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Exports and invoicing: Evidence from the 2015 Swiss Franc appreciation

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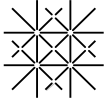
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Exports and Invoicing: Evidence from the 2015 Swiss Franc Appreciation

Raphael Auer, Ariel Burstein, Katharina Erhardt, and Sarah M. Lein*

October 2020

Abstract

The Swiss National Bank's (SNB) elimination of the lower bound on the EUR/CHF exchange rate on January 15 2015 provides a unique setting to study how prices and quantities respond to changes in nominal exchange rates. In this paper, we complement the study of imports in Auer et al. (2020) by looking at how the response of Swiss export prices and export values varies across products according to the currency of invoicing at the border. The rate of pass through (measured in CHF) into export prices was much lower in industries with a higher share of CHF-invoiced export border prices. We show that industries with higher CHF-invoicing shares experienced substantially weaker export growth in the two-year period after January 2015. At short horizons, however, export quantities did not respond across industries as much as prices to the exchange rate shock.

JEL classification: F11, F31, F41, L11

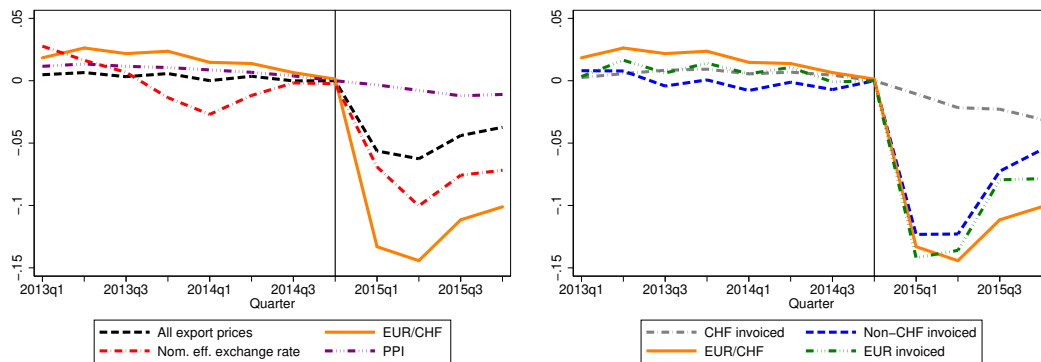
Keywords: Large exchange rate shocks, exchange rate pass-through, invoicing currency, expenditure switching, price-setting, nominal and real rigidities

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1 Introduction

The Swiss National Bank's (SNB) elimination of the lower bound on the EUR/CHF exchange rate on January 15 2015 provides a unique setting to study how prices and quantities respond to changes in nominal exchange rates. The SNB's policy decision followed a three-year period of EUR/CHF stability, occurred in an otherwise stable macroeconomic environment, and was largely a response to external developments (e.g. prospects of quantitative easing in the euro area resulting in a rise in foreign demand for CHF). It resulted in an abrupt and large exchange rate appreciation when compared to typical short-term exchange-rate fluctuations in advanced economies. Relative to December 2014, the EUR/CHF appreciated by more than 20% on January 15 2015, 14.0% three months later, 14.7% six months later, and 10.6% twelve months later, as displayed in Panel A of Figure 1. The trade-weighted nominal appreciation was smaller but still quite large.

Figure 1: *Exchange rates and average price changes*



(a) A: Export and producer prices

(b) B: Export prices by invoicing currency

Notes: This figure displays the evolution of the CHF/EUR nominal exchange rate, trade-weighted nominal exchange rate, average change in producer prices, and average change in export prices (overall and by invoicing currency) between 2013 and 2015.

In Auer et al. (2020) we trace the response of import prices at the border and retail (consumer) level and of consumer expenditures of domestic and imported goods in the aftermath of the 2015 appreciation, and document how the response of consumer prices and import expenditures vary across goods according to currency of invoicing of border prices. In this paper we complement Auer et al. (2020) by looking at how the response of Swiss export

prices and export values varies across products according to the currency of invoicing of export prices at the border.¹ Consistent with our previous findings on import prices and those of the literature (see e.g., Gopinath et al. 2010 for the US and Bonadio et al. (2018), Kaufmann and Renkin 2017 and Kaufmann and Renkin 2019 for Switzerland during the period we study here), exchange-rate pass-through into export prices (measured in CHF) was much lower in industries with a higher share of CHF-invoiced border prices. We then examine whether these differences in border price changes by currency of invoicing carry over to allocations, as measured by changes in the value of Swiss exports by industry (which, at the aggregate level, were quite stable around this time period). We find that industries with higher CHF-invoicing shares (and hence larger increase in foreign-currency denominated prices) experienced substantially weaker export growth in the two-year period after January 2015. At short horizons, however, export quantities did not respond across industries as much as prices to the exchange rate shock.

We view these findings as providing reduced-form evidence, using an identified exchange rate shock, that currency of invoicing (which plays an important role in the design of optimal exchange rate policy) matters for allocations beyond its much-studied link with changes in border prices, as well as evidence of export dynamics in response to exchange-rate movements.²

2 Data

Our analysis is based on two data sources. The first is the price and invoicing data underlying the official Swiss export price index. The Swiss Federal Statistical Office (SFSO) runs

¹Examining the same event, Bonadio et al. (2018) document the response of unit values by currency of invoicing, Kaufmann and Renkin 2017 show the response of employment, Funk and Kaufmann (2020) the role of downward nominal wage rigidities, and Freitag and Lein (2020) the role of product quality adjustment. Efung et al. (2016) and Buchholz et al. (2018) examine the effects on the valuations of publicly listed firms in Switzerland, Binding and Dibiasi (2017) examine exchange rate uncertainty and firm investment plans evidence using survey data, while Hail et al. (2020) examine the impact on firm disclosure policies. Fischer and Yesin (2019) examine the conversion of CHF-invoiced loans in the aftermath of the appreciation.

²Relatedly, Cravino (2017) and Amiti et al. (2018) estimate the response of export unit values and quantities to exchange rate shocks at the product-firm-destination level by invoicing currency (the former for Chilean exports and the latter for Belgian exports). Drozd and Nosal (2012) and Fitzgerald and Haller (2018) are examples of papers studying the gradual dynamics of exports to shocks.

periodical surveys to collect transaction information on export prices and invoicing currency for the main exported products by the largest Swiss exporting firms. Rather than observing a full description of the exported product, we observe its Swiss General Classification of Economic Activities (NOGA) industry code based on the industry of the exporting firm.³ Since some firms are surveyed at a monthly frequency and others at a quarterly frequency, we focus on an analysis at the quarterly frequency. Since the statistical office changed its export pricing survey in 2016, our sample of price changes covers four quarters after the January 2015 appreciation.

In Table A1 of the supplemental appendix we provide summary statistics on the invoicing currency composition of our export price data. In the fourth quarter of 2014, 59.6% of products were invoiced in CHF, 35.2% in euro, 3.9% in USD, and 1.4% in other currencies. These shares are very stable between 2013 and 2015. Across those NOGAs that we concord to the trade data, the mean, max, min and standard deviation of the fraction of prices invoiced in CHF (in the fourth quarter of 2014) are 65%, 100%, 0%, and 36%, respectively. Given data availability, our analysis is silent on the primitive sources of heterogeneity in currency of invoicing across industries.

The second data source is the quarterly export values from the foreign trade statistics published by the Swiss Customs Administration (Swiss-Impex). We concord the HS8-level trade data and NOGA-level export price data as follows. The transaction-level export data from the Swiss Customs Office contains information on the exporting firm's name, address, and HS8 code per transaction. We assign to each firm the corresponding NOGA reported in the Swiss firm registry Bisnode and Bureau van Dijk's ORBIS data. Summing over all firms within each NOGA, we then select the HS8 with the highest export value over the period

³Up to the four-digit level, the NOGA industry classification in Switzerland is identical to the NAICS industry classification used in the US.

2012-2015.⁴ We list in the appendix the set of 127 HS8 products and NOGA industries implied by our concordance. During the period 2012-2015, these HS8 exports account for roughly 30% of Swiss exports of goods exclusive of “non-core” categories such as goods in transit, precious metals and stones, and works of art and antiques.

3 Changes in export prices

Panel A of Figure 1 displays the average logarithmic change in export prices at the border (expressed in CHF) by quarter between 2013 and 2015, relative to the fourth quarter in 2014.⁵ In the first (second) quarter of 2015, export prices fell on average by 4.0% (5.1%). In contrast, domestic producer prices (obtained from the SFSO) fell by only 0.3% (0.8%).

These average changes in export prices mask a lot of heterogeneity in price changes across industries (given by the exporting firms’ NOGA code). Here we focus on heterogeneity originating from variation in the currency of border price invoicing. As can be seen in Panel B of Figure 1, the decline in prices (expressed in CHF) in 2015 was much less pronounced for exported products invoiced in CHF (in the fourth quarter of 2014) relative to those invoiced in non-CHF currencies. In the first (second) quarter of 2015, CHF-invoiced prices fell on average by 1.0% (2.1%) whereas non-CHF invoiced prices fell on average by 8.1% (9.7%). These differences, which are statistically significant at the 1 percent level (see Panel A of Table 1), fall over time as the CHF/EUR reverses in part the initial appreciation and as prices adjust.

⁴We select only the highest export value HS8 per NOGA to more closely approximate the selection of products in the export price data, which surveys the main exported products of large Swiss firms. For example, we concord the NOGA “Manufacture of pharmaceutical preparations” with the HS8 code “Medicaments for therapeutic or prophylactic uses [...]” and exclude HS8 products exported by pharmaceutical firms such as “cartons, boxes, cases, bags and other packing containers [...]”, which are not likely to be included by pharmaceutical firms in the export price surveys. Our results are similar if in our concordance procedure we select the two highest export value HS8s per NOGA, or if we only consider the largest firms (above median) per NOGA.

⁵Quarterly surveys for border prices are carried out by the SFSO in the first two weeks of each quarter (January, April, July, and October). Hence, prices in the January 2015 survey were collected before the appreciation. The first post-appreciation quarterly border price observation are in the March 2015 survey. We drop from the data two products with very large price changes (higher than 600%) in the third quarter of 2015. We consider unweighted averages since we only observe the weight in the export price index for a subset of products. While here we use all prices in the export price data, if we restrict the sample to observations in the subset of NOGAs that we concord with HS8 products we obtain very similar results.

Table 1: Average price changes by currency of invoicing

| | A: All price changes | | | | B: Non-zero price changes | | | |
|---------------------------|----------------------|-------------------|-------------------|-------------------|---------------------------|-------------------|-------------------|-------------------|
| | Quarter | | | | Quarter | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Non-CHF invoiced | -0.123 (0.003) | -0.123 (0.004) | -0.073 (0.004) | -0.057 (0.007) | -0.147 (0.008) | -0.110 (0.006) | -0.066 (0.005) | -0.058 (0.008) |
| CHF invoiced (Difference) | 0.113 (0.004) | 0.102 (0.005) | 0.051 (0.005) | 0.030 (0.009) | 0.108 (0.012) | 0.051 (0.011) | 0.013 (0.010) | 0.001 (0.013) |
| Observations | 2,534 | 2,446 | 2,315 | 2,194 | 771 | 1,011 | 1,143 | 1,191 |
| R^2 | 0.230 | 0.152 | 0.039 | 0.005 | 0.087 | 0.020 | 0.001 | 0.000 |

Notes: Estimates of $\Delta p_{iq} = \alpha_q + \beta_q \mathbb{I}_i(CHF) + \varepsilon_{iq}$, where Δp_{iq} denotes the log difference between the export price of good i in quarter q of 2015 relative to quarter 4 of 2014, and $\mathbb{I}_i(CHF) = 1$ for CHF-invoiced goods in quarter 4 of 2014 and 0 otherwise. α_q is referred to in the table as “Non-CHF invoiced” and β_q is referred to as “CHF invoiced (Difference)”. Panel A considers all price changes and panel B considers only non-zero price changes (measured in the invoicing currency). Robust standard errors in parentheses.

Figure A1 in the appendix reveals that export border prices are quite rigid in the currency of invoicing, even at long horizons. Panel B of Table 1 displays average changes in export prices relative to the fourth quarter of 2014, but only including observations with non-zero price changes in the currency of invoicing. Conditional on changing, prices fell by less for CHF-invoiced goods, as in Gopinath et al. (2010), but this difference is statistically significant only in the first two quarters of 2015.⁶

In what follows we show that this variation in relative price changes across products has allocative consequences in the sense that we observe significant differences in the export growth of CHF versus non-CHF invoiced products.

4 Changes in export values

We consider a regression of the form

$$\Delta exp_{iq} = \alpha_q + \beta_q CHFShare_i + \varepsilon_{iq}, \quad (1)$$

⁶Because some of the regressions conditional on a price change in foreign currency may be affected by the conversion of prices described in the Appendix, we treat some observations that show only very small price changes compared to the average price change in 2015 as zero. The results are quantitatively and qualitatively similar when not doing so.

Table 2: *Changes in export values and currency of invoicing*

| | Quarter | | | | | | | |
|--------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| CHF invoiced | 0.058 (0.052) | -0.036 (0.033) | -0.072 (0.020) | -0.210 (0.075) | -0.145 (0.046) | -0.366 (0.139) | -0.264 (0.084) | -0.337 (0.119) |
| Constant | -0.062 (0.022) | 0.009 (0.017) | 0.012 (0.010) | 0.176 (0.034) | 0.131 (0.019) | 0.394 (0.061) | 0.226 (0.036) | 0.320 (0.056) |
| Observations | 118 | 120 | 120 | 119 | 109 | 110 | 111 | 111 |
| R^2 | 0.034 | 0.013 | 0.074 | 0.189 | 0.114 | 0.210 | 0.191 | 0.200 |

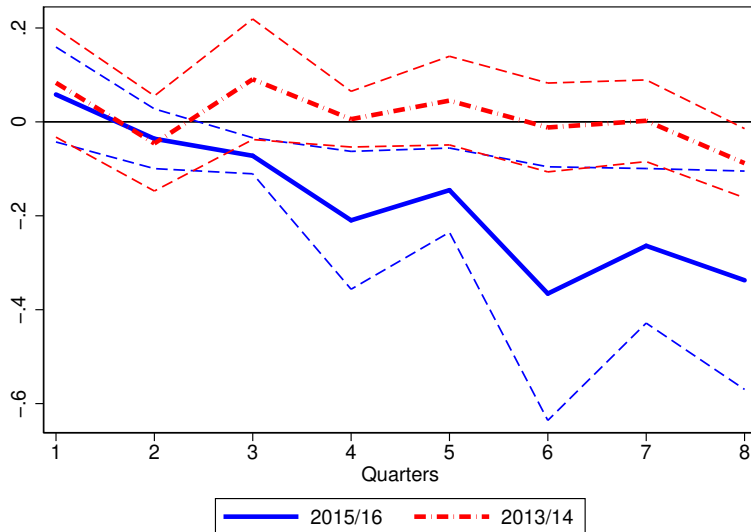
Notes: This table displays estimates of α_q and β_q in equation (1). Running (1) for the entire year 2015 versus 2014 or 2015+2016 versus 2014 gives β_q of -0.063 (0.021) and -0.171 (0.068). Robust standard errors in parentheses.

where Δexp_{iq} denotes the log difference between Swiss exports in HS8 product i , $q = 1, \dots, 8$ quarters after December 2014 relative to the same quarter of 2014, and $CHFShare_i$ denotes the fraction of prices invoiced in CHF in the fourth quarter of 2014 in the corresponding NOGA industry i .⁷ We compare exports values for the same quarter in different years because exports are highly seasonal. We estimate (1) at different time horizons to assess the dynamics of exports over time.

The key coefficient of interest is β_q , interpreted as the difference in export performance between a fully CHF-invoiced and a fully non-CHF invoiced industry. Table 2 shows that β_q is slightly positive in the first quarter of 2015 (suggesting that export quantities responded across industries less than prices to the exchange rate movement) but not statistically significantly different from zero. Starting in the second quarter of 2015, β_q is increasingly negative (significant at the 1 percent level as of the third quarter of 2015) in spite of the fact that the appreciation of the CHF was smaller at longer horizons. In the fourth quarter of 2015, export growth relative to the same quarter of 2014 was roughly 21 percentage points lower in industries that are (hypothetically) fully invoiced in CHF compared with industries that are fully invoiced in foreign currencies. The estimates implied by considering the sum of exports across all quarters in 2015 relative to 2014, reported in Table 2, are negative but much smaller,

⁷We weight observations by 2014 export values, and in each quarter we exclude observations with absolute changes in export values larger than 50%. Depending on the quarter, this removes up to 9 observations in 2015 and 19 in 2016. In the appendix, we show that including all observations or not weighting does not change point estimates substantially, but the increase in standard errors renders some insignificantly different from zero.

Figure 2: *Changes in export values and currency of invoicing*



Notes: This figure displays point estimates and 95% confidence intervals of β_q in equation (1), for $q = 1, \dots, 4$.

consistent with weaker effects in the first two quarters of 2015. The estimates are larger when considering the sum of exports in 2015 and 2016 relative to 2014.

In spite of this statistically significant relationship between changes in export values and CHF invoicing, there is substantial variation in export movements across industries that is not accounted for by invoicing differences — R^2 s reported in Table 2 do not exceed 0.21.

Figure 2 plots the dynamics of β_q over time. We can see that during the 2013-2014 pre-appreciation period, there were no marked trends in exports of CHF-invoiced products relative to non-CHF invoiced products. In the appendix, we report sensitivity of our estimates if we normalize Swiss export growth by German export growth in the same industry (to control for other regional industry effects) or if we use the average of 2013 and 2014 quarterly exports as the baseline year.

5 Changes in export prices and export values

Recall that Figure 1 showed that border prices fall for non-CHF invoiced exports relative to CHF-invoiced exports, and Table 2 showed that export values rise disproportionately in

Table 3: *Changes in export values, prices, and currency of invoicing*

| | Quarter 1 | | Quarter 2 | | Quarter 3 | | Quarter 4 | |
|----------------------------|------------------|-------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS |
| Dlog price exports | 0.535 (0.298) | 0.464 (0.386) | 0.278 (0.207) | -0.293 (0.286) | -0.171 (0.133) | -0.462 (0.174) | -0.851 (0.557) | -1.426 (0.488) |
| Constant | 0.000 (0.025) | -0.004 (0.030) | 0.007 (0.011) | -0.028 (0.023) | -0.040 (0.015) | -0.060 (0.018) | 0.011 (0.062) | -0.024 (0.061) |
| CHF invoiced (first stage) | | 0.125 (0.011) | | 0.127 (0.017) | | 0.157 (0.034) | | 0.147 (0.040) |
| Observations | 117 | 117 | 118 | 118 | 118 | 118 | 119 | 119 |
| R^2 | 0.075 | | 0.021 | | 0.016 | | 0.128 | |
| F-statistic | | 125.4 | | 58.0 | | 21.8 | | 13.4 |

Notes: This table displays estimates of α_q and β_q in equation (2). In the 2SLS specifications, log changes in border prices are instrumented by the share of products that are CHF-invoiced in the corresponding NOGA. Robust standard errors in parentheses.

industries with lower CHF invoicing. In this final section, we assess the extent to which the differential change of exports by currency of invoicing is induced by the differential change in export prices by currency of invoicing.

We first run a regression similar to equation (1), in which we replace the share of CHF-invoicing by industry i , $CHFShare_i$, by the log change in border prices by industry. Specifically, we consider a regression of the form

$$\Delta exp_{iq} = \alpha_q + \beta_q \Delta p_{iq} + \varepsilon_{iq}, \quad (2)$$

where Δp_{iq} denotes the log difference in the export price of NOGA i (averaged over price observations within that NOGA) $q = 1, \dots, 4$ quarters after December 2014 relative to the same quarter of 2014. The OLS estimates of β_q in Table 3 are largely insignificant. This is not very surprising since there are other factors (like industry demand shocks for Swiss imports from the rest of the world) that may induce changes in exports prices and values across industries.

Under the assumption that foreign demand shocks for Swiss exports in 2015 are uncorrelated across industries with pre-2015 CHF invoicing shares, we can use the latter to instrument in

equation (2) for export border price changes between 2014 and 2015.⁸ The 2SLS estimates of β_q , reported in Table 3, measure the average sensitivity of export values to export price changes across industries induced by the CHF appreciation interacted with industry pre-2015 CHF-invoicing intensity. Estimates are insignificant in the first two quarters (consistent with the reduced form results above) and range roughly between -0.5 and -1.4 (significant at the one percent level) in the third and fourth quarters of 2015.

Note that, even if the identification assumptions underlying the instrumental variable estimations are satisfied, these estimates are not structural estimates of the demand elasticity between Swiss and other foreign goods, which would require using measures of foreign exports and theory-based price indices.

⁸If the sensitivity of export values to export prices varies across industries, then we must additionally assume that this variation is uncorrelated with pre-2015 CHF-invoicing shares across industries. Note that standard theories of endogenous invoicing (e.g., Engel 2006) highlight desired exchange rate pass-through as a determinant of invoicing currency, which is not necessarily shaped by demand shocks to individual industries or by the sensitivity of exports to prices in the industry.

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Online Appendix for
“Exports and Invoicing: Evidence from the 2015 Swiss Franc
Appreciation” (Auer, Burstein, Erhardt, Lein)

A Data description

In this paper, we use the export prices underlying the calculation of the Swiss export price index (EPI), which is a component of the producer price index (PPI). For a description of survey methodology and data collection procedures, see Swiss Federal Statistical Office (2016). The survey is conducted separately for products sold domestically (domestic PPI) and products sold abroad (EPI). However, firms have the possibility to indicate when the same product sold domestically and abroad has the same price. Then, the price of that product enters both the domestic PPI and the EPI. We include these observations in our dataset used in the analysis in this paper. To take into account the survey timing, we lag the data by one month. We drop a few duplicate observations that show up in December 2015, which are related to the change in the survey in 2016 mentioned in the main text. We furthermore drop 9 observations, where the same product identifier shows up twice in December 2015, and where the price of the two observations differs. In this case, we keep the price that is closer to the price of the same product identifier from the previous period. Another issue with the data, which we also describe in Auer et al. (2020), is that some prices do not change in CHF and in foreign currency, which may be related to non-response or data collection, or that implied exchange rates are inconsistent with the data. We convert the CHF prices into foreign currency using monthly exchange rates from the SNB and leave the foreign prices unchanged from the previous month in months when a product is not surveyed or in periods of non-response. We then use the CHF price that is consistent with this price in foreign currency. We furthermore correct for product replacements by using the replacement price provided by the SFSO (see also Auer et al., 2020, for a description).

Table A4: Export price observations by currency of invoicing

| | A: All products | | | | B: Concorded sample | | | |
|--------------|-----------------|-------|-------|---------|---------------------|-------|-------|---------|
| | 2013 | 2014 | 2015 | Q4/2014 | 2013 | 2014 | 2015 | Q4/2014 |
| Total | 2,060 | 2,307 | 2,372 | 2,512 | 1,708 | 1,898 | 1,949 | 2,060 |
| CHF invoiced | 59.3 | 59.6 | 58.5 | 59.6 | 60.8 | 61.1 | 59.6 | 60.9 |
| EUR invoiced | 35.7 | 35.2 | 35.7 | 35.2 | 35.0 | 34.3 | 34.9 | 34.4 |
| USD invoiced | 3.9 | 3.8 | 4.0 | 3.9 | 3.1 | 3.1 | 3.6 | 3.3 |
| ROW invoiced | 1.2 | 1.4 | 1.8 | 1.4 | 1.1 | 1.5 | 1.8 | 1.5 |

Notes: Per quarter average number of border export price observations and share by currency of invoicing for all products in our export price sample (Panel A) and for NOGA products that are concorded to our HS8 export data (Panel B). The share of CHF invoiced products falls slightly in 2015, mainly because those products that exit the sample are CHF invoiced. Only 6 products switch invoicing currency from CHF to non-CHF.

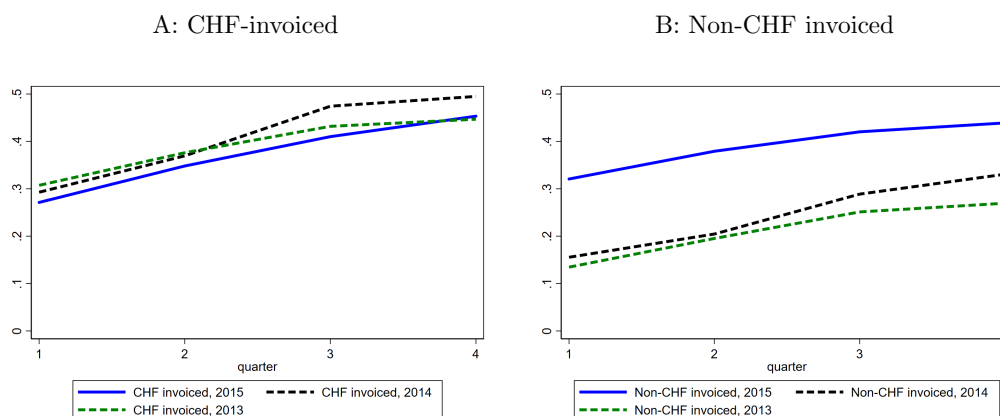
| NOGA description | HS description |
|---|---|
| Aluminium production | Plates, sheets & strip, of aluminium alloy, of a thickness of > 0,2 mm |
| Casting of iron | Steering wheels, steering columns & steering boxes, & parts thereof |
| Cold drawing of bars | Bars & rods, of non-alloy free-cutting steel |
| Copper production | Manufacturing waste, of copper |
| Cutting, shaping & finishing of stone | Granite, crude or roughly trimmed |
| Distilling, rectifying & blending of spirits | Liqueurs & cordials |
| Machining | Tubes, pipes & hollow profiles, welded, of circular cross-section, of iron or non-alloy steel, of an internal diameter ≤ 100 mm |
| Manu. of assembled parquet floors | Flooring panels, multilayer, assembled, of wood |
| Manu. of basic iron & steel & of ferro-alloys | Bars & rods, hot-rolled, in irregularly wound coils, of non-alloy free-cutting steel |
| Manu. of basic pharmaceutical products | Medicaments for therapeutic or prophylactic uses, put up in measured doses |
| Manu. of bearings, gears, gearing & driving elements | Electric motors of an output ≤ 37.5 W |
| Manu. of beer | Beer made from malt |
| Manu. of bread; manufacture of fresh pastry goods & cakes | Wheat or meslin flour |
| Manu. of brooms & brushes | Tooth brushes, incl. dental-plate brushes |
| Manu. of builder' ware of plastic | Structures & parts of structures, of aluminium |
| Manu. of carpets & rugs | Carpets & other floor coverings |
| Manu. of central heating radiators & boilers | Central heating boilers, non-electric, weighing ≤ 500 kg each |
| Manu. of cocoa, chocolate & sugar confectionery | Chewing-gum & sweets, tablets, pastilles & the like |
| Manu. of concrete products for construction purposes | Prefabricated structural components for building or civil engineering of cement, concrete or artificial stone |
| Manu. of condiments & seasonings | Chocolate & other food preparations containing cocoa |
| Manu. of corrugated paper(board) & of containers of paper(board) | Fluting paper, uncoated, in rolls of a width > 36 cm |
| Manu. of cutlery | Secateurs & similar one-handed pruners & shears, incl. poultry shears, with working parts of base metal |
| Manu. of doors & windows of metal | Structures & parts of structures, of aluminium |
| Manu. of dyes & pigments | Pigments, incl. metallic powders & flakes, dispersed in non-aqueous media, in liquid or paste form |
| Manu. of electricity distribution & control apparatus | Parts suitable for use solely or principally with the apparatus of heading 8535, 8536 or 8537 |
| Manu. of electric domestic appliances | Electro-thermic coffee or tea makers, for domestic purposes |
| Manu. of electric motors, generators & transformers | Air pumps, air or other gas compressors & ventilating or recycling hoods incorporating a fan |
| Manu. of electronic components | Boards, panels, consoles, desks, cabinets, incl. numerical control apparatus |
| Manu. of engines & turbines, except aircraft, vehicle & cycle engines | Compression-ignition internal combustion piston engine "diesel or semi-diesel engine" |
| Manu. of essential oils | Mixtures of odoriferous substances & mixtures on the basis of one or more of these substances |
| Manu. of explosives | Propellent powders |
| Manu. of fasteners & screw machine products | Helical springs, of iron or steel, surface-treated, weighing each ≤ 0.5 kg |
| Manu. of fertilisers & nitrogen compounds | Phosphoric acid; polyphosphoric acids |
| Manu. of fibre cement | Sheets, panels, paving, tiles & similar articles, of asbestos-cement, cellulose fibre-cement or the like, not containing asbestos |
| Manu. of fibre optic cables | Parts of transmission apparatus for radio-telephony or radio-telegraphy, without reception apparatus |
| Manu. of fluid power equipment | Valves for oleohydraulic or pneumatic transmission, of iron, of steel other than stainless steel, or of lead |
| Manu. of fruit & vegetable juice | Mucilages & thickeners |
| Manu. of glass fibres | Webs, mattresses, boards & similar nonwoven products, of glass fibres |
| Manu. of glues | Adhesives based on polymers of headings 3901 to 3913 |
| Manu. of grain mill products | Mixes & doughs for the preparation of bakers' wares of heading 1905 |

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| Manu. of hollow glass | Microtomes |
| Manu. of homogenised food preparations & dietetic food | Roasted coffee, not decaffeinated |
| Manu. of household & sanitary goods & of toilet requisites | Sanitary towels (pads) & tampons, napkins & napkin liners for babies & similar articles |
| Manu. of ice cream | Furniture for storage & display, incorporating refrigerating or freezing equipment |
| Manu. of industrial gases | Nitrogen |
| Manu. of instruments & appliances for measuring, testing & navigation | Instruments & apparatus for physical or chemical analysis |
| Manu. of kitchen furniture | Metal furniture |
| Manu. of knitted & crocheted hosiery | Full-length or knee-length hosiery |
| Manu. of light metal packaging | Casks, drums, cans, boxes & similar containers, incl. rigid tubular containers, of aluminium, for any material of a capacity of ≤ 300 l |
| Manu. of lifting & handling equipment | Parts of lifts or skip hoists |
| Manu. of loaded electronic boards | Printed circuits, weighing ≤ 0.3 kg each |
| Manu. of luggage, handbags & the like, saddlery & harness | Travelling-bags, insulated food or beverage bags, toilet bags, rucksacks etc. |
| Manu. of macaroni, noodles, couscous & similar farinaceous products | Pasta, cooked or otherwise prepared |
| Manu. of machinery for food, beverage & tobacco processing | Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables |
| Manu. of machinery for mining, quarrying & construction | Tools for drilling, interchangeable weighing ≤ 0.5 kg each |
| Manu. of machinery for textile, apparel & leather production | Parts & accessories of weaving machines "looms" & their auxiliary machinery |
| Manu. of made-up textile articles, except apparel | Articles of bedding & similar furnishing |
| Manu. of margarine & similar edible fats | Edible mixtures or preparations of animal or vegetable fats or oils |
| Manu. of mattresses | Mattresses of cellular rubber or plastics, whether or not covered |
| Manu. of medical & dental instruments & supplies | Orthopaedic or fracture appliances |
| Manu. of metal structures & parts of structures | Parts of machinery for the industrial preparation or manufacture of food or drink |
| Manu. of mortars | Non-refractory surfacing preparations for facades, inside walls, floors, ceilings & the like |
| Manu. of non-domestic cooling & ventilation equipment | Machinery & apparatus for filtering or purifying gases, weighing $> 5,000$ kg each |
| Manu. of office machinery & equipment | Machines for sorting or folding mail or for inserting mail in envelopes or bands, machines for opening, closing or sealing mail |
| Manu. of office & shop furniture | Parts of other furniture than seats, of iron or steel other than stainless steel |
| Manu. of oils & fats | Protein concentrates & textured protein substances, containing milkfat, other fat or sugar |
| Manu. of other articles of paper & paperboard | Paper or paperboard labels of all kinds, printed |
| Manu. of other ceramic products | Injection or compression-type moulds for rubber or plastics |
| Manu. of other chemical products n.e.c. | Derivatives, organic, of hydrazine or of hydroxylamine |
| Manu. of other electronic & electric wires & cables | Electric conductors, for a voltage $\leq 1,000$ V |
| Manu. of other fabricated metal products n.e.c. | Sinks & washbasins, of stainless steel, surface-treated |
| Manu. of other food products n.e.c. | Food preparations for infant use |
| Manu. of other furniture | Wooden furniture for bedrooms |
| Manu. of other general-purpose machinery n.e.c. | Packing or wrapping machinery, incl. heat-shrink wrapping machinery |
| Manu. of other inorganic basic chemicals | Carboxylic acids, saturated acyclic monocarboxylic & their derivatives |
| Manu. of other knitted & crocheted apparel | T-shirts, singlets & other vests of textile materials |
| Manu. of other non-metallic mineral products n.e.c. | Articles of copper, not surface-treated |
| Manu. of other organic basic chemicals | Preparations of a kind used in animal feeding |
| Manu. of other outerwear | Men's or boys' suits of wool or fine animal hair |
| Manu. of other plastic products | Parts & accessories of bodies for motor cars & other motor vehicles designed for the transport of persons |
| Manu. of other pumps & compressors | Safety or relief valves |
| Manu. of other rubber products | Compounded rubber, unvulcanised, with carbon black or silica |
| Manu. of other special-purpose machinery n.e.c. | Parts & accessories of printing machinery used for printing by means of plates, cylinders & other printing components of heading 8442 |
| Manu. of other tanks, reservoirs & containers of metal | Tanks, casks, drums, cans, boxes & similar containers, of iron or steel, for any material, of a capacity of ≥ 50 l but ≤ 300 l |
| Manu. of other taps & valves | Appliances for pipes, boiler shells, tanks, vats or the like |
| Manu. of other wearing apparel & accessories | Gimped elastomeric yarn |
| Manu. of paper & paperboard | Newsprint, in rolls of a width > 36 cm |
| Manu. of paper stationery | Self-adhesive plates, sheets, film, foil, tape, strip |
| Manu. of perfumes & toilet preparations | Mixtures of odoriferous substances & mixtures based on one or more of these substances |
| Manu. of pesticides & other agrochemical products | Surface-active preparations, washing preparations, auxiliary washing preparations |
| Manu. of pharmaceutical preparations | Medicaments for therapeutic or prophylactic uses, put up in measured doses |
| Manu. of plaster products for construction purposes | Non-refractory surfacing preparations for facades, inside walls, floors, ceilings & the like |
| Manu. of plastics in primary forms | Plates, sheets, film, foil & strip |
| Manu. of plastic packing goods | Articles for the conveyance or packaging of goods, of plastics |
| Manu. of plastic plates, sheets, tubes & profiles | Plates, sheets, film, foil & strip, of plastics, reinforced, laminated, supported or similarly combined with other materials |
| Manu. of power-driven hand tools | Tool holders, incl. tool holders for any type of tool for working in the h&, & self-opening dieheads, for machine tools |
| Manu. of prepared feeds for farm animals | Preparations of a kind used in animal feeding |
| Manu. of prepared meals & dishes | Jams, jellies, marmalades, purees or pastes of fruit or nuts |
| Manu. of ready-mixed concrete | Articles of cement, concrete or artificial stone |
| Manu. of rubber tyres & tubes; retreading & rebuilding of rubber tyres | Instruments & apparatus for measuring or checking pressure of liquids or gases |
| Manu. of rusks & biscuits; manufacture of preserved pastry goods & cakes | Bread, pastry, cakes, biscuits & other bakers' wares |
| Manu. of soap & detergents, cleaning & polishing preparations | Surface-active preparations, washing preparations, auxiliary washing preparations |
| Manu. of soft drinks | Machinery for filling, closing, sealing or labelling bottles |
| Manu. of starches & starch products | Food preparations containing $> 10\%$ but $\leq 25\%$ by weight of a fat other than milkfat |

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| Manu. of steel drums & similar containers | Tanks, casks, drums, cans, boxes & similar containers, of iron or steel, for any material, of a capacity of ≥ 50 l but ≤ 300 l |
| Manu. of synthetic rubber in primary forms | Articles of vulcanised rubber |
| Manu. of tubes, pipes, hollow profiles & related fittings, of steel | Flexible tubes, pipes & hoses, of plastics, reinforced or otherwise combined with other materials |
| Manu. of underwear | Woven fabrics of cotton, unbleached |
| Manu. of watches & clocks | Wrist-watches, whether or not incorporating a stop-watch facility |
| Manu. of wine from grape | Natural white wine, incl. fortified wines, & grape must |
| Manu. of wire products, chain & springs | Electric conductors, for a voltage $\leq 1,000$ V |
| Manu. of wiring devices | Plugs & sockets for a voltage $\leq 1,000$ V |
| Manu. of wooden containers | Flat pallets, box pallets & other load-bearing boards, of wood |
| Manu. of workwear | Men's or boys' tracksuits & other garments of cotton |
| Operation of dairies & cheese making | Hard cheese |
| Other printing | Trade advertising material, commercial catalogues & the like |
| Other processing & preserving of fruit & vegetables | Olives, prepared or preserved |
| Pre-press & pre-media services | Photographic plates & film, exposed & developed, for offset reproduction |
| Preparation & spinning of textile fibres | Textile flock & dust & mill neeps |
| Processing & preserving of meat | Animal or vegetable fats & oils & their fractions |
| Processing & preserving of poultry meat | Parts of machinery for the industrial preparation of food or drink |
| Processing of tea & coffee | Roasted coffee, not decaffeinated |
| Production of abrasive products | Natural or artificial abrasive powder or grain, on a base of materials other than woven textile fabric only or paper or paperboard only |
| Sawmilling & planing of wood | Spruce & pine, sawn lengthwise, of a thickness > 6 mm |
| Shaping & processing of flat glass | Laminated safety glass, of size & shape suitable for incorporation in motor vehicles, aircraft, spacecraft, vessels & other vehicles |
| Tanning & dressing of leather; dressing & dyeing of fur | Grain splits leather of the whole hides & skins of bovine or equine animals |
| Treatment & coating of metals | Plates, sheets & strip, of aluminium alloy, of a thickness of > 0.2 mm |

Table A5: Concordance NOGA industries and HS products

Figure A3: Fraction of price changes relative to fourth quarter of previous year



Notes: For each quarter $q = 1, \dots, 4$ in years 2013, 2014, and 2015, this figure displays the fraction of products that recorded a price different from the price in quarter $q = 4$ of the previous year. For example, a value of 0.4 in $q = 3$ of 2015 means that only 40% of prices (in the currency of invoicing) changed in the third quarter of 2015 relative to the fourth quarter of 2014.

Table A6: *Export changes and currency of invoicing: Robustness*

| A: Swiss relative to German exports | | | | | B: Relative to average 2013 and 2014 | | | | |
|-------------------------------------|-------------------|-------------------|-------------------|-------------------|--------------------------------------|-------------------|-------------------|-------------------|--|
| | Quarter | | | | | Quarter | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| CHF invoiced | -0.011 (0.111) | 0.132 (0.089) | -0.094 (0.043) | -0.325 (0.143) | 0.065 (0.051) | -0.017 (0.037) | -0.114 (0.036) | -0.245 (0.095) | |
| Constant | 0.073 (0.051) | -0.053 (0.044) | 0.072 (0.024) | 0.270 (0.085) | -0.065 (0.021) | -0.003 (0.019) | 0.082 (0.018) | 0.234 (0.043) | |
| Observations | 99 | 101 | 106 | 102 | 127 | 120 | 117 | 116 | |
| R^2 | 0.000 | 0.055 | 0.046 | 0.250 | 0.035 | 0.003 | 0.129 | 0.190 | |

| C: Not excluding outliers | | | | | D: Unweighted | | | | |
|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--|
| | Quarter | | | | | Quarter | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| CHF invoiced | 0.065 (0.051) | -0.032 (0.035) | -0.062 (0.026) | -0.195 (0.083) | 0.127 (0.059) | 0.020 (0.055) | -0.052 (0.052) | -0.167 (0.078) | |
| Constant | -0.065 (0.021) | 0.008 (0.017) | 0.005 (0.012) | 0.164 (0.042) | -0.098 (0.032) | -0.027 (0.035) | 0.007 (0.032) | 0.126 (0.064) | |
| Observations | 127 | 127 | 127 | 127 | 118 | 120 | 120 | 119 | |
| R^2 | 0.035 | 0.007 | 0.025 | 0.116 | 0.068 | 0.002 | 0.016 | 0.078 | |

Notes: This table presents sensitivity of our estimates of α_q and β_q in equation (1) to alternative definitions of export growth and to alternative treatment of outliers and weighting. Panel A normalizes Swiss exports growth by German exports growth in the same industry. Panel B uses the average of 2013 and 2014 quarterly exports as the baseline year. Panel C does not exclude products with absolute changes in export values larger than 50%. Panel D does not weight products by export values in the regression. Robust standard errors in parentheses.