imports and shows that import basket of consumer goods continuously switched towards goods from LWCs and away from those from HWCs. In 1994, high-wage countries accounted for around 76% of total French imports of consumer goods, a figure that declined steadily to reach 57% in 2014 (right scale). Within LWCs, the most dynamic evolution is that of China, that accounted for 7% of total imports in 1994 to reach 21% in 2014 and became the most important origin low-wage country in French imports. The period also saw a threefold increase in the share of the new members of the European Union (NEUMS) in total French imports, passing from 2% to 6% of total consumer goods' imports. Overall, out of the extra 6.3% share of imports on consumption reported above, LWCs explain 4.5 percentage points and HWCs the remaining 1.9 percentage points.

[Insert Figure 2 here]

Fact 3: The (unadjusted) price differentials between domestic, LWCs and HWCs goods were large and stayed roughly constant during 1994-2014

Figure 3 plots the average ratio of import prices to domestic prices, the latter proxied with unit values of exports to high-wage countries, constructed at the level of product × destination country and then averaged across those countries (see section A).2 in the Appendix for more details).

Average ratios calculated across all origins are shown in the solid light grey line, for LWCs in the dashed line and for HWCs in the dark solid line.[6]

[5] Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia

[6] As explained, we use export unit values to proxy for domestic prices, which are unavailable at such disaggregated level, and scale them with a 1.05 coefficient based on the mean estimate of the CIF-FOB margin for France

The average price differential is of -15%. Nevertheless, almost all of the differential comes from the low price levels for imports originating in LWCs. These goods are on average (over time and across products) 41% cheaper than domestic goods. On the contrary, prices from goods originating in HWCs are much closer to those of domestic goods, being on average 3% cheaper.[7] Importantly, and interestingly, the differences in price levels are almost constant throughout the period, reflecting little differences in domestic and imported inflation in French consumption.

[Insert Figure 3 here]

Figure 3 reports unadjusted price levels that do not take into account quality differences or product-specific consumer preferences. Such unobserved characteristics are likely to have played a non-negligible role for explaining the strong movements in consumption shares documented as Facts 1 and 2 above, especially in the light of the small movements in unadjusted prices that are documented in Fact 3. Moreover, such unobserved characteristics have important consequences for the measurement of inflation and the interpretation of inflation measures as we discuss in the rest of the paper. In the next section we develop an analytical framework that will allow to quantify the evolution of French inflation distinguishing between changes in unadjusted prices and changes in unobserved taste shocks.

3 Theoretical Framework

This section presents the inflation decomposition upon which we base our empirical exercise. We first derive expressions for price changes of individual tradable goods (indexed by i) that make explicit the role of imports from LWCs and then show how to aggregate them into an economy-wide inflation rate.

3.1 Product-level Inflation Decomposition

A representative French consumer obtains utility from the consumption of a bundle of N products in quantity Q_i: $U(Q_1, ...Q_i, ...Q_N)$. Some goods are tradable and other goods are non-

provided in Miao and Fortanier [2017]. We first select CN8 products with both positive imports and exports, so that we can compute the ratio $ln\left(P_{it}^{F}\right) - ln\left(P_{it}^{X}\right)$ by product. The lines are constructed using unweighted averages of $ln\left(P_{it}^{F}\right) - ln\left(P_{it}^{X}\right)$ across origins. Very similar results are obtained if we use median values for country groups.

[7] We obtain similar results when restricting to export prices destined to HWCs only, available upon request.

tradable. For each tradable good i, there is a number J_i of varieties available, differentiated by country of origin, and including one French variety.

We assume that each tradable good i is a Dixit-Stiglitz aggregation of the varieties –indexed by j– with constant elasticity of substitution θ. At each time t:

$$Q_{it}^{\frac{\theta-1}{\theta}} = \sum_{j\in\Omega_i^J} \alpha_{ijt}^{\frac{1}{\theta}} Q_{ijt}^{\frac{\theta-1}{\theta}}, \text{ with } \sum_{j\in\Omega_i^J} \alpha_{ijt} = 1. \tag{1}$$

where Ω_i^J represents the set of all available varieties of good i. The parameter α_{ijt} is a demand shifter which captures consumer tastes for variety j of good i.[8]

Variation over time in the taste parameter captures *taste shifts*: conditional on prices, the French consumer switches expenditures between varieties of different origins as its relative preferences across varieties evolve. We assume $\alpha_{it}^D + \alpha_{it}^F = 1$, indicating that taste shocks represent changes in relative preferences across varieties. This assumption ensures that the price index associated with (1) is exact and can be given a welfare interpretation (as we discuss below).[9]

The price index of the tradable good i in period t is

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

Grouping varieties by origin with superscripts D and F referring respectively to domestic and foreign varieties, P_{it} can be expressed as:

$$P_{it} = \left[\alpha_{it}^D P_{it}^{D^{1-\theta}} + \alpha_{it}^F P_{it}^{F^{1-\theta}}\right]^{\frac{1}{1-\theta}}$$

with $\alpha_{it}^F = \sum_{j\in\Omega_i^F} \alpha_{ijt}$. Ω_i^F denotes the set of foreign varieties for good i and P_{it}^F, the price index of imports of good i, is $P_{it}^F = \left[\sum_{j\in\Omega_i^F} \frac{\alpha_{ijt}}{\alpha_{it}^F} P_{ijt}^{1-\theta}\right]^{\frac{1}{1-\theta}}$.

[8] α_{ijt} is an unobservable parameter that can also be interpreted as capturing differences in quality, as has been done in some of the previous literature, for example Khandelwal [2010]. Hottman et al. [2016] choose the term "appeal" in order to encompass both interpretations. Throughout the rest of the paper we will refer to these parameters are taste shocks for simplicity but we keep an open interpretation.

[9] See Redding and Weinstein [2020]for a thorough discussion of taste-shock normalization in a similar context.

Denote the rate of change of P_{it} as $\pi_{it} = \frac{\frac{\mathrm{d}P_{it}}{\mathrm{d}t}}{P_{it}}$. Applying a first-order Taylor expansion on π_{it} we express good i's inflation rate as:

$$\pi_{it} = \underbrace{(1-\eta_{it})\pi_{it}^{D} + \eta_{it}\pi_{it}^{F}}_{\text{pure price}} + \underbrace{\frac{1}{1-\theta}\left[\left(\frac{P_{it}^{F}}{P_{it}}\right)^{1-\theta} - \left(\frac{P_{it}^{D}}{P_{it}}\right)^{1-\theta}\right]\frac{\mathrm{d}\alpha_{it}^{F}}{\mathrm{d}t}}_{\text{taste shift}} \tag{2}$$

where $\eta_{it} = \alpha_{it}^{F}\left(\frac{P_{it}^{F}}{P_{it}}\right)^{1-\theta}$ is the share of foreign varieties in domestic consumption of good i. It equals the sum of the expenditure share of each variety $j \in \Omega_i^F$: $\eta_{it} = \sum_{j\in\Omega_i^F} S_{ijt}$ where S_{ijt} is the share of variety j in total expenditures (i.e. $S_{ijt} = \frac{v_{ijt}}{v_{it}}$).

Equation (2) shows that the change in prices for tradable good i equals the sum of two distinct terms with a clear interpretation. The first term is a traditional *pure price* component, defined as the expenditure share-weighted average of price changes across origins. Notice that it is only the price dynamics that move the term between two periods t and t+1 in the first part of equation (2).

The contribution of taste changes is given by the second term, labeled *taste shift*. A taste shock in favor of foreign varieties, given by $\frac{\mathrm{d}\alpha_{it}^{F}}{\mathrm{d}t} > 0$ will affect inflation depending on relative prices of domestic and foreign varieties, $\left(\frac{P_{it}^{D}}{P_{it}}, \frac{P_{it}^{F}}{P_{it}}\right)$, to an extent mediated by the elasticity of substitution θ. One important implication is that the cost of good i as perceived by the representative consumer can change even if prices of varieties do not change (i.e. even when $\pi_{it}^{D} = \pi_{it}^{F} = 0$).

Thus, whereas unadjusted inflation rates $\left(\pi_{it}^{D}, \pi_{it}^{F}\right)$ are directly measurable from the micro trade data, the taste shifts terms are not but, as shown later, can be recovered from data on prices and market shares provided a value for θ is available. This has an important implication for empirical work, in particular with regards to the interpretation of changes in expenditure shares. Under the benchmark case of Cobb-Douglas preferences ($\theta = 1$), changes in expenditure shares are solely attributed to taste shocks. Under the general case with $\theta > 1$, changes in expenditure shares are a combination of demand shocks and substitution due to changes in unadjusted prices. Therefore, the Cobb-Douglas formulation provides an upper bound to the role of taste shocks versus substitution in affecting inflation: using this approach we can safely provide an upper bound of the impact of taste shocks without relying on estimations of the elasticity of substitution.[10]

3.2 Distinguishing the Contribution of Low- and High-Wage Countries

We can extend the formula to make explicit the role of imports from low-wage and high-wage countries in driving inflation. For this, we express the price index of imported varieties, P_{it}^F, as the combination of prices of varieties originated in low-wage and high-wage countries (respectively denoted with superscripts L and H):

$$P_{it}^F = \left[\alpha_{it}^L {P_{it}^L}^{1-\theta} + \alpha_{it}^H {P_{it}^H}^{1-\theta}\right]^{\frac{1}{1-\theta}} \tag{3}$$

where $\alpha_{it}^L = \sum_{j\in\Omega_i^L} \alpha_{ijt}$ and Ω_i^L are the subset of imported varieties of good i originated in low-wage countries, P_{it}^L is equal to $\left[\sum_{j\in\Omega_i^L} \frac{\alpha_{ijt}}{\alpha_{it}^L} P_{ijt}^{1-\theta}\right]^{\frac{1}{1-\theta}}$, and the same definitions apply to goods indexed with superscript H, which originate in high-wage countries. By definition, $\alpha_{it}^F = \alpha_{it}^H + \alpha_{it}^L$. It will prove useful to express these as $\tilde{\alpha}_{it}^L = \frac{\alpha_{it}^L}{\alpha_{it}^F}$ and $\tilde{\alpha}_{it}^H = \frac{\alpha_{it}^H}{\alpha_{it}^F}$, consequently $\tilde{\alpha}_{it}^H + \tilde{\alpha}_{it}^L = 1$.

Combining with expression (2) for P_{it} and P_{it}^F we obtain an expression that makes explicit the role of imports across origins:

$$\begin{aligned}
\pi_{it} = \; & \underbrace{(1-\eta_{it})\pi_{it}^D + \eta_{it}\gamma_{it}^L\left(\pi_{it}^L - \pi_{it}^H\right) + \eta_{it}\pi_{it}^{HW}}_{\text{pure price } (\pi_{it}^{PP})} \\
& + \frac{1}{1-\theta}\Bigg[\underbrace{\alpha_{it}^F \frac{d\tilde{\alpha}_{it}^L}{dt}\left(\left(\frac{P_{it}^L}{P_{it}}\right)^{1-\theta} - \left(\frac{P_{it}^H}{P_{it}}\right)^{1-\theta}\right) + \frac{d\alpha_{it}^F}{dt}\tilde{\alpha}_{it}^L\left(\left(\frac{P_{it}^L}{P_{it}}\right)^{1-\theta} - \left(\frac{P_{it}^D}{P_{it}}\right)^{1-\theta}\right)}_{\text{taste shifts involving LWCs } (\pi_{it}^{TS_L})} \\
& + \underbrace{\frac{d\alpha_{it}^F}{dt}(1-\tilde{\alpha}_{it}^L)\left(\left(\frac{P_{it}^H}{P_{it}}\right)^{1-\theta} - \left(\frac{P_{it}^D}{P_{it}}\right)^{1-\theta}\right)}_{\text{taste shift between HWCs and Domestic Goods } (\pi_{it}^{TS_H})}\Bigg]
\end{aligned} \tag{4}$$

[10] As noted above, we will assume $\theta_i = \theta \; \forall i$, although the framework we present can easily accommodate nested structures where the elasticity of substitution differs across groups of goods (i.e. imported versus domestic) as done frequently in the literature, e.g. Fajgelbaum et al. [2020]

with γ_{it}^L representing the share of LWCs varieties in total imports of good i.[11]

Equation (4) has a similar interpretation than equation (2). Now the pure price term explicitly includes the growth rate of P_{it}^F as $\pi_{it}^F = \gamma_{it}^L \pi_{it}^L + (1 - \gamma_{it}^L)\pi_{it}^H$. The taste shift term contains extra terms that provide the contribution of changes in the composition of the import basket due to demand shocks across foreign varieties. Such taste shocks affect product i inflation depending on their relative prices $\left(\frac{P_{it}^L}{P_{it}}, \frac{P_{it}^H}{P_{it}}\right)$ to an extent mediated by their elasticity of substitution θ. Given our interest in the impact of LWCs, the decomposition separates taste shifts that involve LWCs from those affecting the changes in consumption between HWCs and domestic goods. Notice that the last term is close to zero given the similarity between price levels of domestic and HWCs imports, as shown in *Fact 2* of Section 2.

3.3 Aggregation Across Goods

After having computed product-specific inflation rates, the next step consists in aggregating these to obtain an expression for macro inflation. For this purpose, we suppose that the economy is composed of a fixed number S of sectors indexed by s, where each individual good i belongs to only one sector. Each sector can include either tradable or non-tradable goods.[12]

Generally, inflation in any sector s can be expressed as the weighted average of price changes of individuals goods $i \in s$: $\pi_{st} = \sum_{i \in s} \frac{v_{it}}{v_{st}} \pi_{it}$, with π_{it} the inflation of good i, v_{it} the expenditure share of good i in total consumption and $v_{st} = \sum_{i \in s} v_{it}$.

Therefore, tradable good inflation is $\pi_t^T = \sum_{s \in T} \frac{v_{st}}{v_t^T} \pi_{st}$, where $v_t^T = \sum_{s \in T} v_{st}$ and T is the set of tradable sectors. Denoting β_t, the share of tradable goods in total consumption and π_t^{NT} the inflation of non-tradable goods, the formula for aggregate inflation is $\pi_t = \beta_t \pi_t^T + (1 - \beta_t)\pi_t^{NT}$.[13]

This result is very useful because it implies that macro inflation can be measured as the simple weighted average of the contributions computed at the product level, in turn constructed with micro data on prices and quantities.

The product-level inflation rates are derived from the minimization of expenditures by the representative consumer. Therefore, the expression for aggregate inflation should be interpreted

[11] $\gamma_{it}^L = \tilde{\alpha}_{it}^L \left(\frac{P_{it}^L}{P_{it}^F}\right)^{1-\theta}$ is the share of varieties from LWCs in total imports of good i. Note that $\gamma_{it}^L = \sum_{j \in \Omega_i^L} \frac{S_{ijt}}{\eta_{it}}$ and similarly $(1 - \gamma_{it}^L) = \sum_{j \in \Omega_i^H} \frac{S_{ijt}}{\eta_{it}}$.

[12] For simplicity we interchangeably use the words "good" or "products" although some of these are services.

[13] This formula is general and does not hinge on a particular form of aggregation across sectors.

as a theoretically-consistent measure of the cost of living, or a COLI index. The particular form of the COLI index depends on the assumption about the value of θ, which in the case of $\theta = 1$ corresponds to the Cobb-Douglas case, and in the case of $\theta > 1$ to the general CES preferences' case.

4 The Impact of Imports From Low-Wage Countries on French Inflation: Quantification

In this section we provide quantitative estimations of the impact of LWCs imports on French consumer prices. The quantification will be based upon expression (4). We first look at *Pure price* effects and then quantify *Taste-Shift* effects on French consumer inflation. We compute year-on-year changes and report averages over 1994-2014 to provide an estimate of "short-term" effects (while highlighting variation over time when significant).

4.1 Pure-price Effects

Pure-price effects hold the structure of consumption constant between any two given periods. We slightly rearrange the first term in (4), π_{it}^{PP}, as follows:[14]

$$\pi_{it}^{PP} = \underbrace{\eta_{it}\gamma_{it}^{L}\left(\pi_{it}^{L} - \pi_{it}^{H}\right)}_{\text{Inflation differential}} + \underbrace{\eta_{it}\pi_{it}^{H} + (1-\eta_{it})\pi_{it}^{D}}_{\text{Competition}} \tag{5}$$

The first term, labeled *inflation differential*, provides the direct contribution arising from differences in the growth rate of prices between LWCs imports and HWCs imports $\left(\pi_{it}^{L} - \pi_{it}^{H}\right)$, affecting π_{it} in proportion to the share of LWCs varieties in good i's consumption (i.e. the product of the share of imports in consumption η_{it} and the share of LWCs in total imports γ_{it}^{L}). The second term shows the evolution of inflation rates of domestic varieties and those imported from high-wage countries. The rise in imports from low-wage countries might have affected $\left(\pi_{it}^{D}, \pi_{it}^{H}\right)$ through pro-competitive effects [Martin and Mejean, 2014]. We now provide

[14] To better understand how the expression is constructed, notice that equation (5) can be written as $\pi_{it} = \eta_{it}\gamma_{it}^{L}\left(\pi_{it}^{L} - \pi_{it}^{H}\right) + \eta_{it}\gamma_{it}^{L}\pi_{it}^{H} + \eta_{it}(1-\gamma_{it}^{L})\pi_{it}^{H} + (1-\eta_{it})\pi_{it}^{D}$

the quantification of both effects.[15]

Imported Inflation Differential

The inflation rate of LWCs imports was higher than the inflation rate of HWCs imports but the average difference was rather small over the sample period (+0.09 pp). Figure 4 plots inflation rates obtained for LWCs and HWCs imports. The difference between the two inflation rates is quite small, overall and for most years individually. This finding is consistent with the relative stability over time of price differential between LWCs and HWCs imports (see previous *Fact 3*).

[Insert Figure 4 here]

We measure the contribution of the *Imported Inflation* on French inflation with the empirical counterpart of the first term in expression (5), summarized by the following expression:

$$\beta_t \sum_{s \in T} \omega_{st} \eta_{st} E_s \left[\gamma_{it}^L \left(\pi_{it}^L - \pi_{it}^H \right) \right] \tag{6}$$

where $\omega_{st} = v_{st}/v_t^T$ is the weight of sector s in consumption of tradable goods (T), η_{st} is the share of imports in sector s, γ_{it}^L is the share of LWCs imports in total imports of consumption good i and $E_s(x_{it})$ denotes the expenditure-weighted mean operator across goods within sector s: $\forall x_i, E_s(x_i) = \sum_{i \in s} \frac{v_{it}}{v_{st}} x_{it}$ (recall that $v_{st} = \sum_{i \in s} v_{it}$).

On average over the period 1994-2014, we find that the contribution of the inflation differential to the overall import inflation rate is positive (+0.06 pp). The average share of imports in total consumption being on average close to 15%, we find that the average contribution of this differential to overall inflation is smaller than 0.01 pp on average across 1994-2014. The contribution varies over time. Imported inflation reduced French inflation during the early 2000's (−0.04 pp on average from 2001 to 2004). Inflation differentials became positive and especially large during 2009-2012 (around +0.05 pp per year on average). This reflects the variations over time of the contribution of the inflation differential to import inflation (see Figure 5). There are no significant differences between inflation of goods imported from China and those from

[15] We leave aside the effect on LWCs imports on HWCs import price inflation to focus our estimations on the direct effects of LWCs imports on French inflation.

HWCs, implying the overall contribution of China through inflation differences is close to 0 on average and also for most years of our sample taken individually.

Table 4 reports the results at level 2 of the COICOP classification. The contribution of the import inflation differential to inflation is rather homogeneous across products and close to 0 for most products.

[Insert Figure 5 here]

Effect on Domestic Inflation

We estimate the pro-competitive effect of imports from LWCs on domestic prices using the following equation:

$$\pi_{i,t}^{D} = \Psi \Delta S_{i,t}^{LWCs} + \kappa \Delta labcost_{i,t} + \eta \Delta inputcost_{i,t} + \lambda_t + \nu_i + \epsilon_{i,t} \tag{7}$$

where $\pi_{i,t}^{D}$ is the log-difference of producer prices (domestic market) between year $t-1$ and t for product i, $\Delta S_{i,t}^{LWCs}$ is the variation of the share of imports from LWCs in domestic consumption of good i,[16] $\Delta labcost$ is the annual growth rate of labour cost in sector i and $\Delta inputcost$ the annual change in the intermediate input cost for sector i, λ_t is a time fixed-effect and ν_i is a product fixed effect.

Ψ is our coefficient of interest. We expect $\Psi < 0$, implying that increases in the market share of low-wage imports in sector i reduce domestic inflation. Notice that the reduced-form equation (7) and the hypothesis $\Psi < 0$ are very general and arise in a broad group of theoretical models of variable markups. In Appendix A).4, we describe in more details a simple model that delivers this equilibrium relationship in the case of oligopolistic competition between domestic and foreign producers.

We estimate equation (7) using data on domestic producer price inflation at the 4-digit level of the CPA classification from INSEE. LWCs import penetration is defined as total imports of country category divided by total imports plus French domestic production (excluding production for exports): $S_t(LWCs) = \frac{M_{i,t}^{LWCs}}{Y_{i,t}+M_{i,t}-X_{i,t}}$, with $Y_{i,t}$, $M_{i,t}$ and $X_{i,t}$ representing sector i's total domestic production, imports and exports. We measure imports with the trade data

[16] Consistently with the notations in the previous sections, $S_{i,t}^{LWCs} = \gamma_{i,t}^{L} \times \eta_{i,t}$.

described in Section A) and we obtain domestic production from Eurostat's PRODCOM survey. We match trade data at the HS 6-digit level with production data at the CPA Rev2 level using a concordance table from the European Commission's RAMON website. We define S_t using imports from all LWCs and alternatively using imports from China only. Following Auer and Fischer [2010] and Auer et al. [2013], the denominator is averaged over the full sample to reduce concerns that results might be driven by the responses of the French production to French prices.[17] Annual change in total labor costs and in intermediate input costs are calculated using sector-level data from STAN-OECD Database (at level 2 of the NACE classification). These variables capture changes in marginal costs.

OLS estimation of Ψ might suffer from endogeneity bias. Both domestic prices and imports depend positively on (unobserved) demand shocks in France, which if present would generate a positive correlation between both variables. Similarly, unobserved productivity shocks affecting French producers might lower prices and change demand towards domestic goods and away from imports. Given these considerations, OLS estimations are likely to provide upward-biased coefficients of the true effect of low-wage import penetration on domestic prices. To account for this potential bias we use instrumental variables that generate variations in low-wage countries' market shares while being exogenous to movements in France's demand and supply. We identify supply shocks in LWCs with the year-on-year growth rate of manufacturing exports from each LWCs to the world, excluding France, in the spirit of Autor et al. [2013]. As argued by Auer and Fischer [2010], these supply shocks should have a relatively higher impact in sectors for which LWCs have a comparative advantage with respect to France. This is captured with a measure of each sector's labor intensity. Thus, the instrument combines a variable that varies over time with a time-invariant sector characteristic. Hence our instrumental variable varies both over time and across products.

We estimate equation (7) with Panel IV 2SLS regressions. In all specifications, we compute heteroskedasticity robust standard errors. Appendix B) provides details on the variables construction and reports the results of the first-stage regressions. In the first-stage equation, our instrumental variable is significant at 1%-level for specifications using all products whereas when restricting the sample to consumption goods or high-import penetration sector estimated

[17] Results are similar if we relax this assumption.

parameters are statistically significant at 5% or 10% level. Our instrument also passes several tests of weak instrument when considering all products whereas when we restrict our sample to some product categories we loose some identification power.

[Insert Table 2 here]

Table 2 reports the results of both the OLS and IV regressions respectively for all LWCs (and Appendix Table C shows the results when restricting the import penetration variable to China only: $\Delta S_{i,t}^{CH}$). Columns (1) and (2) use the full sample of 154 CPA products. An increase in the market share of imports coming from LWCs has a small positive effect on domestic producer-price inflation. Controlling for endogeneity, we find a strong negative effect of LWCs import penetration on producer price inflation. A 1%-increase in the share of LWCs in any given sector's demand decreases domestic producer prices by 1.2%, an effect statistically significant at 5%. Auer et al. [2013] report very similar magnitudes for France (between -1 and -2.7%). The regression using only China provides a negative but non-significant OLS estimates. Like for LWCs, the negative effect is highly amplified in the IV regressions: a 1% increase in Chinese import penetration leads to lower domestic inflation by 1.9 pp. Notice that IV estimates are also much less precise.

In columns (3) and (4) we restrict the sample to consumption goods (that is, those that can be matched with COICOP, in a similar vein as described in Section A)). The elasticity of French PPI to import penetration is estimated at -0.8 for all LWCs and -1.1 in the case of China only. The estimates are much noisier in the light of the smaller sample size and become not significant. The last two columns of Table 2 (and Appendix Table C) report results where we restrict the sample to sectors with high import penetration (larger than 33%), obtaining qualitatively similar effects as those obtained with the full sample.

We measure the contribution of *Competition* to inflation which the empirical counterpart of the second term in equation (5):

$$\beta_t(1-\eta_t)\sum_{s\in T}\omega_{st}\hat{\Psi}\frac{dS_t^{LWCs}}{dt} \tag{8}$$

where η is the share of imports in consumption (measured either at the macro level or at an aggregate product level (COICOP-2)) and β the share of tradables in CPI inflation, $\hat{\Psi}$ is the elasticity of PPI inflation (π_t^D) to LWCs import penetration (S_t^{LWCs}) obtained from the IV estimation on the full sample of sectors (column 2): $\hat{\Psi} = 1.21$.[18]

We find that an overall contribution of *Competition* of -0.06 pp on average per year. When looking at the effect of China alone, the average change in import penetration is a bit smaller (less than 0.1 pp per year) but the impact on producer price inflation is a little higher (1.9), leading to an overall effect of a little more than -0.02 pp.

4.2 Taste Shifts

We now turn to the quantification of taste shifts as given by the second line in the inflation decomposition of equation (4). As before, we focus on the contribution of taste shifts involving imports from LWCs $\left(\pi_{it}^{TS_L}\right)$.

The Cobb-Douglas benchmark case

The contribution of taste shifts α_{it}^F and $\alpha_{it}^L = 1 - \alpha_{it}^H$ to inflation is influenced by the elasticity of substitution, θ. Notice that the role of θ is complex as it appears in the expressions of the price indices $\left(P_{it}^F, P_{it}^D\right)$. We will discuss the role of θ in more details in the next subsection. We first consider the case of Cobb-Douglas preferences, characterized by a unit elasticity of substitution across varieties. When $\theta = 1$, the expression for *Taste Shifts* of LWCs, $\pi_{it}^{TS_L}|_{\theta=1}$, in equation (4) becomes:

$$\pi_{it}^{TS_L}|_{\theta=1} = \underbrace{\frac{d\eta_{it}}{dt}\gamma_{it}^L\left(p_{it}^{LWCs} - p_{it}^D\right)}_{\text{Taste shifts between LWCs and domestic goods}} + \underbrace{\eta_{it}\left[\frac{d\gamma_{it}^L}{dt}(p_{it}^{LWCs} - p_{it}^{HWC})\right]}_{\text{Taste shifts within imports}} \tag{9}$$

where prices are expressed in logs (denoted by small letters), γ_{it}^L is the share of LWCs imports in overall imports and η_{it} the share of imports in consumption. Imposing $\theta = 1$ implies that expenditure shares variations fully reflect changes in taste and are invariant to relative prices. Generically, $\forall j, \alpha_{ijt} = \frac{P_{ijt}Q_{ijt}}{P_{it}Q_{it}} = \frac{v_{ijt}}{v_{it}} = S_{ijt}$, where α_{ijt} is the taste shifter and S_{ijt} denotes the

[18] We prefer this estimate to the one including only consumption goods because using the sample of all goods allows us to have a better identification power. Moreover, estimates for all goods or restricting to consumption goods are not statistically different.

expenditure share of origin country j in total expenditures on good i.[19]

Hence the contribution of taste shifts under Cobb-Douglas preferences can be directly computed from data on prices and values. Since all variation in expenditure shares is attributed to demand shocks, the Cobb-Douglas formulation provides us with an upper bound of the contribution of taste shifts. Such quantification presents two advantages: i) it is highly transparent and easily computed using datasets that are readily available for many countries (without relying on estimated values of θ), and ii) the expression is identical to a weighted *Geometric mean index*, which is a good approximation to the way in which the official Consumer Price Index is constructed at a very detailed level of product definition by most statistical agencies, a point that will be discussed at the end of this section.

Taste shifts between domestic goods and LWCs imports Each year, the contribution of taste shocks between LWCs import goods and domestic goods is given by the empirical counterpart of the first term in expression (9):[20]

$$\beta_t \sum_{s \in T} \underbrace{\omega_{st}}_{\text{sector s weight}} \underbrace{\frac{d\eta_{st}}{dt} E_s[\gamma_{it}^L (p_{it}^{LWCs} - p_{it}^D)]}_{\text{effect in sector } s} \tag{10}$$

As documented above, the share of LWCs in consumption has increased quickly over the period 1994-2014 (Fact 2) while LWCs imports are much cheaper than domestic goods on average (Fact 3). Overall, this contributes to lower inflation by -0.05 pp per year on average over the sample period. Among LWCs countries, about half of the effect comes from Chinese imports. The overall effect masks strong heterogeneity across sectors.[21] Table 3 provides an estimation of taste-shift effects by broad consumption category (Column (4)). The largest effects are obtained for *Clothing* and *Furnishings*, being of -0.8 and -0.2 pp respectively. The last column reports the contribution of each product category to the aggregate taste-shift effect (i.e. taking into account the share of each product category in the CPI): a large majority of the overall effect is

[19] The equivalence with expression (4) is the following: $\eta_{it} = \alpha_{it}^F$ and $\eta_{it} \frac{d\gamma_{it}^L}{dt} = \alpha_{it}^F \frac{\mathrm{d}\tilde{\alpha}_{it}^L}{\mathrm{d}t}$

[20] As for pure price effects, we leave aside the measurement of potential effects of LWCs imports on HWCs import price levels that could then affect the difference between domestic prices and HWCs import prices, contributing finally to French consumer price inflation.

[21] In Appendix, Figure B plots the share of imports in consumption by COICOP level 1 sector. Between 1994 and 2014, the largest increases in import penetration are observed for *Clothing* and *Furnishings*. In 2014, imports account for about 75% of French consumption of *Clothing*, 55% of *Furnishings*.

due to *Clothing* and *Furnishings* (−0.04 pp out of −0.05 pp for the overall effect).

[Insert Table 3 here]

Taste shifts across imported goods Consumers have also shifted from HWCs imports to LWCs imports. To measure the impact of taste shifts within the import basket to overall inflation we use the empirical counterpart of the second term in expression (9):

$$\beta_t \sum_{s \in T} \omega_{st} \eta_{st} E_s \left[\frac{d\gamma_{it}^L}{dt} (p_{it}^L - p_{it}^H) \right] \tag{11}$$

Focusing on the effect on import inflation only (i.e. the average of $\left[\frac{d\gamma_{it}^L}{dt} (p_{it}^L - p_{it}^H) \right]$ among imports), we find that the shift from HWCs to LWCs imports contributed negatively and strongly to reducing imported inflation, given the persistent price-level differential shown in *Fact 3* of Section 2. On Figure 5, we plot the taste-shift effect on import inflation by year and how it compares with the inflation differential effect. The taste-shift effect has reduced the overall import price index by −0.47 pp on average over 1994-2014 because of the increased market shares of LWCs. The effect was the strongest during 2000-2012 (−0.59 pp). By comparison, the inflation differential effect was smaller in absolute value terms and was not systematically negative.

[Insert Figure 5 here]

The data displays heterogeneity across origin countries, with China standing out. Figure 6 plots the contribution of each country category and shows that almost all of variation is due to imports from China: −0.39 pp out of −0.47 pp per year on average. In particular, the highest values for the effects are around the year 2000, a time when China entered the WTO and the effects of market-oriented reforms that started some years before started to kick in (see Autor et al. [2016]).

Using the expression above, we can easily calculate the taste-shift effect on import inflation. On average, the taste-shift effect within imports reduced French inflation by −0.07 pp. The overall effect of imported inflation of consumer goods is almost fully driven by Chinese imports (a little less than -0.05 pp) while the contribution of NEUMS is about -0.01 pp and that of very low-wage countries and intermediate low-wage countries less than -0.01 pp.

[Insert Figure 6 here]

Looking by products (Table 4), the imported inflation channel is at play in almost all COICOP categories except *Food*, *Alcohol* & *Tobacco* (and by construction in product categories with only services like *Restaurants* & *Hotels*).

[Insert Table 4 here]

4.3 Prices and demand shocks in measures of inflation

The Consumer Price Index (CPI) is the measure of macro inflation produced by statistical agencies and used commonly by economic agents to base their consumption and saving choices as well as policy-makers (e.g. monetary policy decisions in the Euro area), playing also an important role in wage negotiations. It is thus of interest to quantify the impact of imports from LWCs on the CPI and highlight any potential differences with the effects of LWCs on cost of living indices.

The CPI is constructed by most statistical agencies using a *geometric Laspeyres* formula, defined as the geometric weighted average of prices of a *Fixed-Basket-of-Goods* (FBG) index that holds constant the structure of consumption, with the weights being the expenditure shares calculated in a reference period, most commonly computed following the "chain-linking method", in which the reference period at t is $t-1$ and weights are updated every year. (see Braun and Lein [2021] for a discussion). Thus, the CPI is, by construction, a *pure price* index.[22]

Therefore, an interesting feature of formula (3) is that we can use it to approximate the contribution of imports by origin to CPI inflation, which is given by the pure price terms.

[22]Note that in practice contemporaneous expenditure shares are typically unavailable at the time of price collection. At the most disaggregated level, elementary prices indices combine prices of a same good collected in different location or type of store. Statistical agencies compute unweighted geometric means of prices when a product is not perfectly homogeneous, arithmetic mean otherwise. Compared to the arithmetic mean, the geometric one assigns lower weights to relatively larger price increases. Such *Jevons indices* are then aggregated at higher levels using *weighted geometric (Laspeyres) means* of the type derived in this section. In the empirical exercise we use unit values calculated at the 8-digit level of the European Combined Nomenclature. The 8-digit level is close to a level of aggregation at which statistical agencies use weighted geometric means and at which the dispersion of unit values tends to be rather high. *Jevons* is a special case of the geometric Laspeyres in which the taste parameters are supposed symmetric across goods and the weights are equal to 1/J.

We can also contrast it with the contribution of imports by origin to consumer welfare under CES preferences, which are the object of study of a large literature on international trade and macroeconomics.

We use our empirical estimates to quantify each term:

$$\beta_t \sum_{s \in T} S_{st} \left[\eta_{st} E_s \left[\gamma_{it}^L \left(\pi_{it}^L - \pi_{it}^H \right) \right] + (1 - \eta_{st}) \hat{\Psi} \frac{dS_t^L}{dt} \right] = -0.05 \; pp \tag{12}$$

and

$$\beta_t \sum_{s \in T} S_{st} \left[\frac{d\eta_{st}}{dt} E_s \left[\gamma_{it}^L \right] E_s \left[p_{it}^L - p_{it}^D \right] + \eta_{st} E_s \left[\frac{d\gamma_{it}^L}{dt} \left(p_{it}^L - p_{it}^H \right) \right] \right] = -0.12 \; pp \tag{13}$$

Table 5 provides more results on these estimations. The contribution of *Pure Price* effects can be decomposed into a slightly positive contribution of the effect coming from imported prices (+0.01 pp) whereas the contribution on domestic prices is equal to −0.06 pp. Similarly, we find that the taste-shift contribution can be decomposed into a −0.07 pp effect coming from imported inflation and −0.05 pp from domestic prices. If we focus more closely on the impact of Chinese imports, we find that they explain most the overall taste-shift effect (−0.08 pp of the total effect of −0.12 pp). Overall, LWCs imports have reduced inflation by −0.17 pp per year on average.

Figure 5 plots these results year by year. The dashed black line quantifies the contribution of LWCs on inflation through *Pure Price* effects while the solid black line corresponds to the sum of *Pure Price* effects and *Taste Shift* effects of LWCs imports on inflation. The contributions of *Pure Price* effects (blue bars) and *Taste-Shift* effects (grey bars) are decomposed by country of imports' origin (China vs other LWCs). The overall effect of LWCs imports is much larger over the period 2004-2011 (−0.22 pp on average) mainly driven by Chinese imports while before 2000 the effect is about −0.1 pp on average mainly coming from other LWCs imports.

[Insert Figure 5 here]

4.4 CES preferences

We have relied on Cobb-Douglas preferences so far because they provide linear expressions that are easily interpretable and measurable. We now discuss the general case of a CES utility function elasticity of substitution larger than one (e.g. Broda and Weinstein [2006], Redding and Weinstein [2020] and Braun and Lein [2021]).[23] How would the magnitude of our estimates change under such preferences? To answer this question, we compare the decomposition of inflation under the two systems of preferences.

We focus on an individual good i with a constant number of varieties j and omit subscript i for notational convenience. To focus on the role of LWCs and simplify the exposition, we assume that domestic goods and goods originating in high-wage countries are equivalent for consumers. Pooling both types of goods seems a reasonable assumption given that empirically we observe $p_{it}^D \approx p_{it}^H$ across goods and in almost every year of the sample (e.g. *Fact 3* of Section 2). Moreover, most of the substitution observed during the period occurred in favor of goods from LWCs (e.g. *Fact 2* of Section 2).

Using R to denote the group of rich countries, equation (4) becomes:

$$\pi_t = \underbrace{\pi_t^R + \gamma_t\left(\pi_t^L - \pi_t^R\right)}_{\text{pure price}} + \underbrace{\frac{1}{1-\theta}\left[\left(\frac{P_t^L}{P_t}\right)^{1-\theta} - \left(\frac{P_t^R}{P_t}\right)^{1-\theta}\right]\frac{d\alpha_t^L}{dt}}_{\text{taste shift}} \tag{14}$$

where γ_{it} is the share of imports from LWCs in total consumption of good i and the price of good i is defined as $P_t^{1-\theta} = \alpha_t^R P_t^{R\,1-\theta} + \alpha_t^L P_t^{L\,1-\theta}$, with P^R the price index of goods originating in rich countries and P^L the price index of varieties from low-wage countries.[24]

α^L is the taste parameter that measures relative preferences of goods from LWCs and those originating in rich countries, and $\frac{d\alpha_t^L}{dt}$ is the taste shift favouring such goods. We are interested in how the estimate of $\frac{d\alpha_t^L}{dt}$ varies with different values of the elasticities of substitution θ.

In the general case α_t^L cannot be directly observed in the data but can be retrieved conditional on the estimate for θ. Noting that the expenditure share of variety j is $S_{jt} = \alpha_{jt}\left(\frac{P_{jt}}{P_t}\right)^{1-\theta}$, and given that $\alpha_t^L + \alpha_t^R = 1$ and $S_t^L + S_t^R = 1$, it follows that:

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

and

[23] See Feenstra et al. [2018] discuss macro and micro estimates of Armington elasticities.

[24] $P_t^{R\,1-\theta} = \frac{\alpha_t^d}{\alpha_t^R}P_t^{d\,1-\theta} + \frac{\alpha_t^{HWC}}{\alpha_t^R}P_t^{HWC\,1-\theta}$, with $\alpha^R = \alpha^d + \alpha^{HWC}$.

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

With this information at hand, we compute the evolution of taste shift ($\frac{d\alpha_t^L}{dt}$) and measure its contribution to inflation. Figure 8 (left panel) plots the average contribution of the taste-shift term[25] to COLI inflation for different values of θ. We find a value of -0.11 pp per year for $\theta = 1$ which is close to our benchmark case discussed previously in the paper where we differentiated domestic and high-wage goods (-0.12 pp), therefore showing that pooling both type of origins together provides with a very good approximation.

Interestingly, as the elasticity of substitution θ increases, the estimated contribution of taste shift decreases. For θ between 4 and 6, the contribution of taste shift lies between -0.08 and -0.07 pp per year, about one-third lower than the magnitude derived with Cobb-Douglas preferences.

Why is the estimated contribution of taste shift to welfare gain decreasing in θ? First, remember that $S_t^L = \alpha_t^L \left(\frac{P_t^L}{P_t}\right)^{1-\theta}$. Thus, the variation of α_t^L over time is related to the change in the expenditure share of LWCs in the following way:

$$\frac{d\alpha_t^L}{dt} = \frac{dS_t^L}{dt}\left(\frac{P_t^L}{P_t}\right)^{\theta-1} + (\theta-1)S_t^L\left(\frac{P_t^L}{P_t}\right)^{\theta-1}(\pi_t^L - \pi_t) \tag{15}$$

Figure 8 (right panel) plots the two terms of this decomposition for different values of θ. Focusing on the contribution stemming from observed variations in market shares (i.e. the first term in equation (15)), we can easily show that $\frac{d\alpha_t^L}{dS_t^L} \approx \left(\frac{P_t^L}{P_t}\right)^{\theta-1}$ is decreasing in θ since $\frac{P_t^L}{P_t} = \exp(-0.4) < 1$. Conditional on relative unadjusted prices $\left(\frac{P_t^L}{P_t}\right)$ a larger observed change in market shares implies, ceteris paribus, a larger shift in relative preferences. This relationship is mediated by θ. A higher value for θ implies that, when faced with a lower relative unadjusted price of LWCs goods, consumers substitute more towards those goods. Therefore, a larger share of observed changes in expenditure shares is due to price substitution and less of that variation can be attributed to unobserved changes in consumer preferences. Notice that this is equivalent to say that, in cases where the elasticity of substitution is higher, *preference-adjusted prices*

[25] i.e. the third term on the right side in equation (14)

implied by the data are lower.

The second term shows how the estimation for taste shifts varies with differences in inflation rates, holding price levels and expenditure shares fixed at their initial levels. Conditional on observed expenditures shares S_t^L, a higher inflation rate for LWCs goods (leading to a lower unadjusted relative price of those goods) implies a positive taste shift (that is, an increase in α_t^L is required to deliver the observed market shares) and therefore a higher contribution of preference changes to inflation. The relationship is governed by θ: for any given inflation differential $(\pi_t^L - \pi_t)$, the model implies a larger value of α_t^L to accommodate the expenditure shares observed in the data. Intuitively, when the price increase is larger, a higher preference shock is required to deliver adjusted prices that are compatible with observed expenditure shares.

Overall, the message of the exercise is that when the elasticity of substitution is higher, relative prices matter more for determining market shares, while taste shocks contribute less. Therefore, for a given observed variation in the market share of LWCs, the estimate of the contribution stemming from taste shocks is smaller when the elasticity of substitution (θ) is higher.

Overall, since the pure-price effect remains the same for any value of θ (ie. equal to -0.05 pp), this would suggest that the effect of LWCs imports on inflation would range between -0.17 pp for our benchmark Cobb-Douglas case and -0.13 pp for θ equal to more standard values (between 4 and 6).

5 Conclusion

In this paper, we assess empirically how LWCs imports of consumption goods have affected inflation in France over the period 1994-2014. Our key contribution is to decompose the inflation of an exact price index into two different effects of LWCs imports and quantify separately each of them.

First, “pure-price” effects of LWCs imports reduced CPI inflation -0.05 pp per year on average. Most of this effect comes from the effect of LWCs on domestic prices while the differential between LWCs and HWCs imports was to small to contribute significantly to consumer inflation. Second, "taste shift" effects are much larger and under Cobb Douglas assumption, they have reduced inflation by 0.12 pp. We can decompose this overall effect between the effect of shift between domestic goods and LWCs imports and the effect of shift between HWCs imports and LWCs. The rise in the proportion of LWCs goods in total imports reduced French inflation by -0.07 pp whereas import penetration of consumption goods led to a reduction of -0.06 pp of inflation through a competition channel. Overall, we find that inflation for French consumers would have been 0.17 pp higher on average each year if the share of LWCs had remained at its 1994 level. Chinese imports alone explain about half of this overall effect.

This exercise allows us to disentangle the impact of LWCs on cost-of-living versus CPI inflation - the latter abstracting for taste-shift effects. Assuming Cobb-Douglas preferences leads to a lower bound of the LWCs effect on the cost of living. When we assume that the elasticity of substitution is larger and closer to more standard values (between 4 and 6), the effect of LWCs imports is found to be a little lower at -0.13 pp on average per year. One of our main result is still that most of the disinflationary effect on the cost of living is stemming from the reallocation of consumption towards goods produced in LWCs, that is largely driven by taste shifts. CPI inflation does not account for such changes in the structure of consumption and captures pure-price effects only.

We have focused on the direct effect of consumer goods imports. An indirect channel might that transits through the productivity effects of imported intermediate goods, a topic that we leave for future research.

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Table 1: Imported inflation differential - Decomposition by COICOP Product Categories (average, 1994-2014)

COICOP	% of CPI	Imports pen. $\beta\eta$	Product impact Infl. diff. $\gamma\,(\pi^{LWC}-\pi^{HWC})$	Product-level CPI infl. in pp	Contrib. to CPI infl. in pp
1- Food and non-alcohol. beverages	0.15	0.11	-0.01	0.00	0.000
2- Alcoholic beverages and tobacco	0.04	0.14	0.00	0.00	0.000
3- Clothing and footwear	0.04	0.57	0.24	0.14	0.005
4- Housing, water, elect., gas...	0.14	0.37	0.07	0.03	0.004
5- Furnishings, house services	0.06	0.53	0.07	0.04	0.002
6- Health	0.10	0.15	0.03	0.00	0.000
7- Transport	0.16	0.23	0.05	0.01	0.002
8- Communication	0.03	0.56	1.20	0.67	0.020
9- Recreation and culture	0.08	0.40	0.04	0.01	0.001
11- Restaurants and hotels	0.08	0.00	-	-	0.000
12- Miscellaneous goods and services	0.13	0.24	0.08	0.02	0.003

Note: The first column "% CPI" reports the average weight of the COICOP 2 product in the French CPI. The second column "Import pen." reports import penetration by COICOP aggregate category as the share of total imports (source: Customs) in the product category consumption (source: Insee, national accounts) (including VAT and distribution margins). Third column reports the contribution of the inflation differential between HWC and LWC imports to the product-level import inflation (following the decomposition presented in equation 11) (i.e. HWC import prices growing more or less quickly than LWC import prices). Column 4 reports the estimation of the contribution of LWC import to CPI product-level inflation (at COICOP-2 level) coming from the pure price effect, calculated as $col.(2) \times col.(3)$. Column 5 reports the estimation of the contribution of LWC import to the overall CPI inflation (for each COICOP-2 product) coming from the pure price effect, calculated as $col.(4)$ multiplied by the share of the COICOP in CPI consumption (col. (1)).

Table 2: 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)
Cragg-Donald statistic	-	24.79	-	8.38	-	6.66
Stock-Yogo crit. value	-	10%	-	20%	-	20%
F-stat. 1st stage	-	18.22	-	3.64	-	4.43
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

Note: this table reports estimates of OLS and IV regressions where the dependent variable is the annual PPI inflation calculated as the annual change in producer price index (domestic market) for 154 products defined at level 4 of the NACE rev2 classification (manufacturing industries only) (source: Insee) on the period 1995-2014 (when available). Product and year dummies are included in all specifications. Robust standard errors are reported in brackets. "Δ share" is the annual change in the share of LWC's imports in total French imports and domestic production. Year (19 years) and product (154 products) dummies are included, controls for annual growth rate of intermediate input costs and labour costs at the sectoral level (level 2 of NACE classification, source: Stan OECD) are also included. "All goods" include all goods for which producer price inflation is available, "'Consumption goods"' include goods that can be match with CPI classification, "'High import penetration"' include goods for which the import penetration is higher than the average (about 33%). Columns (1), (3), and (5) correspond to results obtained from OLS regressions, all other columns report results of IV regressions where the instrumental variable is the sector's labor share multiplied by the annual growth rate of LWC exports (see Appendix B) for details and results of first-stage regressions).

Table 3: Taste shifts between LWC imports and domestic goods - Decomposition by COICOP Product Categories (average, 1994-2014)

COICOP (% of CPI)	Share of tradables β	Δ imp. pen. $\frac{\partial \eta_t}{\partial t}$	Share of LWC imp. γ	Price diff. $p^{LWC} - p^D$	Product-level CPI infl. in pp	Contrib. CPI infl. in pp
1- Food and non-alcohol. beverages (15%)	0.73	0.30	0.12	-0.27	-0.01	-0.001
2- Alcoholic beverages and tobacco (4%)	1.00	-0.03	0.11	-0.16	0.00	0.000
3- Clothing and footwear (4%)	0.97	2.23	0.56	-0.64	-0.80	-0.038
4- Housing, water, elect., gas... (14%)	0.18	0.57	0.13	-0.51	-0.04	-0.002
5- Furnishings, house services (6%)	0.85	1.42	0.26	-0.62	-0.23	-0.010
6- Health (10%)	0.27	0.88	0.17	-0.47	-0.07	-0.001
7- Transport (16%)	0.43	0.68	0.16	-0.52	-0.06	-0.003
8- Communication (3%)	0.10	0.59	0.45	-0.89	-0.02	-0.001
9- Recreation and culture (8%)	0.53	0.76	0.27	-0.38	-0.08	-0.004
11- Restaurants and hotels (8%)	0.00	-	-	-	-	0.000
12- Miscellaneous goods and services (13%)	0.29	0.87	0.30	-0.58	-0.15	-0.005

Note: The first column "share of tradables" reports for each COICOP aggregate category the ratio between total imports of a given product (source: Customs) and the total French consumption of tradable goods (source: Insee, national accounts), including VAT and distribution margins. "Δ in import pen." is the average year-on-year change in the share of imports in French tradables. "Share of LWC imports" reports the share of imports from low-wage countries in overall French imports. "Average price diff." is the average difference in the (log) level of prices of goods imported from LWCs and the ones produced in France (this latter price is proxied by French export prices) (we also take into account a wedge of 5% bewteen CIF imports an FOB exports). "Product-level CPI inflation" is calculated by COICOP 1 as the product of column (1), (2), (3) and (4) and is the impact on the product inflation of the substitution of domestically produced goods with LWC imports. "Contribution" is the substitution channel effect multiplied by the share of the COICOP in CPI consumption.

Table 4: Taste shifts between LWC imports and HWC imports - Decomposition by COICOP Product Categories (average, 1994-2014)

COICOP	% of CPI	Imports pen. $\beta\eta$	Product impact Infl. diff. $\gamma\,(\pi^{LWC} - \pi^{HWC})$	Product-level CPI infl. in pp	Contrib. to CPI infl. in pp
1- Food and non-alcohol. beverages	0.15	0.11	-0.06	-0.01	-0.0010
2- Alcoholic beverages and tobacco	0.04	0.14	-0.08	-0.01	-0.0005
3- Clothing and footwear	0.04	0.57	-0.63	-0.36	-0.0143
4- Housing, water, elect., gas...	0.14	0.37	-0.27	-0.10	-0.0140
5- Furnishings, house services	0.06	0.53	-0.63	-0.33	-0.0200
6- Health	0.10	0.15	-0.34	-0.05	-0.0050
7- Transport	0.16	0.23	-0.43	-0.10	-0.0155
8- Communication	0.03	0.56	-0.01	-0.01	-0.0002
9- Recreation and culture	0.08	0.40	-0.64	-0.25	-0.0201
11- Restaurants and hotels	0.08	0	-	0.00	0.0000
12- Miscellaneous goods and services	0.13	0.24	-0.45	-0.11	-0.0140

Note: The first column "% CPI" reports the average weight of the COICOP 2 product in the French CPI. The second column "Import pen." reports import penetration by COICOP aggregate category as the share of total imports (source: Customs) in the product category consumption (source: Insee, national accounts) (including VAT and distribution margins). The third column reports the taste-shift effect (i.e consumers switching from HWC imports to LWC imports). Column 4 reports the estimation of the contribution of LWC import to CPI product-level inflation (at COICOP-2 level) coming from the taste-shift effect, calculated as $col.(2) \times col.(3)$. Column 5 reports the estimation of the contribution of LWC import to the overall CPI inflation (for each COICOP-2 product) coming from the taste shift effect, calculated as $col.(4)$ multiplied by the share of the COICOP in CPI consumption (col. (1)).

Table 5: Average Values of Main Variables (1994-2014)

Pure Price effects

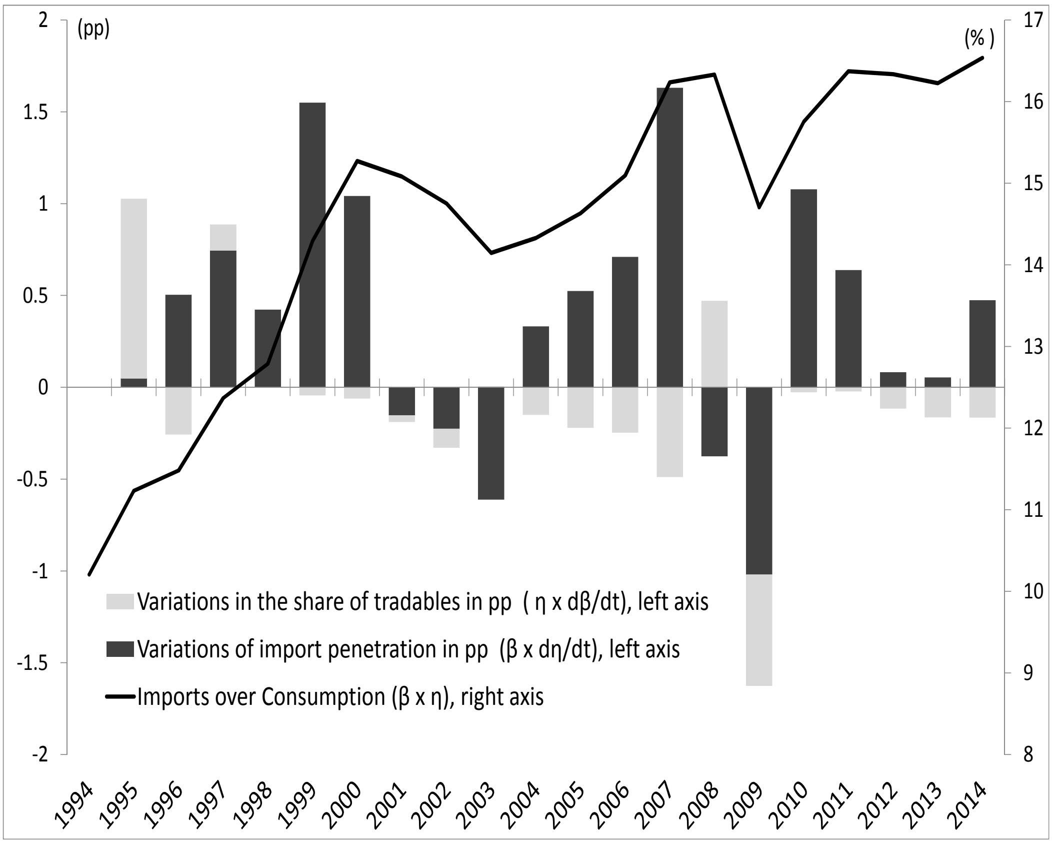
	Imported inflation			
	$\beta\eta$	$\gamma\,(\pi^{LWC}-\pi^{HWC})$		Contrib CPI
All LWC	0.14	0.06		+0.01
China only	0.14	0.06		+0.01
	Domestic inflation			
	$\beta \times (1-\eta)$	$\frac{\partial S_t^{LWC}}{\partial t}$	$\frac{\partial \pi_t}{\partial S_t^{LWC}}$	Contrib CPI
All LWC	0.32	0.17	-1.21	-0.06
China only	0.32	0.05	-1.85	-0.02

Taste-shift effects

	Imported Inflation			
	$\beta\eta$	$\frac{\partial \gamma_t}{\partial t}(p^{LWC}-p^{HWC})$		Contrib CPI
All LWC	0.14	-0.47		-0.07
China only	0.14	-0.39		-0.05
	Domestic inflation			
	β	$\frac{\partial \eta_t}{\partial t}$	$\gamma \times (p_t^{LWC}-p_t^{D})$	Contrib CPI
All LWC	0.46	0.81	0.31×-0.41	-0.05
China only	0.46	0.81	0.13×-0.52	-0.03

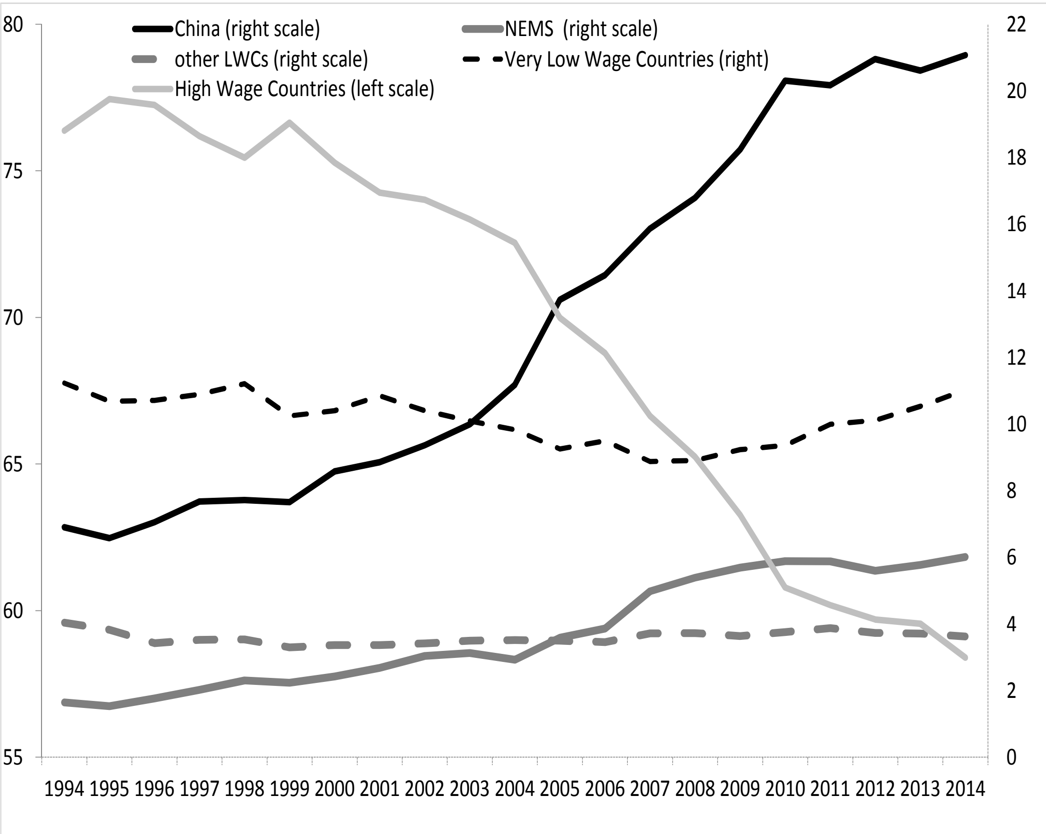
Note: The table presents the values of the main variables used in the analysis. Each variable is first calculated yearly, and then averaged over the period 1994-2014. In the case of variable denoting changes over time (i.e. $\frac{\partial \eta_t}{\partial t}$), first the year-on-year percentage change is calculated and average over the period. "Contrib CPI" is the total contribution of each channel to the evolution of French CPI inflation. Details of the variables' construction are provided in sections 3 and 4.

Figure 1: Import Penetration (1994-2014)



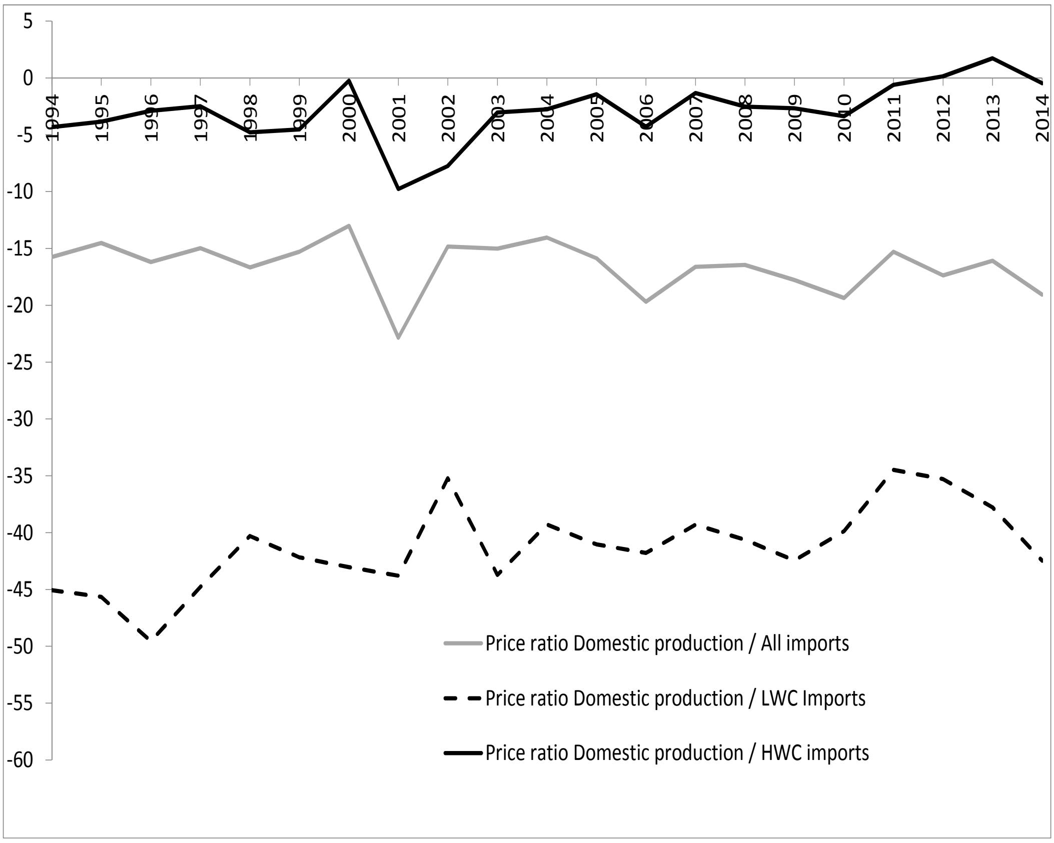
Note: this figure plots the share of imports in total CPI consumption by year (RHS scale, in percentage). Grey histograms The yearly change in import penetration (i.e. the yearly change in the back dashed line) is the sum of both histograms (LHS scale) in a given year. The plain grey histogram plots the changes in total import penetration (η_t) weighted by the share of tradable goods in consumption and the share of LWCs in imports. Once this term is multiplied by the price difference ($p_t^{LWC} - p_t^d$), we get exactly the channel 1. The dashed grey histogram represents the contribution of changes in β_t to yearly changes in import penetration from LWCs.

Figure 2: Import Market Shares over Time and by Country Category



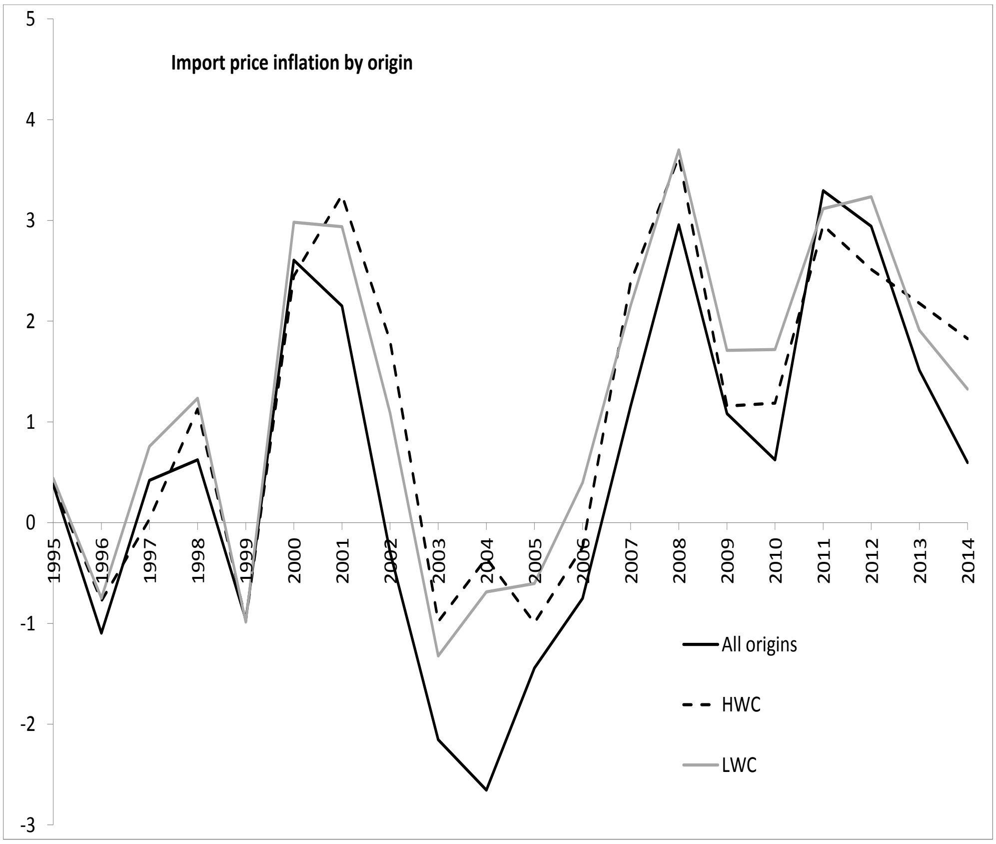
Note: the figure plots the ratio of imports value coming from a given country category over all French imports (in percent), these ratios are computed for the five country categories (see Table A). The grey line plots the share of high wage countries imports in all French imports (left axis), the black line plots the share of Chinese imports in all French imports (right axis), the dashed black line plots the share of very low wage countries imports in all French imports (right axis), the dark grey line plots the share of NEUMS countries imports in all French imports (right axis) and the dashed dark grey line plots the share of low wage countries imports in all French imports (right axis).

Figure 3: Price of Domestically Produced Goods Relative to Prices of Imported Goods (Consumer Goods)



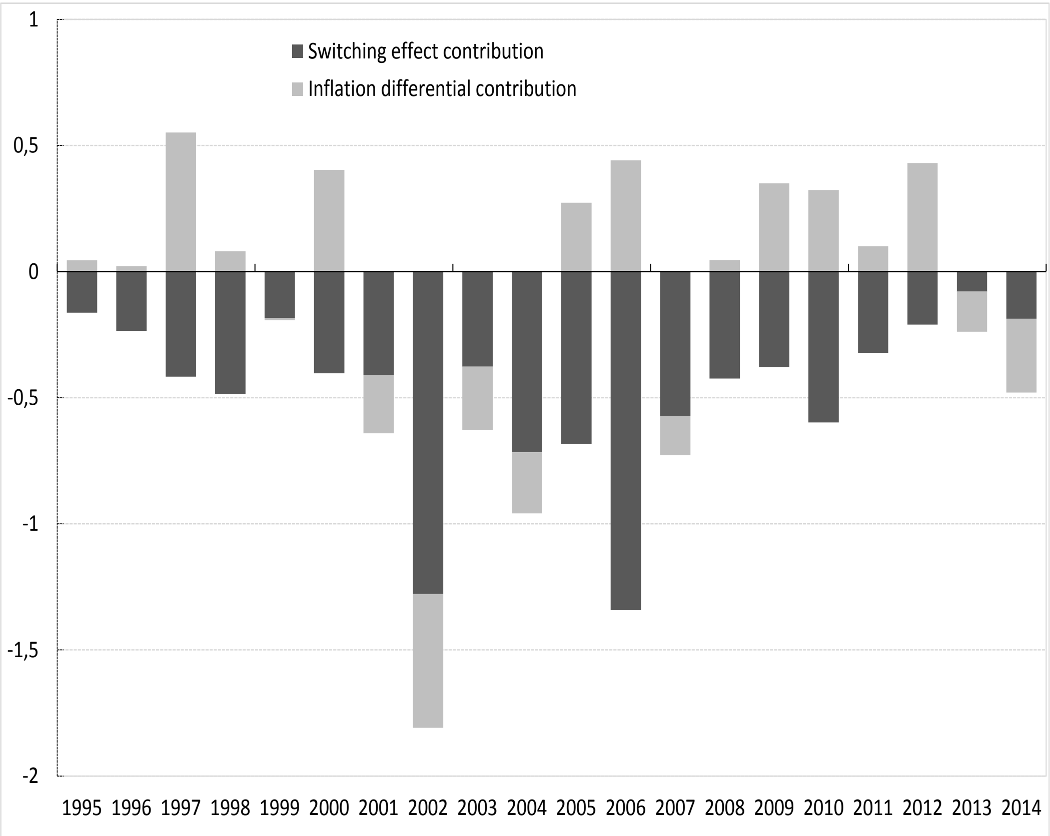
Note: We first compute the price differential (in a given year) at the level 8 of the trade product classification (HS classification) between import unit values and export unit values (considered as equivalent to the domestic producer price). The figure reports the weighted average of this price differential. The black line corresponds to the price differential between HWC imports and French export prices, the grey line corresponds to the average using price differential between imports of all origins and French exports prices, the dashed black line corresponds to the average price differential between LWC imports and French exports prices.

Figure 4: Import Price Inflation Differential: High-wage vs. Low-wage Countries



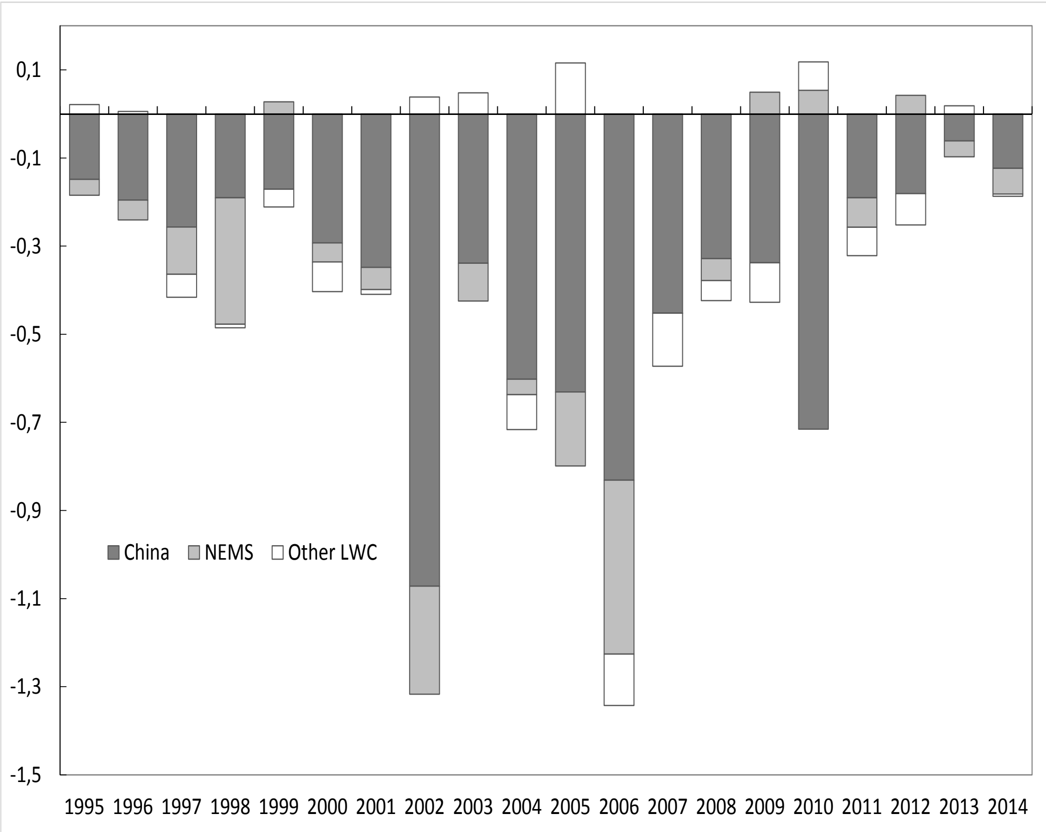
Note: the figure plots the y-o-y inflation rate of two components of the overall French import price inflation (the solid black line). The solid light-grey line is the import price inflation for goods produced in LWCs while the dashed black line corresponds to goods imported from HWCs. Note that overall import price inflation might be lower than the weighted average of the two components because a switching effect is also at play, and the weight of LWCs (with lower import prices in *level*) increase to the detriment of HWCs.

Figure 5: Contribution to Import Price Inflation: Taste-Shift vs Inflation Differential Effects



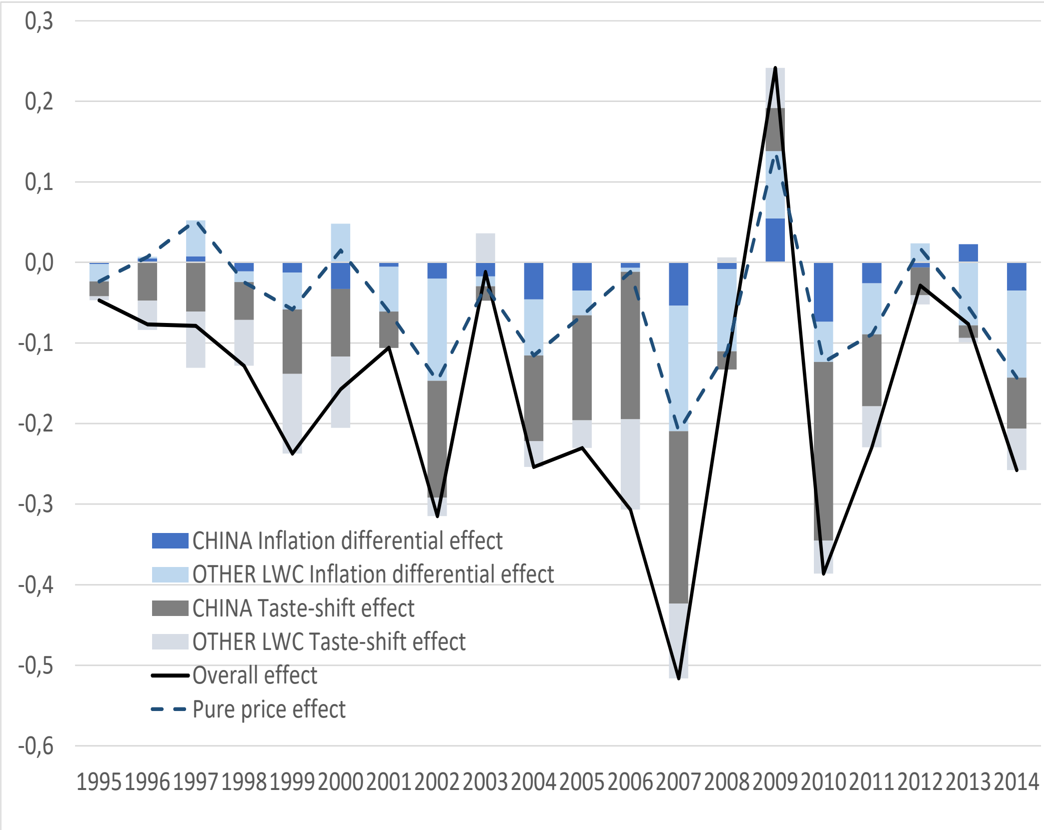
Note: We first calculate for each year and each product (restricting to consumer goods) the impact of LWC imports on import price inflation. We distinguish the impact coming from a variation of the share of LWC imports in total imports (called taste-shift effect) and the impact coming from differences in inflation between LWC and HWC imports (called inflation differential effect). The figure plots the weighted average contribution of LWC imports on French import inflation and distinguish between taste-shift effect (black histogram) and inflation differential effect (grey histogram) contributions. The overall impact of LWC imports on French import inflation is obtained as the sum of both histograms in a given year.

Figure 6: Taste-shift Contribution to Import Inflation: Country Category Decomposition



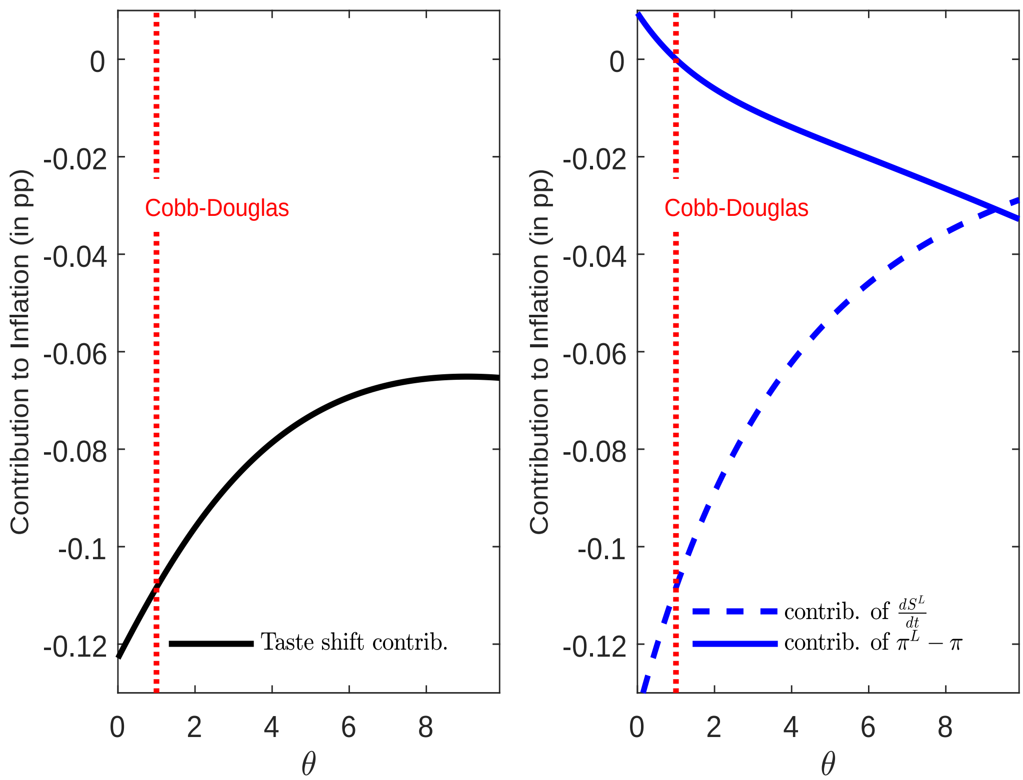
Note: we first calculate the contribution of LWC imports due to variations in the share of LWC imports in total imports by country category. The figure plots the weighted average contribution of LWC imports on French import inflation due to taste-shift effect by country category. The dark grey histogram plots the taste-shift contribution due to the Chinese imports, the light grey histogram plots the taste-shift contribution due to NEUMS imports, the white histogram plots the taste-shift contribution due to all other LWC imports (obtained as the sum of the taste-shift effect due the other LWC imports and other VLWC imports). The overall taste-shift effect of LWC imports on French import inflation is obtained as the sum of all three histograms in a given year.

Figure 7: Contributions of taste-shift vs inflation differential effects



Note: we calculate year by year the effect of LWC imports on inflation. The dotted black line plots the "pure price" effects of LWC imports calculated as the sum of the effect on import inflation differential and of the effect on domestic inflation. This pure price effect is decomposed by country of import origin: the dark blue histogram corresponds to the effect coming from Chinese imports and the light blue histogram corresponds to the effect of all other LWC. The black solid line corresponds to the overall effect of LWC imports calculated as the sum of the pure-price effect and the taste-shift effect (coming from the shift between domestic and LWC imports and from the shift between HWC and LWC imports). The dark grey histogram corresponds to the taste-shift effect of Chinese imports whereas the light grey histogram corresponds to the taste-shift of other LWC imports.

Figure 8: Contribution of the Taste Shift to Inflation - Variations Over θ



Note: The left-hand-side panel represents the contribution of taste-shift to inflation. It corresponds to the second term in equation (Dixit-Stiglitz) ($-\frac{1}{\theta-1}\left(\left(\frac{P^L}{P}\right)^{1-\theta} - \left(\frac{P^R}{P}\right)^{1-\theta}\right) \times \frac{d\alpha^L}{dt}$) multiplied by the share of tradable goods in consumption. Since taste parameter for LWC, α^L, can be expressed as a function of the market share and the relative price, we decompose this effect into two sub-contributions. The right-hand-side panel presents the contribution stemming from observed variations in market shares ($\frac{dS^L}{dt}$) (dashed blue line) and the contribution stemming from inflation differential ($\pi^L - \pi$) (plain blue line). The sum of the plain and dashed blue lines is equal by construction to the black one on the left.

Appendix

(Not intended for publication)

Date: July 25, 2022

A) Appendix

A).1 Data Sources

We merge an administrative dataset on trade flows by product and country with publicly available data on French household consumption and domestic production. Our data cover the period 1994-2014.

Product-country level imports and exports We obtain trade data from a quasi-exhaustive administrative file collected by the French Customs Office. It provides the yearly values (in euros) and quantities of imports (by country of origin and product) and exports (by country of destination and product) for all trading firms over the period 1994-2014.[26]

Trade flows are classified at the CN 8-digit level (Combined Nomenclature of the EU). The first six digits are identical to the subheading level (6-digit) of the international Harmonized Nomenclature (HS6), and the last two digits are added by the European Commission.[27] We restrict our sample to imports and exports of manufactured goods, around 14,000 product codes.[28]

We use the customs data to construct import and export unit values and calculate the share of imports on consumption by product and country.

[26]Flows with non-EU countries whose value is below 1,000 euros are excluded from the data set. In the case of EU countries, the threshold is larger, varying from 40,000 to 150,000 euros depending on the year. These thresholds leave out a very small proportion of French trade flows.

[27]As an example, CN8 code 18061015 "Cocoa powder, containing added sugar or sweetening matter - Containing no sucrose or containing less than 5% by weight of sucrose (including invert sugar expressed as sucrose) or isoglucose expressed as sucrose" is an extension of HS6 code 18061015 "Cocoa powder, containing added sugar or sweetening matter".

[28]We exclude raw materials (HS01-15, 23, 25-27, 31 and 41) e.g., "Vegetable products", "Mineral products", "Fertilizers" and "Works of art, collector's pieces and antiques", and "Services" (HS97-99). We keep only importers whose main activity falls within NACE Rev-2 codes 10-33. Excluded trade flows are about 5% of the total value of French imports and exports.

Product-level consumption expenditures The yearly value of household consumption is provided by INSEE at the 3-digit level of the COICOP (51 sectors), the United Nations' purpose-based classification of consumption expenditures by households. It is the classification used to build the official Consumer Price Index. Values of household consumption will allow us to measure the share of imported goods in households'consumption and thus the share of expenditures devoted to imported goods in the CPI.

Identification of consumer goods in the import data Our aim is to quantify the contribution of imports to the evolution of French consumer prices. We thus restrict our analysis to imports of consumption goods and we define the set of consumption goods as those goods included in the French CPI.

Implementing this definition requires mapping CN8 codes to products in COICOP classification of which the INSEE provides yearly values of consumption expenditures. There is no direct concordance table from CN8 to COICOP available. We first concord CN8 codes into 6-digit CPA codes (about 3,000 different products) and then we use a concordance table from CPA to COICOP.[29] We keep only those products in the Customs data set that match into COICOP categories (about 4,500 CN8 codes out of a total of 14,000).

By definition, products without a match are classified as imports of intermediate goods. As an example, the CN8 code 61112010, "Babies' garments and clothing accessories, knitted or crocheted: Gloves, mittens and mitts", maps into the COICOP code 03.1.2, "Garments". An example of a CN8 code that has no counterpart in the COICOP classification is 28121011, "Chlorides and chloride oxides".

One important caveat is that some products can be used either for consumption or as inputs, depending on the user (e.g., personal computers). This distinction is impossible to make in the data, and thus our import penetration measure might be overestimated. For COICOP categories that refer to services, we assume imports of consumption goods to be zero (e.g. restaurants).

[29] The CPA is the statistical classification of products by activity used in the European Union. Concordance tables were obtained from the EU statistical website RAMON: $http : //ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl = LST_REL$.

Country Categories The Customs data provide information on the country origin of imports allowing us to identify imports from LWCs imports. We follow Bernard et al. [2006] and Auer and Fischer [2010] and classify source countries intro three categories according to their GDP per capita relative to the French GDP per capita. "High-wage countries" are those with GDPpc higher than 75% of the French GDPpc. "Low-wage countries (LWCs)" are those for which the GDPpc lies between 25% and 75% of the French GDPpc. "Very low-wage countries (VLWCs)" includes countries with GDPpc lower than 25% of France's. We look separately at the cases of China and the New European Union member states (NEUMS), the former grouping countries that joined the EU after 2004.[30]

GDPpc ratios are averaged over 1994-2014 and the composition of groups is fixed over time. Table A reports a detailed list of countries by category.

A).2 Construction of Main Variables

We consider that a good i is defined at the CN8 level, and that each CN8-country combination identifies a differentiated variety j of such good i. Denote by $(v_{ijt}, P_{ijt}, Q_{ijt})$ the value, price and quantity of variety j of good i, with $v_{ijt} = P_{ijt}Q_{ijt}$, and with g the country groups defined as above. Ideally, we would like to have data on the values and quantities of domestically produced-goods at the CN8 level. Such data is however not available: for all products i, we observe v_{ijt} and q_{ijt} for all origins j except France. Hence we match the detailed trade data with the sector-level consumption (COICOP classification). Let $v_{it} = \sum_{j \in \Omega_i^J} v_{ijt}$ denote the total value of consumption on good i by French households. We have this information at the COICOP level –that corresponds in our framework to a *sector*. We observe v_{st}, defined as $v_{st} = \sum_{i \in s} v_{it}$.

We construct our variables of interest as follows:

Expenditure shares

- γ_{it}^g is the share of imports from country group g in total imports of good i: $\gamma_{it}^g = \sum_{j \in \Omega_i^g} v_{ijt} / \sum_{j \in \Omega_i^F} v_{ijt}$, where Ω_i^g is the set of imported varieties for good i belonging

[30] Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia

to country group g and Ω_i^F denotes the set of all foreign varieties

- η_{st} is the share of imports in COICOP sector s: $\eta_{st} = \sum_{i\in s}\sum_{j\in\Omega_i^F} v_{ijt}/v_{st}$
- β_t is the share of tradable goods T in total consumption: $\beta_t = \sum_{s\in T} v_{st}/\sum_{\forall s} v_{st}$
- η_t is the share of imports in tradable goods: $\eta_t = \sum_{s\in T}\sum_{i\in s}\sum_{j\in\Omega_i^F} v_{ijt}/v_t$, where v_t represents total consumption expenditures in France.

We scale import values with a uniform 20% distribution margin and apply VAT rates to the import values inclusive of margins (20% applies to most products since January 2014, and 5.5% applies to food products).[31]

Price levels We proxy product-level prices with unit values. We calculate unit values at the product(CN8)-country level, the most disaggregated available, in order to minimize measurement errors arising from heterogeneity at lower levels of disaggregation (still more disaggregated than the six-digit level at which the literature tends to focus). For each variety, we define: $P_{ijt} = v_{ijt}/Q_{ijt}$. Given the lack of available data on the price levels of domestically-produced goods, we proxy domestic prices with French export unit values, as in Emlinger and Fontagné [2013]. We compute export unit values similar to the case of imports.

Importantly, we compare prices by origin at the CN8 level and we assume that the definition of products is sufficiently precise so that varieties within each category i share the same "observed" quality. Hence we compare prices of goods that are observationally equivalent.[32]

Inflation rates Based on the discussion of Section 2, we build Import Price Indices in the following way. For each country category $g \in \{HWCs, LWCs, VLWCs, NEUMS, China\}$ and product i, we first calculate a price index $P_{i,0}^g$ as a weighted geometric average of unit

[31] It is the average margin of the retail sector from Andrieux and d'Isanto [2015], inclusive of both transportation and distribution costs. The sample of products covered by Andrieux and d'Isanto [2015] for this calculation is close to the set of tradable goods purchased for consumption purposes we consider. Andrieux and d'Isanto [2015] found some heterogeneity in margin rates across products or type of outlets but we cannot apply different margin rates to different types of outlets or different goods. Overall, these differences are going from 10% in communication products sold in supermarkets to 40% for frozen products sold in specialized outlets.

[32] Another dimension of quality is the *subjective* quality, as perceived by the consumer. Even though two goods have the same observable characteristics, the *perceived* quality refers to the relative preference/taste of consumers for each variety. Section 4.4 shows how, for a given elasticity of substitution θ, the taste parameter for each variety can be recovered from the observed market shares and prices. We measure how changes in taste do contribute to price dynamics.

values, where $t = 0$ is the first year this product is in our sample. Weights $\gamma^g_{ij,t}$ are the share of imports at time t of each product i and country j in total French imports of product i from country-group g: $P^g_{i,0} = \prod_{j \in \Omega^g_i} P^{\gamma^g_{ij,0}}_{ij,0}$. For the remaining years we compute the import price level for product i imported from country group g at time t as: $P^g_{i,t} = P^g_{i,t-1}\pi^g_{i,t}$, with $\pi^g_{i,t} = \prod_{j \in \Omega^g_{i,t-1}} (P_{ij,t})^{\gamma^g_{ij,t-1}} / \prod_{j \in \Omega^g_{i,t-1}} (P_{ij,t-1})^{\gamma^g_{ij,t-1}}$

The total import price level for good i is $P^F_{i,t} = \prod_{\forall g} (P^g_{i,t})^{\gamma^g_{i,t}}$. For each good i, imported inflation is constructed as $\pi^F_{i,t} = \log\left(\frac{P^F_{i,t}}{P^F_{i,t-1}}\right)$.

Then, aggregate import price inflation, π^F_t, is calculated as the weighted average of all products' inflation $\pi^F_{i,t}$. As discussed in Section 3, these indices are exact for Cobb-Douglas preferences and are defined for goods present in both $t-1$ and t ("common goods"). When product-country pairs drop out of the sample we impute a price change equal to the average change of the remaining of the index, as prescribed by the IMF Export and Import Price Index Manual (International Monetary Fund [2009]). As highlighted by Atkeson and Burstein [2008], it is equivalent to excluding these goods at the time they drop from the index and re-normalizing the weights for the remaining goods to sum up to one.

Our index has a correlation coefficient of 0.73 with the monthly import price index for the manufacturing industry, constructed by INSEE with surveys to individual firms starting in 2005, and a high correlation, of 0.55, with the import deflator from the National Accounts, in spite of the fact that such index covers a wider range, including manufacturing, services and extractive industries (the latter increasing the volatility of import inflation). Figure A in Appendix shows the evolution of π^F_t and that of the official indices for 1995-2014 (as we use 1994 as the base year, inflation measures start in 1995).

Sector level data on Producer Price Indices (PPI) To estimate the effect of imports from LWCs on domestic inflation we use Producer Price Indices (PPI) of domestic production at the 4-digit level of the French NAF Rev 2 classification from INSEE (NAF Rev 2 is identical to the NACE Rev 2 classification of activities).

A).3 Additional Tables and Figures

Table A: 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, Ivory Coast,...

Table B: Contribution of LWC Imports to Import Price Inflation: an International Comparison

Country	Period	Impact of LWC imports on import inflation	Source
France	1995-2005	-0.48 pp	This study
Austria	1995-2005	-0.66 pp	Glatzer et al. [2006]
Finland	1996-2005	-1 pp	Bank of Finland [2006]
Portugal	1998-2006	-0.2 pp	Cardoso and Esteves [2008]
Sweden	1996-2004	-1 to -2 pp	Sveriges Riksbank [2005]
United States	1993-2002	-0.8 to -1 pp	Kamin et al. [2006]
France	2000-2005	-0.74 pp	This study
United Kingdom	2000-2005	-0.7 pp	Mac Coille [2008]

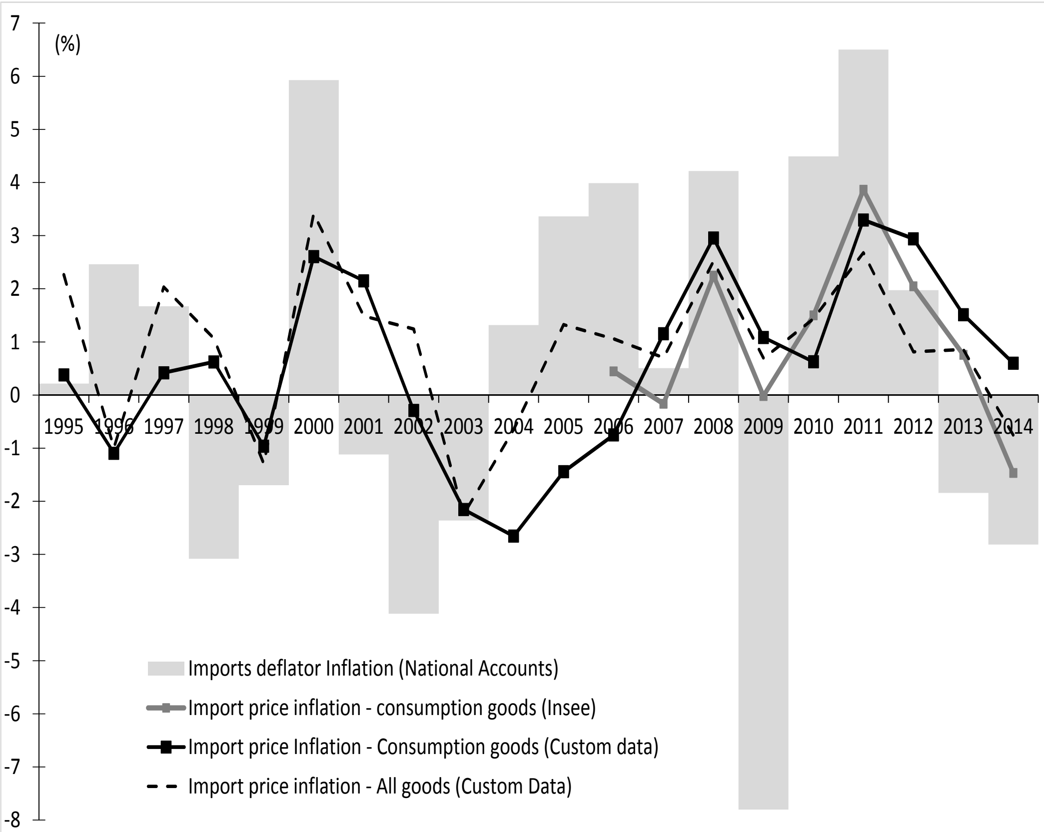
Note: this table reports estimates of the contribution of LWC imports to import price inflation in different countries. These estimates are obtained using a very similar methodology presented in section 3 and correspond to our "imported inflation effect" (Channel 2). Differences in methodologies may 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) to facilitate cross country comparisons.

Table C: Impact of Chinese Imports on French Producer Price Inflation

	All goods		Consumption goods		High Import penetration	
	OLS	IV	OLS	IV	OLS	IV
Δ share - China	-0.043	-1.846*	0.122	-1.124	-0.067	-1.550
	(0.082)	(0.990)	(0.116)	(1.555)	(0.087)	(1.110)
Δ Interm. Input costs	0.228***	0.224***	0.095**	0.093*	0.251***	0.254***
	(0.041)	(0.039)	(0.047)	(0.049)	(0.057)	(0.055)
Δ Labour costs	-0.043	-0.010	-0.059	-0.013	-0.028	0.032
	(0.044)	(0.047)	(0.080)	(0.083)	(0.068)	(0.075)
Cragg-Donald statistic	-	25.56	-	4.98	-	13.13
Stock-Yogo crit. value	-	10%	-	$> 25\%$	-	15%
F-stat. 1st stage	-	15.71	-	2.83	-	9.37
R^2	0.11	0.04	0.14	0.07	0.11	0.04
Nb products	154	154	52	52	81	81
Nb observations	1,986	1,981	699	699	984	981

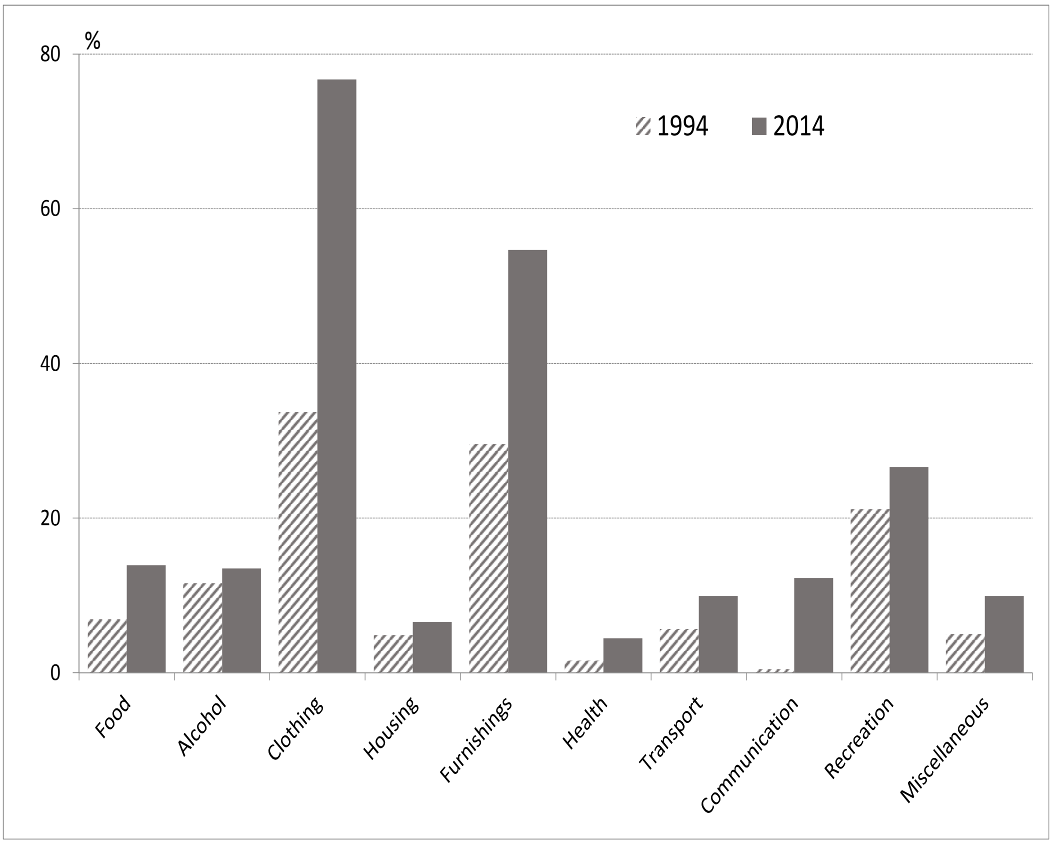
Note: this table reports estimates of OLS and IV regressions where the dependent variable is the annual PPI inflation calculated as the annual change in producer price index (domestic market) for 154 products defined at level 4 of the NACE rev2 classification (manufacturing industries only) (source: Insee) on the period 1995-2014 (when available). Product and year dummies are included in all specifications. Robust standard errors are reported in brackets. "Δ share" is the annual change in the share of China's imports in total French imports and domestic production. Year (19 years) and product (154 products) dummies are included, controls for annual growth rate of intermediate input costs and labour costs at the sectoral level (level 2 of NACE classification, source: Stan OECD) are also included. "All goods" include all goods for which producer price inflation is available, "'Consumption goods"' include goods that can be match with CPI classification (a little more than 50 products), "'High import penetration"' include goods for which the import penetration is higher than the average (about 33%). Columns (1), (3), and (5) correspond to results obtained from OLS regressions, all other columns report results of IV regressions where the instrumental variable is the sector's labor share multiplied by the annual growth rate of Chinese exports (see Appendix B) for details and results of first-stage regressions).

Figure A: Comparison between Import Price Indices



Note: the figure plots in dark grey line the annual variation of import price inflation for industrial goods (source: Insee - aggregate monthly series of import price index), in grey histogram the annual variation of the import deflator for manufactured goods including mining and quarrying (source Insee - annual national accounts) and in black lines, annual variations of our import price index computed using trade unit values and price indices by product and country categories (see section 3.2). The black dashed line corresponds to import inflation including all goods whereas the black line corresponds to import inflation only for consumption goods.

Figure B: Share of imports in consumption by COICOP category



Note: "% of imports in consumption" reports for each COICOP aggregate category the ratio between total imports of a given product (source: Customs) and the total French consumption (source: Insee, national accounts) (including VAT and distribution margins).

A).4 Model

This section builds a simple model of oligopolistic competition at the sector level (à la Atkeson and Burstein [2008]),that generates complementarities in price setting, from which we derive equation (7). Specifically, we suppose there are only two firms within each sector: one domestic and one foreign. Since firms are not atomistic within a sector, strategic behaviors arise and the domestic producer adjusts its price in response to changes in the market shares of its foreign competitor.

Turning to the details of the model, we assume that the final consumption good is the Dixit-Stiglitz aggregation of imperfect substitutable products, denoted by i. There are two layers of production:

1. The final consumption good, denoted Y_t, is composed of differentiated products supplied by a continuum of "sectors" (indexed by i) on $[0, 1]$: $Y_t = \left[\int_0^1 Y_t(i)^{\frac{\sigma-1}{\sigma}} dk\right]^{\frac{\sigma}{\sigma-1}}$, where σ is the elasticity of substitution between products from different sectors. The demand for sectoral good is $Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\sigma} Y_t$, where P_t is the consumption price index defined as $P_t = \left[\int_0^1 P_t(i)^{1-\sigma} dk\right]^{\frac{1}{1-\sigma}}$ and $P_t(i)$ is the sectoral price.

2. Each good i is produced by a retailer that combines two intermediate varieties (supplied by one domestic and one foreign firm): $Y_t(i) = \left[\sum_j x_t(j, i)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$ with $j \in \{D, F\}$. The associated price index is $P_t(i) = \left[\sum_j P_t(j, i)^{1-\theta}\right]^{\frac{1}{1-\theta}}$.

   The demand for good j in sector i is:

$$x_t(j, i) = \left(\frac{P_t(j, i)}{P_t(i)}\right)^{-\theta} Y_t(i) = \left(\frac{P_t(j, i)}{P_t(i)}\right)^{-\theta} \left(\frac{P_t(i)}{P_t}\right)^{-\sigma} Y_t \tag{16}$$

   The elasticity of substitution between goods within a sector is greater than the elasticity of substitution across sectors ($\theta > \sigma$). To be consistent with the benchmark model presented in section3 that relies on Cobb-Douglass aggregation across varieties, we can assume $\theta \to 1$ and $\sigma \to 0$ (i.e. Leontief demand structure across sectors).

Consider the behavior of a firm j within a given manufacturing industry i. Under Bertrand oligopolistic competition, the perceived elasticity of demand to a firm's own price, $\Theta_t(j,i)$, is not constant, although the elasticity of substitution between goods in the sector is constant (θ).

$$\Theta_t(j,i) = -\frac{\partial x_t(j,i)}{\partial P_t(j,i)} \frac{P_t(j,i)}{x_t(j,i)} = \theta - (\theta - \sigma) \underbrace{\left(\frac{\partial P_t(i)}{\partial P_t(j,i)} \frac{P_t(j,i)}{P_t(i)} \right)}_{= \left(\frac{P_t(j,i)}{P_t(i)} \right)^{1-\theta} \neq 0} \tag{17}$$

The profit maximization problem of firm j at time t given the cost function $\mathcal{C}(\dot{})$ is:

$$\begin{aligned} &\max_{P_t(j,i)} P_t(j,i) x_t(j,i) - \mathcal{C}(x_t(j,i)) \\ &\text{s.t. } x_t(j,i) = \left(\frac{P_t(j,i)}{P_t(i)} \right)^{-\theta} \left(\frac{P_t(i)}{P_t} \right)^{-\sigma} Y_t \end{aligned}$$

The first order condition implies that the firm sets its optimal price as a markup over marginal cost:

$$P_t(j,i) = \mathcal{M}_t(j,i) mc_t(j,i) \tag{18}$$

where:

$$\begin{aligned} \mathcal{M}_t(j,i) &= \frac{\Theta_t(j,i)}{(\Theta_t(j,i) - 1)} \\ \Theta_t(j,i) &= \theta - (\theta - \sigma) \underbrace{\left(\frac{P_t(j,i)}{P_t(i)} \right)^{1-\theta}}_{S_t(j,i)} \end{aligned}$$

and $mc_t(j,i)$ is the marginal cost of production, $\mathcal{M}_t(j,i)$ is the markup function and $\Theta_t(j,i)$ the elasticity of demand to its own price.

We denote $S_t(j,i)$ the share of firm j in sector i total expenditures:

$$S_t(j,i) = \frac{P_t(j,i)}{P_t(i)} \frac{x_t(j,i)}{Y_t(i)} = \frac{P_t(j,i) P_t^{-\theta}(j,i)}{P_t(i) P_t^{-\theta}(i)} = \left(\frac{P_t(j,i)}{P_t(i)} \right)^{1-\theta}$$

The markup, $\mu_t(j,i)$, can be written as a decreasing function of the equilibrium market share of firm j, $S_t(j,i)$. This is a very useful feature because, even though equilibrium markups are unobservable, the pro-competitive channel can be captured by expressing markups as a function of equilibrium markets shares, which we observe in the data.

Rewriting equation (18) in log:

$$\begin{aligned}
&\log(P_t(j,i)) = \log(\mathcal{M}_t(j,i)) + \log(mc_t(j,i)) \\
&\frac{\partial \log}{\partial t}(P_t(j,i)) = \frac{\partial \log}{\partial t}(\mathcal{M}_t(j,i)) + \frac{\partial \log}{\partial t}(mc_t(j,i))
\end{aligned} \tag{19}$$

Besides,

$$\frac{\partial \log}{\partial t}(\mathcal{M}_t(j,i)) = \underbrace{\left[-\frac{1}{\Theta_t(j,i)-1}\right]}_{\varepsilon_{\mathcal{M}\Theta}} \underbrace{\left[-(\theta-\sigma)\frac{S_t(j,i)}{\Theta_t(j,i)}\right]}_{\varepsilon_{\Theta S}} \frac{\partial \log}{\partial t}(S_t(j,i))$$

where ε_{uv} denotes the elasticity of u with respect to v.

In the end:

$$\pi_t(j,i) = \varepsilon_{\mathcal{M}\Theta}\varepsilon_{\Theta S}\frac{\partial \log}{\partial t}(S_t(j,i)) + \frac{\partial \log}{\partial t}(mc_t(j,i)) \tag{20}$$

Equation (20), applied to the domestic producer ($j = D$), relates domestic producer price inflation in sector i to changes in the domestic producer's market share. The latter is a function of the market shares of its foreign competitor: $S_t(D) = 1 - S_t(F)$ ($\forall$ sector i). Thus, equation (20) can be rewritten as a negative relationship between domestic firm's price and the share of foreign competitor in industry sales – i.e. import penetration:

$$\pi_t(D,i) = \psi\frac{\partial \log}{\partial t}(S_t(F,i)) + \frac{\partial \log}{\partial t}(mc_t(D,i)) \tag{21}$$

We obtain the empirical counterpart by appending a residual term $\mu_{it} = \lambda_t + \nu_i + \epsilon_{i,t}$, where λ_t is a time fixed-effect and ν_i is a sector fixed effect:

$$\pi^D_{i,t} = \Psi\Delta S^F_{i,t} + \kappa\Delta labcost_{i,t} + \eta\Delta inputcost_{i,t} + \lambda_t + \nu_i + \epsilon_{i,t} \tag{22}$$

where $labcost_{i,t}$ and $inputcost_{i,t}$ capture changes in the marginal cost of production.

B) Instruments

In this Appendix, we provide details on the construction of the instrumental variables and present the results from the first-stage regressions. Our instrumental variable is defined as the product of the average French labor share ls in sector i and the annual growth rate of LWC manufacturing exports ΔX: $x_{it} = ls_i \times \Delta X_t$. The instrument provides sector × year variation obtained from the product of a time-varying country category-level variables ΔX_t and a time-invariant sector-level variable, ls_i. ls_i is averaged over the period to reduce endogeneity concerns. Labor shares are calculated using firm-level balance-sheet quasi-exhaustive administrative data constructed from tax records, labeled "BRN" (Benefices Reels Normaux). We first sum the firm-level wage bill and value-added for all firms in the same sector, we then define the labor share for each sector as the ratio of (wage bill)/(value added). Then we take the average across years. For the growth rate of exports ΔX_t we use data from the World Bank's Development Indicators Database. We obtain manufacturing exports by country and by year (in current dollars) as the product of annual merchandise exports and a variable indicating the proportion of manufacturing exports in merchandise exports. We sum exports of all LWCs to all destinations except France, then we calculate the year-on-year growth rate. In the case of the China share we use Chinese exports to all destinations except France.

The first-stage regression is the following:

$$\Delta S^{LWC}_{i,t} = a + bx_{i,t} + c\Delta labcost_{i,t} + d\Delta inputcost_{i,t} + T_t + P_i + z_{i,t} \tag{23}$$

where $\Delta S^{LWC}_{i,t}$ is the variation of the share of imports from China in domestic consumption of good i, x_{it} is our instrumental variable, $\Delta labcost$ is the annual growth rate of labour cost in sector i and $\Delta inputcost$ the annual change in input cost for sector i, T_t is a time fixed-effect and P_i is a product fixed effect, $z_{i,t}$ is the residual term.

The second stage equation is as defined in the main text by equation (7).

Table D reports results of the first-stage estimation. The first stage results show that our instrument has a significant positive effect on the change in LWC / Chinese import penetration.

Table D: 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

Note: this table reports first-stage estimates of our IV regressions where the dependent variable is "Δ Export LWC × Labour share", the annual change in LWC manufcaturing exports (source: WTO) times the average labour share calculated at the product-level (source: administrative firm-level data). Year (19 years) and product (154 products) dummies are included, controls for annual growth rate of intermediate input costs and labour costs at the sectoral level (level 2 of NACE classification, source: Stan OECD) are also included. Robust standard errors are reported in brackets. "All goods" include all goods for which producer price inflation is available, "'Consumption goods"' include goods that can be match with CPI classification.