

# Exports and Invoicing: Evidence from the 2015 Swiss Franc Appreciation

By RAPHAEL AUER, ARIEL BURSTEIN, KATHARINA ERHARDT, AND SARAH M. LEIN\*

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.

In Auer et al. (2018) 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 in-

voicing of border prices. In this paper we complement Auer et al. (2018) 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. Consistent with our previous findings on import prices and those of the literature (see e.g., Gopinath et al. 2010), 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.<sup>1</sup>

\* Auer: Bank for International Settlements, Centralbahnplatz 2, 4002 Basel, Switzerland, raphael.auer@bis.org. Burstein: University of California, Los Angeles, Bunche Hall 8365, Los Angeles, CA 90095, United States, arielb@econ.ucla.edu. Erhardt: ETH Zurich, Leonhardstrasse 35, 8092 Zurich, Switzerland, erhardt@kof.ethz.ch. Lein: University of Basel, Peter-Merian-Weg 6, 4002 Basel, Switzerland, sarah.lein@unibas.ch. The views presented in this paper are those of the authors and not necessarily those of the Bank for International Settlements. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

<sup>1</sup>Relatedly, Bonadio et al. (2018) document the response of unit values by currency of invoicing in the 2015 CHF/EUR appreciation, while 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.

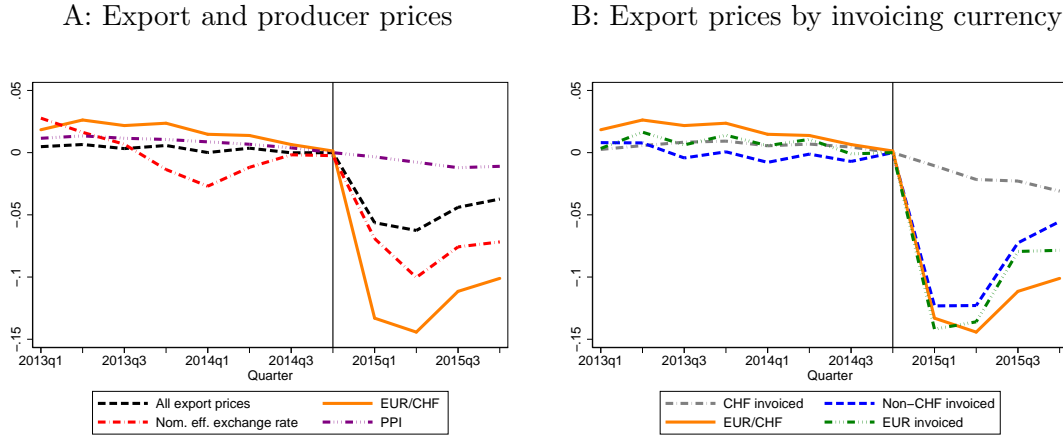


Figure 1. : Exchange rates and average price changes

*Note:* 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.

## I. 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 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.<sup>2</sup> 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 2012-2015.<sup>3</sup> We list

<sup>2</sup>Up to the four-digit level, the NOGA industry classification in Switzerland is identical to the NAICS industry classification used in the US.

<sup>3</sup>We 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 exam-

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.

## II. 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.<sup>4</sup> 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)

ple, 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.

<sup>4</sup>Quarterly 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.

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.

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.

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.

## III. Changes in export values

We consider a regression of the form

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

where  $\Delta exp_{iq}$  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  $i$ .<sup>5</sup> 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

<sup>5</sup>We 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.

	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

Table 1—: Average price changes by currency of invoicing

Note: Estimates of  $\Delta p_{iq} = \alpha_q + \beta_q \mathbb{I}_i(CHF) + \varepsilon_{iq}$ , where  $\Delta p_{iq}$  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.  $\alpha_q$  is referred to in the table as “Non-CHF invoiced” and  $\beta_q$  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.

of exports over time.

The key coefficient of interest is  $\beta_q$ , interpreted as the difference in export performance between a fully CHF-invoiced and a fully non-CHF invoiced industry. Table 2 shows that  $\beta_q$  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,  $\beta_q$  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, 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  $\beta_q$  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.

#### IV. 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 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

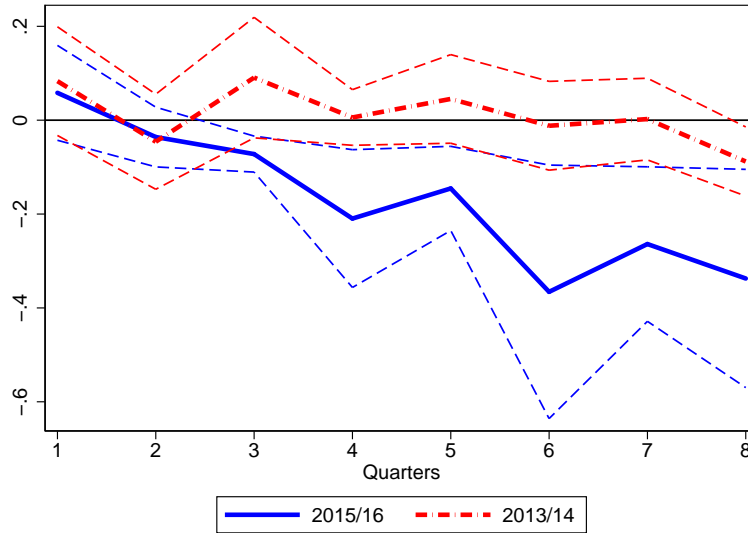


Figure 2. : Changes in export values and currency of invoicing

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

	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

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

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

	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

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

Note: This table displays estimates of  $\alpha_q$  and  $\beta_q$  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.

the form

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

where  $\Delta p_{iq}$  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  $\beta_q$  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.<sup>6</sup> The 2SLS estimates of  $\beta_q$ , 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.

<sup>6</sup>If 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.

## REFERENCES

- Amiti, Mary, Oleg Itskhoki, and Jozef Konings**, “Dominant currencies: How firms choose currency invoicing and why it matters,” 2018. mimeo, Princeton University.
- Auer, Raphael, Ariel Burstein, and Sarah M. Lein**, “Exchange Rates and Prices: Evidence from the 2015 Swiss Franc Appreciation,” Working papers 2018/23, Faculty of Business and Economics - University of Basel 2018.
- Bonadio, Barthelemy, Andreas M Fischer, and Philip Saure**, “The speed of the exchange rate pass-through,” SBN Working Papers 5/2018, Swiss National Bank 2018.
- Cravino, Javier**, “Exchange Rates, Aggregate Productivity and the Currency of Invoicing of International Trade,” 2017. mimeo, University of Michigan.
- Drozd, Lukasz A. and Jaromir B. Nosal**, “Understanding International Prices: Customers as Capital,” *American Economic Review*, February 2012, 102 (1), 364–395.
- Engel, Charles**, “Equivalence results for optimal pass-through, optimal indexing to exchange rates, and optimal choice of currency for export pricing,” *Journal of the European Economic Association*, 2006, 4 (6), 1249–1260.
- Fitzgerald, Doireann and Stefanie Haller**, “Exporters and shocks,” *Journal of International Economics*, 2018, 113 (C), 154–171.
- Gopinath, Gita, Oleg Itskhoki, and Roberto Rigobon**, “Currency Choice and Exchange Rate Pass-Through,” *American Economic Review*, March 2010, 100 (1), 304–36.

# Supplementary Online Appendix

	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

Table A1: Export price observations by currency of invoicing

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	Scateurs & 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
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 $\leq 0.5$ 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 $\geq 50$ l but $\leq 300$ 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&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
Manu. of steel drums & similar containers	Tanks, casks, drums, cans, boxes & similar containers, of iron or steel, for any material, of a capacity of $\geq 50$ l but $\leq 300$ 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 neps
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 A2: Concordance NOGA industries and HS products



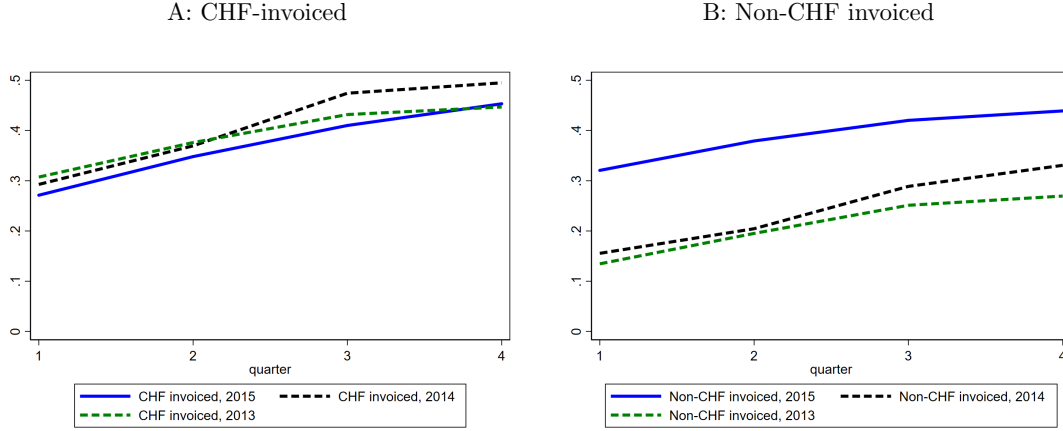


Figure A1: Fraction of price changes relative to fourth quarter of previous year

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.

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	0.132	-0.094	-0.325		0.065	-0.017	-0.114	-0.245
	(0.111)	(0.089)	(0.043)	(0.143)		(0.051)	(0.037)	(0.036)	(0.095)
Constant	0.073	-0.053	0.072	0.270		-0.065	-0.003	0.082	0.234
	(0.051)	(0.044)	(0.024)	(0.085)		(0.021)	(0.019)	(0.018)	(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	-0.032	-0.062	-0.195		0.127	0.020	-0.052	-0.167
	(0.051)	(0.035)	(0.026)	(0.083)		(0.059)	(0.055)	(0.052)	(0.078)
Constant	-0.065	0.008	0.005	0.164		-0.098	-0.027	0.007	0.126
	(0.021)	(0.017)	(0.012)	(0.042)		(0.032)	(0.035)	(0.032)	(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

Table A3: Export changes and currency of invoicing: Robustness

This table presents sensitivity of our estimates of  $\alpha_q$  and  $\beta_q$  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.