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Strukturberichterstattung
Nr. 56/4

Daniel Kaufmann
Tobias Renkin

Manufacturing prices and employment after the Swiss franc shock

Schwerpunktthema:
Die Schweizer Wirtschaft in einem schwierigen Währungsumfeld

Study on behalf of the State Secretariat for Economic Affairs SECO

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Zusammenfassung

Wie wirkt sich eine permanente nominelle Aufwertung auf Preise und Beschäftigung im verarbeitenden Gewerbe aus? Um diese Frage zu beantworten untersucht diese Studie die 10-prozentige Aufwertung des Schweizer Frankens nach der unerwartenden Entscheidung durch die Schweizerische Nationalbank im Januar 2015 den Mindestkurs gegenüber dem Euro aufzuheben. Die Studie zeigt: Preise von Produkten die auf dem Inlandmarkt verkauft wurden, sowie Exportpreise die in Schweizer Franken gesetzt waren, sind nur leicht gefallen. Exportpreise die in Euro gesetzt waren, sowie auch Importpreise, sind dagegen schneller und stärker gesunken (gemessen in Schweizer Franken). Ein Grund für diese unterschiedliche Entwicklung liegt darin, dass Preise sich in derjenigen Währung in der sie gesetzt wurden kaum veränderten. Dies ist ein Anzeichen für sogenannte Preisrigiditäten, die in Modellen der Neu-Keynesianischen Tradition zu realen Effekten von nominellen Wechselkursveränderungen führen können. Der zweite Teil der Studie zeigt tatsächlich, dass die Beschäftigung im verarbeitenden Gewerbe aufgrund der Aufwertung deutlich reduziert wurde. Relativ zu einer Kontrollgruppe, die aus ähnlichen Firmen in Österreich gebildet wurde, sank die Beschäftigung im verarbeitenden Gewerbe zwei Jahre nach der Aufwertung um 4%. Der graduelle Rückgang der Beschäftigung ging mit einer sofortigen Reduktion der offenen Stellen einher. Daher wurde die Beschäftigung in erster Linie über natürliche Fluktuation und nicht mittels grösserer Entlassungen reduziert. Schliesslich finden wir keine Evidenz, dass vor allem Sektoren oder Firmen mit tiefer Produktivität von der Aufwertung betroffen waren.

Abstract

What is the impact of a permanent nominal appreciation on manufacturing prices and employment? To answer this question this study exploits the unexpected 10% appreciation in the aftermath of the removal of the Swiss National Bank's exchange rate floor in January 2015. Prices of products sold by domestic firms, as well as, export prices set in domestic currency, declined only slightly. By contrast, export prices denominated in euro and prices of imported products changed more quickly and more strongly (measured in Swiss francs). We show that sticky prices in the corresponding currency of pricing are one reason for this pattern, supporting modeling assumptions in the New Keynesian tradition. These missing price adjustments therefore can be responsible why nominal exchange rate fluctuations affect the real economy. In line with this idea, we find that manufacturing employment has declined significantly after the appreciation. Relative to a control group of similar Austrian firms, employment in an average Swiss manufacturing firm declined by 4% two years after the appreciation. The gradual decline can be traced back to an immediate reduction in the number of vacancies and was likely driven by natural turnover. We find little evidence that the appreciation reduced employment mainly in low-productivity firms or sectors.

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Daniel Kaufmann and Tobias Renkin

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Kurzfassung

Aufgrund der starken Aufwertung des Schweizer Frankens über die letzten 10 Jahre wurde vermehrt darüber diskutiert ob die Wechselkursinterventionen der Schweizerischen Nationalbank (SNB) wünschenswert, wirksam, oder sogar schädlich sind. In diesem Zusammenhang ist es wichtig zu untersuchen, wie und ob sich eine starke Aufwertung auf die schweizerische Volkswirtschaft auswirkt. Diese Studie schätzt daher den Einfluss einer permanenten nominellen Aufwertung auf die Preise und Beschäftigung im verarbeitenden Gewerbe. Im Zentrum der Studie steht die 10-prozentige Aufwertung des Schweizer Frankens nach der unerwarteten Entscheidung durch die Schweizerische Nationalbank im Januar 2015 den Mindestkurs gegenüber dem Euro aufzuheben. Diese Episode ist aus mehreren Gründen besonders geeignet um die Auwirkungen von Wechselkursschwankungen zu untersuchen. Erstens hat die Aufwertung die meisten Wirtschaftsakteure überrascht. Zweitens gingen die meisten Wirtschaftsakteure davon aus, dass sich der Franken danach nicht mehr deutlich abwerten würde. Drittens traf die Aufwertung die schweizerische Volkswirtschaft in einem relativ robusten Zustand und auch im Ausland waren gleichzeitig keine grösseren Verwerfungen zu beobachten. Dies erlaubt es den Effekt der Aufwertung von anderen makroökonomischen Einflussfaktoren zu isolieren, die die Beschäftigung und die Preise im verarbeitenden Gewerbe beeinflussen könnten.

Falls nach einer Auf- oder Abwertung alle nominellen Preise, Löhne und Schuldenkontrakte sofort angepasst werden könnten, wäre eine Intervention von Seiten der Geldpolitik tatsächlich kaum begründbar. Die Tatsache, dass nominelle Wechselkursschwankungen in der Regel mit gleichlaufenden Veränderungen des realen Wechselkurses einhergehen zeigt jedoch, dass Preise und Löhne wahrscheinlich nur teilweise angepasst werden. Der erste Teil der Studie untersucht daher, wie stark sich Preise in verschiedenen Absatzmärkten des verarbeitenden Gewerbes nach der Aufwertung des Schweizer Frankens verändert haben.

Die Analyse zeigt: es gibt beträchtliche Unterschiede wie stark Import- und Exportpreise, sowie Preise für den Inlandabsatz nach einer Aufwertung fallen. Preise von Produkten die auf dem Inlandmarkt verkauft wurden, sanken innerhalb eines Jahres nach der 10-prozentigen Aufwertung lediglich um 2%. Auch Exportpreise die in Schweizer Franken gesetzt waren sanken nach der Aufwertung kaum. Im Gegensatz dazu sanken Exportpreise die in Euro gesetzt waren (gemessen in Schweizer Franken) um 9%. Schliesslich beobachten wir einen überraschend starken Rückgang der Importpreise im verarbeitenden Gewerbe. Unabhängig ob die Preise in Euro oder Schweizer Franken gesetzt waren, sanken diese Preise nach knapp zwei Jahren ungefähr im Ausmass der Aufwertung. Da die Preise für den Inlandabsatz deutlich weniger stark sanken litten die betroffenen Firmen daher unter verstärkter Preiskonkurrenz von billigeren Importprodukten.

In einer Welt mit flexiblen Preisen und Löhnen wäre zu erwarten, dass es nach einer solch starken Aufwertung zu einer Vielzahl an Preisänderungen kommt. Tatsächlich beobachten wir jedoch, dass Preise für den Inlandabsatz und Exportpreise rigide sind (in der Währung in der sie gesetzt wurden). So beobachten wir viele Preise auf dem Inland- und Exportmarkt, die selbst ein Jahr nach der Aufwertung kaum oder überhaupt nicht angepasst wurden (ca. 50% der Preise in Schweizer Franken und ca. 40% der Preise in Euro). Im Gegensatz dazu sind Importpreise die in Schweizer Franken gesetzt wurden flexibler. Es ist daher anzunehmen, dass eine nominelle Aufwertung aus mindestens zwei Gründen reale Auswirkungen auf das verarbeitende Gewerbe haben dürfte. Zum einen führen fehlende Preisanpassungen in Schweizer Franken dazu, dass die Produkte relativ zur ausländischen Konkurrenz teurer werden. Zum anderen dürften fehlende Preisänderungen in Euro dazu führen, dass die Margen der jeweiligen Unternehmen sofort und deutlich sinken. Für einen Teil der Firmen erlauben unsere Daten den Einfluss der Aufwertung auf die Margen von Exportprodukten zu quantifizieren. Auf Produkten die in Euro gesetzt waren sind die Margen um durchschnittlich 4% bis 10% gesunken. Im Gegensatz dazu blieben die Margen auf Produkten die in Schweizer Franken gesetzt waren stabil.

Der zweite Teil der Studie schätzt die realen Auswirkungen der Aufwertung auf die Beschäftigung. Erschwert wird die Analyse dadurch, dass die Beschäftigung im verarbeitenden Gewerbe nicht nur durch die Aufwertung, sondern auch von globalen und sektoralen Entwicklungen beeinflusst wird. Es ist zu vermuten, dass die Globalisierung und die vermehrte Automation von Produktionsprozessen tendenziell zu fallender Beschäftigung in der Industrie führt. Tatsächlich beobachten wir in vielen entwickelten Ländern, dass der Anteil der Industrie an der Gesamtbeschäftigung stetig abnimmt. Um den Einfluss der Aufwertung nicht zu überschätzen müssen wir also für Entwicklungen kontrollieren, die nicht mit der Aufwertung in Zusammenhang stehen. Dazu erstellen wir eine Kontrollgruppe aus Firmen in Österreich. Diese Firmen sind von ähnlichen langfristigen globalen und sektoralen Entwicklungen betroffen, nicht jedoch von der Aufwertung.

Tatsächlich stieg die Beschäftigung in der Schweiz und in der Kontrollgruppe praktisch im Gleichschritt als der Mindestkurs noch durchgesetzt wurde. Gleich nach der Aufwertung beobachten wir jedoch eine divergierende Entwicklung: Im Gegensatz zur Kontrollgruppe sank die Beschäftigung in einer durchschnittlichen Firma im verarbeitenden Gewerbe deutlich und lag zwei Jahre nach der Aufwertung um 4% tiefer. Zudem zeigen die Resultate, dass die schweizerischen Firmen Sofortmassnahmen ergriffen haben indem sie die Zahl der offenen Stellen sofort reduzierten. Simulationen mit einem theoretischen Modell zeigen, dass dieser Rückgang für den Hauptteil des Rückgangs der Beschäftigung verantwortlich sein dürfte und somit die Beschäftigung vor allem durch natürliche Fluktuation reduziert wurde.

Die Aufwertung traf jedoch nicht alle Firmen im selben Ausmass. Grosse und mittlere Firmen reduzierten die Beschäftigung stärker als kleine Firmen. Mittlere Firmen reduzierten die Beschäftigung um 4.3% und grosse Firmen um 7.3%. Die Aufwertung traf erfolgreiche Firmen, das heisst grössere Firmen die ihre Beschäftigung vor der Aufwertung noch erhöhen konnten, stärker. Solche Firmen reduzierten die Beschäftigung relativ zur Kontrollgruppe sogar um 11.1%. Im Gegensatz dazu finden wir keine signifikanten Effekte für kleine Firmen.

Dieses Muster dürfte zum Teil darauf zurückzuführen sein, dass unsere Analyse auf Firmen

beschränkt ist, die über den gesamten Zeitraum beobachtet sind. Somit schliessen wir potentiell kleine Firmen aus, die aufgrund der Aufwertung Konkurs gegangen sind. Falls dies der Fall wäre, würden wir die Auswirkungen der Aufwertung unterschätzen. Die Resultate könnten aber auch damit zusammenhängen, dass es für grössere Firmen einfacher ist Teile der Produktion ins Ausland auszulagern. Grosse Firmen dürften eher über bestehende Produktionskapazitäten im Ausland verfügen und somit sind die Hürden einer Auslagerung kleiner.

Es wird oft argumentiert, dass die Aufwertung langfristig die durchschnittliche Produktivität von Schweizer Firmen steigern sollte. Sinkende Margen könnten dafür verantwortlich sein, dass unproduktive Firmen innovieren, investieren, sich restrukturieren oder sogar schliessen. Dadurch würde es zu einer Reallokation von Beschäftigten von unproduktiven zu produktiveren Firmen kommen. Obwohl die Datenlage zur Untersuchung dieser Frage nicht ausreicht um eine definitive Antwort zu präsentieren, finden wir keine klare Evidenz die diese Hypothese unterstützen würde. Üblicherweise sind die produktivsten Firmen grosse, expandierende Exporteure in high-tech Branchen. Unsere Resultate zeigen jedoch, dass gerade grosse und stark wachsende Firmen die Beschäftigung am meisten reduziert haben. Mittelgrosse und stagnierende Firmen weisen dagegen einen kleineren Beschäftigungsrückgang aus. Zudem waren Firmen in high-tech und low-tech Branchen sowie inland- und exportorientierte Firmen etwa gleich stark von der Aufwertung betroffen.

Insgesamt zeigt die Analyse, dass Export- und Inlandpreise sogar nach einer starken Aufwertung kaum oder gar nicht angepasst werden. Im Gegensatz dazu werden Importpreise schneller und stärker angepasst. Wir zeigen zudem, dass der Rückgang der Beschäftigung nicht auf die fortschreitende Deindustrialisierung oder effiziente sektorale Reallokationen zurückzuführen sein dürfte. Es ist wahrscheinlicher, dass die Aufwertung zu ineffizienten relativen Preisverzerrungen geführt hat. Die Beschäftigung im verarabeitenden Gewerbe sollte sich also wieder erholen sobald sich Preise und Löhne vollständig angepasst haben oder sich der Franken gegenüber dem Euro wieder abwertet.

Diese Studie beschreibt zuerst die Entscheidung der SNB den Mindestkurs gegenüber dem Euro aufzuheben (Kapitel 1). Die restlichen Kapitel stehen weitgehend für sich: Kapitel 2 untersucht den Einfluss der Aufwertung auf das Preissetzungsverhalten der Firmen und Kapitel 3 schätzt den Einfluss der Aufwertung auf die Beschäftigung. In der ganzen Studie definieren wir den Wechselkurse als Preis einer Einheit ausländischer Währung in Schweizer Franken. Daher misst ein Rückgang des Wechselkurses, dass eine Einheit ausländischer Währung günstiger wird und sich somit der Schweizer Franken aufwertet.

Executive summary

The strong appreciation of the Swiss franc over the last decade triggered an ongoing discussion whether exchange rate interventions by the Swiss National Bank (SNB) are desirable, effective or even harmful. In this context it is crucial to assess how an appreciation affects the Swiss economy. In this study, we therefore estimate the impact of a permanent nominal appreciation on manufacturing prices and employment. We focus on the Swiss franc appreciation in the aftermath of the removal of the Swiss National Bank's exchange rate floor policy in January 2015. This episode is particularly suited to assess the exchange rate sensitivity of prices and employment, for several reasons. First, the appreciation came as a surprise. Second, the appreciation was perceived to be permanent. Third, the appreciation occurred in an otherwise stable macroeconomic environment in Switzerland and its main trading partners. This allows us to isolate the effect of the appreciation itself from other factors affecting prices and employment.

If all prices, wages and debt contracts would adjust seamlessly to a change in the nominal exchange rate there would be little reason for policy makers to intervene in currency markets. However, economists have long observed that the real exchange rate moves closely with the nominal exchange rate. This observation suggests that prices and wages are only partially adjusted to nominal exchange rate fluctuations. We thus start our analysis by assessing the extent to which prices of Swiss manufacturing firms react to the nominal appreciation of the Swiss franc.

We find that prices of products sold by domestic firms declined only slightly, by 2% until the end of 2016. This change is surprisingly small given that the Swiss franc appreciated by 10% during the same period. Prices of exports denominated in Swiss francs show a similarly small response. However, the behavior of export prices denominated in euro differs strongly. Converted to their Swiss franc value they declined by 9%. Surprisingly, perhaps, prices of imported products change more quickly and more strongly. By the end of 2016, the prices for manufacturing imports have declined by almost the full extent of the appreciation, irrespective of the currency of pricing. This suggests that import competition has increased, since the Swiss franc price of foreign products has declined more strongly than the prices of Swiss firms producing for the domestic market.

Even in response to a large appreciation, domestic and export prices are remarkably sticky in the currency they are set in. A relevant share of export and domestic prices barely change within one year after the appreciation (50% of prices denominated in Swiss francs and 40% of prices denominated in euro). By contrast, this share is smaller for import prices set in Swiss francs. These results suggest that missing price adjustments are one reason why changes in the nominal exchange rate can lead to fluctuations of the real economy as a whole. On the one hand, missing price adjustments in Swiss

francs render Swiss products less competitive relative to their counterparts abroad. On the other hand, we provide evidence that markups of export products priced in euro have declined by 4% to 10% after the Swiss franc shock.

To gauge the real impact of the appreciation, we investigate in the second part of the report whether Swiss manufacturing firms responded to this adverse development by reducing employment. The analysis is tricky because manufacturing employment is likely affected by sectoral trends, resulting from globalization, innovation, and automation of production. Put differently, we have to control for other factors that affect manufacturing employment independently of the nominal appreciation. To do so, we compare Swiss firms with their peers from neighboring Austria. Those firms are subject to similar long-run trends but not significantly affected by the Swiss franc appreciation.

We find that before the appreciation, manufacturing employment in both countries evolved in a similar way. However, the development diverges immediately after, as employment in Austrian firms is more or less constant, and employment in Swiss firms starts to decline significantly. Over the course of two years, employment in an average Swiss manufacturing firm declined by 4% relative to its Austrian peers. The control group allows us to rule out ongoing structural trends, or concurrent international shocks to manufacturing as the driver of this result. In addition to substantial declines in employment, we find an immediate reduction in vacancy postings. Simulations based on a theoretical model suggest that most of the decline in employment can indeed be explained by a reduction in hiring in combination with natural turnover. We find little evidence of additional large-scale layoffs.

We further investigate whether the appreciation affected certain groups of firms differently. We find stronger effects on employment in medium and large firms, especially those that were expanding employment before the shock. In medium sized firms, the appreciation caused a decline in employment by 4.3%, and in large firms by 7.3%. In successful firms, that is medium and large firms that grew strongly during 2014, the appreciation caused an employment loss of 11.1%. In contrast, we find no significant effect for small firms.

This pattern may be related to the fact that our analysis only takes into account firms that survive until the end of 2016. Smaller firms may be more likely to close down instead of reducing employment, and the surviving firms may be a selected group that is less affected by the exchange rate. If this is the case, we may underestimate the impact on manufacturing employment. But also, larger firms may be more capable to offshore production to other countries, because they are more likely to already operate production establishments abroad.

A prevailing narrative in Switzerland is that the strong Swiss franc may have a positive effect on average firm productivity. The argument goes that declining profit margins may force low productivity firms to innovate, restructure, or go out of business. This would in turn result in a reallocation of workers to the most profitable and productive firms. While our data lacks information on firm-level productivity, a common regularity is that large and growing exporters in high-tech sectors are among the more productive firms. Our results suggest, however, that large and fast growing firms shrink by far the most relative to their peers in Austria. In addition, high-tech sectors are similarly affected as low-tech sectors and export-oriented firms do not differ significantly from their domestically-oriented peers.

To summarize, we find that export and domestic prices of Swiss manufacturing firms are sticky in the currency they are set in. By contrast, import prices are more responsive to a large appreciation. This suggests that nominal exchange rate fluctuations may have real effects through imperfect price adjustments. Indeed, we find substantially negative effect on employment. The drop in employment observed after the strong appreciation is unlikely to mirror ongoing deindustrialization trends or efficient sectoral reallocation of resources. It is more likely that the appreciation was associated with inefficient relative price distortions that should vanish once prices and wages have adjusted, or, as the Swiss franc may weaken against the euro.

This report starts with a description of the well-known decision by the SNB to remove the exchange rate floor (chapter 1). The remaining chapters are relatively self-contained so that the interested reader can focus only on the impact of the appreciation on the price-setting behavior of firms (chapter 2) or on the real side of the economy, namely manufacturing employment (chapter 3). Throughout the report, we define the exchange rate as the price of one unit of foreign currency in terms of Swiss francs. Therefore, a decline of the exchange rate implies that one unit of foreign currency costs less in Swiss francs and therefore the Swiss franc appreciates.

Chapter 1

The Swiss franc shock

To estimate the impact of exchange rate changes on prices and employment we exploit an unexpected change in Swiss National Bank's (SNB) exchange rate policy, which led to a a sudden, unexpected and permanent appreciation of about 10% against the euro. On 15 January 2015, the SNB announced that it would no longer defend an exchange rate floor vis-à-vis the euro, which had been in place for the previous three and a half years. Because the Swiss franc was relatively stable during and after the revaluation, this episode is ideally suited to study the immediate impact of a large appreciation in an event-study.[1] In this chapter we review the monetary and international economic environment before and after the policy change to establish the following facts: First, the appreciation was a surprise. Second, the appreciation was expected to last. Third, there was little uncertainty about the future level of the CHF/EUR exchange both before and after the appreciation. Fourth, the appreciation against the US Dollar was temporary. Finally, there were only small movements in other factors that may coincidently affected employment and prices in Switzerland.

The exchange rate floor was introduced as a nonconventional policy measure in the aftermath of the global financial crisis. The crisis triggered sharp declines in policy rates around the world and the SNB had lowered its interest rate target close to zero in early 2009. Because the dominant view at the time was that policy rates cannot fall below zero, conventional monetary policy was effectively out of ammunition (SNB, 2009).[2] As a consequence the SNB resorted to nonconventional measures, intervening in the foreign exchange market to curb an excessive appreciation of the Swiss franc.[3] In March 2010, however, the Swiss franc started to gain strength amid the euro area debt crisis, rising interest rate expectations in Switzerland, and a falling monetary base.[4] Up to June 2011, the Swiss franc appreciated by about 30% against the euro but also against the US Dollar and other typical safe haven currencies. This appreciation came to a halt after the SNB expanded its balance sheet considerably in August 2011. Although this weakened the currency temporarily, the Swiss franc started to appreciate again during the first days of September. The SNB thus announced an official

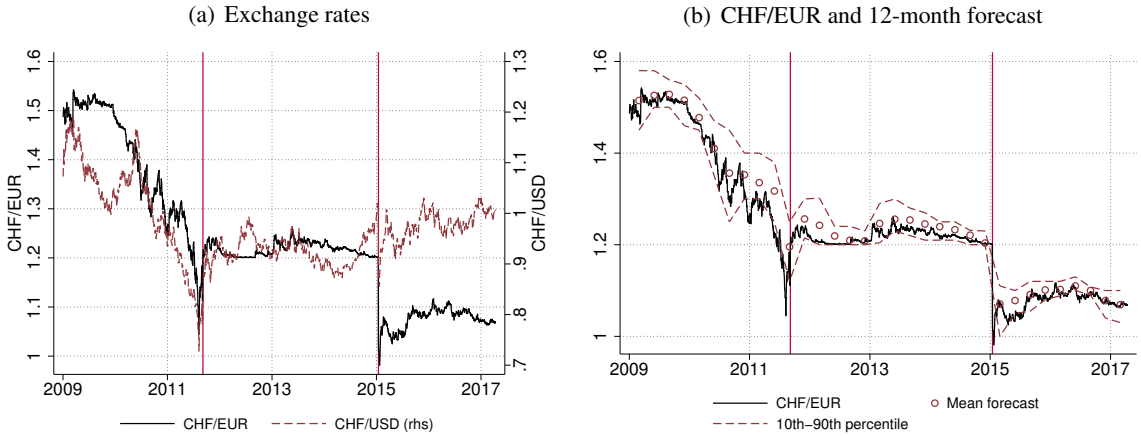
[1] This paper is therefore in the spirit of Bonadio et al. (2016), Efing et al. (2015), Auer et al. (2017) and Kaiser et al. (2017) who investigate the impact of the appreciation on various macroeconomic outcomes.

[2] We use the term conventional monetary policy meaning an effective change in the current short-term policy rate.

[3] Markets believed that the SNB was defending a floor at CHF/EUR 1.50 and the Swiss franc indeed hovered slightly above this value (see Figure 1.1 panel a).

[4] Figure 1.2 shows that the monetary base (banknotes plus sight deposits) started to decline despite the fact that the balance sheet remained roughly constant because the SNB absorbed liquidity by issuing debt certificates (SNB bills).

Figure 1.1. Exchange rate movements during various monetary regimes



Notes: Red vertical lines denote the introduction and removal of the exchange rate floor at CHF/EUR 1.20. In panels(b) forecasts for the 12-month horizon (mean and 10th-90th percentile) are based on the individual responses of the KOF Consensus Forecast survey.

exchange rate floor at CHF/EUR 1.20 on 6 September and promised to buy unlimited foreign currency to maintain it if necessary. Afterwards, the CHF/EUR exchange rate stabilized slightly above the announced floor for the following years (see Figure 1.1).

This period of stability ended abruptly when the SNB announced it would no longer defend the floor on 15 January 2015. The Swiss franc immediately appreciated against the euro and most other european currencies.[5] In the accompanying media release, the SNB gave two reasons for this unexpected policy change: First, it stated that the overvaluation of the Swiss franc had become less pronounced, and that the Swiss economy had had enough time to adjust to a lower nominal CHF/EUR exchange rate. Second, it noted that differences in the monetary policy of other currency areas had become larger. Indeed, one week after the abolishment of the floor, the ECB announced a new and enlarged round of large-scale asset purchases. Media and economists have argued ex post that the impending quantitative easing program by the ECB moved the SNB to abolish the floor, that the SNB was facing mounting political pressure (Brunnermeier and James, 2015), and that the exchange rate floor was not a credible long-term commitment because of the lower inflation rate prevailing in Switzerland relative to the euro area (Rathke and Sturm, 2015).[6]

Although it was clear from the outset that the exchange rate floor was not here to stay, we argue that the timing of the policy change was a surprise. Panel (b) of Figure 1.1 shows the daily CHF/EUR exchange rate with the 12-month forecasts of a panel of 20 economists surveyed quarterly for the KOF Consensus Forecast. Judging by these forecasts, the exchange rate floor was credible throughout its existence. The overwhelming majority of economists predicted that the CHF/EUR exchange rate

[5]Figure A.1 shows that the Swiss franc appreciated against all EU related currencies, except the GBP, while it did not appreciate against many US related currencies.

[6]See also the discussion in Binding and Dibiasi (2017).

would remain above 1.20 for the next twelve months right up to the end of 2014.[7] The survey evidence is consistent with recent contributions analyzing high-frequency financial market data. Mirkov et al. (2016) use option prices to show that the timing of the policy change was not expected by financial market participants. Moreover, Jermann (2017) suggests that the credibility of the peg, as estimated by the probability of observing a CHF/EUR above 1.20, was high towards the end of the exchange rate floor. This is corroborated by Janssen and Studer-Suter (2017) who suggest that the floor lost credibility only for a short period in November 2014.[8] Finally, Moser (2015) provides evidence from order books of CHF/EUR trades: in the first minute after the removal of the floor, no trades happened. This suggests that market participants had no private information on the impending appreciation. It is noteworthy that Hertrich and Zimmermann (2017) analyze option prices and find that the implied probability of an abolishment of the floor started to increase in August 2014. However, they also find that similar increases occurring during 2012, when the SNB had to intervene heavily to defend the exchange rate floor without ultimately abandoning the exchange rate floor.

The KOF survey also shows that the appreciation against the euro after the abolishment of the exchange rate floor was perceived to be permanent. The mean 12-month forecast for the CHF/EUR exchange rate declined to just below 1.10 in Q1 and Q2 2015. The surveyed economists believed that the Swiss franc overshot somewhat against the euro, but not dramatically. In hindsight, this forecast was surprisingly accurate. Although the Swiss franc initially gained strength against the US Dollar as well, it quickly returned to a level observed before the policy change. It follows that the appreciation against the US Dollar was only temporary.[9] Additional empirical evidence and theoretical considerations corroborate that it was reasonable to believe that the appreciation would be permanent. First, the extent of applications to the Swiss short-time work scheme has increased little in the aftermath of the appreciation.[10] At least for some observers, this came as a surprise because SECO publicly emphasized that, while normal exchange rate fluctuations are not sufficient to be eligible for short-time work compensation, the removal of the exchange rate floor constituted a notable exception (see Schärli, 2015; SECO, 2017). Second, Hanke et al. (2015) estimate the latent CHF/EUR exchange rate during the minimum exchange rate regime in the absence of SNB interventions. They find that this counterfactual exchange rate amounted to between 1.05 and 1.15 CHF/EUR. Third, theoretical considerations suggest that when short-term interest rates become less responsive, for example because of an effective lower bound, a nominal appreciation tends to be larger

[7] In Q4 2014, a single member of the panel predicted an appreciation of the Swiss franc to 1.00 CHF/EUR within 12 months. None of the 20 economists predicted a CHF/EUR exchange rate below 1.20 within the following three months.

[8] This is also in line with reports in the *Finanz und Wirtschaft* on 19 November 2014, in which an FX-strategist mentions ongoing bets against the exchange rate floor visible in option prices. Investors appeared to be willing to pay a relevant premium for insurance against a possible appreciation. Although the report mentions that the willingness of the SNB to defend the floor is being tested, analysts still thought that the SNB will succeed as during a similar period in 2012.

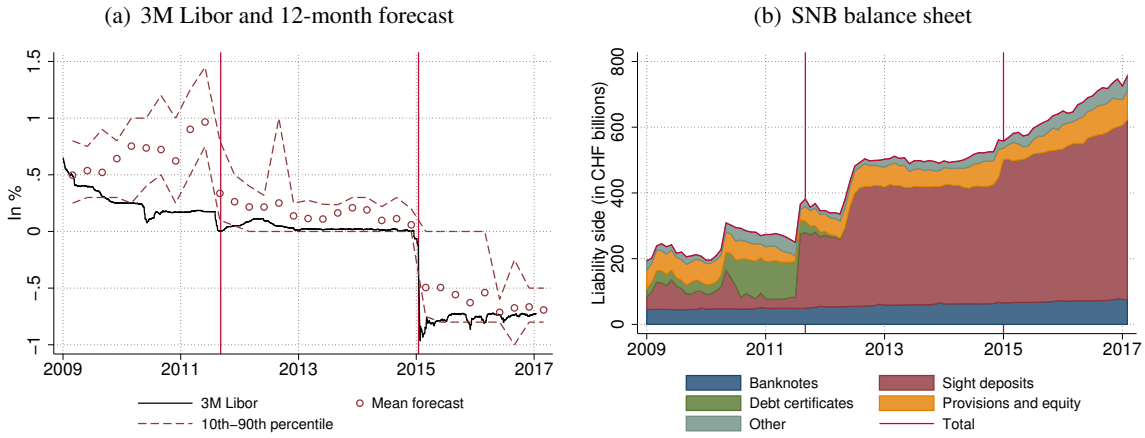
[9] The CHF/USD exchange rate forecast was not particularly affected corroborating that the appreciation against the US Dollar was perceived to be temporary (see Figure A.2). Although there was substantial disagreement about the value of the CHF/USD in twelve months, the mean forecast in Q4 2014 was almost identical to the mean forecast in Q1 2015. Of course, this does not imply that the CHF/USD was not affected by the SNB's decision as the Swiss franc may have been weaker against the USD in a counter-factual where the floor would have remained in place. But, maybe by coincidence, the mean forecast remained at CHF/USD 1.00 just before and after the policy change.

[10] Swiss firms can apply for *Kurzarbeit*, a temporary reduction of working hours, in which the government covers some of the income losses to workers. A similar scheme is available to German firms. The scheme has been used extensively in Germany and Switzerland to cover demand shortfalls during the global financial crisis.

and permanent under conventional monetary policy regimes (Bäurle and Kaufmann, 2014).[11]

Forecasting exchange rates is inherently difficult and, in normal times, the surveyed economists disagree strongly over future rates. During the exchange rate floor and after the removal disagreement among the surveyed economists was very low, however. After the policy change the disagreement increased only briefly (as measured by the 10th and 90th percentiles among the survey responses). In Q3 2015, the forecasts' dispersion again indicated low disagreement over the future CHF/EUR exchange rate by historical standards.[12] The economists in the panel therefore broadly agreed that the appreciation would be permanent and that the CHF/EUR rate would hover slightly below 1.10 over the next twelve months. Interestingly, after the removal of the floor, the volatility of the Swiss franc was also low by historical standards and comparable to the period when the floor was still in place. This reflects the fact that the SNB has continued to intervene in the foreign exchange market, taking into account "the overall currency situation" (see e.g. SNB, 2017).[13]

Figure 1.2. Monetary policy



Notes: Red vertical lines mark the introduction and removal of the CHF/EUR exchange rate floor in September 2011 and January 2015. Forecasts for the 12-month horizons (mean and 10th-90th percentile) are based on the individual responses of the KOF Consensus Forecast survey.

A critical assumption underlying our analysis is that there are no factors other than the appreciation affecting prices and employment. In a macroeconomic setting, this assumption is probably never

[11] A key assumption for this to happen is that the central bank cannot commit to hold interest rates low in the future, or permanently increase the monetary base, or introduce a nominal level target (see Cook and Devereux, 2014; Krugman, 1998; Svensson, 2003; Fujiwara et al., 2013; Bäurle and Kaufmann, 2014). At first sight, this argument seems at odds with the Dornbusch (1976) overshooting model predicting that after a contractionary monetary policy shock, the exchange rate appreciates immediately and then slowly converges back to its original level. Note, however, that in his model, Dornbusch assumes that the central bank follows a stationary money supply rule which pins down, at the same time, the long-run equilibrium nominal exchange rate and the price level. Implicitly this assumes a price-level target. Under an inflation target, the preferred choice of most central banks, the price level and the nominal exchange rate are subject to permanent shifts in response to temporary shocks.

[12] This interpretation is qualitatively in line with evidence from news data and business tendency surveys. Binding and Dibiasi (2017) find that uncertainty spiked but receded just two months after the appreciation to a relatively low level.

[13] Although the exchange rate interventions during the floor period were geared at stabilizing the Swiss franc against the euro, the volatility of the CHF/USD declined as well (see Figure A.2).

fulfilled in a strict sense. However, we think that other factors that changed at the same time do not bias our results strongly in any particular direction. First, the SNB has taken additional policy measures after the abolishment of the exchange rate floor. As panel (a) of Figure 1.2 shows, the SNB lowered its target for the 3M-Libor to -75bp at the same time it abolished the floor. As the appreciation itself, this move was unexpected, as shown by the KOF Consensus Forecast.[14] Moreover, the SNB also resorted to substantial foreign exchange interventions to keep the Swiss franc from appreciating further. This is reflected in a gradual increase in sight deposits after January 2015 as shown in panel (b). Lowering the short-term interest rate and the ongoing expansion of the balance sheet may in principle lead to a depreciation of the currency and therefore bolster prices and employment. This indirect effect via the exchange rate is properly accounted for in our analysis by the fact that the CHF/EUR did not depreciate substantially after the policy change. However, we cannot disentangle the effects of these policy measures that go through other channels.[15] Our results could therefore be seen as reduced form estimates of the overall policy change, and we expect the direct effect from the CHF/EUR appreciation do dominate the indirect effects. Because negative interest rates and the expansion of the balance sheet probably tend stimulate economic activity, our results would be biased, if anything, towards finding a smaller effect of the appreciation on prices and employment.

Second, we have to rule out abrupt changes in the international environment that could contaminate our estimates. The results suggest that the international economic environment was relatively stable (see Figure 1.3). Despite very heterogeneous developments among EU countries, the EU28 as a whole grew around 2% before and after the removal of the floor. Switzerland's main trading partners were also growing at steady and slightly higher rate during 2014, 2015 and 2016.[16] Panel (b) shows inflation according to the Producer Price Index (PPI) in the euro area as well as in Switzerland. We focus on PPI inflation because this will be one major data source in the following analysis. Inflation abroad declines at the end of 2014 because of falling oil prices. The same decline occurs in Switzerland. After the appreciation, however, Swiss PPI inflation drops strongly while inflation in the euro area remains at a higher level. This shows that prices abroad have declined somewhat during 2015 and 2016, which could lead us to spuriously find stronger price decreases than what we attribute to the appreciation alone. Compared to the appreciation, however, the price reductions were relatively small and therefore we think that the potential bias is small.

A remarkable fact is that Swiss macroeconomic performance has converged quite rapidly towards the euro area during the exchange rate floor. Growth of the Gross Domestic Product (GDP) was at a similar level during 2014 and PPI inflation was practically identical in 2013 and 2014. Furthermore, the appreciation hit the Swiss economy while it was in a relatively good shape (see Figure A.3). GDP growth in Switzerland was close to potential growth, that is, a growth rate that is sustainable in the long-run. Moreover, inflation according to the Consumer Price Index (CPI) was broadly in line with the SNB's definition of price stability. Our results are therefore not contaminated by equilibrating

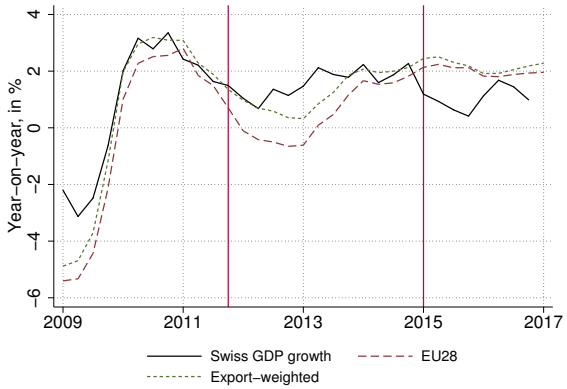
[14] A survey conducted by a Swiss financial newspaper (*Finanz und Wirtschaft*) on a higher frequency but with fewer participants confirms this conclusion. We are grateful to Peter Rohner for sharing this information.

[15] An intuitive example is that the balance sheet expansion may be responsible for the slight depreciation of the Swiss franc against the US Dollar. But also, lower interest rates may spur economic activity through wealth gains from rising asset prices.

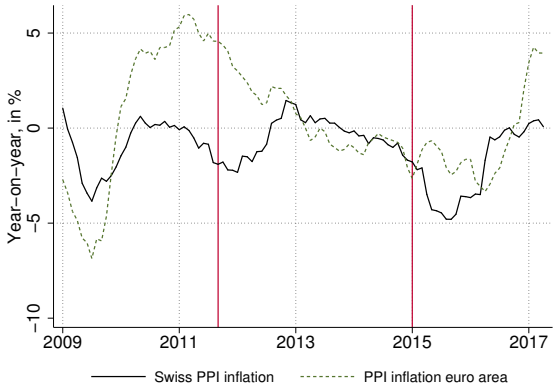
[16] We thank Florian Eckert for providing export-weighted international GDP growth used by the KOF Swiss Economic Institute.

Figure 1.3. GDP growth and inflation abroad

(a) GDP growth abroad



(b) PPI inflation abroad



Notes: Red vertical lines mark the introduction and removal of the CHF/EUR exchange rate floor in September 2011 and January 2015. Swiss data and exchange rates stem from the SNB. International data stems from the OECD.

forces that may occur if the economy would start out from a severe recession or an unsustainable boom.

To summarize, the Swiss franc shock provides a suitable setting to study the effects of an unexpected but permanent appreciation on prices and employment. Previous studies of large exchange rate shocks have focused on devaluations in troubled middle income economies, and the 1992 breakdown of the European Monetary System (see e.g. Burstein et al., 2005). Those devaluations tend to be associated with government defaults or financial crises, as well as large fluctuations in output, consumption and inflation. Moreover, due to the underlying structural causes of the devaluation, these variables are typically affected already before the actual shock. Compared to these episodes, the economic environment in Switzerland and abroad has been remarkably stable before and after the appreciation.

Chapter 2

Price-setting behavior and exchange rate pass-through

In this chapter we examine to what extent exchange rate fluctuations are associated with changes in import prices, export prices and prices of domestically produced goods. Economists refer to the relationship between prices and the exchange rate as "exchange-rate pass-through" or pass-through for short. Pass-through measures by how many percent prices drop (or rise) if the Swiss franc appreciates (or depreciates) by one percent. We say that pass-through is complete if a one percent appreciation leads to a one percent decline in prices. By contrast, there is no (or perfectly incomplete) pass-through if a one percent appreciation has no impact on prices.

Pass-trough measures the reduced form relationship between prices and the exchange rate. Therefore, pass-through works through various channels and can be affected by a variety of factors. Low pass-trough may be the result of nominal frictions, in which case it would be associated with relative price distortions that can lead to falling real activity and employment. Low pass-through of domestic producers could also be the result of a low price elasticity of demand, and in this case, it would be less likely to go along with a substantial reduction in employment. To provide evidence of such frictions we investigate not only the degree of exchange rate pass-through but also analyze the price-setting behavior in response to the removal of the exchange rate floor.

The analysis of this chapter proceeds as follows. First, we estimate the extent to which the change in the exchange rate is passed on into domestic, import, and export prices of manufacturing products. Second, we investigate to which degree the Swiss franc shock has triggered more price adjustments. Third, we relate the magnitude of the average sectoral price response to sectors' cost structure, market structure and price-setting behavior. Fourth, we provide estimates of the reduction of markups of exported products priced in Swiss franc and euro.

2.1 Related literature

Researchers agree that pass-through is largest for import prices at the docks and declines along the production and distribution chain (see Cavaliere, 2007; McCarthy, 2000; Stulz, 2007; Bachmann,

2012).[1] The reason is relatively uncontroversial. Domestic distribution and other costs that accrue along the production chain do not respond to exchange rate fluctuations (see Burstein et al., 2003). Therefore, the exchange rate sensitivity of marginal costs declines along the production chain. In addition, the share of non-tradable goods in a consumer price index is higher than in a producer or import price index. Moreover, a consumer price index typically measures prices including indirect taxes, which additionally reduces the exchange rate sensitivity of those prices.

There is more disagreement on the absolute size of exchange rate pass-through. Border prices of imported products are measured without taxes and they are little affected by transportation or distribution costs in Swiss francs; one may therefore expect that pass-through should be mostly complete. Two studies confirm this intuition and report that, for Swiss import prices at the docks, pass-through is high. Campa and Goldberg (2005) use time series data from 1975 to 2003; Bonadio et al. (2016) measure pass-through to unit values based on trade data after the removal of the exchange rate floor in January 2015. Bonadio et al. (2016) report complete pass-through for products invoiced in EUR (more than 60% of transactions) and a pass-through of about 0.6 for products invoiced in CHF. By contrast, Herger (2012) reports substantially lower pass-through to import prices: from 1999 to 2010 a one percent appreciation lowers import prices only by 0.3 percent. Most other studies report import price pass-through in between (see e.g. Bachmann, 2012; Stulz, 2007; Balastèr, 2011).[2]

The wide range of estimates can be traced back to changes in pass-through over time. Stulz (2007) and Bachmann (2012) both report lower pass-through to consumer or import prices when excluding the 1980s. A secular decline in pass-through may therefore explain the even lower estimates by Herger (2012).[3] We can think of various competing theoretical explanations why exchange-rate pass-through changes over time. A classic explanation for incomplete pass-through is that high market power allows firms to price discriminate across various markets and in turn absorb exchange rate fluctuations in their markups (Krugman, 1986). Therefore, changes in the competitive position of firms could be responsible for time-varying pass-through.[4] Gust et al. (2010) provide a related explanation. They suggest that higher trade integration allow foreign firms to increase their markup. If firms desire to keep their price close to the price of their competitors, a foreign firm selling its product in Switzerland may find it optimal to keep its price stable and instead vary its markup in response to a change in the exchange rate. Lower trade costs improve the competitive position of the foreign firm such that it can charge a higher, albeit more variable, markup. This implies that the price becomes less responsive

[1] This is in line with a vast international literature. Pass-through to border import prices is usually high, pass-through to wholesale producer prices lower, and pass-through to consumer prices minor. Within consumer prices, pass-through is smallest for non-tradable prices, while imported consumer prices are more responsive. See Burstein and Gopinath (2014) for a survey on international price-setting.

[2] Compared to other countries, pass-through to Swiss import prices appears sizeable (see Campa and Goldberg, 2005). For the US Gopinath et al. (2010) estimate a pass-through to import prices of 0.3. For a large economy pass-through is likely to be smaller because if products abroad become cheaper because of an appreciation the shift of demand towards those cheaper goods will drive up prices in foreign currency and therefore offset part of the appreciation (Krugman, 1986).

[3] Pass-through has also declined in other countries. Gagnon et al. (2014) find that the pass-through has declined generally since the 1980s and attribute this observation to increased attention of monetary policy to stabilizing inflation. Berger and Vavra (2017) instead suggest that pass-through even changes at business cycle frequencies and suggest that time-varying responsiveness of firms markups is the most likely interpretation.

[4] There is a recent literature that indeed finds that concentration in sales and markups have increased in the US since the 1980s (Autor et al., 2017; De Loecker and Eeckhout, 2017). This development could also be partly responsible for the decline in pass-through.

to exchange rate fluctuations. Pass-through may also decline if costs of exporters are less exposed to currency fluctuations because more products are bought abroad in foreign currency (see Burstein and Gopinath, 2014, p. 416). For instance, suppose a Swiss exporter pays a dominant share of its intermediate inputs in euro. Only a fraction of its costs will be affected by, for example, an appreciation of the Swiss franc against the euro. Therefore, the Swiss exporter will only partially pass-through the appreciation to prices in Germany.

While these theories are capable to explain the secular decline in pass-through because of slow-moving changes in market structure and trade integration, they are unlikely to be useful explanations for more rapid changes in pass-through, which recent empirical work documents (see Fleer et al., 2016, for Switzerland). Berger and Vavra (2017) argue that firms respond more strongly to shocks during recessions which could also explain the high pass-through found by Bonadio et al. (2016) and Fleer et al. (2016) during the recent exchange rate turmoil in Switzerland. A competing explanation is that, in the presence of adjustment costs in price-setting, pass-through depends on whether firms expect an appreciation to be permanent or transitory (see Krugman, 1986; Taylor, 2000; Burstein and Gopinath, 2014, p. 421).[5] This explanation requires some degree of market power, rare price adjustments, as well as rapid changes in exchange rate expectations.[6] For Switzerland, at least, little is known whether the competitive position of the firm, price rigidities, and rapidly changing exchange rate expectations are indeed associated with higher pass-through.

The degree of pass-through is closely related to the currency of invoicing. Gopinath et al. (2010) show for US import prices that pass-through is complete for prices set in foreign (non-US Dollar) currency. Not surprisingly, perhaps, if firms rarely adjust their prices set in foreign currency the corresponding prices in US Dollars move one-for-one with the exchange rate.[7] This suggests that the decision in which currency to set a price is key to understand the size of exchange rate pass-through. For Switzerland, the currency of pricing has only recently been investigated by Bonadio et al. (2016) who report that between 30% (imports) and 40% (exports) of all transactions with the euro area are invoiced in CHF while the bulk of the remaining transactions are invoiced in EUR. This results in an immediate response of a large fraction of import prices and therefore a high pass-through of CHF/EUR fluctuations to Swiss import prices. Moreover, they argue that there is little evidence that prices are

[5] Suppose that an Austrian exporter reviews its CHF price only in January. At one of those annual reviews, the Swiss franc appreciates by 10% and the exporter has to decide whether to lower its price. Knowing that she will adjust the price only one year later, she will think about whether the appreciation is temporary or will persist. If she is convinced that the Swiss franc depreciates in February, she will change the price only little (if at all). If she expects the Swiss franc to linger at the new level, she will adjust more strongly.

[6] These expectations are in turn closely related to the monetary regime in place (see Bäurle and Kaufmann, 2014). This is why Taylor (2000), and many others suggest that the secular decline in pass-through is related to a more stable and predictable monetary policy regime because stabilizing inflation also leads to less persistent exchange rate fluctuations and therefore pass-through declines. It follows that rapid changes in the monetary regime should be associated with higher pass-through.

[7] Pass-through to US import prices is still lower than in Switzerland, however, because US import prices are predominantly set in US Dollar and pass-through to those prices is smaller.

sticky in the transaction currency based on the dynamic responses of unit values.[8] In the same vein, Auer et al. (2017) find that the share of price changes for imported retail goods increased sharply with the appreciation of the Swiss franc. In contrast, Bachmann (2012) suggests that his results are at least consistent with the idea that a relevant share of prices are set in local currency and the sluggish response indicates a role for sticky prices.

We add to this literature in several respects. First, this is the first study that uses actual product-level border price data to examine the impact of the large and unexpected appreciation of the Swiss franc. So far, studies have focused on large appreciations that may be driven by other underlying factors or have used the same episode as we did but based on unit values or retail prices. Second, we provide evidence that exchange rate pass-through differs between permanent and transitory movements in the exchange rate. Third, we provide estimates of the change in markups of products priced in foreign and domestic currency.

2.2 Data

We use product-level price data covering the period from December 2010 to November 2016. The data is collected by the Swiss Federal Statistical Office (SFSO) in surveys to construct the Producer Price Index (PPI) and Import Price Index (IPI). The PPI measures price developments of goods and services of domestically operating firms. Firms are asked to report prices for the domestic market as well as for the export market if they do export.[9] Domestic prices are measured ex-factory and export prices free on board (excluding transportation cost, insurance cost, VAT and other taxes).[10] By contrast, the IPI measures price developments of imported goods and prices are measured at the docks (duties unpaid). Although the prices are collected in a survey of domestically operating firms, the IPI effectively measures prices of goods sold by firms operating abroad and exporting to Switzerland.

The sample of firms is partly random and partly selected. The largest firms within a sector are always surveyed. In addition, the SFSO randomly samples a group of small and medium-sized firms. Participation in the survey is mandatory and the panel is strongly balanced as a result. Usually, less than 2% of the total number of firms enter or exit the panel a quarter.

Firms are asked to report prices of products that generate a high revenue and that are expected to be available over an extended time period. As a result, we are able to track the price of a product over time. When products are no longer available, or no longer generate sufficient revenue, firms are asked to make a substitution. The SFSO handles those substitutions in several ways.[11] If a product is substituted by a new one that is functionally similar, the SFSO will ask the firm to provide the price

[8] Unit values are often used as approximations when actual price data is not available. To obtain a unit value researchers divide the total value of all shipments for a certain goods category by the total quantity (i.e. weight) of the shipments. Unit values do not represent actual transaction prices for specific goods because the composition, quality, and packaging of the goods included in the shipments change over time. The data set has the advantage that it is available on a high frequency (daily) and covers the universe of trade transaction. Therefore, the estimates of shares of invoicing currency are more accurate.

[9] See Appendix E for the SFSO questionnaires. Before 2011, export prices were not separately surveyed and the export price index was calculated assuming that export prices move in parallel to domestic prices.

[10] For a detailed description of the methodology of the PPI/IPI see SFSO (2012) and SFSO (2016).

[11] The SFSO ensures the appropriate treatment of such replacements through phone calls or on-site visits.

of the new product in the previous period. The overlapping price observations of the old and new product are then used to adjust for a change in quality and link the two series. We follow the SFSO's approach and link the adjusted prices of substituted products. If the new product differs substantially, or if no price in the previous period is available, the old price series ends without substitution and a new series starts. Over the entire sample, the share of new products in a given quarter is usually below 10%. Only in Q1 2016 this share is unusually high because of a benchmark revision of the PPI/IPI (see SFSO, 2016). The SFSO updated the goods basket and sample of firms so that many price series end in this quarter. For this reason, we can only follow part of the prices beyond that point in time which leads to higher estimation uncertainty.

Surveyed firms also report the currency of the reported price since the beginning of 2011. During 2011, we observe a substantial extent of changes in the reported currency, which we attribute to initial difficulties in the new data collection process for export prices. For this reason, our main analysis starts in early 2012. For the period after and including 2012, the share of price series with currency changes is smaller than 1%. The SFSO does not check whether a firm transforms the foreign currency price to Swiss francs and then reports the price in its home currency. If this is the case, the currency indicator is measured with error and does not accurately identify the actual transaction currency. Similar issues are present in prominent studies using US survey data (see Gopinath and Rigobon, 2008; Gopinath et al., 2010; Gopinath and Itskhoki, 2010). We are confident, however, that the currency indicator is quite accurate. First, the share and absolute size of price changes in the PPI data is roughly the same for prices reported in domestic currency and foreign currency. If firms would simply transform their foreign currency prices to Swiss francs we would observe more and larger price changes relative to prices reported in foreign currency. Only for prices underlying the IPI we observe a somewhat higher share of price changes in CHF and a larger size of price changes.

Most firms are surveyed at a monthly or quarterly frequency. Firms have to report the price of the first eight days of the corresponding month.[12] Some products, with particularly rare price adjustments, are surveyed less frequently or irregularly. We drop products that are surveyed with less than quarterly frequency and conduct the analysis at the quarterly frequency.[13] Unfortunately, this implies that we have to disregard prices for machinery and electronic equipment. For prices that are collected monthly, we use the average price over a quarter.[14]

The sample comprises almost 2,400 firms (see Table 2.1). More than half of the firms report prices for either the domestic market or the import price index. Less than 800 firms report export prices. Overall, we obtain price series for almost 17,000 products which yields almost 190,000 quarterly price observations from Q1 2012–Q3 2016. The overwhelming majority of prices in the domestic market are reported in Swiss francs. For the export market, almost half of prices are reported in a foreign currency, in most cases euro. For import prices this share is somewhat smaller. Bonadio et al.

[12] When needed, we transform prices reported in foreign currency into Swiss francs and use the average daily exchange rate during the first eight days of the month. Daily Swiss franc exchange rates are inferred from an ECB data set retrieved in April 2017 from `www.ecb.europa.eu/stats/eurofxref/`.

[13] In addition, we drop prices for oil products to avoid confounding effects of the drop in oil prices in late 2014, although this choice does not alter any conclusions.

[14] For some product categories, the quarterly survey takes place early in the first month of the quarter. For this reason, prices in Q1 2015 only partly reflect the removal of the exchange rate floor.

Table 2.1. Number of observations in price data

			Observations			
	Firms	Products	Total	CHF	EUR	Other
Domestic	1,576	6,984	86,412	85,431	947	34
Export	747	3,215	33,967	18,009	13,722	2,236
Import	1,275	6,593	66,090	38,765	24,537	2,788
Total	2,352	16,792	186,469	142,205	39,206	5,058

Notes: All statistics calculated from Q1 2012–Q3 2016. A firm can have products for various markets and therefore the number of firms in the individual samples does not sum up to the number of firms in the total sample.

(2016) analyze the universe of Swiss trade transactions to the euro area and find that about two-thirds of transactions are invoiced in euro. Based on the same data source EZV (2015) report that in 2014, one third of total exports were reported in euro, one third in Swiss francs, and 18% in US Dollars. The main difference to our data set is that the share of prices that are reported in currencies other than euro or Swiss franc is much lower. This is due to the fact that the survey asks firms to report prices for their main export market, which in most cases is the EU.

Table 2.2. Sector characteristics

	Nominal value added	Exports in revenue	Main market EU (if exporter)	Markup	Labor expenses in revenue	Intermediate expenses in revenue
Food	1.8	13.2	93.6	24.1	24.2	51.4
Textiles	0.2	29.0	98.0	26.9	36.7	35.9
Wood	0.5	2.9	88.5	22.4	38.8	40.0
Paper	0.2	35.0	98.5	19.0	33.1	46.1
Print	0.3	6.9	99.4	25.5	43.7	31.2
Chemicals	1.0	40.6	94.6	24.5	28.0	47.3
Pharmaceuticals	3.9	54.9	80.2	30.2	29.9	39.3
Rubber and plastics	0.5	31.0	99.8	25.3	33.0	41.2
Minerals	0.5	5.8	100.0	31.0	31.7	38.3
Basic metals	0.3	36.0	90.4	19.3	35.5	45.0
Fabricated metals	1.4	15.6	93.9	23.4	41.4	35.5
Electrical equipment	0.8	35.5	82.1	21.7	32.7	45.6
Electronics	4.0	42.0	82.0	21.0	41.2	37.8
Other	0.8	23.5	85.1	19.3	41.1	38.7
Transport equipment	0.4	26.9	71.8	23.5	32.3	43.4

Notes: All statistics are shares measured in %. Nominal value added corresponds to 2014 and stem from the SFSO annual national accounts. All other statistics are calculated from the past three waves (2011, 2013, 2015) of the KOF Innovation Survey. The markup is defined as revenue minus variable costs (that is labor and intermediate inputs).

The price data includes a detailed product description, a classification according to sector (NOGA

two-digit), as well as the product type (capital, intermediate and consumption goods).[15] We use this information to complement the price data set with information from the KOF Innovation Survey (see Arvanitis et al., 2017) and the annual national accounts at the sectoral level.[16] Table 2.2 provides descriptive statistics on several relevant sector characteristics. There is substantial heterogeneity with respect to the export share in total revenue. There are sectors that rely little on exports (e.g. Wood 2.9%) and sectors that generate a higher share of their revenues abroad (e.g. Pharmaceuticals 54.9%). A striking feature is that if a firm exports, its main market is very likely the European Union. In most sectors this is the case for more than 80% of all firms. Recall that in the PPI survey, firms are asked to report prices for their most important export destinations. In combination with the results of the KOF Innovation Survey, this suggests that most of our prices are for products with export destination EU and explains the relatively low share of foreign invoicing currencies other than euro. The last three columns report statistics on variable costs and the markup. Labor cost makes up between 24% and 43% of total revenues. For most sectors, the cost of intermediate products is equally or more important than labor cost. The markup, which we define as the share of revenues in excess of variable costs, varies relatively little across sectors and amounts to about 20% of revenues in most sectors.[17] Two sectors with a higher markup are pharmaceuticals and minerals.

One important shortcoming the price data is that we have little accurate information on the destination of firms' exports or the origin of firms' imports. We thus assume that all exports and imports that are denominated in euro and Swiss franc originate from, or are exported to, countries against which the Swiss franc has appreciated. Because some prices belong to products traded with countries not in the euro area, our results may be biased for two reasons. First, there are some prices that are actually not affected by the appreciation. For example, the price of a product imported from the UK is included in our analysis if it is not priced in pounds. As a consequence, we underestimate the pass-through to Swiss import prices. We do not think that this bias is substantial. About 73% of Swiss imports originate from, and 54% of Swiss exports go to countries in the EU. But more importantly, the price surveys ask to report prices for the most important export markets, which for the overwhelming majority of firms is an EU country. Because the Swiss franc has appreciated by the same amount against most EU related currencies, with the notable exception of the UK, those prices will also be affected by the policy change.

Second, we cannot control for changes in marginal costs abroad, which are often approximated by the inflation rates in the corresponding countries. For example, the price of a product sold in Switzerland imported from Germany is affected by two main factors: the marginal costs of the

[15] NOGA is the Swiss statistical classification of economic activities. The two-digit level is compatible with Divisions according to NACE Rev. 2. The data set largely covers the sectors NOGA 10-32 (manufacturing). Note that instead of the NOGA, we use a slightly coarser classification to match our data to additional information from the KOF Innovation Survey.

[16] The KOF Innovation Survey asks firms every two years about various aspects of innovative activities. In addition, it asks about market and cost structure of the firms, which are usually not reported (see Appendix E for an excerpt form the questionnaire). We calculated the average sector statistics using the years 2011, 2013, and 2015, from the individual responses using weights that take into account the stratified sampling scheme as well as non-responses (see Arvanitis et al. (2017), for a detailed documentation). We would like to thank Martin Wörter and Andrin Spescha for providing access and helping with the data.

[17] This definition therefore differs from measures of profit margins that may take into account, for example, fixed costs, taxes and depreciation.

German exporter and the CHF/EUR exchange rate. If marginal costs of the German exporter would fall substantially at the same time as the CHF/EUR has appreciated, we would wrongly attribute the price decline of the product sold in Switzerland to the appreciation and, in contrast to the previous bias, overestimate its impact. Although producer prices in the euro area have fallen somewhat after the appreciation, the annual decline at the beginning of 2016 was only between 1% and 3% for Switzerland's most important EU trading partners (Germany, UK, France and Italy). Because the two biases are likely to be small and of opposite sign, there is no reason to believe that our results are strongly biased in a particular direction.

2.3 Exchange rate pass-through before and after the Swiss franc shock

Our methodology is quite simple and analogous to the one employed by Bonadio et al. (2016) and Efing et al. (2015). We analyze the impact of a permanent appreciation on prices in a model similar to an event-study. The model is estimated on quarterly data for samples ranging from eight quarters before to six quarters after the removal of the floor. The generic form of the estimation equation reads:

$$p_{it} = \gamma_i + \sum_{k \neq -1} \alpha_k D_t^k + \varepsilon_{it}, \text{ for } t = t^* - 8, \ldots, t^* + 6 \,. \tag{2.1}$$

The dependent variable is the log-price of product i at time t. We convert all prices to Swiss francs using the average exchange rate during the survey period. We regress the dependent variable on a product fixed effect γ_i, that absorbs price differences in the baseline quarter one period before the shock, and a set of time dummy variables $D_t^k \equiv \mathbf{1}_{\{t=t^*+k\}}$. Each dummy D_t^k equals one in the quarter k periods after the shock in $t^* =$ Q1 2015.[18] We saturate the model with dummy variables for eight quarters before and six quarters after the event ($k = -8, \ldots, 6$) except for $k = -1$. The response is therefore normalized to zero in the period before the removal of the floor. The estimates of α_k for $k = 0, \ldots, 6$ are interpreted as the percentage change in the price relative to the reference quarter and constitute an impulse response to the appreciation of the Swiss franc assuming that other factors remain constant in the meantime. The inclusion of dummies for time periods preceding the event allows us to analyze pre-existing trends in the average price level of Swiss manufacturing firms. For a credible causal interpretation of our coefficients, those estimates should not be significantly different from zero. We estimate differences in the response across various dimensions by either restricting the sample or interacting the event-study dummies with price- or firm-level characteristics. Because our model is fully saturated, both procedures yield numerically identical results.

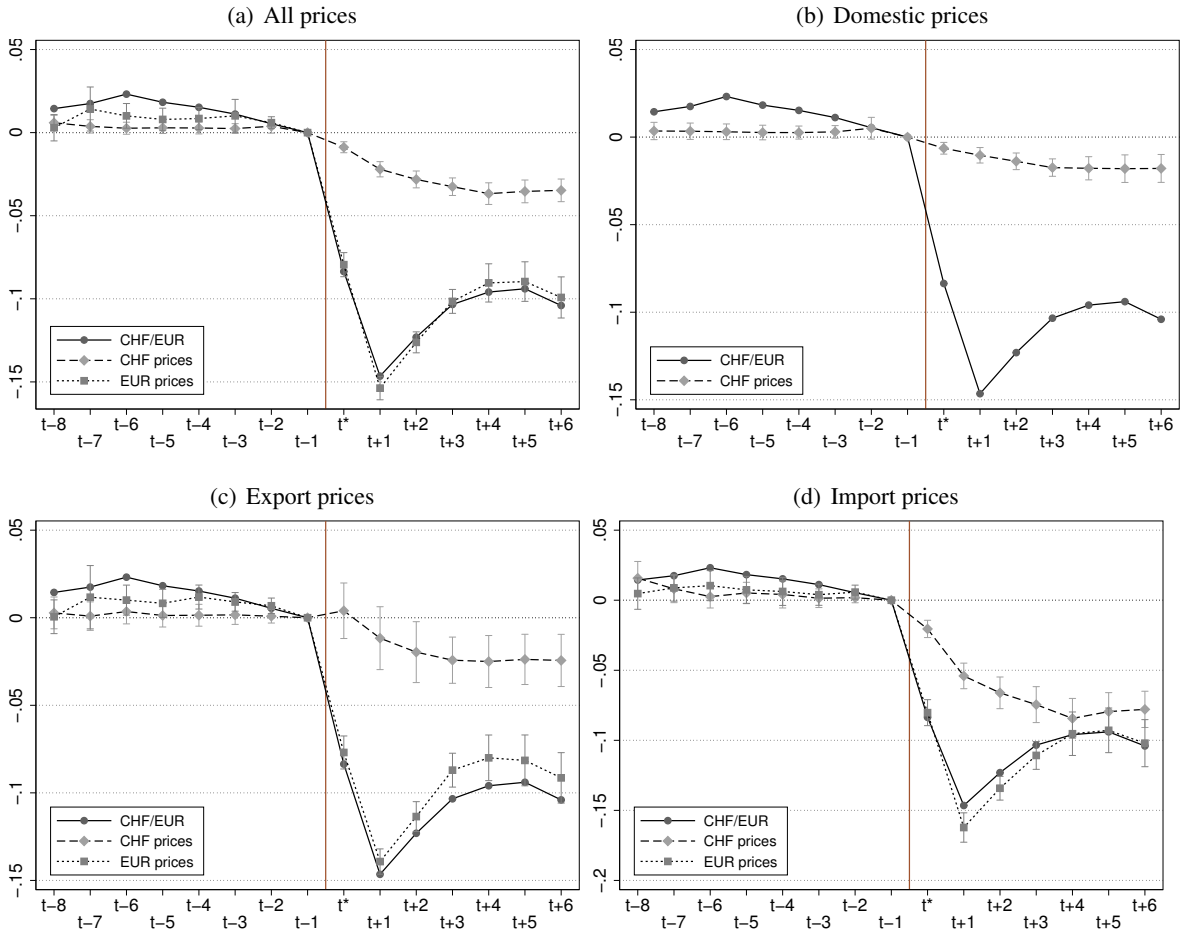
Figure 2.1 shows the impulse responses estimated from the event-study regressions using all prices (panel a), domestic prices (panel b), export prices (panel c) and import prices (panel d). The sample is restricted to products that are observed in the reference quarter.[19] 95% confidence intervals are shown as vertical bars, where standard errors are clustered at the firm-level. For comparison, we also

[18] A negative k therefore indicates periods before the removal.

[19] Note that we drop a few price series observations that are reported in other currencies than CHF, EUR, or USD.

show the evolution of the normalized logarithm of the CHF/EUR exchange rate.[20] If exchange rate fluctuations would be directly and completely passed-trough to prices in terms of Swiss francs, the impulse response of prices would closely track the exchange rate. Because all prices are measured in Swiss franc-equivalent prices, full pass-through implies that prices have not changed significantly in terms of foreign currency.

Figure 2.1. The price response according to currency



Notes: Estimates of the average response of log-prices transformed to Swiss francs after the removal of the exchange rate floor in $t^* =$ Q1 2015. The solid line denotes the normalized evolution of the log-CHF/EUR exchange rate, the dashed line the response of prices reported in CHF and the dotted line the response of prices reported in EUR. All regressions control for prices reported in USD (not shown). Vertical bars denote 95% confidence intervals based on standard errors clustered at the firm-level. The red vertical line denotes the removal of the exchange rate floor.

To get a first idea how prices measured in Swiss franc adjust to the strong appreciation, we group together all price data (see panel a). In the periods before the removal of the floor in t^* = Q1 2015 the event dummies are close to zero and prices appear to be stable. This shows that our estimates are

[20]To make the exchange rate more consistent with the survey pattern of prices, we compute the quarterly CHF/EUR as an average of the monthly CHF/EUR used to transform the price data to Swiss francs.

unlikely to suffer from confounding ongoing trends from before the removal of the floor.[21] After the removal of the floor, both CHF and EUR prices start to decline, but to a different extent. Prices set in EUR decline immediately and are never significantly different from the movement of the CHF/EUR exchange rate.[22] This implies that on average over all euro denominated prices, exchange rate pass-through is complete. By contrast, the response of CHF prices is slower and significantly smaller than the movement in the exchange rate. On average over all CHF denominated prices, exchange rate pass-through is thus incomplete.

The remaining panels show that there are relevant differences between exchange rate pass-through in the domestic markets, export markets and in import prices. Because domestic prices are overwhelmingly reported in CHF we only show one response. Panel (b) shows that the pass-through to prices in the domestic market is incomplete but not zero. Export prices set in CHF respond somewhat more strongly, but the difference to the domestic response is small and statistically not significant (panel c). In contrast, export prices set in EUR respond quickly and closely follow the CHF/EUR exchange rate. The same holds for import prices denominated in euro. Import prices denominated in CHF show a slower response, but decrease substantially more strongly than export or domestic prices denominated in CHF and pass-through is almost complete after 6 quarters.

To formally test whether pass-through is complete or incomplete Table 2.3 provides the ratio of the event study coefficients after one quarter and four quarters and the corresponding percentage change in the CHF/EUR exchange rate over the same period. A ratio of zero indicates that the appreciation was not accompanied by a change in prices in Swiss francs. A ratio of one suggests that prices in Swiss francs have changed one-for-one with the appreciation.

The table confirms that pass-through for the domestic market is incomplete. After four quarters, a one percent appreciation lowers prices by 0.2 percent. For export prices set in CHF, the long-run pass-through ratio amounts to 0.3, which is similar to the domestic ratio. CHF prices of Swiss products seem to respond similarly on the domestic and export markets. By contrast, export prices set in EUR exhibit a high pass-through ratio at 0.95 after one quarter and 0.8 after four quarters. The last two lines of the table provide the p-value of a test for the null hypothesis that the pass-through is different from one. A value below 0.05 implies that we reject the null hypothesis at the 5% level. The null of complete pass-through is rejected in the long run for both CHF and EUR prices. This suggests that exporters were able to slightly increase their prices in foreign currency countering the initial decline in their markups. For import prices at the docks we find substantial pass-through for both CHF prices and EUR prices. After four quarters, the pass-through ratio is not significantly different from one for both currencies.

Our estimates of import prices pass-through are at the upper end reported in the existing literature.

[21] Figure B.1 shows the pre-shock trends for up to 12 quarters. At least up to six quarters before the removal there are no significant changes in CHF prices. Before, import prices reported in CHF decline somewhat because of the lagged effects of the appreciation in 2010 and 2011. Meanwhile, prices reported in euro move in tandem with the exchange rate, as we would expect. We therefore do not detect any suspect pre-shock trends that may confound our analysis.

[22] For export prices, a perfect "pass-through" in our analysis suggests that the price in terms of Swiss francs (domestic currency) moves one-for-one with the exchange rate. Of course, export prices in Switzerland are import prices abroad. Therefore, if the response of export prices in Swiss franc is complete, this implies that the same prices are perfectly sticky abroad. A perfect pass-through in export prices implies therefore, all else equal, a corresponding reduction in the markup of the Swiss exporter.

Table 2.3. Exchange rate pass-through after the Swiss franc shock

	Domestic		Export		Import	
	1 quarter	4 quarters	1 quarter	4 quarters	1 quarter	4 quarters
CHF prices	0.07***	0.19***	0.08	0.26***	0.37***	0.88***
	(0.02)	(0.04)	(0.06)	(0.08)	(0.03)	(0.08)
EUR prices			0.95***	0.83***	1.11***	0.99***
			(0.03)	(0.07)	(0.04)	(0.08)
CHF prices = 1	0.00	0.00	0.00	0.00	0.00	0.11
EUR prices = 1			0.05	0.02	0.00	0.94
Firms	1131	1131	513	513	814	814
Products	4379	4379	1725	1725	3219	3219
Observations	74105	74105	27522	27522	51405	51405

Notes: Estimated pass-through in the short-run (after 1 quarter) and long-run (after 4 quarters) pass-through. The pass-through ratios are calculated as the response of prices divided by the log-change in the CHF/EUR exchange rate $\alpha_k/(e_{t^*+k} - e_{t^*-1})$. Standard errors clustered at the firm-level are given in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level. The lower panel shows p-values of a test whether the pass-through is complete (equal to unity).

One possibility is that the appreciation was perceived to be permanent and therefore firms immediately and fully incorporated the shock into their prices. This explanation would imply substantially lower pass-through during the exchange rate floor when exchange rate fluctuations were perceived as temporary. To corroborate this interpretation, we perform pass-through regressions on the sample with the exchange rate floor in place (Q1 2012 to Q4 2014). The generic regression equation reads:

$$\Delta p_{it} = \gamma_i + \sum_{p=0}^{4} \phi_p \Delta e_{t-p} + \sum_{p=0}^{4} \theta_p Z_{t-p} + \varepsilon_{it} \tag{2.2}$$

where Δe_t is the log-change of the CHF/EUR exchange rate and Z_t is a vector of additional control variables.[23] Since the dependent variable is the log-change of a price, this equation boils down to a standard exchange rate pass-through regression as used by Campa and Goldberg (2005).[24] Because the equation is estimated in log-changes, the impulse response after h periods is given by the sum of the estimated coefficients ($\sum_{p=0}^{h} \phi_p$).

Table 2.4 shows estimates based on Eq. (2.2), where we include the CHF/EUR exchange rate interacted with an indicator for the currency of pricing. We also control for the change in the foreign (trade-weighted) price level.[25] All regressors enter contemporaneously as well as with four lags and we sum up the coefficients to derive the corresponding pass-through estimates.

[23] Because we do not know the export destination of the products we have to make the simplifying assumption that all products in CHF or EUR are exported to the euro area and countries with related currencies. Therefore, the exchange rate does not differ among products.

[24] But also, similar regressions have been used by Gourinchas (1999) and Kaiser and Siegenthaler (2016) to examine the impact of real exchange rate fluctuations on labor demand.

[25] We also experimented with controlling for log-changes in CHF/USD because some export (import) CHF prices may be sold (purchased) in the US. The results remained qualitatively unchanged.

Table 2.4. Exchange rate pass-through during the exchange rate floor

	Domestic		Export		Import	
	1 quarter	4 quarters	1 quarter	4 quarters	1 quarter	4 quarters
CHF prices	-0.03	-0.09	0.04	0.12	-0.23	-0.27*
	(0.08)	(0.09)	(0.15)	(0.12)	(0.14)	(0.14)
EUR prices			0.80***	0.89***	0.62**	0.60***
			(0.27)	(0.16)	(0.25)	(0.20)
CHF prices = 1	0.00	0.00	0.00	0.00	0.00	0.00
EUR prices = 1			0.45	0.52	0.13	0.04
Firms	1113	1113	486	486	786	786
Products	4701	4701	1738	1738	3912	3912
Observations	50178	50178	18217	18217	36228	36228

Notes: Estimated pass-through in the short-run (after 1 quarter) and long-run (after 4 quarters) of a 1% change in the CHF/EUR based on pass-through regressions from Q1 2012 to Q4 2014. The pass-through is calculated by summing up the regression coefficients ($\sum_{p=0}^{k} \phi_p$) as shown in Eq. (2.2). HAC-robust standard errors in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level. The lower panel shows p-values of a test whether the pass-through is complete (equal to unity).

Indeed, exchange rate pass-through is low during the exchange rate floor regime. The pass-through ratio for prices set in CHF is lower than in the event study and never statistically significantly different from zero. For EUR prices, however, the pass-through is still substantial and, with the exception of import prices, the ratio is not statistically different from one. These results are consistent with the idea that prices are sticky in the currency they are set in, so that firms do not pass-through exchange rate fluctuations to prices set in domestic currency if they are perceived to be temporary. Note that for import prices in particular, this implies that exchange rate pass-through can be low when exchange rate fluctuations are temporary but increases substantially if they are permanent.

2.4 The role of sticky prices

After the removal of the exchange rate floor, pass-through was slow and incomplete for domestic and export prices set in CHF. Meanwhile, EUR prices showed an immediate and substantial adjustment. This pattern could stem from price rigidities in the corresponding currency. If CHF prices are rarely adjusted (for example because of ongoing implicit or explicit delivery contracts), even a large appreciation may not lead to substantial price changes.[26] If EUR prices are rarely adjusted, however, the corresponding price in Swiss francs changes mechanically with the exchange rate.

To examine the role of price rigidities, we repeat the event-study on a sample restricted to prices that change at least once between the removal of the exchange rate floor and the end of our sample. Table 2.5 shows the pass-through ratios estimated on those price series.[27] The estimated pass-through

[26] It does not follow, however, that perfectly flexible prices would be associated with perfect pass-through (Krugman, 1986; Burstein and Gopinath, 2014). The degree of actual pass-through depends on the market structure, as well as, the cost structure of the firm.

[27] See also Figure B.2 for the responses conditional on a price change.

Table 2.5. Exchange rate pass-through conditional on a price change

	Domestic		Export		Import	
	1 quarter	4 quarters	1 quarter	4 quarters	1 quarter	4 quarters
CHF prices	0.14***	0.35***	0.15	0.48***	0.48***	1.09***
	(0.03)	(0.06)	(0.12)	(0.14)	(0.04)	(0.09)
EUR prices			0.91***	0.71***	1.18***	1.00***
			(0.04)	(0.11)	(0.06)	(0.14)
CHF prices = 1	0.00	0.00	0.00	0.00	0.00	0.30
EUR prices = 1			0.04	0.01	0.00	0.98
Firms	710	710	338	338	637	637
Products	2250	2250	938	938	2140	2140
Observations	39001	39001	15107	15107	34961	34961

Notes: Estimated pass-through in the short-run (after 1 quarter) and long-run (after 4 quarters). The sample is restricted to prices that change at least one time between Q4 2014 and Q1 2016. The pass-through ratios are calculated as the response of prices divided by the log-change in the CHF/EUR exchange rate $\alpha_k/(e_{t^*+k} - e_{t^*-1})$. Standard errors clustered at the firm-level are given in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level. The lower panel shows p-values of a test whether the pass-through is complete (equal to unity).

ratios do not change much for prices set in EUR, but show a slightly lower pass-through conditional on a price change. This is in line with the idea that these firms raise prices in EUR once they adjust their price in order to reestablish their markups. In contrast, the pass-through conditional on a price change is larger for prices set in CHF. For the domestic market, the pass-through ratio amounts to 0.4, for the export market to 0.5 and for import prices to 1.1. This suggests that sticky prices are indeed partly responsible for the incomplete pass-through into CHF prices.[28] Moreover, the difference between the pass-through ratios of CHF and EUR prices is smaller for export prices and essentially zero for import prices once we condition on a price change. This is an additional indication that price rigidities prevent a fast adjustment of prices towards the desired price a firm would like to set in a frictionless world.

An advantage of our product-level price data is that we can determine exactly whether a price of a particular product has changed after the removal of the exchange rate floor. Figure 2.2 shows the distribution of log-price changes between Q4 2014 and Q4 2015.[29] Like in the pass-through regressions, we transform the prices set in foreign currency to Swiss francs. For domestic prices, the large spike at 0% shows that more than half of the prices have hardly been adjusted after one year, despite the large permanent appreciation. The red bar denotes the share of price changes that are exactly zero, which also amounts to almost 40%. For the domestic market, there is strong evidence that prices are sticky even in the presence of a large and permanent exchange rate shock.

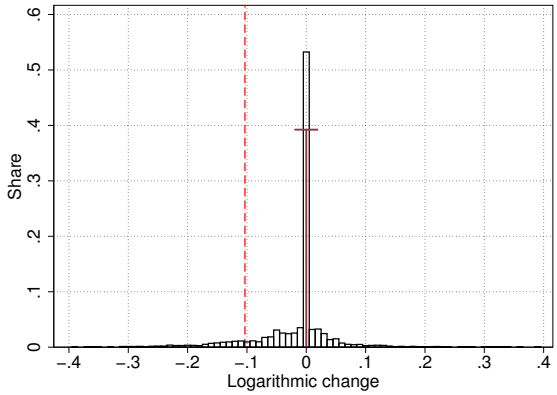
A similar pattern emerges for export prices that are set in CHF (panel b). 40% of prices do not change at all after the appreciation, which implies that the corresponding products became

[28] Nakamura and Steinsson (2010) show that sticky prices in few sectors may suffice to explain a sluggish response of perfectly flexible prices if there is strategic complementarity in price setting.

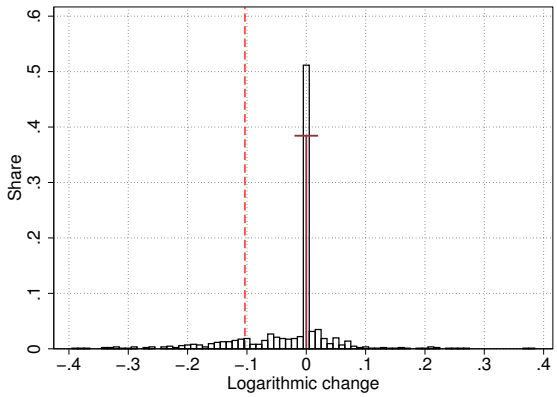
[29] For comparison Figure B.3 shows histograms of price changes between Q4 2013 and Q4 2014.

Figure 2.2. The distribution of price changes from Q4 2014 to Q4 2015

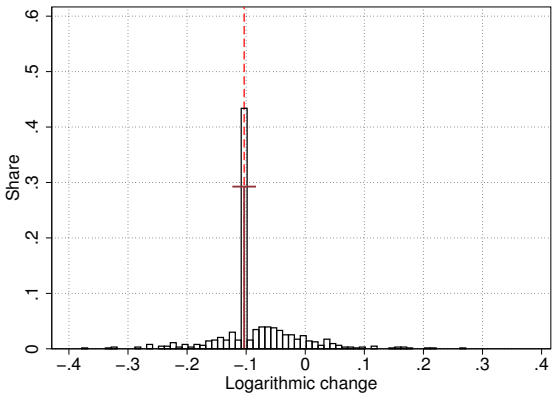
(a) Domestic CHF prices



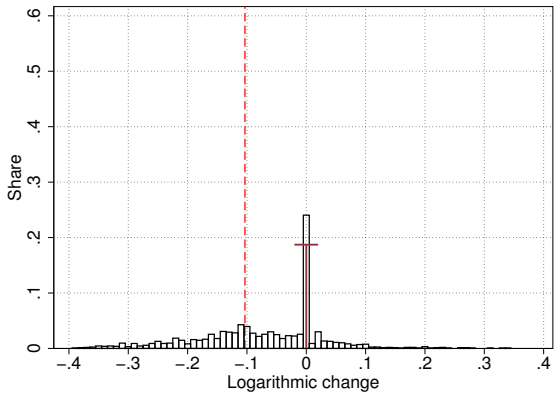
(b) Export CHF prices



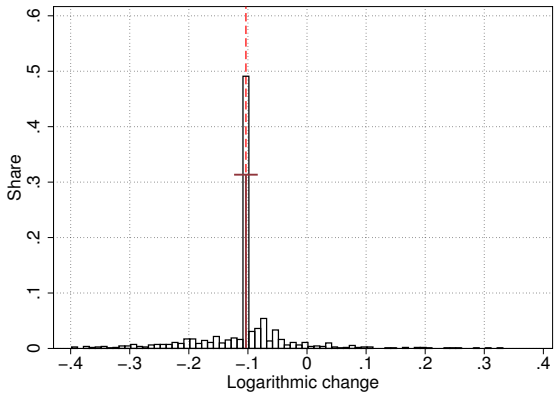
(c) Export EUR prices



(d) Import CHF prices



(e) Import EUR prices



Notes: Log-change in prices transformed to Swiss francs between Q4 2014 and Q4 2015. The left panels show prices set in CHF and the right panel prices set in EUR. The dashed line denotes the size of the appreciation of the CHF/EUR. The red bar gives the share of price changes that are exactly 0 (CHF prices) or exactly equal to the CHF/EUR appreciation (EUR prices). The histograms are censored at a log-change of -0.4 and 0.4.

substantially more expensive in the euro area. By contrast, prices reported in EUR show a spike at slightly above -10%, the exact amount of the appreciation until the end of 2015 (see panel c). Almost 30% of all prices exactly track the CHF/EUR exchange rate, and are not changed at all in foreign currency. The histogram also shows that, for those prices that do adjust, a somewhat larger share of prices increase.

The event-study responses in the previous section show a complete pass-through to import prices. But even on the import side, we observe a substantial share of CHF prices that do not adjust at all (20%). Import prices, however, appear to be more flexible than prices for the domestic or export market. The histogram of CHF prices shows a symmetric distribution around -10% with the exception of the spike at 0%.[30] The substantial pass-through can be traced back to the fact that prices are sticky but many of them are set in EUR. Panel (e) shows that more than 30% of all price changes exactly amount to the CHF/EUR appreciation implying that they remained unchanged in terms of EUR.

After the removal of the exchange rate floor, many prices remained unchanged. But how does this compare to the episode when the exchange rate floor was in place? Figure 2.3 shows the share of prices that change in a given quarter in the reported currency as well as the average absolute size of price changes. All series are seasonally adjusted. The share of price changes in CHF remained remarkably constant in the domestic and export markets (panel a). We observe only a slight increase from about 27% to 30% and a subsequent decline in the course of 2015. The share of CHF price changes increases somewhat more strongly for import prices, from just over 40% to more than 50%. This corroborates that import prices are more flexible than export prices and also that the price-setting behavior changes more strongly when facing shocks.

We observe a stronger response in the absolute size of price changes. During the exchange rate floor period, the average absolute size of CHF price changes amounted to about 4% for the domestic market and to about 5% for the export market and import prices. The size of export and import price changes shows a substantial spike in Q1 2015 indicating that those firms that did adjust their prices did so by a larger amount.[31] Also, the size of price changes for the domestic market increases somewhat, but actually already before the removal of the floor.

The price-setting behavior of exporters and firms producing for the domestic market is similar to the price-setting behavior at the retail stage. Kaufmann (2009) reports that from 2000-2005 the average share of price changes in the Swiss CPI (including sales) amounts to 23.4% (excluding sales this share is lower). This implies a duration between two consecutive price changes of 4.3 quarters.[32] Surprisingly, perhaps, producer prices appear to be as sticky as consumer prices. The average share of price changes before the removal of the exchange rate floor ranges from 23% to 26% for export and domestic prices set in EUR and in CHF, respectively. The implied duration therefore ranges from 3.8

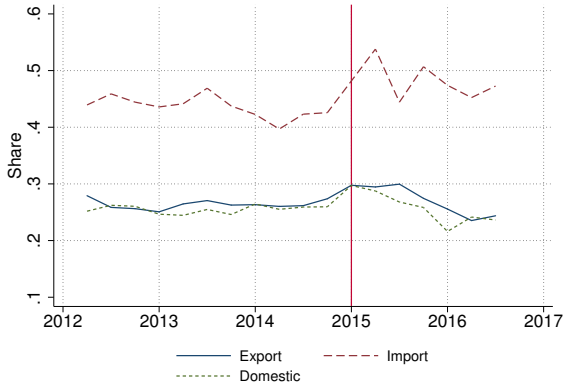
[30] This is a strong indication that our currency indicator is well measured. If firms would simply transform their foreign currency prices to Swiss francs before reporting we would expect a large spike at about -10%.

[31] This contrasts the findings by Auer et al. (2017) showing that the absolute average size of price cuts declined after the Swiss franc shock. Their study, however, uses retail prices for imported products from homescan price data, whereas we use import prices at the docks.

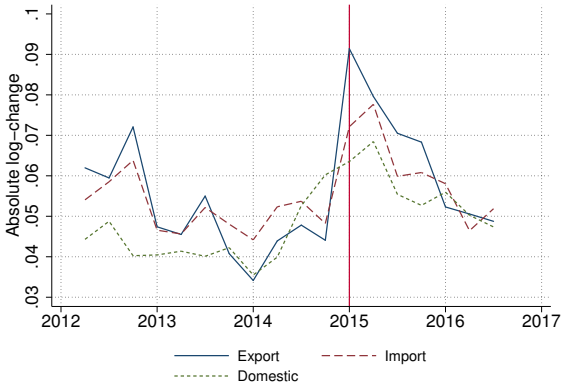
[32] Note that we calculate the implied duration by the inverse of the share of price changes $d = 1/share$ to make the results comparable with Gopinath and Rigobon (2008).

Figure 2.3. Time-variation in price-setting behavior

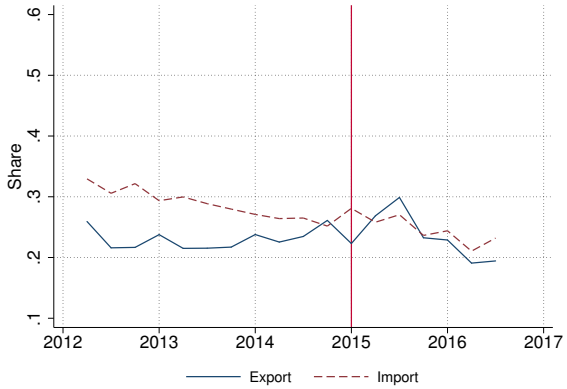
(a) Share of CHF price changes



(b) Size of CHF price changes



(c) Share of EUR price changes



(d) Size of EUR price changes

Notes: Share and absolute size of log-price changes in a given quarter in the corresponding currency of pricing. All series are seasonally adjusted using deterministic seasonal dummies. The red vertical line denotes the removal of the exchange rate floor.

to 4.4 quarters. Only for import prices set in CHF we find a higher share of price adjustments (43%) implying a duration of 2.3 quarters. Meanwhile, import prices set in EUR also change relatively rarely (29%). Gopinath and Rigobon (2008) find for the US a similar duration between price changes for export prices (12.8 months). For US import prices, however, the duration amounts to 10.6 months, which is longer that what we observe for Swiss import prices. Therefore, Swiss import prices display not only a substantial pass-through in international comparison but are also somewhat more flexible.

2.5 The role of factor costs, currency choice, and market structure

Price rigidities and the foreign currency are not the only determinants of the degree of exchange rate pass-through. The theoretical and empirical literature has emphasized that the competitive position, exchange rate sensitivity of factors costs, and market structure play a role. We therefore examine whether pass-through differs between different product types, as well as firms and sectors with different characteristics.

We first separately estimate exchange rate pass-through for intermediate, capital, and consumption goods by interacting the event dummies with product-type dummies. Table 2.6 shows the resulting pass-through ratios for the three price data sets and according to the currency of pricing. Independent of the market and independent of the currency of pricing, the pass-through is largest for intermediate products, followed by capital goods. Consumption goods consistently exhibit the lowest exchange rate pass-through. We find that pass-through seems to decline along the production chain, which is consistent with the existing literature. Domestic prices and export prices denominated in CHF behave similarly for all product types and exhibit an incomplete pass-through. It is a widely held view in Switzerland that pass-through to import prices is incomplete. While this is not consistent with our baseline result, it may stem from the fact that pass-through for imported consumption goods is lower than for capital and intermediate goods. Compared to domestic and export prices, however, import prices respond more strongly after four quarters for all product types. This suggests that import price competition on the domestic market has substantially increased because import prices at the docks fell more strongly than prices for similar product types of domestically operating firms. For consumption goods prices set in EUR we observe complete pass-through initially. After four quarters, the pass-through of EUR prices (0.59) is more similar to the pass-through of CHF prices (0.38). Again, this is in line with the idea that prices are sticky in the currency of pricing but when they are adjusted firms seek to set the same implied CHF price. Moreover, most of the incomplete pass-through for consumption goods seems to arise at the docks rather than at the retail stage. Auer et al. (2017) use homescan prices for imported retail products from the EU and find a pass-through ratio of 0.47, which is quite close to our estimates for border prices.

Unfortunately we lack firm-level data on the market structure and competitive position to examine whether these factors indeed matter for the degree of pass-through. Instead, we use information at the sector-level from the KOF Innovation Survey. Because the number of observations is extremely small, however, this should be regarded as suggestive evidence only. Moreover, the results come with the caveat that the sectoral averages may mask more important within-sector differences. We calculate the average response of the price transformed to Swiss francs for 14 manufacturing sectors and then

Table 2.6. Exchange rate pass-through according to product type

	Domestic		Export		Import	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
CHF prices:						
Intermediate	0.15***	0.32***	0.09	0.45***	0.52***	1.34***
	(0.03)	(0.06)	(0.16)	(0.15)	(0.05)	(0.11)
Capital	-0.01	0.16**	0.06**	0.16***	0.26***	0.61***
	(0.05)	(0.07)	(0.03)	(0.06)	(0.06)	(0.13)
Consumption	0.01	0.05	0.08	0.23	0.23***	0.38***
	(0.02)	(0.04)	(0.06)	(0.20)	(0.04)	(0.06)
EUR prices:						
Intermediate			1.01***	0.96***	1.13***	1.15***
			(0.04)	(0.09)	(0.06)	(0.09)
Capital			0.86***	0.83***	1.19***	1.20***
			(0.06)	(0.14)	(0.10)	(0.15)
Consumption			0.91***	0.69***	1.02***	0.59***
			(0.04)	(0.12)	(0.04)	(0.21)

Notes: Estimated pass-through in the short-run (after 1 quarter) and long-run (after 4 quarters). The pass-through ratios are calculated as the response of prices divided by the log-change in the CHF/EUR exchange rate $\alpha_k/(e_{t^*+k} - e_{t^*-1})$. Standard errors clustered at the firm-level are given in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level.

regress these sectoral price responses on sector-characteristics from the KOF Innovation Survey and price-setting statistics based on the price data set. We then identify the factors that explain exchange rate pass-through from cross-sectoral differences.

The competitive position explains a substantial share of the cross-sectoral differences in pass-through. For the domestic market, the price response is smaller for sectors with a higher markup and lower price competition (see Table 2.7). This implies that firms with a high markup and a low price elasticity of demand tend to absorb exchange rate fluctuations rather than passing them on to the customers. Note that the competition measure is a qualitative indicator with values ranging from 1 (low price competition) to 5 (high price competition). Therefore, the coefficient cannot be interpreted quantitatively. In the second column we see that the price-setting statistics show a reasonable association with the price response. Sectors with a higher share of price changes are associated with a stronger price response. Moreover, the pass-through is higher in sectors with a higher share of euro prices, although, the coefficient is significant only at the 10% level. Gopinath et al. (2010) suggest that currency choice itself, and therefore the share of EUR prices, may depend on the competitive position and price-setting behavior of firms. Indeed, when including all regressors the share of EUR prices is not relevant to explain differences in pass-through. Meanwhile, the other regressors keep their expected sign.

We find a similar pattern in the export market. Sectors with a higher markup and lower price

Table 2.7. Price response according to sector characteristics

	Domestic			Export			Import		
Market structure:									
Markup	0.21*		0.19**	0.22*		0.18			
	(0.10)		(0.08)	(0.10)		(0.11)			
Competition	-10.11***		-5.35**	-11.15***		-8.80**	-14.96**		-16.93*
	(2.47)		(2.10)	(2.31)		(3.44)	(6.37)		(9.18)
Price setting:									
Share changes		-13.92***	-9.05***		-13.75***	-6.39		-13.80*	-0.33
		(2.62)	(1.73)		(1.77)	(4.05)		(7.26)	(10.93)
Share EUR		-47.84*	-4.43		-4.33	-0.83		-5.30	12.61
		(25.53)	(18.96)		(2.99)	(3.17)		(3.73)	(12.25)
R-squared	0.66	0.74	0.87	0.71	0.51	0.77	0.43	0.45	0.60
Observations	14	14	14	14	14	14	15	15	15

Notes: Regression of the average sectoral price response in Swiss francs between Q4 2014 and Q4 2015 on various sector characteristics. Robust standard errors in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level.

competition are associated with a weaker price response in Swiss francs.[33] This implies that in sectors with a low elasticity of demand, firms were able to keep their Swiss franc-equivalent prices relatively high and therefore protect their margins. The price-setting statistics also explain a relevant share of the cross-sectional differences in pass-through. Firms that adjust their prices more often lowered their Swiss franc price more strongly. Because firms that face fierce price competition may also be more likely to adjust their price more often, the two covariates are likely to be related. If we include all covariates, only the competition coefficient remains statistically significant.

Note that the KOF Innovation Survey asks domestically operating firms about their cost structure and therefore, the markup variable is not appropriate for foreign firms selling their products in Switzerland. For import prices it would be therefore inappropriate to include the markup variable. The results for import prices are similar as for domestic and export prices. Pass-through is higher in sectors with high price competition and a high share of price changes. The coefficients are only borderline statistically significant, however.

Cross-sectional differences in the share of prices set in euro cannot explain differences in pass-through. This may be because currency choice itself depends on the degree of price stickiness and the degree of competition (Gopinath and Itskhoki, 2010). Table 2.8 repeats the cross-sectoral regressions using the share of CHF prices as dependent variable.[34] For import prices, we find that a higher share of price changes is associated with a higher share of prices set in CHF. This suggest that firms exporting to Switzerland with relatively flexible prices set their prices in local currency. This observation is in line with the theory by Gopinath and Itskhoki (2010) suggesting that firms with more flexible prices are more likely to optimally choose to price in the local currency. In addition, in sectors with higher price competition we observe a smaller share of prices set in CHF. This implies that firms

[33] The results are robust when excluding the pharmaceutical sector. Note that Berman et al. (2012) find that French high performance exporters absorb exchange rate fluctuations in their markup. This would actually imply that exporters with a higher markup should reduce their Swiss franc-equivalent price more strongly and is thus inconsistent with our result.

[34] See Table B.1 and B.2 for detailed statistics on currency choice.

Table 2.8. Determinants of currency choice

	Domestic	Export	Import
Competition	-0.01	-0.34	-0.55***
	(0.04)	(0.29)	(0.12)
Share changes	0.04	0.65*	0.64***
	(0.04)	(0.32)	(0.10)
R-squared	0.14	0.12	0.75
Observations	15	15	15

Notes: Regression of sectoral share of CHF prices between Q4 2014 and Q4 2015 on various sector characteristics. Robust standard errors in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level.

exporting to Switzerland facing a high price elasticity of demand are more likely to set the price in producer currency (other currencies than CHF). Again, this is in line with theory because with higher competition, firms are less able to price discriminate among different markets and therefore firms let prices fluctuate with the exchange rate. For domestic prices we do not find a significant relationship, which is not surprising because most prices are set in CHF and thus the cross-sectoral variation is negligible. For export prices, the relationship is barely statistically significant and explains little of the cross-section variation.

2.6 The impact on export price markups

To what extent did export firms lower their markups in response to the large appreciation? This question is related to the degree of pricing to market, that is, to what extent the same firm charges different prices in terms of home currency in different markets.[35] This is not a trivial question because the firm-specific cost structure is generally unobserved and the impact of an appreciation on markups depends, among other things, on the degree of pass-through to imported intermediate products.

We have qualitative evidence from two surveys conducted by the SNB among more than 200 Swiss firms just after the removal of the exchange rate floor (see SNB, 2015a,b). More than 40% of firms negatively affected by the appreciation faced lower profit margins on foreign sales while volumes and market share effects have been smaller (SNB, 2015a,b). At the same time, a similar share reports a lower Swiss franc-equivalent price in foreign sales. We have no quantitative information, however, how strongly markups of export products were affected and whether this depends on the currency of pricing.[36]

Our data set allows to gauge the impact of the appreciation on markups of products priced in CHF and EUR under various assumptions. The results suggest that products with prices set in EUR suffered from a substantial reduction in markups while products priced in CHF show no change in markups.

[35] Classic explanations of pricing to market involve some degree of market power to price discriminate (Krugman, 1986).

[36] An exception is Hess (2015) who suggests that Swissmem members in the machinery electronics and metal industry had to reduce profit margins between 5% and 15%.

This is in line with the idea that prices are sticky in the currency they are set in such that markups vary more strongly with the exchange rate for products set in foreign currency.[37] In contrast to the cross-sectoral regressions from the previous section, we are able to exploit firm-level information. The disadvantage is that the results are based on a smaller sample of firms.

First, we identify the markup elasticity under the assumption that all export prices in CHF and EUR were affected by the appreciation, while USD prices were not affected. This is a reasonable assumption because the Swiss franc did not appreciate permanently against the US Dollar. Because we observe for some firms USD prices in addition to CHF and EUR prices, we can estimate the relative response controlling for firm-specific time effects.[38] In particular, these time effects absorb unobserved changes in firms marginal costs stemming from cheaper intermediate inputs because of the appreciation of the Swiss franc. The first two columns of Table 2.9 show that the markup of products priced in EUR respond immediately and strongly to the appreciation. By contrast, the markup elasticity of products priced in CHF is zero. This stark difference remains even after four quarters.[39] This implies that prices set in EUR are associated with larger markup fluctuations than prices set in CHF.

Table 2.9. Export price markup elasticity

	Relative to USD		Relative to domestic prices		Relative to import prices	
	1 quarter	4 quarters	1 quarter	4 quarters	1 quarter	4 quarters
CHF prices	-0.01	-0.01	-0.13*	-0.07	0.03	0.11
	(0.24)	(0.45)	(0.07)	(0.07)	(0.04)	(0.10)
EUR prices	0.91***	1.42***	0.67***	0.38***	0.76***	0.64***
	(0.17)	(0.33)	(0.05)	(0.10)	(0.06)	(0.10)
CHF prices = 1	0.00	0.03	0.00	0.00	0.00	0.00
EUR prices = 1	0.61	0.19	0.00	0.00	0.00	0.00
Firms	61	61	452	452	243	243
Products	234	234	3617	3617	760	760
Observations	2981	2981	46952	46952	9167	9167

Notes: Estimated markup elasticity relative to USD prices and domestic prices, respectively. The elasticity is calculated as the response of markups divided by the change in the CHF/EUR exchange rate $\alpha_k/(e_{t^*+k} - e_{t^*-1})$. Standard errors clustered at the firm-level are given in parentheses. Coefficients with superscript ***/**/* are statistically significant at the 1%, 5% and 10% level. The lower panel shows p-values of a test whether the markup elasticity is equal to unity.

Second, for some firms we observe both, prices for the domestic and for the export market.

[37] If prices could be adjusted every period, currency choice is irrelevant. If prices are sticky, then it matters whether a price is set in foreign currency so that exchange rate fluctuations are absorbed in the markup.

[38] We drop the event dummies for USD prices and, instead, include firm-specific time effects. These controls absorb all factors that change for a given firm over time. Examples include a decline in costs for imported intermediate products. The idea is that if a firm can import cheaper intermediate inputs this will affect the marginal costs for all products independent of the currency of pricing. Therefore, we measure the markup of a given product of a firm that is priced either in CHF or EUR relative to prices set in USD that were not affected by the appreciation. The sample is reduced considerably, to only 61 of over 500 firms taking part in the export price survey, when restricting the sample to firms that report at the same time USD and EUR, or, USD and CHF prices.

[39] After four quarters, the markup elasticity is even larger than unity. This may stem from the slight depreciation of the Swiss franc relative to the US Dollar which is not taken into account here.

Therefore, we can estimate the markup elasticity of export relative to domestic prices. This approach allows to identify the markup if we assume that the domestic price is not affected by the appreciation. Because domestic prices are likely to be indirectly affected, namely through increased import competition from cheaper imported products, this assumption is not strictly satisfied. For example, a firm selling a product on the domestic market may have to lower its price if similar imported products become cheaper because of the appreciation. The estimates still give a lower bound on the response of markups because we will tend to underestimate the markup elasticity of exported products. The advantage is that the sample of firms for which we observe domestic as well as export prices is almost as large as the original export price survey sample (452 firms). The results suggest that the markup elasticity of prices set in CHF is barely significantly different from zero, whereas, prices set in EUR show a markup elasticity of 0.7 after one quarter and 0.4 after four quarters.

Finally, for some firms we observe export prices as well as import prices. We therefore estimate the markup elasticity by adding the average of all import prices reported by each firm as a control. The implicit assumption is that the average import prices we observe for a given firm is the only time-varying factor affecting marginal costs. While this is a strong assumption, the sample of firms is somewhat larger than for the markup estimates relative to USD prices (243 firms). The estimates in Table 2.9 confirm that products priced in CHF display an inelastic markup whereas markups for EUR products are substantially more elastic.

2.7 Summary

Exchange rate pass-through differs considerably for imported, exported, and products sold on the domestic market. In line with existing literature for the US, the currency of pricing is key to understand the various degrees of exchange rate pass-through for export prices. These differences are related to the fact that a large share of prices remain unchanged even after a 10% appreciation of the Swiss franc. By contrast, we find a substantial pass-through for import prices independent of the currency of pricing.

Overall, import prices fall by the same amount as the Swiss franc appreciation. Because a large fraction of import prices set in EUR do not change, the corresponding price in Swiss francs falls immediately. Although import prices set in CHF take a longer time to adjust, after somewhat more than a year they almost fully adapt to the exchange rate. The remaining small difference can be explained by the fact that some prices have not yet adjusted even after almost two years. In comparison to earlier studies we find a substantially larger pass-through to import prices. But, for the period with the exchange rate floor in place, the pass-through is substantially smaller. We argue that a reasonable explanation for this time-varying pattern in pass-through is that the appreciation after the removal of the exchange rate floor was perceived to be permanent. This implies that the degree of pass-through can change quickly with economic agents expectations about the future level of the exchange rate.

A different picture emerges for export prices (set in CHF) and prices for products sold on the domestic market. Those prices respond slowly and incompletely to the appreciation. This implies that export prices become relatively more expensive abroad and products for the domestic market become more expensive relative to their imported counterparts. Again, this incomplete pass-through

goes along with a relevant share of prices that remain completely unchanged. This is also the reason why pass-through is almost complete for export prices set in EUR.

The stark difference between the response of domestic prices and import prices suggests that import price competition has increased substantially and that, therefore, domestically oriented firms may have lost market share. Indeed, the stark differences between domestic and import prices carries over to more homogeneous groups of intermediate, capital and consumption goods.

Finally, for a smaller sample of firms participating in the export price survey, we estimate the impact on markups for products priced in domestic and foreign currency. We find that markups of products priced in EUR decline much more strongly than markups of products priced in CHF, which are essentially unchanged. This implies that price stickiness in the currency of pricing matters in the sense that missing (or incomplete) price adjustments of prices set in EUR and CHF lead to a long-lasting divergence of the markups associated with those products.

We show that prices are surprisingly sticky given the substantial permanent appreciation of 10% against the euro.[40] This leads to a long-lasting reduction of markups on products priced in euro. This is qualitatively in line with survey evidence from the SNB and Swissmem, an association of firms in the machinery, electronics, and metal industry. There is narrative evidence that it takes six to nine months between an incoming order and the financial settlement.[41] If it is difficult to adjust the price of an existing order after the appreciation, this explains partly why prices changed so little. Moreover, Hess (2015) suggests that about half of the firms in this sector faced reductions in their profit margins between 4% and 15%. Although our sample only partly overlaps with this sector, our findings are similar for products priced in euro.[42]

The results also line up well with two surveys conducted by the SNB among somewhat more than 200 firms in all sectors of the economy (see SNB, 2015a,b). In Q2 2015, more than 80% of manufacturing firms in their sample reported moderately or significantly negative effects because of the appreciation. Among the negatively affected firms (in all sectors of the economy), only slightly more than 10% reported that they will take action on the price front. However, more than 40% of negatively affected firms reported lower profit margins on foreign sales and lower Swiss franc equivalent prices. In Q3 2015, the follow-up survey shows that only 10% of negatively affected firms refrain from a response. While more than 50% aimed at reducing costs, the fraction of firms aiming at changing selling prices was still below 20%. The share of negatively affected firms reporting lower profit margins and lower Swiss franc equivalent prices increased to over 70%.

[40] This corroborates the US study by Gopinath and Rigobon (2008) who find that, even when restricting their sample to large exchange rate shocks, the share of unchanged prices remains remarkably stable. Goldberg and Hellerstein (2007) argue that price adjustment costs are higher for manufacturers than for retailers. This may explain the high degree of price stickiness for our domestically oriented manufacturing firms relative to the distinct increase in the frequency of price changes reported by Auer et al. (2017) for retail prices.

[41] See `https://www.nzz.ch/ld.148326`, accessed on 1 September.

[42] In addition, they focus on profit margins, whereas, we focus on markups over variable costs.

Chapter 3

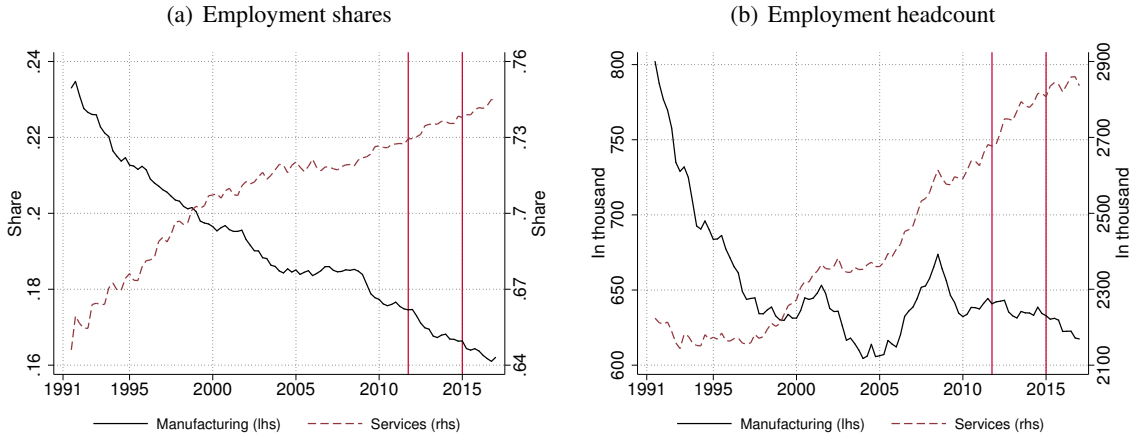
Manufacturing employment after the appreciation

We now turn to study the effects of the Swiss franc appreciation on employment of Swiss manufacturing firms.[1] We have shown in the previous chapter that import prices and export prices that are set in euro declined one-for-one with the sharp appreciation of the Swiss franc. However, export prices set in Swiss francs and prices for products sold on the domestic market declined much less. Based on those observations, there are two channels through which the nominal appreciation may have an effect on employment in manufacturing firms. Swiss products became more expensive relative to manufacturing products produced elsewhere. This is true on the domestic market because domestic prices declined less than the prices of imports. This is also true for export prices set in Swiss francs. The higher relative price could lead to a shrinking market share at home and in world markets, and as a consequence, a downsizing to adjust productive capacities. In addition, we have shown that markups of products priced in euro declined strongly. To restore markups, firms could choose to downsize in order to make production more efficient, or offshore parts of their production process to other countries.

In theory, imperfect price adjustments give rise to temporary employment effects of the appreciation because of relative price distortions, which should vanish once firms have adjusted their prices and wages to new circumstances. It is well known, however, that the share of manufacturing firms in employment in Switzerland has been decreasing since the 1990s, largely because of structural reasons (see Figure 3.1 panel a). This development is by no means unique to Switzerland, but it has stirred worries about deindustrialization in the Swiss public and policymakers in the wake of the recent appreciation. The sectoral shift away from manufacturing employment is a trend ongoing for many

[1] Our focus stays on manufacturing firms. The Swiss producer price index covers mostly manufacturing firms, and we can thus link our employment results to the levels of pass-through observed for the same group of sectors in the first part of the report. There are two exceptions. The price data lacks information on the sectors machinery and equipment and repair and installation. Moreover, for a subset of firms, we can link price and employment data at the firm level, and the results on the link between pass-through and firm employment development will be discussed in the final chapter of the report. But even beyond that, manufacturing is an interesting sector to study in the context of an exchange rate shock, because manufacturing products are mostly tradeable. As a result, in a small open economy such as Switzerland, manufacturing firms are exposed to considerable competition on world markets when exporting, and to import competition from foreign manufacturing firms when selling goods in their domestic market. Furthermore, offshoring parts of the production process to other countries is an option only in sectors with tradeable final or intermediate products. As a result, it is likely that manufacturing firms are more strongly affected by the appreciation than firms in the service sector. Finally, the existing literature mostly focuses on manufacturing employment and our results are therefore easier to compare to existing studies.

Figure 3.1. Employment in the manufacturing and services sectors



Notes: Share of employees in total employment in the manufacturing and services sector (panel a) and number of employees in the manufacturing and services sectors (panel b). The red vertical lines denote the introduction and removal of the exchange rate floor.

years and probably related to technological progress, automation, and globalization, rather than to the nominal appreciation of the Swiss franc. There is indeed little evidence that the share of employment in the secondary sector has declined more strongly in Switzerland than in other countries since the 1990s.[2] It is more likely that manufacturing employment suffers temporarily because of relative price distortions during sharp appreciations of the Swiss franc. Panel (b) shows that actual employment in manufacturing has remained relatively steady since the mid-1990s. By contrast, during times of an appreciating Swiss franc we observe temporary declines in employment that seem to be reversed during times of a relatively weak Swiss franc (for example in the early 2000s and from 2006-2008).

Against this backdrop, we aim to disentangle to what extent the sharp and permanent appreciation of the Swiss franc in January 2015 reduced employment and whether this reduction should be attributed to ongoing structural or cyclical factors. We put special emphasis on controlling for existing trends in sectoral employment that may confound the analysis. We also discuss differences at the employee-, firm- and sector-level. Finally, we examine the speed of the impact and the role of mass layoffs and vacancies.

[2] An international comparison is given in Figure C.1 in the Appendix.

3.1 Related literature

Given the substantial importance exchange rate fluctuations are given in Swiss policy discussions, existing studies find relatively modest effects of an appreciation on employment.[3] Kaiser and Siegenthaler (2016) show that a 10% Swiss franc appreciation is associated with a 2.5% reduction in Swiss manufacturing employment. One reason for the modest effect is that firms with a high share of intermediate inputs may effectively benefit from an appreciation through cheaper imported inputs.[4] Efing et al. (2015) analyze the employment response of publicly listed firms after the substantial appreciation of the Swiss franc in January 2015 and find little impact. The finding comes with the caveat that it applies only to listed firms and only to worldwide rather than Swiss employment. Shifts in labor demand from Switzerland to abroad (offshoring) are therefore not captured. Kaiser et al. (2017) confirm the relatively moderate employment elasticities using tri-annual and annual data from two censuses until 2014. Therefore, the data does not allow to examine the impact of the Swiss franc shock on employment. But, they additionally examine the response of employment of firms participating in the KOF Investment Survey and find that firms with a high exchange rate exposure reduced employment by 6.5% after the removal of the exchange rate floor.[5] Because most of those studies use annual data, little is known about how rapidly an appreciation reduces employment. There is, however, evidence that exchange rate shocks are rapidly affecting economic activity in general. Siliverstovs (2016) finds for Switzerland that the impact on an indicator of the latent business cycle occurs within one year after the appreciation.

Measuring the impact on employment is complicated by the fact that temporary exchange rate fluctuations imply different responses than permanent ones (Gourinchas, 1999). Unanticipated permanent appreciations force firms to lay off unproductive workers immediately. By contrast, if those appreciations are anticipated, firms may be able to optimally smooth layoffs over time. Quite generally, in models with costly adjustment of labor, firms with a certain degree of market power may choose to smooth employment when facing temporary exchange rate fluctuations. By contrast, permanent or very persistent fluctuations are more likely to trigger immediate and larger

[3]This is line with the international evidence mostly showing that the response of employment to exchange rate fluctuations is small. Campa and Goldberg (2001) report a relatively weak response of US manufacturing employment to an appreciation. According to their estimates a 10% appreciation reduces employment only by 1%. They report substantial differences across sectors, however. Sectors with high markups, that is relatively low competition, exhibit a weaker employment response.Moser et al. (2010) support this finding using firm-level data on German manufacturing employment. For Italian firms, Nucci and Pozzolo (2010) estimate the response of employment to be close to the findings by Kaiser and Siegenthaler (2016). In addition, they show that when the currency strengthens, employment falls more strongly for firms with low market power and high import competition. Nucci and Pozzolo (2010) attribute the higher responsiveness relative to Campa and Goldberg (2001) to the fact that currency swings mostly lead to within-sector job reallocation that cannot be detected using industry-level data. Older studies find more significant effects on employment suggesting that this relationship may have changed over time as well. Branson and Love (1988) find that real exchange rate movements are associated with large and significant declines in US manufacturing employment from 1970-1985. Burgess and Knetter (1998) analyze the manufacturing employment impact in G7 countries from 1970-1988 and find that most countries are negatively affected by an appreciation. Only Germany and France appear to be less affected.

[4]In addition, they show that a stronger Swiss franc is associated with higher demand for high-skilled relative to low-skilled workers. They argue that this is because low-skilled work is more substitutable with imported inputs.

[5]Moreover, the overall employment elasticity to exchange rate shocks implied by the KOF/ETH-macro model is somewhat higher. Abrahamsen and Simmons-Süer (2011) suggest that (our own calculations in parentheses) a 7% (10%) depreciation of the Swiss franc would increase overall employment by 2.7% (3.9%).

adjustments in labor demand. In empirical work, permanent exchange rate fluctuations are usually estimated ex-post by in-sample time-series procedures assuming that firms form their expectations as a statistician would. If such a statistical procedure is an imperfect approximation to actual expectations this can distort the estimates.

Another issue is that identifying the causal impact of an exogenous change in the exchange rate on employment is tricky. First, exchange rates and employment change for many different reasons. A surprisingly loose monetary policy stance, for example, may weaken a currency and at the same bolster real activity (see e.g. Eichenbaum and Evans, 1995). By contrast, improvements in technology relative to a foreign economy increases real activity while at the same time appreciate the currency in real terms (see e.g. Enders et al., 2011). Clearly, whether an appreciation is associated with higher or lower economic activity therefore depends on the underlying reason for the appreciation. What is more, to the extent that exchange rate fluctuations endanger price stability and full employment, central banks respond to an appreciation by loosening monetary policy. The response of real activity to exchange rate fluctuations will therefore usually include the expected response of the central bank and therefore the estimated relationship will be subject to the Lucas critique (Gourinchas, 1999). The muted response of employment to exchange rate fluctuations may therefore stem from the fact that central banks and governments take measure to dampen the impact on employment of excessive exchange rate fluctuations. Because central banks rarely refrain from responding to a strong appreciation of the currency, this critique is usually not addressed.

Our main contributions to the literature is therefore that we take into account those concerns and investigate the employment and vacancy response at a relatively high frequency. Moreover, focusing on the Swiss franc shock allows to investigate an unexpected and permanent appreciation. Finally, we can trace back the appreciation directly to the SNB's decision to remove the exchange rate floor and therefore we can rule out that the reason for the appreciation is a sudden increase in Switzerland's productivity relative to the euro area.

3.2 Data

Our data for Switzerland is based on the Swiss *Beschäftigungsstatistik* (BESTA) and covers the period from Q1 2011 to Q4 2016.[6] The BESTA is a quarterly firm survey designed to track short-run fluctuations in the Swiss labor market. It is collected partly at the firm level and partly at the establishment level. Our data is aggregated to the firm level. In 2015, the survey polled 18,000 firms with 65,000 establishments and over 2,000,000 employees.

Firms report the number of employees who are subject to social security contributions at the last work-day of a quarter. For employees with hourly compensation, firms are advised to count the actual number of hours worked in the preceding quarter and divide it by the normal work-time at the firm to obtain the activity level. For persons working overtime, the activity level does not increase but is reported according to the contract. This implies that the data may imperfectly reflect the possibility that firms ask their employees to work more at the same pay. Temporary workers are not attributed to

[6] See Saucy et al. (2002), Renaud (2008), and Renaud et al. (2008) for methodological descriptions of the survey, and the appendix for the survey questionnaire.

the firm surveyed but to the firm that pays the wage, usually a temporary contract firm in the services sector. Employment is reported separately for full-time employees and three different categories of part-time employees. Furthermore, firms report the number of vacancies, and whether they expect employment to increase or decrease in the next quarter. Most variables are reported separately for males and females.

The BESTA covers firms in all sectors of the economy.[7] The sampling procedure is for the most part not random, but designed to produce reliable estimates of quarterly employment for cells consisting of the intersection of the seven Swiss NUTS-2 regions, four size bins and combined groups of 2-digit NOGA sectors.[8] The BESTA sample is redrawn every four years. Unfortunately, the last resampling was conducted in Q2 2015, immediately after the removal of the exchange rate floor. In addition, the sample size was reduced at this point. As a result, many firms vanish from the sample and we cannot estimate the effect of the appreciation for these firms. Instead, we focus on a panel of firms that are observed at least once each year throughout 2014, 2015 and 2016. We refer to this data set as the "balanced" sample in the remainder of the report. This decision implies that we neither account for firms exiting the sample because they went bankrupt after the appreciation nor for new firms entering the market. We may speculate that our results therefore underestimate the fall in employment because, right after the appreciation of the Swiss franc, firms were more likely to go bankrupt than new firms were entering the market. Kaiser et al. (2017) provide evidence that backs up this view. They show that after a 10% appreciation, the annual probability of exiting the market increases by 0.3 percentage points for firms that are heavily exposed to exchange rate fluctuations.[9] However, absent more information on actual firm entry for our estimation sample we should be careful to assume a bias in a particular direction.[10]

Fortunately, the balanced sample still comprises a substantial number of firms. First, this is because many large firms with numerous establishments prefer to deliver employment data directly without being surveyed and are therefore in the sample permanently. Second, in cells that are very small, the SFSO surveys every firm in the population to make sure that the number of observations is sufficient. Third, all firms above a cell-specific employment threshold will be included in the sample. These firms will also be in the sample permanently unless their employment falls drastically or the threshold changes. The remaining randomly drawn firms constitute only for about one third of the full BESTA sample.

Table 3.1 illustrates the effective sampling rates and sizes for firm size bins and sectors for the initial BESTA sample and the balanced sample that we use in our estimation.[11] The initial sample of the BESTA covers 12% of Swiss manufacturing firms in the last quarter of 2014. These firms account

[7] The response rate to the survey is above than 80% and telephone interviews conducted by the SFSO indicate that it is unlikely to lead to a relevant bias.

[8] For example, the 23 2-digit manufacturing industries 10–33 are summarized to 12 sectoral bins. To make the exposition consistent with the price data we show results according to the manufacturing sectors as defined in the KOF Innovation Survey.

[9] They define exposure as the share of revenues earned in exports minus the share of imported intermediate inputs.

[10] At least, we also observe a clear deceleration of employment in available aggregate employment data based on the BESTA and the ETS (see Figure C.2). This indicates that the appreciation also had an impact on total manufacturing employment.

[11] The numbers for the population are taken from a complete 2014 census of Swiss firms (STATENT).

for 71% of Swiss manufacturing employment. It includes 5% of micro enterprises, 22% of small firms, 77% of medium sized firms and the universe of large firms with more than 249 employees.[12] The effective sampling probabilities in the BESTA are increasing in firm size and medium-sized and large firms are substantially overrepresented. In the balanced sample, the oversampling of large firms is even more pronounced. The effective sampling rate is less than 1% for micro enterprises, 5% for small firms, 36% for medium sized firms and 67% for large firms. The balanced sample still accounts for 46% of manufacturing employment, but it is not representative for the population of Swiss manufacturing firms. We also examined the coverage rates by sector bins. There is substantial heterogeneity in the coverage rates, but this is largely driven by heterogeneity in the size composition of different sectors.[13]

Table 3.1. Effective sampling rates by size in the overall BESTA and the estimation sample

	BESTA			Balanced sample		
	Firms	Empl	N Firms	Firms	Empl	N Firms
Overall	0.12	0.71	5095	0.03	0.46	1401
Micro firms	0.05	0.07	1547	0.0	0.0	65
Small firms	0.22	0.27	1657	0.05	0.07	370
Medium firms	0.77	0.84	1499	0.36	0.42	708
Large firms	1.02	1.07	392	0.67	0.85	258

Notes: The table shows effective sampling rates of manufacturing firms and employees in Q4 2014 in the BESTA survey and in the balanced sample. Population values are taken from the 2014 census of the universe of Swiss firms (STATENT). Micro firms: less than 10 employees. Small firms: 10-49 employees. Medium firms: 50-249 employees. Large firms: more than 249 employees.

Based on the numbers for the balanced sample it is clear that we cannot conduct a meaningful analysis of micro enterprises. While these enterprises make up almost 80% of Swiss manufacturing firms, they cover just about 10% of employment. These firms constitute an important part of the Swiss economy, but the average size of these enterprises is only about 2.4 full-time equivalent workers. Therefore, we expect that those firms have little room to reduce the number of employees. Rather, the relevant decision is about entering the market or shutting down the business altogether. However, even excluding micro enterprises, neither the original BESTA sample nor the balanced sample are representative of the population of small, medium and large firms, since the sampling rate is increasing in firm size among these bins as well. We address this challenge in two ways. First, firms should be representative for the overall population within each bin, and we will present most results separately according to firm size. Second, we will present reweighed results. In this case we reweight the

[12] The effective sampling rate for large firms slightly exceeds 100%. The STATENT is based on social security data, while the BESTA is based on a survey. We think that both employment numbers and size classification based on the BESTA are subject to some measurement error. Furthermore, the definition of a firm may differ between the business register (which the BESTA sample is based on) and social security data.

[13] The results are shown in Table C.1 in the Appendix. Once we control for size composition only textiles and transport equipment are slightly oversampled.

observations to be representative of the population of Swiss manufacturing firms with more than 10 employees. We use the inverse sampling rates computed for combinations of firm size and sector to achieve this. We do not use this specification as our baseline because putting a large weight on a small group of small firms—whose employment is rather volatile in the first place—goes along with a substantial loss in the precision of the estimates.

In addition we use employment data for Austria to construct a control group that was not affected by the sharp appreciation of the Swiss franc. The data is based on the Austrian Social Security Database (ASSD), which covers the universe of all firms that employ workers subject to social security contributions. The ASSD is described in more detail in Zweimüller et al. (2009). We construct quarterly firm level employment data by taking the number of employees at the last day of each quarter for each firm. This corresponds to the reference day used in the BESTA. Because the ASSD includes all employees that are subject to social security contributions, the concept of employment used in this calculation is equivalent to the one used in the BESTA, except for potential minor differences between Austria and Switzerland in who is subject to such contributions.

In contrast to the BESTA, the data for Austria covers the universe of firms. To make the Austrian control group comparable to the Swiss data we apply three restrictions for a firm to be included in the sample. First, we include a firm only if it appears in the data in 2014, 2015 and 2016. Second, we drop micro enterprises with less than ten employees from the Austrian data. Third, we drop small firms with strongly seasonal employment patterns from the Austrian data.

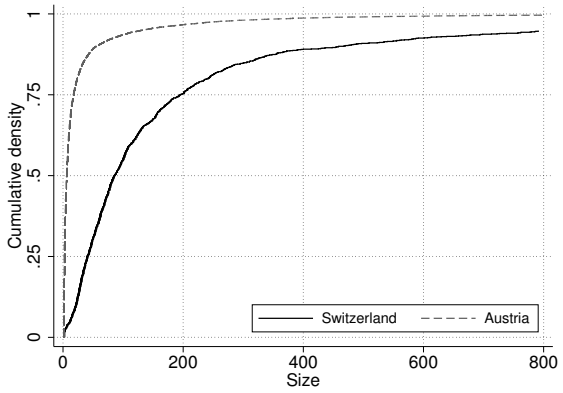
The first two restrictions simply mirror the sampling decisions necessary for the Swiss data. We therefore ensure that we treat firms consistently over the two data sets and make the samples more comparable in terms of the firm size distribution. The Austrian register data covers the universe of firms and just as in the Swiss universe, most firms in Austria are micro enterprises. Figure 3.2 shows the firm size distribution for Austria and in Switzerland in the last quarter of 2014. The baseline sample restriction in place for all three figures is that firms are in the data from 2014 to 2016. Panel (a) shows the distribution of all firms that survive this restriction. As expected, the Austrian data contains many more small firms. Panel (b) shows the firm size distribution in our final estimation sample that excludes micro enterprises. The firm size distribution is more similar, but the Austrian sample still includes more small firms. Finally, panel (c) shows the firm size distribution for firms with more than 49 employees. This illustrates that while the Austrian sample covers more small firms, the distribution looks very similar in both countries for larger firms. We also examine the distribution of firms across sectors in Switzerland and Austria. Not unexpectedly, the importance of specific manufacturing sectors is different. For example, manufacturing of chemicals and pharmaceuticals, as well as of electronic and optical products (including watches) is more important in Switzerland than in Austria (see Figure C.3).[14]

The third restriction deals with the qualitative difference between our Austrian and Swiss employment data with respect to the extent of seasonality. Employment in Austria is substantially

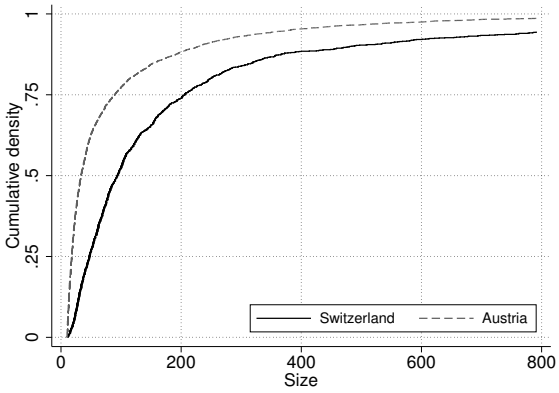
[14]We will deal with the apparent discrepancies in the size distribution, and to a smaller extent, sector distribution as follows. First, we control for common time-varying factors at the sector level. Second, we present most results for different samples according to firm size. Third, we conduct a robustness check, in which we match every Swiss firm in our sample with exactly one Austrian firm from the same sector, based on criteria that should balance both the sectoral and firm size distribution between both groups.

Figure 3.2. Firm size distribution in Switzerland and Austria

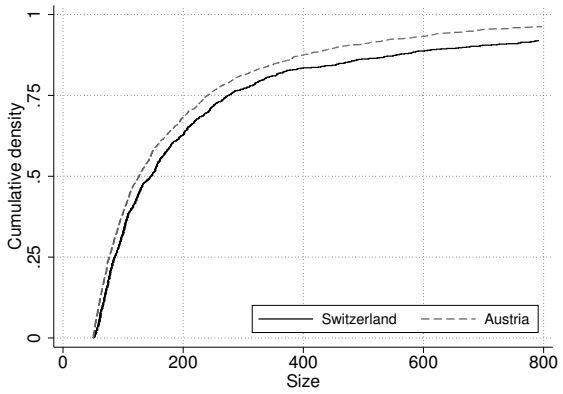
(a) All firms



(b) Estimation sample



(c) Only medium and large firms



Notes: Cumulative firm size distribution in 2014. Panel (a) shows all firms in the available data sets, panel (b) shows the distribution for the estimation sample including small firms and panel (c) the distribution for the estimation sample excluding small firms.

more seasonal than in other European countries, with a peak in the summer months and troughs in the last and first quarters of a year. This phenomenon has been documented, among others, by Del Bono and Weber (2008). A large part of the cyclical variation is driven by construction and tourism sectors, but strong seasonality is also a feature of manufacturing employment. Del Bono and Weber show that this seasonality is largely driven by firms laying off workers during the winter months only to recall them several months later. In the manufacturing sector, small firms are responsible for the biggest part of seasonal fluctuations.[15] The Swiss data exhibits much less seasonality. We therefore exclude small Austrian firms that show the strongest seasonal patterns from our control group.[16] We do not exclude any medium sized or large firms. This restriction makes our results clearer and more easily interpretable. None of our conclusions would be altered qualitatively or quantitatively, however, by including seasonal firms.

3.3 Time-series evidence on the employment impact

In the first part of our analysis, we present evidence on the effect of the Swiss franc shock on manufacturing employment. In particular, we compare the average percentage differences in firm employment to a reference point in the fourth quarter of 2014, one period before the shock. To be concrete, the model we will estimate is given by:

$$emp_{jt} = \gamma_j + \sum_{k \neq -1} \alpha_k D_t^k + \varepsilon_{jt}, \quad \text{for } t = t^* - 8, \ldots, t^* + 7 \,. \tag{3.1}$$

This model effectively estimates the average percentage change in the employment relative to the last quarter of 2014 for all time periods in our sample. Our outcome variable is the logarithm of employment in firm j at time t. The coefficient γ_j is a fixed-effect that controls for differences in employment in the reference quarter. Our sample covers the time period from the first quarter of 2013, eight quarters before the shock, to the last quarter of 2016, seven quarters after the shock. For each quarter except the reference quarter, the model is saturated with dummy variables ($D_t^k \equiv \mathbf{1}_{\{t=t^*+k\}}$), which equal one if the corresponding time period occurs k periods after the removal of the exchange rate floor in $t^* =$ Q1 2015. The α_k coefficients associated with these dummies then estimate the average logarithmic difference in employment to the reference quarter. Consequently, they should be interpreted as (semi) elasticities. The standard errors of all estimates are clustered at the firm level and robust to the likely scenario of autocorrelation in the error term ε_{jt}.

For interpretation of the results, three remarks are in order. First, this is a simple descriptive procedure and a causal interpretation of these estimates requires strong assumptions. Interpreting the change in employment relative to the reference quarter as a causal effect of the appreciation is only

[15] See Figure C.4.

[16] We calculate a firm specific seasonality measure. In particular, we calculate the quarterly deviation from a four quarter moving average of employment for each firm and compute the average for each quarter. We then calculate the difference between the quarter with the largest (positive) deviation and the quarter with the smallest (most negative) deviation from the moving average for each firm. We then exclude small Austrian firms whose peak-to-through difference is above the 50th percentile.

reasonable, if the reference quarter is a good counterfactual for subsequent employment dynamics in case the exchange rate floor would have stayed in place. It turns out that, on average over the entire sample, employment is flat and stable in the two years before the appreciation. The insignificant pre-shock trend and the fact that producer price inflation and GDP growth have converged to roughly the same values as in the euro area before the appreciation (see chapter 1) make a causal interpretation tempting.

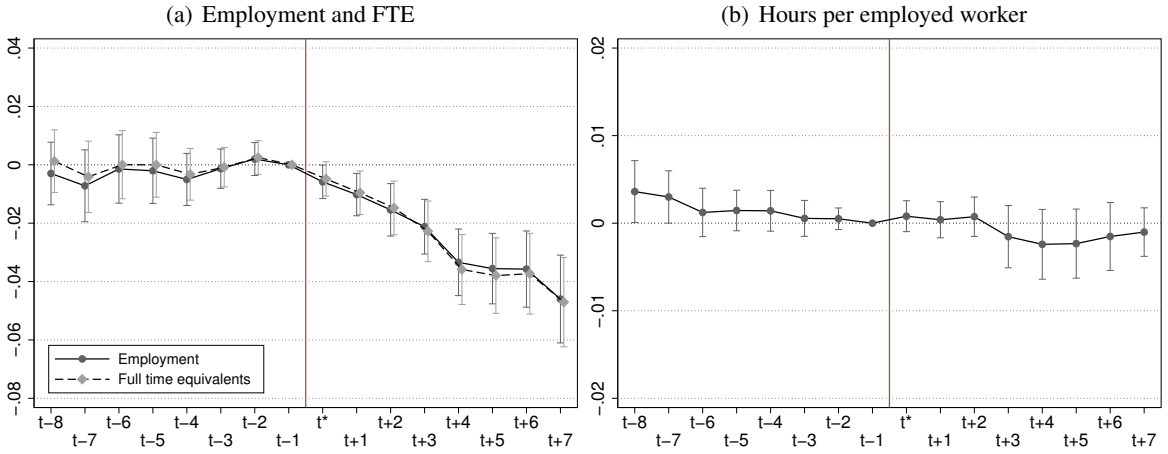
Second, for a causal interpretation we need to assume that no other shocks than the appreciation confound our estimates. In our case, this means that we have to assume the absence of other events that may have affected the employment development in an average Swiss manufacturing firm after the appreciation. While we do not think this assumption holds in a strict sense, we view it as relatively unproblematic given the stable development of manufacturing employment before the shock and the relatively stable international environment before and after the shock. However, we will relax both assumptions in the next section to corroborate our conclusions.

Third, our main outcome variable throughout this chapter will be the logarithm of firm level employment. While this variable is closely linked to percentage changes in aggregate manufacturing employment produced by the SFSO based on the same survey, there are important differences to keep in mind. The mean change in firm level employment is not equal to the change in aggregate employment. This is best illustrated by a simple example. Suppose there are two firms, one with 1000 and one with 10 employees. After the exchange rate shock, the larger firm reduces employment by 20% to 800 employees. The smaller firm reduces employment by 10% to 9 employees. Our analysis would correctly report that firms on average reduced employment by 15%. However, total manufacturing employment in this example declined by 19.9%—clearly the large firm is much more important for aggregate employment than the smaller one. Moreover, the SFSO adjusts its extrapolation for changes in the population of firms based on current numbers obtained from the Swiss business register. For example, it will increase the sampling weight of firms in sectors with net entry and decrease the weights of sectors with net exit rates to account for the change in aggregate employment caused by entry and exit of firms. In contrast, our sample and weights are fixed in 2014 in order to be able to estimate firm-level changes relative to the period before the appreciation. Our analysis is concerned with average changes in the employment of firms existing before the shock and does not account for the entry of new firms. Furthermore, since we cannot distinguish exit from the sample from the closing of a firm, we condition on survival of the firm to the end of 2016 and do not take into account changes in employment due to firms that close down.

We find that the 10% permanent appreciation of the Swiss franc had a substantial impact on the employment decisions of manufacturing firms. Figure 3.3 shows log-employment relative to the last quarter of 2014 for all firms in the balanced sample. For the two years before the appreciation, the development of employment is remarkably flat and not significantly different to the reference quarter. Immediately after the appreciation employment starts to decline for several quarters. The decline is swift with most of the impact occuring within the first five quarters after the shock. For the average manufacturing firm employment decreased by 2.1% by the end of 2015, and by 4.6% by the end of 2016.

We perform several robustness tests. Since our sample overweights medium and large firms

Figure 3.3. Impact on employment and hours



Notes: Impact on average employment and hours per employee. The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

relative to smaller firms, we reweight the balanced sample to be representative of the distribution of manufacturing firms over firm-size and sector bins. For brevity we show Figure C.5 only in the Appendix. This reweighing puts a lot of weight on a small number of small firms and, as a result, the estimates are less precise. The weighted estimates are smaller and suggest a less gradual decline, but are still significant both statistically and economically. Firms reduced employment by about 1% by the end of 2015, and by 3.3% by the end of 2016. Importantly, the weighed estimate is not statistically different to our preferred unweighted baseline. In addition, we examined whether the estimates are insignificantly different from zero three years before the shock. On average, this is the case increasing our confidence in the assumption that the Q4 2014 is a valid counterfactual. Finally, our results may overestimate the actual decline in employment if firms chose to layoff people only to hire them again through temporary work companies.[17] This could make sense to the extent that the collective labor agreement for temporary workers envisages a lower minimum wage or if there is no minimum wage at all for temporary workers, which is the case for six manufacturing sectors.[18] To examine this question, we investigate the official series of employment in the NOGA sector 78 (employment activities) according to the BESTA. Employment in this sector remained flat (compared to a year earlier) after the removal of the exchange rate floor. This suggests that there were no measurable movements from the manufacturing sector towards temporary work contracts.

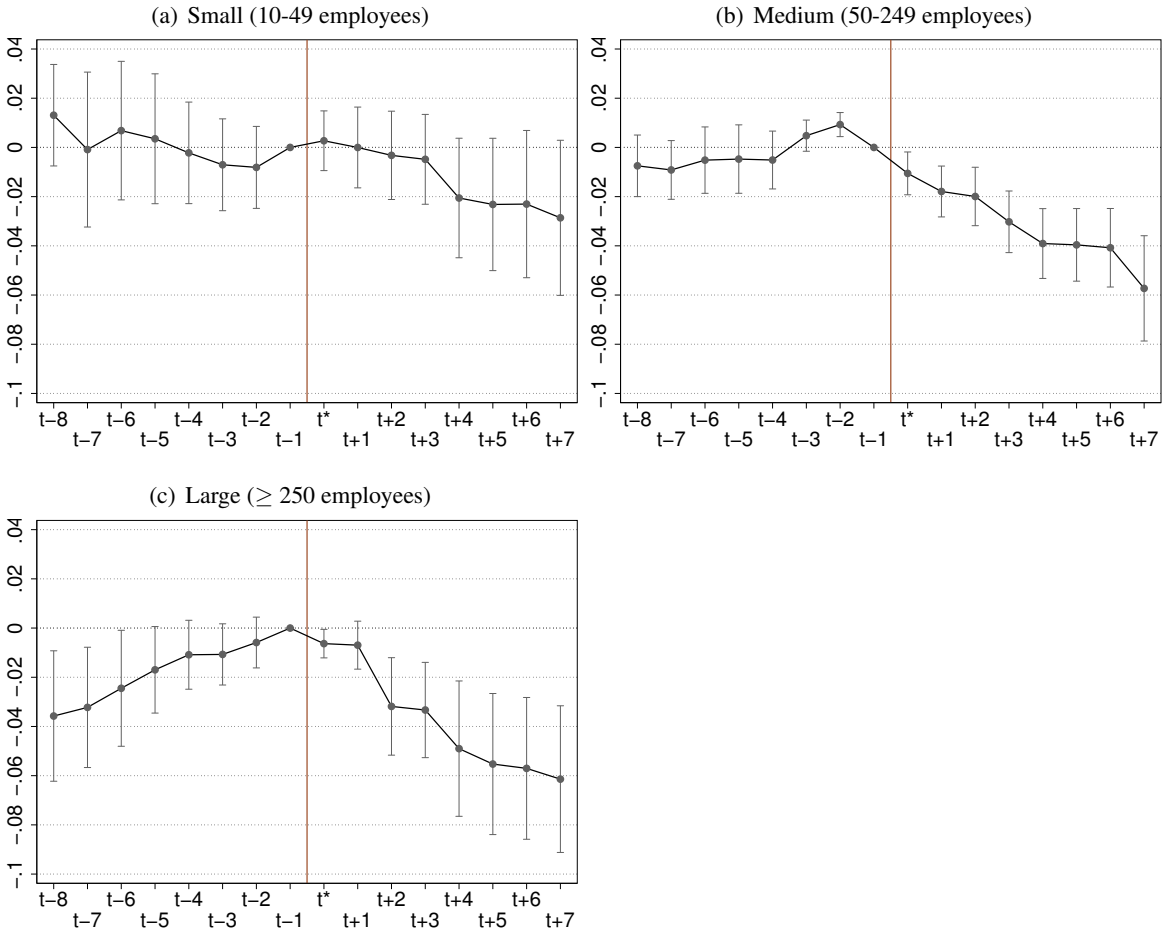
Figure 3.3 also shows that the reduction in employment occurred mostly through a lower headcount rather than a reduction in hours worked. The development of employment headcounts is almost identical to the development of full-time equivalents. This is also mirrored in panel (b), which shows

[17] Workers are directly hired by those temporary work offices and attributed to the NOGA sector 78 (see SFSO, 2008).

[18] This is the case for chemicals, pharmaceuticals, machinery and equipment, food, print, and watchmaking (see `http://www.tempservice.ch/tempservice/dynasite.cfm?dsmid=118304`, retrieved on 15 August 2017).

no significant change in the development of log-hours per employee.[19] Note that BESTA asks only for the contractually agreed working hours so that the data do not allow to examine the popular notion that firms increased working hours at the same pay. Because of the negligible difference between number of employees and FTE we will show results only for employment headcounts unless otherwise stated.

Figure 3.4. Impact on employment by firm size



Notes: Impact on average employment by firm size. The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

In Figure 3.4, we separate firms by their size in 2014.[20] Employment in small firms is flat before the appreciation and in the first four quarters afterward. We find a moderate decline of 2.9% by the end of 2016. This decline is insignificant at a 5% confidence level but borderline significant at the

[19] Log-hours per employee are calculated as the log ratio of full-time equivalents to employees. This is equivalent to log-hours up to an additive constant.

[20] We find no significant change in employment relative to the reference quarter for micro enterprises. However, due to the small number of micro enterprises —our balanced sample includes 74 micro enterprises with less than 10 employees—, the estimates for this group are very imprecise. Furthermore, we think that conditioning on survival after the appreciation may affect conclusions for this group more than it does for larger firms, since micro enterprises may be more likely to exit in response to a big negative shock.

10% level. By contrast, employment falls strongly and rapidly for medium-sized and large firms. In medium-sized firms, employment is stable during the two years before the shock, with a slight uptick in Q3 2014. Immediately after the removal of the exchange rate floor employment starts to decline substantially: by the end of 2015 by 3% and by the end of the 2016 by 5.7%. Panel (c) shows that large firms exhibit significant growth before the appreciation. On average, those firms grew by 3.6% from the beginning of 2013 to the end of 2014. This trend breaks immediately upon the removal of the exchange rate floor. By the end of 2016, large firms have shrunk by 6.1% relative to the reference quarter. This illustrates nicely that we cannot interpret the reduction in employment as a causal effect on employment because we do not know whether employment of large firms would have continued to grow at a similar pace without the removal of the exchange rate floor. If this would be the case, we would therefore underestimate the impact of the appreciation.

Are domestically oriented firms more or less affected than export-oriented firms? It turns out that we find no significant differences. To make this distinction, we use two different sources of information. First, we use information from the price data survey to indicate whether a firm is an exporter (reports an export price) or not (reports only a domestic price).[21] Because we can match the two data sets only for a subsample of firms, those results are more uncertain. Second, we use sectoral information from the KOF Innovation Survey to determine sectors with high export-orientation (more than 27% of revenues from exports) or low export-orientation.

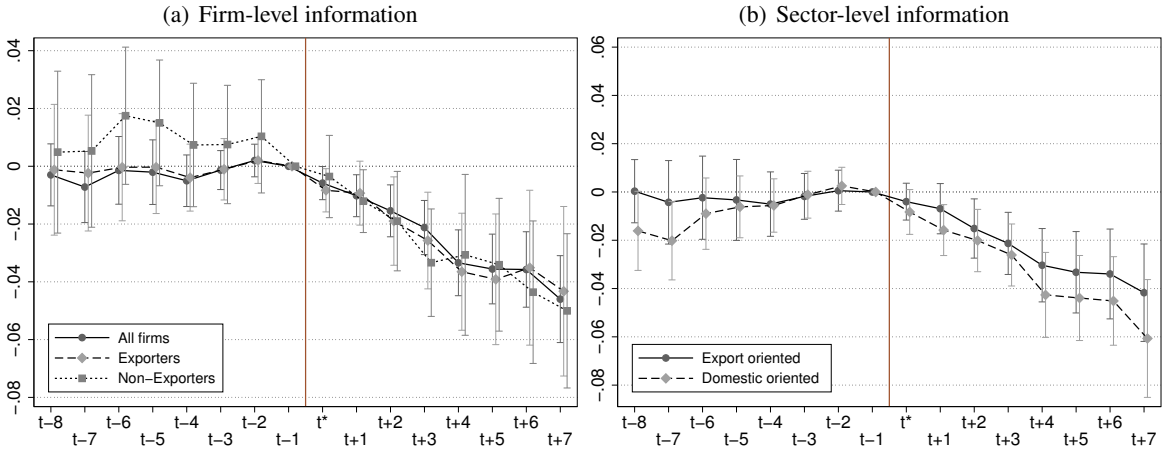
Figure 3.5 panel (a) shows that there are no significant differences between exporters or non-exporters. This is consistent with the idea that in a small open economy such as Switzerland, import competition makes exchange rate variation as relevant to firms producing tradeables for the domestic market as it is for exporting firms. This argument is reinforced by our results on prices, where we show that, first, pass-through into import prices is complete for capital and intermediate goods and happens rather quickly, and second, that domestic prices respond not significantly different to exports that are also denominated in CHF. This is corroborated when using sector-level information to determine the export-orientation. For both groups of sectors we observe a similar decline in employment. This implies that export-oriented firms, which are likely to be more productive[22], have reduced employment similarly as less productive firms oriented toward the domestic market.

We now analyze the development of different groups of employees. The data allows us to distinguish between female and male employees. The share of female employment in the manufacturing firms in our sample is about 30% in 2014. Figure 3.6 panel (a) shows that, prior to the appreciation, there is a slight upward trend in female manufacturing employment. Female employment stops growing immediately at the time of the appreciation and declines by 4.5% during the two years after the shock. By contrast, male employment is stable in the two years before the shock and it declines more slowly thereafter. By the end of 2016, the decrease in male employment amounts to 3.6%. A similar pattern emerges in the comparison of part-time and full-time employment. There

[21] Our identification of exporters and non-exporters relies on our match with price data: exporters are firms that report an export price, and non-exporters are firms that report a price for the domestic market but no export price. We can match 33% of the firms in our balanced sample to the PPI price data, and of those firms, 67% are exporters and 33% are non-exporters.

[22] There is a large literature showing that exporting firms are more productive, pay higher wages, and perform better along a variety of other indicators. This reflects a selection of the most productive firms into exporting. See e.g. Bernard et al. (2007) for an overview of the evidence.

Figure 3.5. Impact on employment by export-orientation



Notes: Impact on average employment for Switzerland. Panel (a) uses information from the price data survey to indicate whether a firm is an exporter (participates in the export price survey) or not (participates only in the producer price survey). Those results are based on a substantially smaller sample. Panel (b) uses sectoral information from the KOF Innovation Survey to determine sectors with high export-orientation (more than 27% of revenues because of exports) or low export-orientation. The red vertical line denotes the removal of the exchange rate floor.

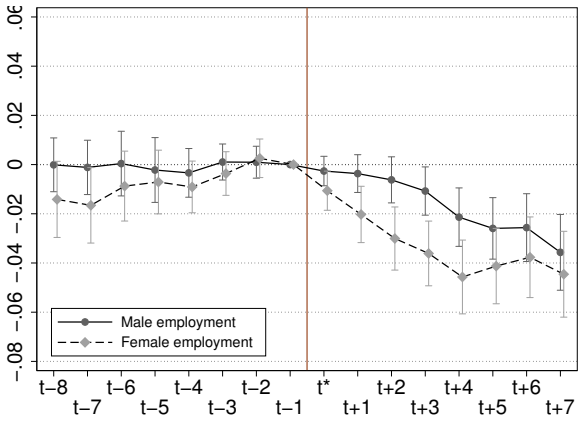
is a slight upward trend in part-time employment before the shock, which reverses at the time of the appreciation. Full-time employment is stable before the shock and declines by about 4.8% thereafter. This pattern is consistent with the idea that more women work part-time and were also more strongly affected by the appreciation.

We also analyze the evolution of the employment of cross-border workers. This group of workers is interesting because after the appreciation, new hires may be more likely to accept a lower nominal Swiss franc wage with the same purchasing power in their place of residence. Also, there is anecdotal evidence that some current cross-border workers may be paid in euro rather than Swiss francs. If nominal wages of Swiss workers are not adjusted downwards, the appreciation would make cross-border workers relatively cheaper. We observe an upward trend in cross-border employment during 2013 and 2014. This growth comes to a halt during 2015, however, in contrast to other workers, the employment of cross-border workers does not decline. As a result, the share of cross-border workers in total employment increased more quickly in the four quarters after the appreciation than during 2014. The development of cross-border employment is similar when we restrict the sample to include only firms in border cantons.[23]

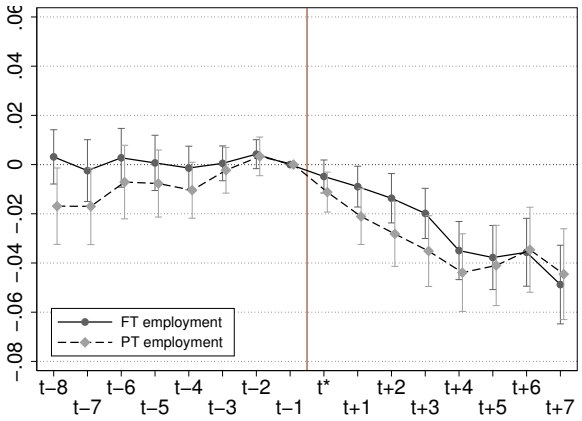
[23]This is partly consistent with Bello (2017), who shows that cross-border traffic in Ticino increased substantially after the removal of the exchange rate floor. She finds the effect early in the morning (from Italy to Switzerland) in the afternoon (from Switzerland to Italy) and in the late morning (for both directions). She argues that the first two effects are mostly because of cross-border workers and the third effect due to cross-border shopping.

Figure 3.6. Employment response by employee characteristics

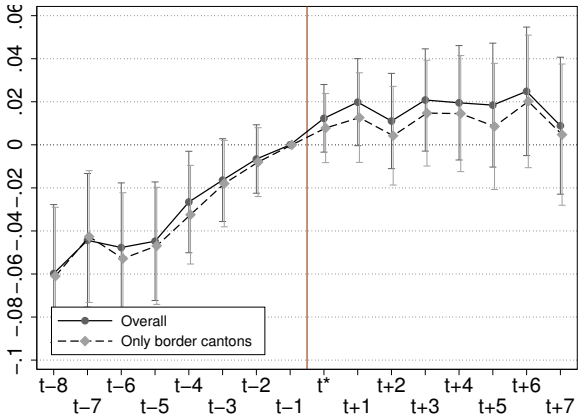
(a) Male and female employees



(b) Full-time and part-time employees



(c) Cross border workers

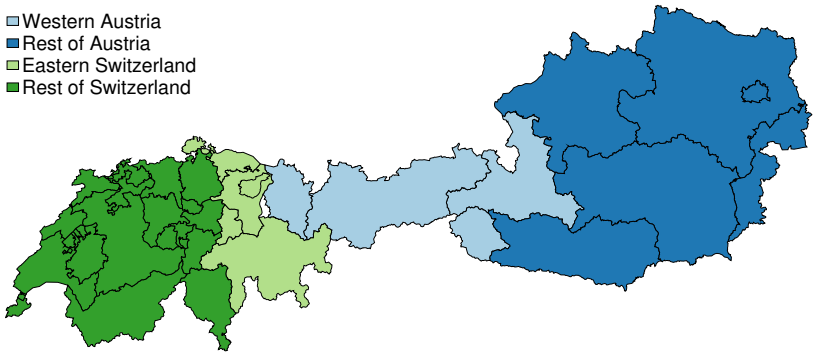


Notes: Impact on average employment by employee characteristics. The responses are measured in logarithms and normalized to zero in Q4 2014. Part-time employment are working less than 90%. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

3.4 Evidence from a counterfactual

The previous section suggested that the appreciation of the Swiss franc indeed reduced manufacturing employment in Switzerland. However, we cannot rule out an influence of other simultaneous developments such as international demand shocks or changes in sectoral trends. To alleviate this concern we compare the development of firms in Switzerland with similar firms in neighboring Austria. This comparison rests on the idea that the development of similar firms in Austria during 2015 and 2016 constitutes a valid counterfactual to employment dynamics in Swiss firms had the exchange rate floor not been abolished.

Figure 3.7. Geography of treatment and comparison group



The geography of our treatment and control groups is illustrated in Figure 3.7. The primary control group will consist of manufacturing firms in all of Austria that we compare to manufacturing firms in all of Switzerland. We also conduct robustness checks using just the geographically closest western Austrian states of Vorarlberg, Tirol and Salzburg and compare them to eastern Switzerland. Besides the geographical proximity, Austria is similar in many respects. Although Switzerland is not part of the EU, Switzerland and Austria are both member states of the European Single Market (with some exceptions) and the Schengen area with free movement of persons. Both countries are textbook examples of small open economies. In 2016, Switzerland had a population of 8.4 million and Austria of 8.8 million people. The share of exports in GDP is 63% in Switzerland and 53% in Austria. The most important destination of exports and source of imports for both countries is Germany. In Switzerland, Germany accounts for 19% of exports and 28% of imports. In Austria, Germany accounts for 29% of exports, and 36% of imports. Despite their geographical proximity, Austria and Switzerland do not make up a very large share in each others' trade flows due to their small sizes. Austria accounts for 3% of Swiss goods exports and 4.8% of Swiss goods imports.

One major difference, of course, is that Switzerland is not part of the euro area. In this respect, it is important that the exchange rate floor had been in place for more than three years and that the SNB effectively stabilized the CHF/EUR also after the removal of the exchange rate floor. Therefore, the main difference between Austria and Switzerland is the one time revaluation of the CHF/EUR exchange rate. This is corroborated by the fact that Swiss producer price inflation and GDP growth converged to the euro area during the exchange rate floor. The comparison with Austria enables us to credibly estimate causal effects of the appreciation on employment. The assumptions underlying

this causal interpretation is that absent the appreciation the dynamics of employment at Austrian and Swiss manufacturing firms would evolve in the same way.

Based on this assumption, we estimate the causal impact on Swiss manufacturing employment using the following difference-in-differences model:

$$emp_{jt} = \gamma_j + \phi_{ts(j)} + \sum_{k \neq -1} \alpha_k (D_t^k \times CH_j) + \varepsilon_{jt} \tag{3.2}$$

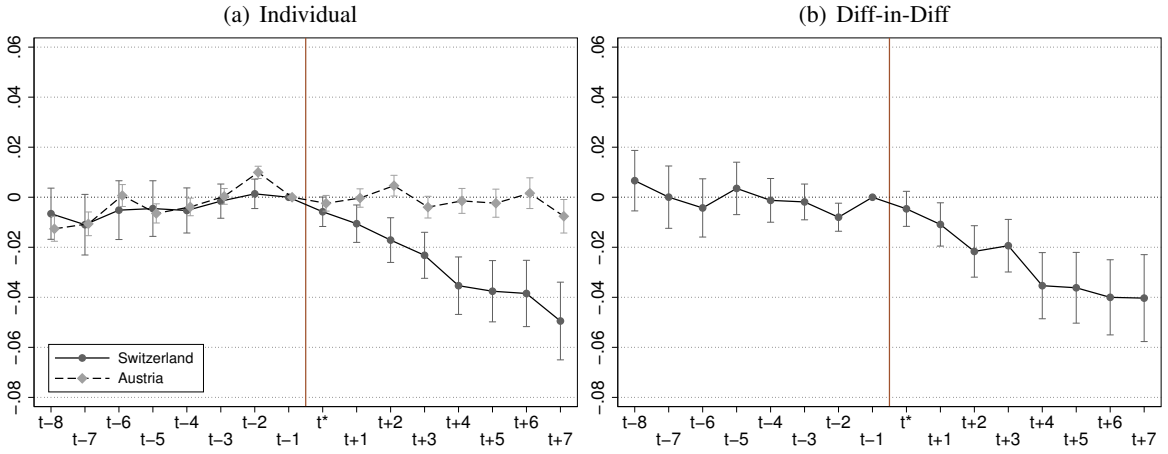
This model estimates the average difference in the percentage change in employment relative to the last quarter of 2014 between firms in Switzerland and firms in the same sector in Austria,—hence difference-in-differences. Again, we estimate these differences for all time periods between 2013 and 2016. This specification is estimated using a combined sample of Swiss and Austrian firms. In contrast to the previous specification, the coefficient $\phi_{ts(j)}$ is an additional time-sector fixed effect that absorbs changes in employment that are common to both Austrian and Swiss firms in a sector ($s(j)$) at any time (t). The event-dummies are now interacted with an indicator CH_j for Swiss firms. The coefficients α_k estimate the differences between Austrian and Swiss firms k quarters after the shock.

The use of the Austrian control group allows us to relax several assumptions. Most importantly, international shocks to demand or productivity in specific industries would be absorbed in the time-sector fixed effect. Ongoing deindustrialisation and automation trends that affect certain sectors or manufacturing as a whole therefore do not confound our results if they equally affect manufacturing firms in Austria and in Switzerland. To convince the reader that Austrian firms are indeed a good counterfactual for Swiss firms we can examine the period before the appreciation and show that employment has indeed moved in parallel when the CHF/EUR exchange rate was practically fixed. Ideally, the dynamics of employment closely resemble each other before the shock, and any gap that emerges at the time of the shock can then be interpreted as a causal effect.

A critical assumption underlying our approach is that the appreciation against the euro did not affect firms in Austria. But if Swiss products become more expensive, customers could potentially switch to Austrian manufacturers. Therefore, Austrian employment could be positively affected by the CHF/EUR appreciation and therefore the diff-in-diff approach would overestimate the impact on Swiss employment. We do not believe such a bias is quantitatively important. Switzerland and Austria are small relative to the European single market as a whole: the share of Austria in its manufacturing production is just 1.2%, and the share of Switzerland is 1.9%. The shares of other countries in the single market's total production should be a basic indicator for the magnitude of potential gains in the case of Swiss market share losses. This would suggest that any decline in the market shares of Swiss firms would primarily benefit producers in other countries, and that the effect of the appreciation on firms in Austria is quantitatively unimportant.

The comparison with Austrian firms confirms that manufacturing employment in Switzerland suffered substantially after the Swiss franc shock. Figure 3.8 panel (a) shows separate estimates using Eq. (3.1) for Austria and Switzerland. Before the appreciation of the Swiss franc, employment in manufacturing is following a similar slight upward trend in both countries. After the appreciation employment in Switzerland starts to decline while employment in Austria stays flat during the

Figure 3.8. Impact on employment relative to Austria



Notes: Impact on average employment for Switzerland and Austria (panel a) and diff-in-diff estimates (panel b). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

two following years. The difference-in-differences comparison between Austria and Switzerland in panel (b) estimates the causal effect as the difference visible in panel (a) while controlling for contemporaneous sectoral trends. The estimates suggest that Swiss firms shrank by 1.9% relative to their Austrian counterparts by the end of 2015, and by 4% by the end of 2016. Because Austrian employment remained relatively stable in 2015 and 2016 we conclude that most of the decline we observe in the previous section is due to the appreciation rather than structural shocks affecting the manufacturing sector.[24]

We checked the robustness of this result by comparing only manufacturing firms in eastern Switzerland with firms in the neighboring regions in western Austria. These regions are geographically closer, all German speaking, and may be even more similar than Switzerland and Austria as a whole. The same conclusion emerges from the narrower comparison (see Figure C.7). Moreover, we construct an artificial control group by matching each Swiss firm with one Austrian firm in the same sector.[25] In this case we estimate Eq. (3.2) with a time-firm-pair fixed effect. The matching estimator also yields very similar estimates, suggesting that Swiss firms shrank by 1.1% by the end of 2015 and by 4.6% by the end of 2016. The two diff-in-diff specifications corroborate the validity of our approach: before the appreciation, there are no significant differences in the employment dynamics of Austrian and Swiss manufacturing firms, suggesting that Austrian firms are indeed a good control

[24] We also find that employment in the tertiary sector declined significantly relative to Austria (see Figure C.6). The pre-shock coefficients of the diff-in-diff are not significant for four quarters before the shock but are significant for two years before the shock. This indicates either that Austria is not an ideal control group or that services sector employment took more time to converge. Because employment in the Swiss services sector increased more strongly before the shock than in Austria, we may even underestimate the impact of the appreciation on employment in the services sector.

[25] We pair each Swiss firm with the Austrian firm in the same sector that most closely resembles the employment dynamics of the Swiss firm before the shock. In particular, for a Swiss firm i we choose the Austrian firm j that minimizes $\sum_{t\in[2013Q1,2014Q4]}(lemp_{it} - lemp_{jt})^2$. The advantage of this specification is that it balances the sector and size distribution between treatment and control.

group for Swiss firms.[26] We also examined the estimates including small seasonal firms. Our main conclusions remain unchanged (see Figure C.8).

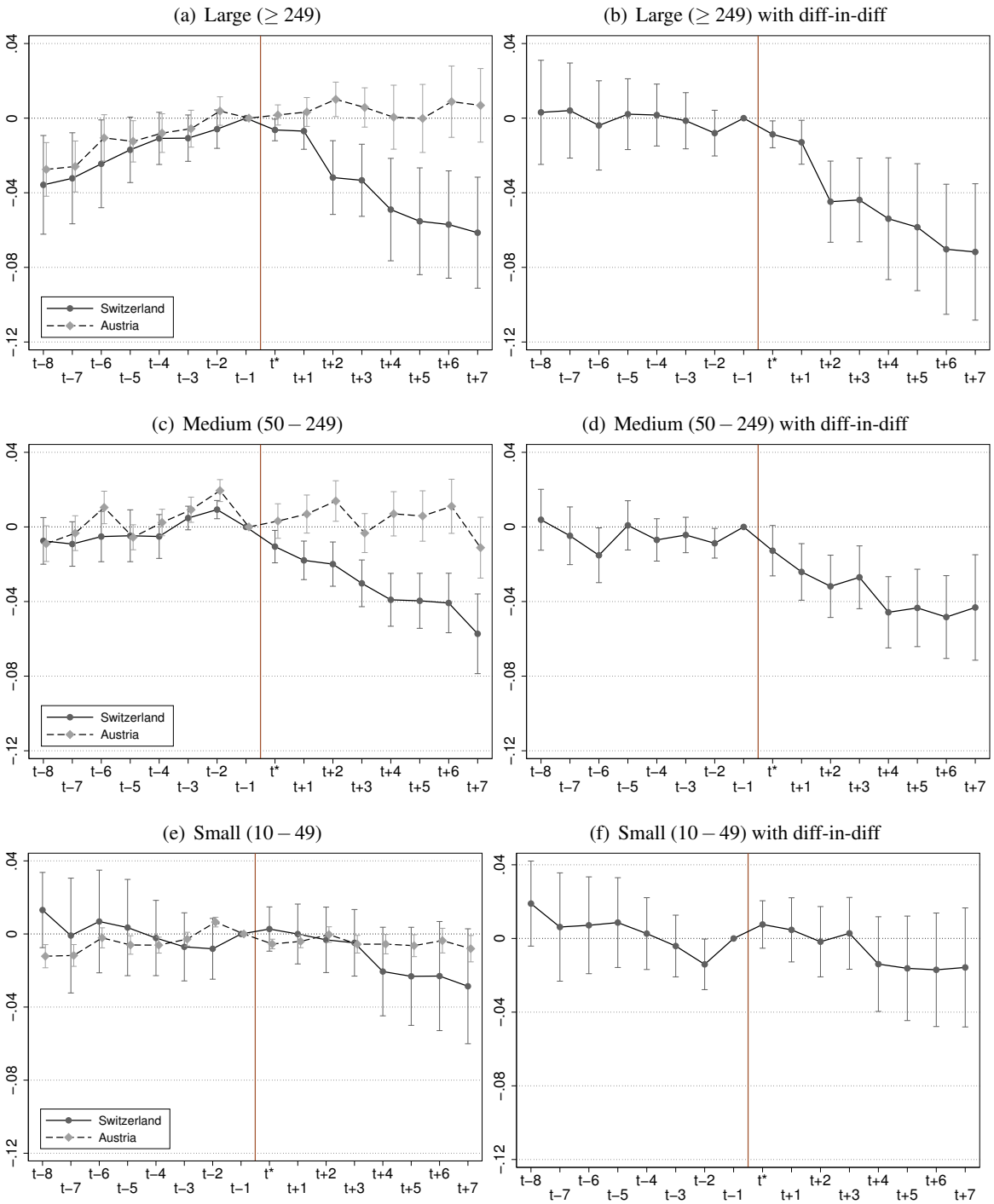
An ongoing narrative is that the appreciation hurts mainly relatively unproductive firms. We have already seen that this is unlikely to be the case because export-oriented firms are similarly affected than domestically oriented firms. We now aim to corroborate this view using the Austrian control group. Although we lack information on actual productivity at the firm level or export-orientation of Austrian firms, we split the samples according to different types of firms that we deem to be successful in a broad sense. We therefore examine different responses according to firm size, employment growth before the appreciation, and high- and low-tech industries. In doing so we assume that large, growing, and high-tech firms are likely to be more productive.

We find that large firms are more strongly affected than medium-sized and small firms. Figure 3.9 panel (a) shows the average development of large firms. Large firms in Austria and Switzerland grew at similar rates during 2013 and 2014. Swiss firms stop to grow after the appreciation and subsequently decrease their employment levels substantially. Austrian firms also grow at slightly slower rates than before, and their employment stays roughly constant for two years. The diff-in-diff in panel (b) suggests that the Swiss franc shock caused employment in large Swiss firms to decline by 7.3%. Medium sized firms' employment was roughly flat in both Austria and Switzerland in the two years before the shock (see panel c). This development continues in Austria during 2015 and 2016, but in Switzerland, employment declines significantly. Relative to Austria, the appreciation caused a decline in employment by 4.3%. Finally, panels (e) and (f) show the development of small firms. As suggested in the last section, we find no statistically significant effects of the exchange rate shock on employment in small firms.

We now explore the response by firm performance previous to the shock. Firms that were expanding strongly during 2014 show the strongest decline in employment relative to Austria. To show this, we split Swiss firms into three bins based on their employment growth during 2014. We assign firms above the 75th percentile of growth during 2014 into a high-growth bin. Firms between the 25th and the 75th percentile are assigned to a medium-growth bin. Firms below the 25th percentile are assigned to a low-growth bins. We then assign Austrian firms to the same three bins, based on the percentile cutoff values for Switzerland. Figure 3.10 shows the result for high-growth firms. The time series plot in panel (a) shows that on average, firms in this bin grew by about 12% to 13% in both Austria and Switzerland over the two years preceding the shock. Note that there is to some extent a selection effect: We pick strongly expenading firms whose growth may regress toward the mean to some extent. Indeed, employment growth is lower in 2013 but also in 2015. However, we can control for this selection effect by using the counterfactual from Austria. Because Austrian firms continue growing after the appreciation, we confirm that we selected a group of firms that is on average particularly successful. For Switzerland, however, employment starts to decline after the appreciation. The difference-in-differences estimates in panel(b) put the employment loss of high-growing firms at 6.9% by the end of 2016. This loss is even bigger for large and medium firms in the high growth bin

[26] In some specifications there are significant differences during 2012 indicating that Swiss firms grew less strongly than Austrian firms (see Figure C.9). We are not particularly worried about this difference because it is reasonable to believe that the sharp appreciation until mid-2011 affected Swiss manufacturing employment well into 2012.

Figure 3.9. Comparison between Swiss and Austrian firms by firm size



Notes: Impact on average employment for Switzerland and Austria (left column) and diff-in-diff estimates (right column). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

who reduce their employment by 11% relative to their Austrian peers by the end of 2016.[27]

The development of medium growth firms is also very similar in Switzerland and Austria before the appreciation. A smaller and insignificant gap of about 2% emerges after the appreciation. This is primarily because medium-growth, or stagnating firms, are mostly small firms that do not adjust their employment substantially. The effect is about 3.3% and significant for medium and large medium-growth firms. Low-growth firms are shrinking at a similar rate in both countries before the appreciation (panel e). After the shock, firms in Switzerland continue to shrink at a faster rate than similar firms in Austria. The resulting gap amounts to 4.4%. However, the gap is smaller and insignificant when we restrict the sample to medium-sized and large firms in this growth bin.[28]

As an additional indicator of high productivity, we attribute sectors to so-called high- and low-tech industries following Arvanitis et al. (2017). There are no significant differences and employment falls for both groups. Figure 3.11 shows the results for both groups of sectors. In both groups employment declines more strongly in Switzerland than in Austria. If anything, the decline is somewhat more pronounced for high-tech industries than for low-tech industries, although the differences are not statistically significant.

We now discuss the development of selected manufacturing sectors. Unfortunately, for the small number of firms that are left at this level we can hardly provide strong results (see Figure C.11 and C.12). We discuss the results for the three largest manufacturing sectors in terms of employees, which are the computer and electronic products—this sector includes manufacturing of watches and clocks—, of metal products, and of machinery and equipment. Furthermore, we discuss the pharmaceutical industry because of its importance for Swiss exports. Manufacturers of computer and electronic products in our sample exhibited growth during 2013 to 2014 in both Austria and Switzerland. After the shock employment starts to decrease in Switzerland but not in Austria. By the end of 2016, the causal effect of the appreciation amounts to -8.8% for all firms in this sector. In the fabricated metal products sector we see no substantial growth in either Austria or Switzerland before the appreciation. While Swiss firms start to shrink after, employment at the Austrian firms in the sample stays constant. We estimate that the appreciation caused an employment loss of 6.7% for all firms. We find no negative effects for firms in the manufacturing of machinery and equipment—employment in this sector appears to be stable in both Austria and Switzerland. In the pharmaceutical industry we find no significant effect when looking at all firms in the sector.[29]

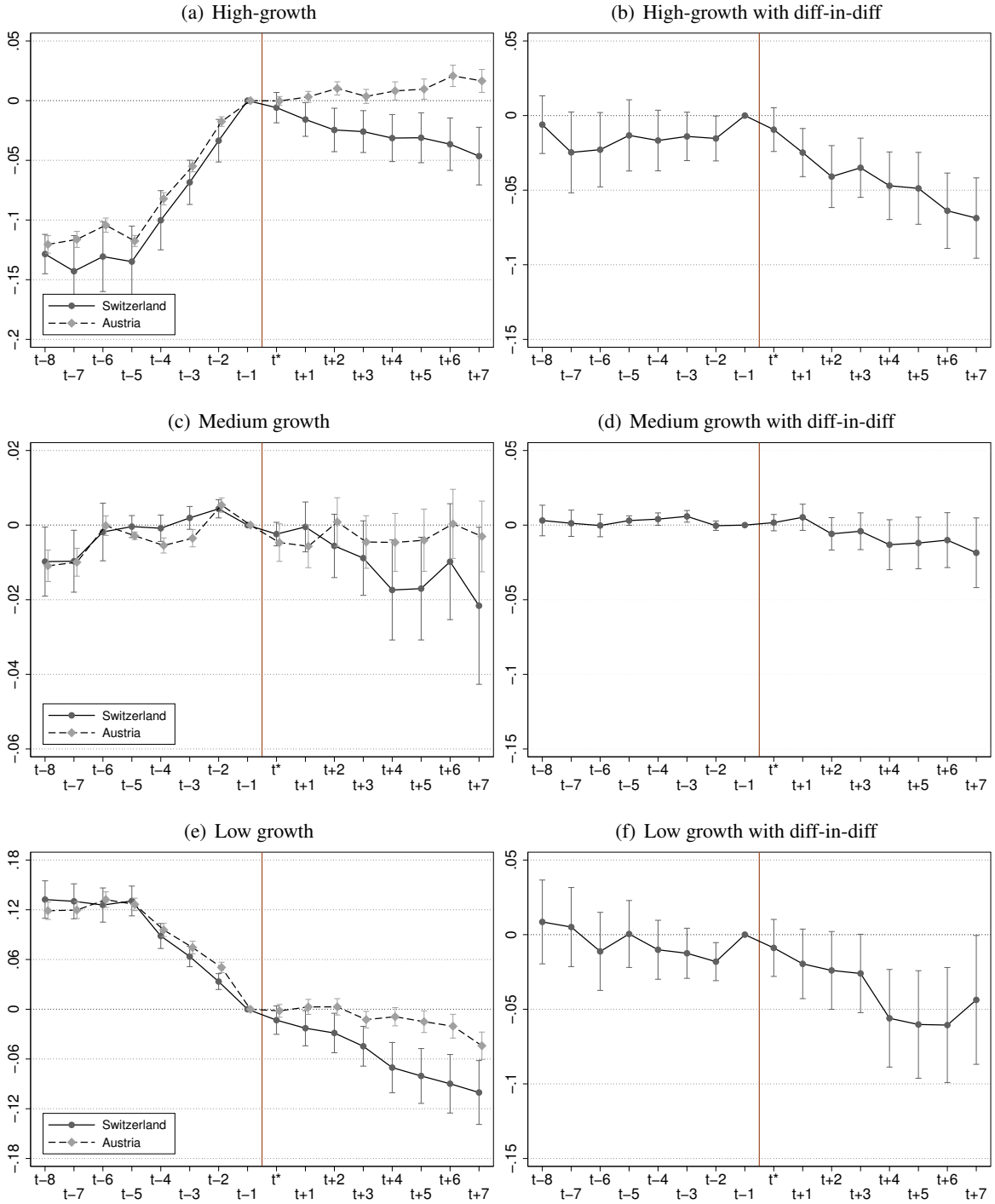
We checked that these sectoral results are qualitatively in line with the development of the sectoral unemployment numbers from late 2014 until late 2016 provided by SECO. However, the results are not strictly comparable because unemployment can increase because of ongoing deindustrialisation and automation trends (which may affect structural unemployment) and the appreciation (which should affect cyclical unemployment). A good example is the textile sector where unemployment increased since late 2014. Our diff-in-diff estimates, however, do not point to a significant employment decline. This difference stems from the fact that employment in the textile sector shows a secular

[27] See Figure C.10 in the Appendix.

[28] See Figure C.10

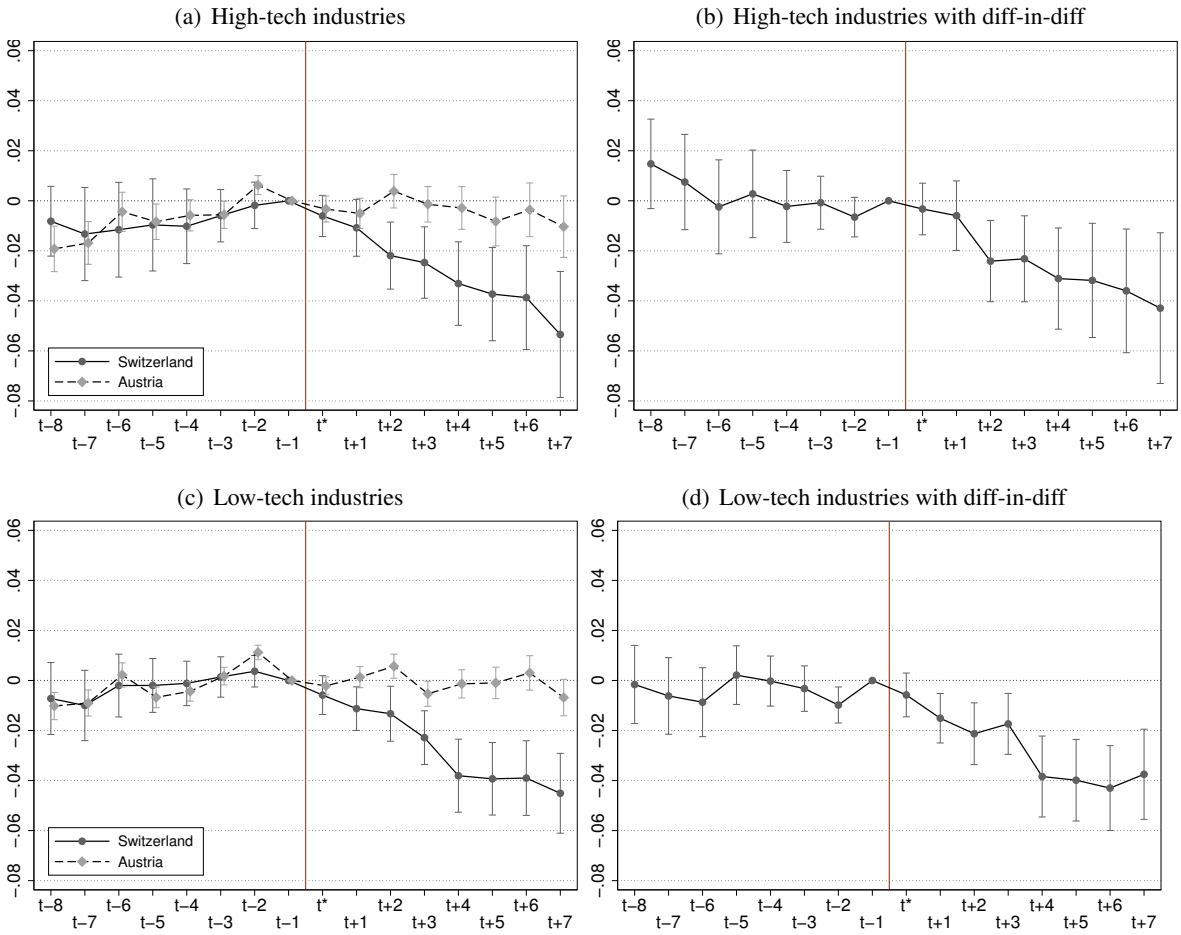
[29] However, when we restrict the sample to medium sized and large firms, we find an average employment decline of 5.2%.

Figure 3.10. Comparison between Swiss and Austrian firms according to employment growth



Notes: Impact on average employment for Switzerland and Austria (left column) and diff-in-diff estimates (right column). Swiss firms are assigned into three bins of employment growth during 2014 (High-growth: above 75th percentile; medium-growth: 25th-75th percentile; low-growth: below 25th percentile). We then assign Austrian firms to the same three bins, based on the percentile cutoff values for Switzerland. The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

Figure 3.11. Impact on High- and low-tech industries



Notes: Impact on average employment for Switzerland and Austria (left column) and diff-in-diff estimates (right column). High- and low-tech industries defined following Arvanitis et al. (2017) but at a slightly coarser level. High-tech industries are chemicals, pharmaceuticals, machinery and equipment, computer and electronics, electrical equipment, transport equipment, other (including medical equipment). Low-tech industries are food, textiles, wood, paper, printing, rubber and plastics, fabricated metals, basic metals, minerals, repair and installation. The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

decline in Austria as well as in Switzerland and our approach therefore attributes this decline to ongoing structural trends.

Finally, we separately compare the employment development of firms in different Swiss regions with comparable firms in Austria (see Figure C.13). Firms in different regions may be affected by the shock differently, first, because of compositional reasons—some regions may be home to smaller firms, or firms in sectors that had been less affected by the shock—and second, because of geographic factors, such as distance to the border. Firms in Northwestern and especially Central Switzerland seem to be less affected. For other regions we find significantly negative effects ranging from slightly above -2% to almost -9% in the combined Lake Geneva and Ticino region. Because the estimates for these smaller samples are imprecise, most of the point estimates are not significantly different from each other.

3.5 Vacancies and mass layoffs

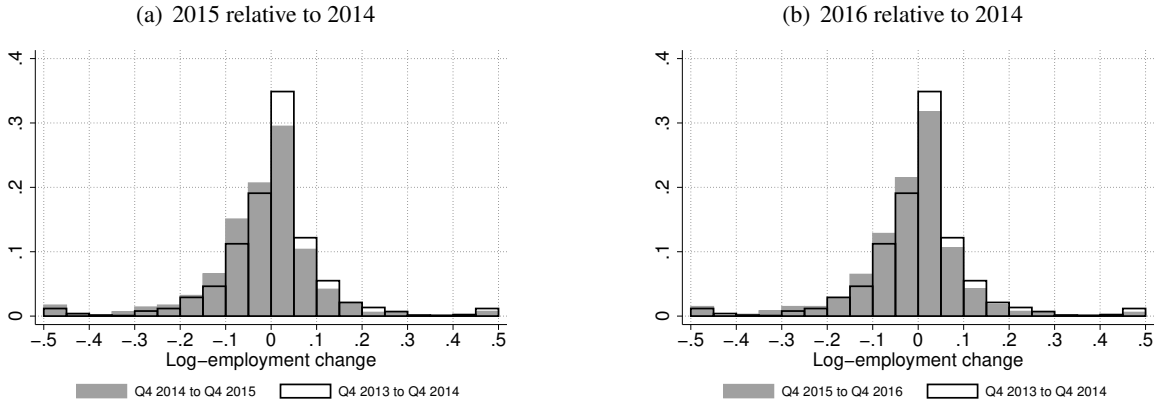
We now turn to the question how the rapid decline in manufacturing employment came about. One explanation is that firms cut vacancies and reduced employment through natural staff turnover. Another possibility is that firms resorted to actual layoffs. We find that an immediate reduction of vacancies goes a long way in explaining the rapid decline in manufacturing employment.

In Figure 3.12 we compare the distribution of annual firm-level employment growth after the appreciation to the pre-shock distribution. It appears that for both years, the entire distribution has shifted to the left. This shows that the decline in average employment growth has not been driven by radical downsizing of few firms. Instead, we observe a decline in the share of firms with moderate growth rates between 0% and 5% and with somewhat larger growth rates between 5% to 10% and 10 to 15%. Meanwhile, the share of firms with negative growth rates between 0 and -15% has increased substantially. This shift in the distribution could have been driven by either declines in hiring or by a rise in the frequency of layoffs. Because of the gradual shift of the distribution, however, it seems unlikely that mass layoffs are the main driver of the employment decline.

Before we go to our discussion of vacancies, it is important to point out some limitations of our data. First, since we do not have vacancy data for Austria, we will rely on descriptive time series evidence rather than diff-in-diff estimation. Second, we observe neither hires nor layoffs of the firms in our data. What we do observe is the stock of vacancies at the reference day at the end of a quarter. While these vacancies may be informative about the average stock of vacancies throughout a quarter, many vacancies are likely to be posted and filled at the firm level in the three months in between two reference days. As a result it is difficult to relate our vacancy data to changes in employment at the firm level without additional assumptions.

Figure 3.13 shows the development of the share of firms with at least one open vacancy at the reference day of a quarter relative to the reference quarter. The share is slightly elevated compared to the rest of the the sample period during 2014 but declines immediately after the appreciation. It is between 4.2 and 2.7 percentage points lower than in the reference quarter for one year. The drop corresponds to the time period in which we observe most of the employment losses. Since 45% of

Figure 3.12. Firm-level employment growth distributions



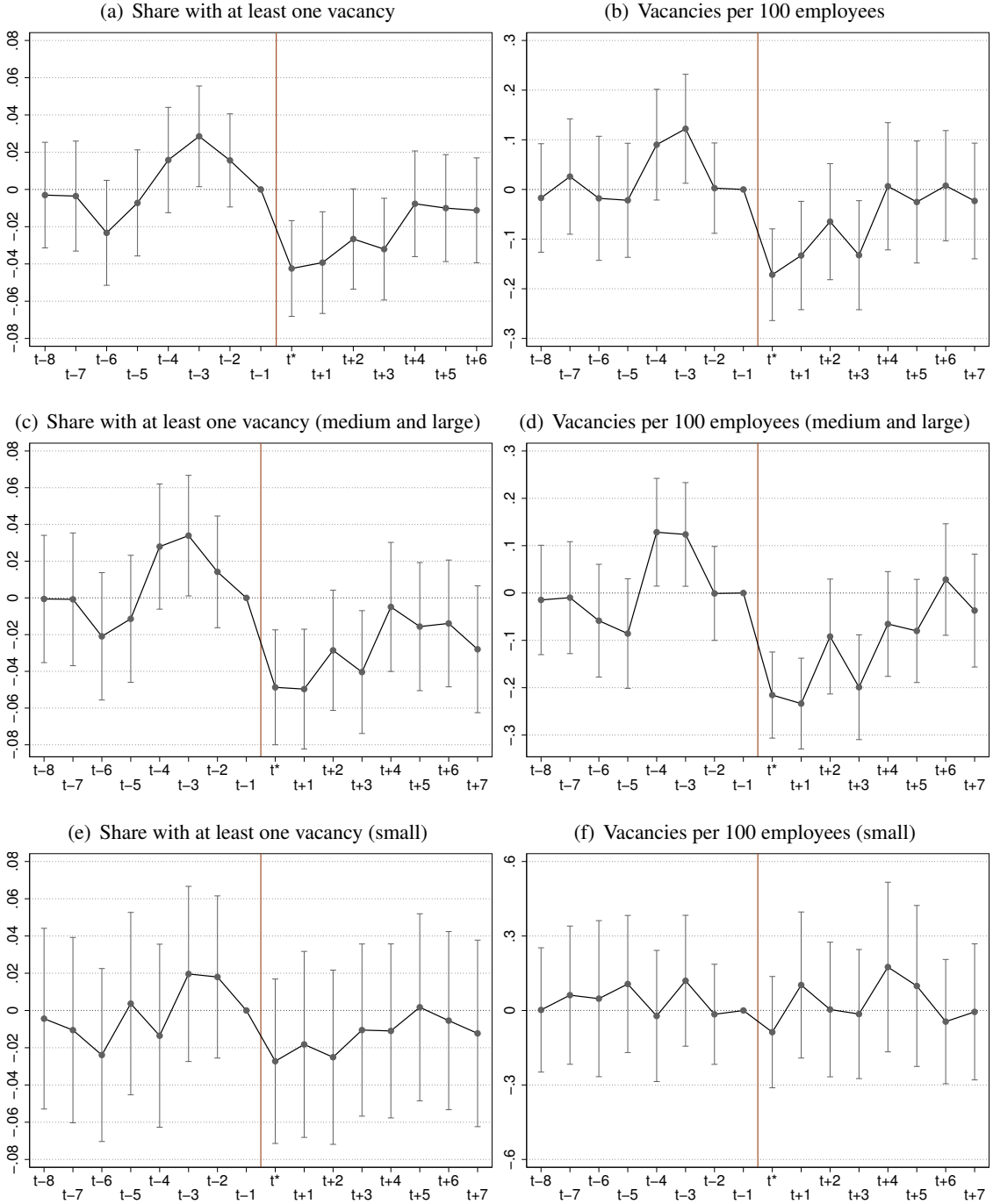
Notes: Distribution of year-on-year employment growth across firms in 2014 (white bars), 2015 (gray bars, panel a), and 2016 (gray bars, panel b).

firms had at least one open vacancy on average during 2014, the decline in the first quarter after the shock represents a relative decrease in the number of hiring firms by 9% relative to the year before. A similar picture emerges when we look at the number of vacancies per 100 employees in panel (b). We keep the employees in the denominator fixed at the base period in Q4 2014. This fraction decreases by about 0.2 immediately after the appreciation. Taking into account that the the mean number of vacancies per 100 employees during 2014 is about 1.12, this corresponds to an average drop of 15% in the number of vacancies in the first quarter after the shock. The number of vacancies is significantly lower than in the reference period for one year, but returns to its pre-shock level at the beginning of 2016.

Consistent with our results on employment, we find that the decline in vacancies is more pronounced for medium sized and large firms, and we find no significant decline for small manufacturing firms. Vacancies in large and medium firms immediately drop by about 5 percentage points after the appreciation (panel c). This corresponds to an 8% drop in the number of firms with vacancies relative to the average share in 2014. The average number of vacancies per 100 employees drops by about 0.2 percentage points in medium and large firms, and this corresponds to a 17% decline relative to the average ratio in 2014. Both outcomes are significantly lower than in the reference quarter for about one year and return to their pre-shock levels during 2016. We do not find a significant drop in job postings of small firms.

These results also hold when splitting small firms into high, medium and low growth firms as we do in the previous section (see Figure C.14). We find no decline in vacancies for small firms in any of these groups. For medium and large firms, we find a significant drop in vacancies in all three. For medium and large firms, we find a persistent decline in hiring of firms that grew strongly right before the appreciation. Vacancies per 100 employees decline by 18% immediately after the appreciation. They stay lower than in the reference quarter for the following two years and do not return to their pre-shock levels. For medium sized and large firms with medium growth rates before

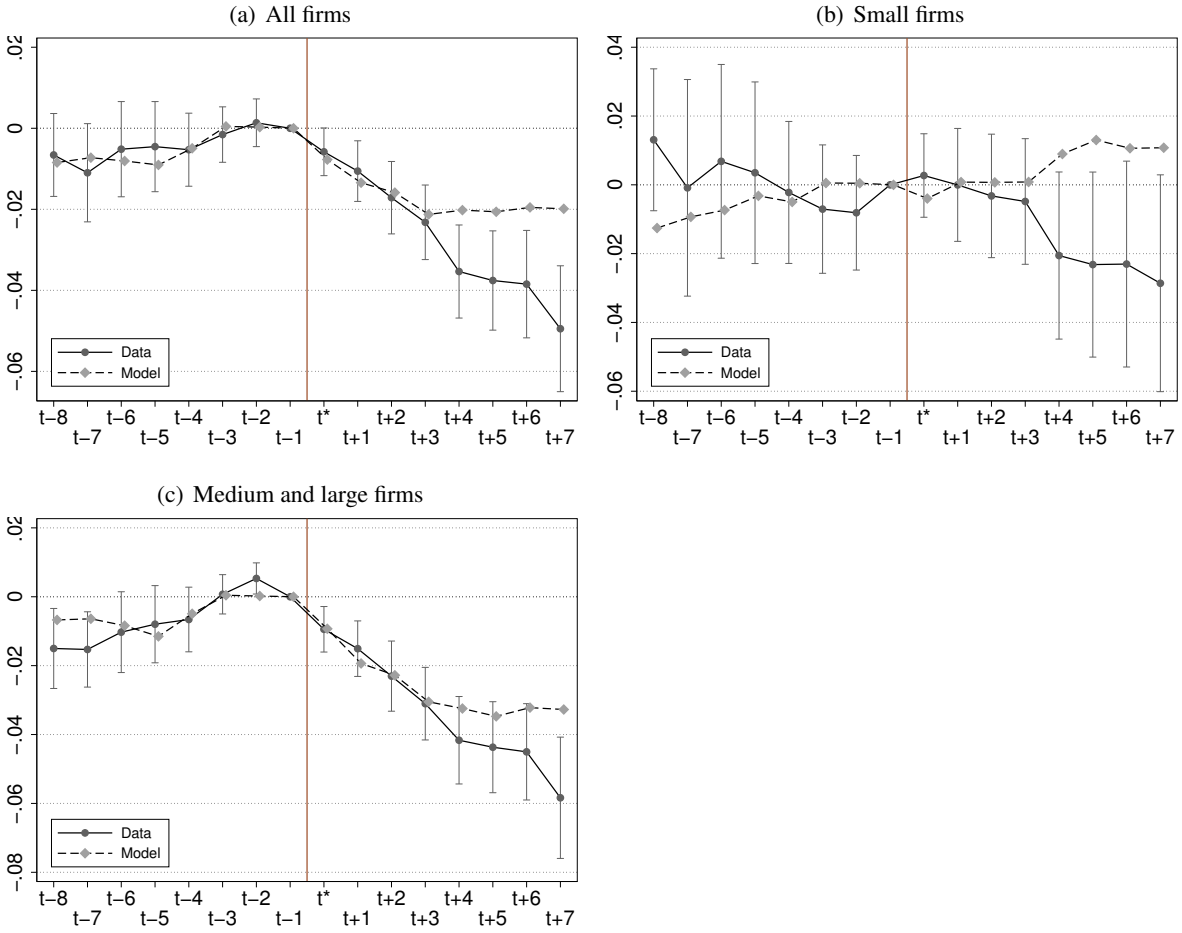
Figure 3.13. Impact on vacancies in Swiss manufacturing firms



Notes: Impact on the average share of firms with at least one vacancy (left column) and on number of vacancies per 100 employees (right column). The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

the appreciation, we find a two-quarter dip in vacancies. Vacancies decline by 13% in the quarter following the appreciation, but return to their pre-shock levels in the third quarter of 2015 and remain there for the rest of the sample period. Finally, for low growth firms we find a decline by 21% percent in the first quarter after the appreciation. Vacancies at these firms remain low during the rest of 2015 but return to their pre-shock values at the beginning of 2016.

Figure 3.14. Comparison with the predictions of a vacancy model



Notes: Impact on average employment with simulations implied by the model. The model takes the response of vacancies as given and the parameters are calibrated using sensible values from the literature. The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

It remains an open question if the decline in vacancies is substantial enough to explain the decrease in firm employment after the appreciation, or if the decline in employment can only be explained through additional layoffs. We present a back-of-the envelope calculation that suggests the decline in vacancies is potentially sufficient to explain most of the decline in employment. Our model is explained in more detail in Appendix D. The model is very simple and meant as a suggestive thought experiment rather than a precise description of the Swiss labor market. The model assumes that firm choose the level of vacancies, which are filled at an exogenous constant rate. Furthermore

firms are subject to a constant natural turnover. The model does not feature layoffs—the point of the exercise is to see whether variation in vacancy postings can explain the observed variation in employment on its own. In order to calculate a predicted development of employment, we need to set the two model parameters: the vacancy filling rate, and the separation rate. Hobijn and Sahin (2009) estimate separation rates for OECD member states. Their estimates suggest a quarterly rate of 0.036 for Switzerland. Unfortunately, no estimates of the vacancy filling rate in Switzerland exist. Davis et al. (2013) estimate a daily rate for US manufacturing. We convert this rate to quarterly values. This value for the vacancy filling rate predicts an average vacancy duration of 20 days. The Swiss labor market is different to the US labor market in many dimensions, but we nevertheless use this value as our baseline.

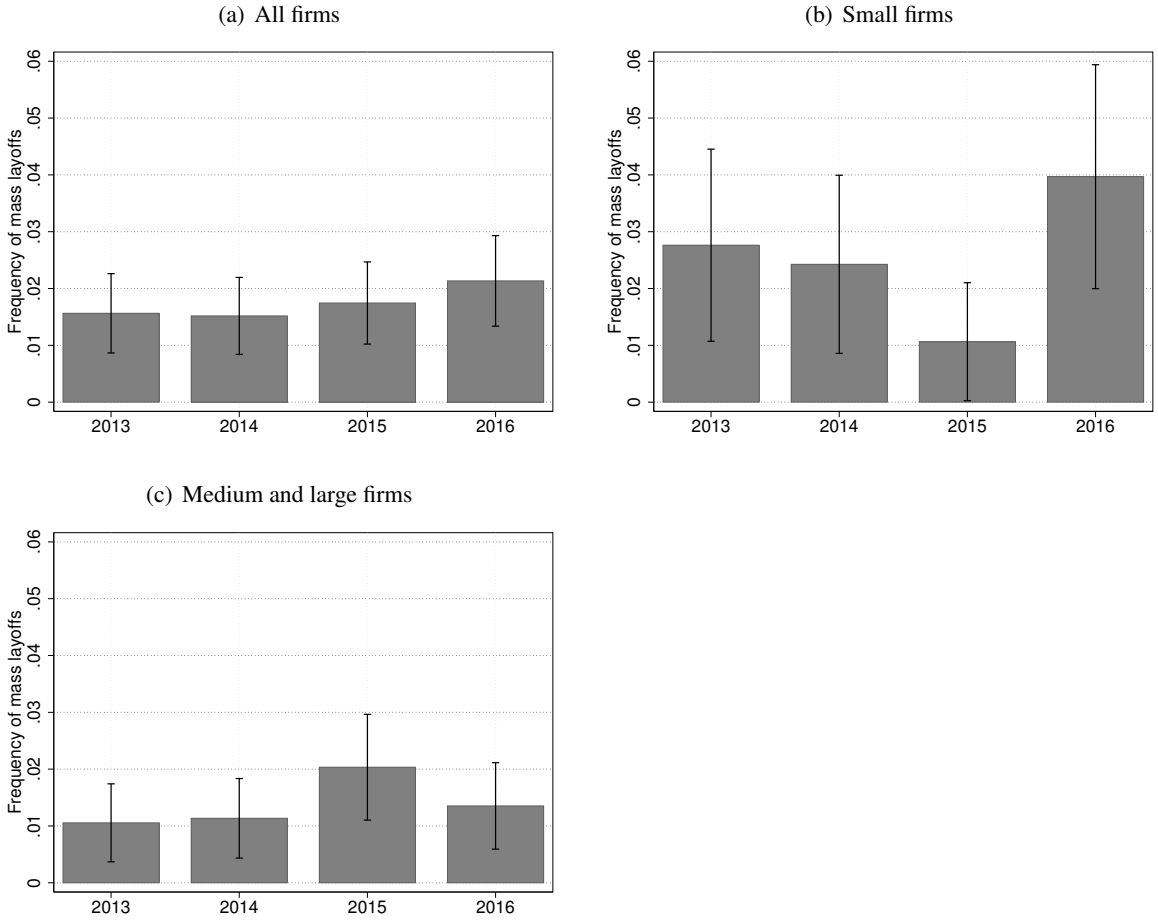
Figure 3.14 shows the results of this calculation. The model fits the data before the shock well for this choice of parameters. The model can explain all of the decline in employment during 2015 from the decline in vacancy postings. However, it cannot explain the further decline during 2016. Overall, about half of the employment decline can be explained through variation in vacancies. Conducting the same exercise for small and larger firms separately, we see that the model cannot explain the decline in small firm employment during 2016, because this decline was not accompanied by a drop in vacancies. For larger firms, the model explains most of the decline during 2015 and a part of the decline during 2016. Our takeaway is that medium and large firms in particular were initially able to reduce employment by reducing vacancies. Further down the road, however, they might had to resort to additional layoffs. Small firms, who usually have a small stock of vacancies, exhibited smaller declines in employment which probably were achieved through layoffs.

We look at the frequency of mass layoffs around the time of the appreciation in a next step. Our definition of a mass layoff is any quarter in which a firm loses more than 25% of its workforce. We deliberately choose a high threshold to make sure that such events are caused by layoffs rather than a decrease in hiring. Mass layoffs are rare in our data. Figure 3.15 illustrates the frequency of mass layoffs over time. During 2013 and 2014, about 1.5% of firms in our sample experience a mass layoff. In the two years after the shock, this frequency increases to 1.7% in 2015 and to 2.1% in 2016. As in our results on employment and vacancies, there seems to be some heterogeneity in this variable between firms of different sizes as well. In medium and large firms, the frequency of mass layoffs doubles from slightly over 1% in 2013 and 2014 to 2% in 2015, however, this increase is not significant. Mass layoffs at small firms actually declined in 2015 but rose again substantially in 2016. As with medium and large firms, these increases are not significant. This evidence is consistent with our view that most of the decline in employment at medium and large firms took place through natural turnover rather than additional substantial layoffs.

3.6 Employment expectations

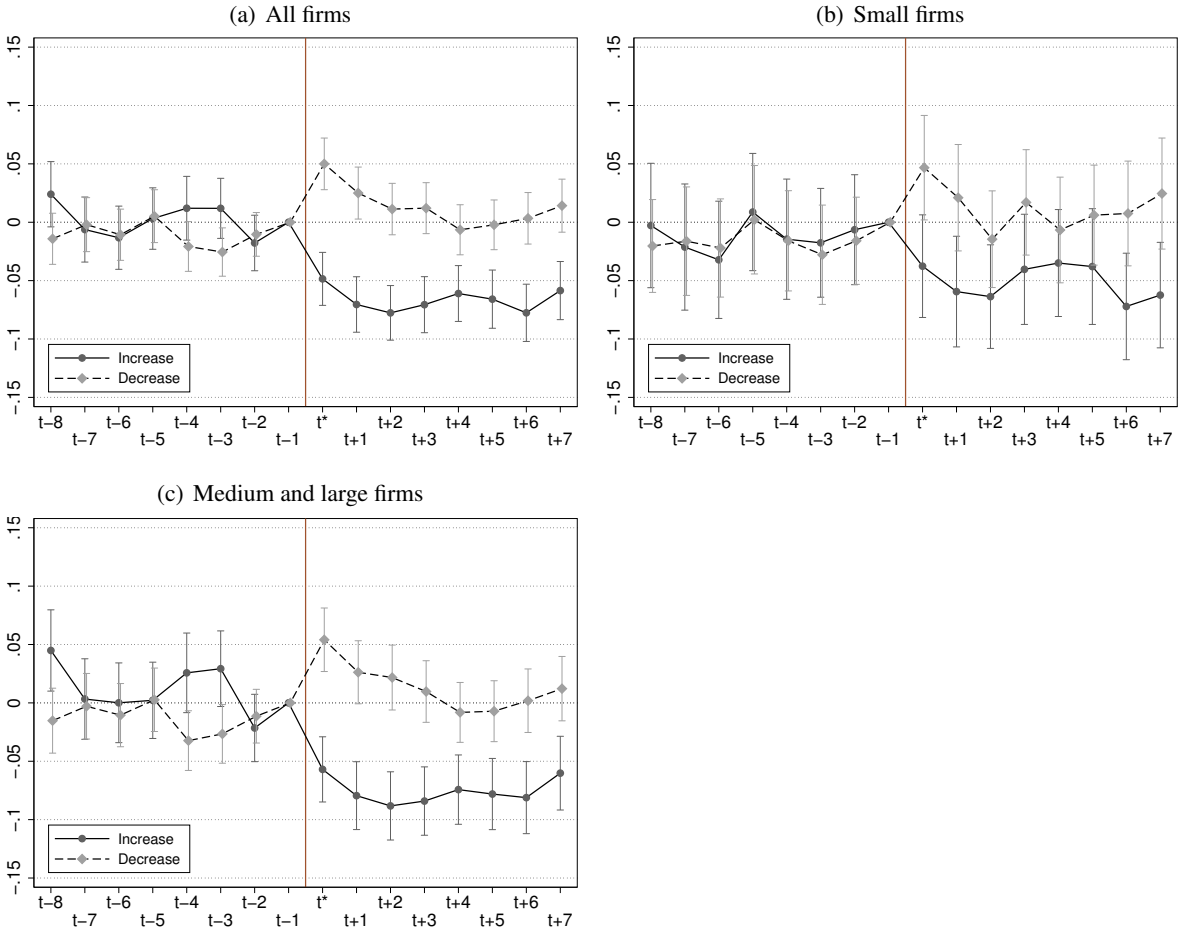
The BESTA data can also be used to determine how firms' expectations about their short-term employment decisions evolved. This provides further evidence that the appreciation was unexpected. Furthermore, we can examine whether and when firms' outlook started to improve after the shock. Because the BESTA asks whether firms expect to expand or contract employment in the next quarter

Figure 3.15. Frequency of mass layoffs



Notes: Share of mass layoffs over time. Vertical bars represent 95% confidence intervals.

Figure 3.16. Expected change in employment in the next quarter



Notes: Impact on the share of firms that expect to increase employment in the next quarter and share of firms that expect to decrease employment in the next quarter. The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

the analysis is restricted to short-term expectations.

During 2014, on average 73% of firms expected their employment to stay the same in the next quarter, 9% expected a decrease, and 19% expected an increase. Figure 3.16 shows the share of firms expecting an increase or a decrease in employment in the next quarter, relative to the share in the reference quarter (panel a). These expectations are not significantly different from zero in the quarters preceding the appreciation. Therefore, we conclude that the appreciation was a surprise for the firms in our sample. In the first quarter after the shock, the share of firms expecting a decrease rises by about 5 percentage points, while the share of firms expecting an increase declines by 5 percentage points. Relative to the 2014 values, this reflects a decrease in the number of firms expecting to expand employment by 26%, and an increase of 57% in the number firms expecting to reduce employment.

Similar patterns hold for both small as well as medium and large firms, although the shift in expectations seems to be slightly more pronounced for medium and large firms. The share of small

firms expecting to expand employment goes down by 3.8 percentage points or 24%, and the share of small firms expecting to shrink increases by 4.7 percentage points or 48%. For medium and large firms the share of firms expecting to grow goes down by 5.7 percentage points or 27% while the share of firms expecting a decline goes up by 5.4 percentage points or 62%.

We see that the short-term expectations have permanently shifted. In particular, the share of firms expecting to grow has not recovered from its decline at the end of 2016. However, the increase in the share of firms that expect to shrink was only temporary, and the share went back to its baseline level at the beginning of 2016. This is consistent with the permanent decline in manufacturing employment in our baseline results. Thus we conclude that firms have not become more optimistic about their employment outlook during our sample period.

3.7 Employment and international price-setting

In this final section we provide results on the relationship between employment decisions and the price setting behavior of firms. Traditional monetary macroeconomic models make extensive use of the assumption that prices are sticky and that this stickiness is responsible for inefficient economic fluctuations. We now examine whether there is a link between price-setting behavior, in particular the degree of pass-through, and employment based on a matched data set. However, the matched data set is substantially smaller and therefore estimates are much more uncertain. We therefore emphasize that the results are suggestive at best and should be interpreted with caution.

We examine whether differences in the degree to which firms changed their prices are associated with changes in employment. From a theoretical perspective, it is not clear ex-ante what relationship one would expect. One hypothesis would be that because of nominal price rigidities in domestic currency, firms fail to adjust their prices in Swiss francs. Consequently, their prices would increase relative to those of their competitors abroad (on the domestic as well as the export market) and therefore demand for products produced in Switzerland declines. Recall that products of Swiss firms producing for the domestic market also become relatively more expensive because import prices declined strongly after the appreciation. This mechanism would thus suggest that firms with high pass-through would reduce employment less than firms with low pass-through. Alternatively, one could suppose that firms keep their prices stable in euro and therefore face initially a strong decline in prices in Swiss francs. If they cannot at the same enforce nominal reductions in costs, for example because of nominal wages rigidities, they may resort to reductions in employment. Lowering costs this way could therefore be used to counteract the contraction in markups to some degree. If this is the case, a loss of market share is not the main problem but rather a sharp contraction in markups. This mechanism suggests that firms with high pass-through would reduce employment more strongly than firms with low pass-through.

We can match the price and employment data used in the previous chapters for a subset of firms, and we use this joint dataset to investigate the relationship between the price-setting behavior of firms and their employment decisions. Table 3.2 summarizes the number of quarterly observations in our matched dataset. About one-fifth of the observations in the overall BESTA cover manufacturing firms. Because of resampling in the second quarter of 2015, the balanced dataset is reduced to about 5,000

Table 3.2. Number of observations in employment data

	Total	Manufacuring		
		Total	Balanced	Matched
2012-2016	470,983	91,794	26,699	9,762
2012	124,346	24,224	5,112	1,902
2013	100,967	20,184	5,236	1,934
2014	98,298	20,045	5,450	1,981
2015	88,738	16,537	5,497	1,987
2016	58,634	10,804	5,404	1,958

Notes: Number of quarterly firm-level observations for all sectors and the manufacturing sector. For the latter, we report the number of firms in the total sample, in the balanced sample for firms that are observed at least once in 2014, 2015, and 2016, as well as for the balanced sample that can be matched with the price data. All analyses are performed using the balanced samples.

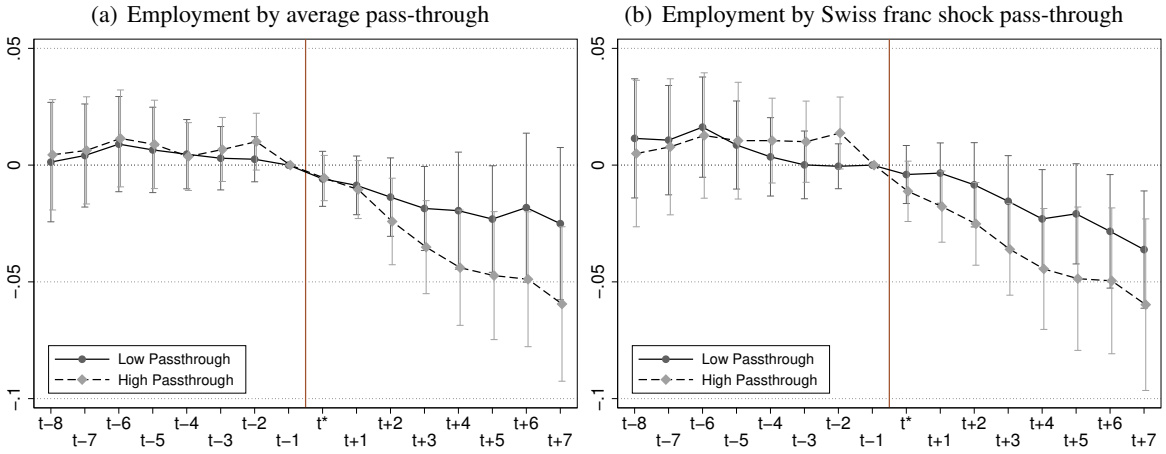
observations per year. Of these, we can match about 40% to price data, which results in about 2,000 observations per year. However, for many firms we observe only export, import or domestic prices, but not all three.

The matching procedure introduces an additional level of selection into our data which can bias our results. However, we compare some key results for all three samples (see Figure C.15), and the point estimates turn out to be quite similar. We are therefore confident that firms in the matched data resemble those in the larger balanced sample used for our baseline employment results. However, the table illustrates that our analysis is limited by a very small sample size and thus associated with substantially larger estimation uncertainty.

Figure 3.17 shows the average employment response of firms with high pass-through to prices in Swiss francs. We measure pass-through either as an average at the firm-level over the entire sample period (panel a) or as pass-through after the Swiss franc shock (panel b). We split observations into high- and low-pass-through firms at the median. Importantly, for each firm we pool prices in the domestic and export market, as well as, prices denominated in various currencies to measure pass-through. Only for firms with high pass-through we find a statistically significant decline in employment. The difference in the point estimates is not statistically significant, however. Panel (b) shows a similar pattern, although the difference is less pronounced. Taking the result at face value, the reduction of employment is particularly strong for firms that faced a stronger compression in markups because of strong reductions in their Swiss franc equivalent prices.

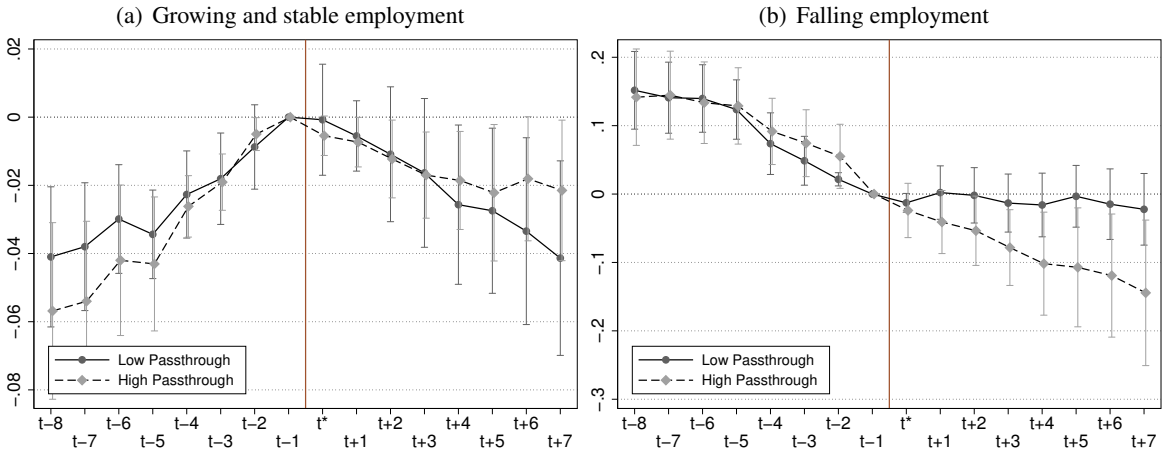
We now conduct the analysis separately for firms with growing or stable employment, and compare the response to firms with falling employment. As in the previous section, we allocate firms to those categories based on the employment growth in 2014. We may expect that growing and stable firms have a relatively high initial markup and are therefore in a better position to accept a markup compression. In line with this idea, the point estimates suggest that for this group there is no difference between exchange rate pass-through and subsequent employment development. In contrast, we find that for firms that were already in decline, and supposedly had lower markups to begin with, high exchange rate pass-trough is accompanied by a relatively larger decline in employment.

Figure 3.17. Employment and pass-through



Notes: Impact on average employment at firms with different rates of exchange rate pass-through. Panel (a) uses data from the entire sample to estimate pass-through at the firm level and panel (b) uses the pass-through observed after the shock. For firms with multiple prices, the average of pass-through for the Swiss franc implied price is used. The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

Figure 3.18. Employment, pass-through and state of firm



Notes: Ihe impact on average employment at firms with different rates of exchange rate pass-through. Panel (a) uses only firms that with stable or growing employment before the appreciation and panel (b) only firms that are shrinking. For firms with multiple prices, the average of pass-through for the Swiss franc implied price is used. The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

Our results can be interpreted against the backdrop of the findings from the previous chapter and existing survey evidence. In the previous chapter we have seen that firms setting prices in euro faced a strong contraction in their markups in the same order of magnitude as the appreciation. The results presented here suggest that firms with sharp declines in the Swiss franc equivalent price indeed reduced employment more strongly.

3.8 Summary

Employment in the average Swiss manufacturing firm was stable in the two years before the surprise appreciation of the Swiss franc. In the following two years it declined abruptly by 4.6%. This reduction of employment can be traced back to the fact that firms immediately cut their vacancies by a substantial amount. A simple back-of-the-envelope calculation suggests that most of the employment decline can indeed be explained by the decline in vacancy posting, and occurred without substantial outright layoffs. Women and part-time workers were initially hit harder, but, after one year we do not find a significant difference relative to men or full-time workers.

It is noteworthy that we find a larger effect of an appreciation on employment than the previous literature. Existing studies report that after a 10% (real) appreciation manufacturing employment falls by 2.5% (or less). Our estimates suggest that a 10% (nominal) appreciation is associated with a more than 4% reduction in employment. Because the Swiss franc appreciated less in real terms, the difference becomes even more pronounced. We may speculate why such a large difference emerges. Similarly as for prices, one explanation could be that the appreciation was perceived to be permanent so there was little use of waiting for reducing vacancies and employment and hoping for a weakening of the currency. The fact that applications to the short-time work scheme increased relatively little after the appreciation is in line with this interpretation (see chapter 1). Another explanation would be that the appreciation was particularly large and the response of labor demand to exchange rate fluctuations is non-linear. Against this backdrop, more research in this area is certainly warranted.

We make it a point to control for other factors that may reduce manufacturing employment such as ongoing deindustrialisation, globalisation, and automation trends. Even when controlling for such factors using an Austrian control group we find a decline in employment of 4%. This suggests that most of the employment loss is a direct consequence of the appreciation. Using this control group, we can also examine the impact on non-randomly selected groups of firms that exhibit employment trends before the appreciation. We find bigger effects for medium and large firms (especially those that were growing strongly before the shock) but no significant effect for small firms. Employment in Swiss manufacturing firms declined relative to Austria, because medium and large firms, and especially those that were growing fast before the shock, stopped growing and entered a period of downsizing.

We can think of various potential explanations for this pattern. First, small firms may be more likely to close down rather than downsize when they are hit by a negative shock. Since we can only include firms that survived until 2016, we may unintentionally exclude the small firms that were hit hardest by the appreciation from our sample. Second, larger and growing firms are more likely to have existing foreign production facilities as well as the financial and organizational capability to quickly expand and offshore production to these facilities. Note that Kaiser et al. (2017) find that the

appreciation led to a decline in investment of manufacturing firms because of financial constraints or a lack of cash flow. However, larger firms, and firms that undertook foreign direct investment before the appreciation, substantially increased their foreign direct investments after the appreciation. This is not the case for smaller firms, or firms that did not undertake foreign direct investment before.

A prevailing narrative in Switzerland is that the strong Swiss franc may have a positive effect on average firm productivity. The argument goes that declining profit margins may force low productivity firms to innovate, restructure or go out of business. This would in turn result in a reallocation of workers to the most profitable and productive firms. Our results can be interpreted as suggestive evidence against this hypothesis: in fact, large and fast growing firms, shrink by far the most relative to their peers in Austria. While our data lacks information on firm-level productivity, a common regularity is that these large and growing firms are in fact the most productive ones. We find that the appreciation had much smaller effects or no effects on the employment of small manufacturing firms, and on firms with low and medium growth rates. In addition, high-tech sectors are similarly affected as low-tech sectors and export-oriented firms do not differ significantly from their domestically-oriented peers. In this story, the pharma sectors is the exception rather than the rule. This arguably successful high-tech sector shows no significant decline in employment after the Swiss franc shock.

Finally, we link the employment response to the missing price adjustments we documented previously. Unfortunately, the sample size for the matched data set between employment and prices is very small and therefore we regard the following results as speculative and suggestive at best. More research is needed to back up the patterns we find in the data. Firms with high pass-through reduce employment by a larger amount. This suggests that firms with a large compression in their markups reduced employment the most. Recall that those are also firms that do not adjust their prices denominated in EUR. Therefore, sticky prices set in EUR imply a substantial reduction of markups in Swiss francs and those are the firms that reduced employment more strongly.

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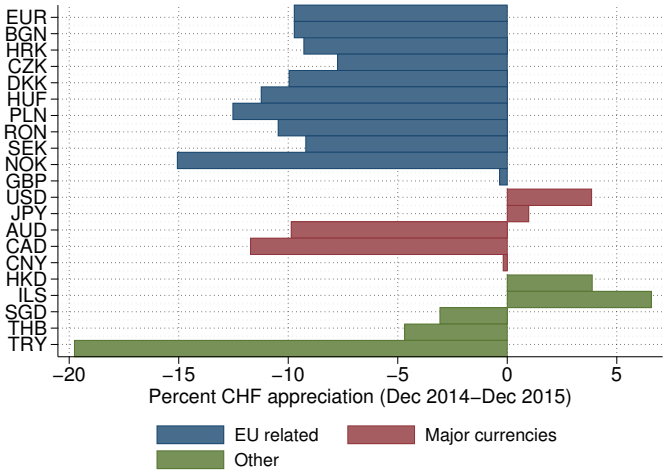
Appendix

Appendix A

Additional results: The Swiss franc shock

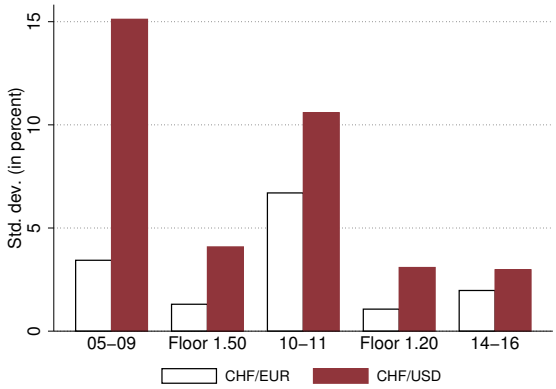
Figure A.1. Appreciation of the Swiss franc against various currencies



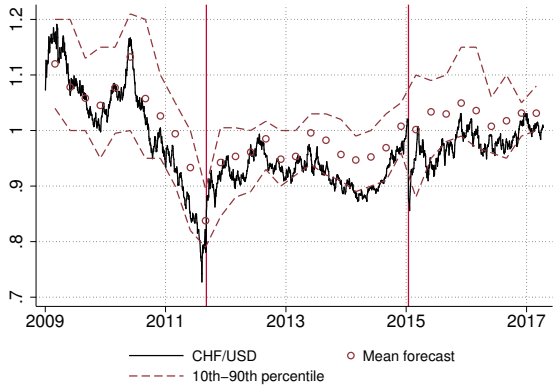
Notes: The figure shows that the Swiss franc appreciated against most currencies of countries closely related to the EU and less so against currencies related to the US. The major exception are the currencies of Canada and Australia.

Figure A.2. Volatility and CHF/USD forecast

(a) Volatility of daily exchange rates



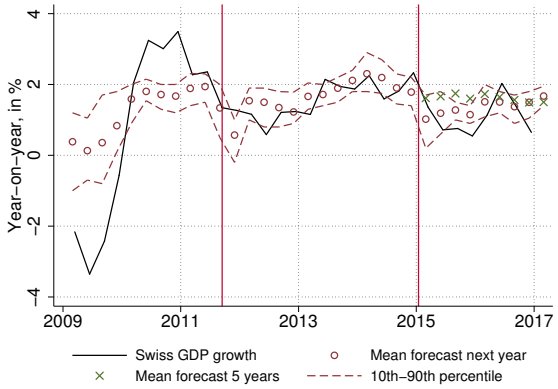
(b) CHF/USD and 12-month forecast



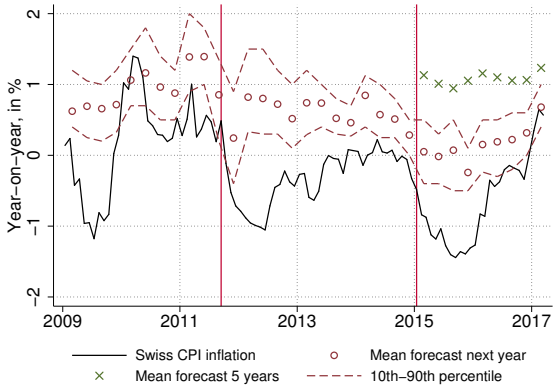
Notes: In panel (a) the volatility is calculated for the daily log-exchange rate over the period before the floor of CHF/EUR 1.50 (January 2005–February 2009) between the two floor periods (March 2010–August 2011) and after the floor of CHF/EUR 1.20 (January 2015–December 2016). We see that the volatility declined markedly for both currency pairs when the SNB intervened in the foreign exchange market. Moreover, the volatility remained low even after the removal of the exchange rate floor in January 2015. In panel (b) forecasts for the 12-month horizon (mean and 10th-90th percentile) are based on the individual responses of the KOF Consensus Forecast survey. Red vertical lines denote the introduction and removal of the exchange rate floor at CHF/EUR 1.20. We see that economists expected the appreciation against the US Dollar to be temporary although the disagreement temporarily increased.

Figure A.3. GDP growth and inflation expectations

(a) GDP growth and forecast



(b) CPI inflation and forecast

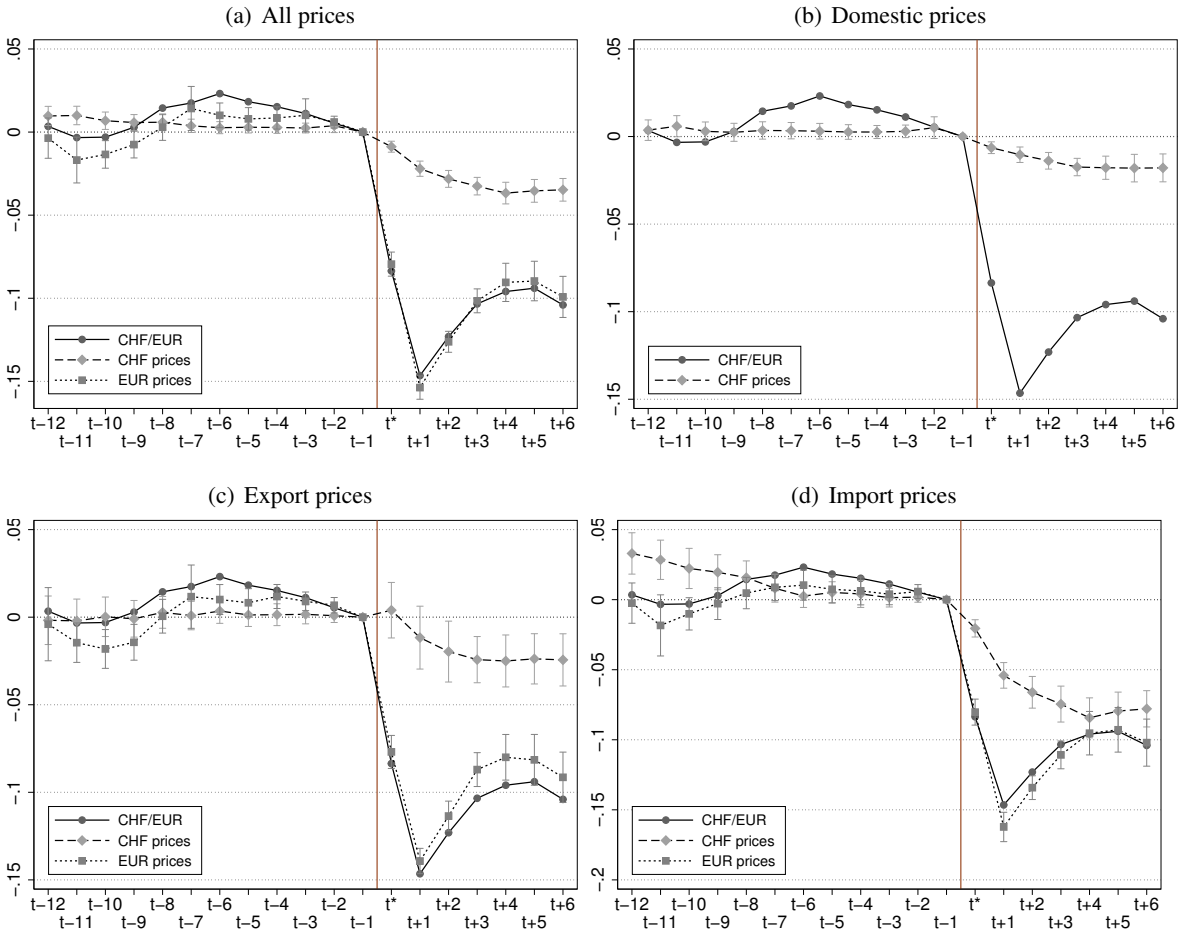


Notes: Red vertical lines mark the introduction and removal of the CHF/EUR exchange rate floor in September 2011 and January 2015. Forecasts for the next year (mean and 10th-90th percentile) are based on the individual responses of the KOF Consensus Forecast survey. Note that those forecasts refer to the next calendar year at the time the forecast was made. Therefore, the forecast horizon shortens over the course of the year and lengthens when a new year starts. In addition, we display the mean forecast for the five-year-ahead horizon. We can interpret the five-year-ahead forecast as the potential growth rate of the Swiss economy. Thus, the growth rates observed just before the removal of the exchange rate floor show that Swiss economy was neither in an ongoing recession nor in an unsustainable boom. Retrospective estimates of the output gap reported by the SNB confirm this view as they were all close to zero at the time of the shock (see e.g. SNB, 2017). CPI inflation was low but not much below the SNB's medium-term definition of price stability (0%-2% CPI inflation). CPI inflation hovered around 0% in 2014, before declining towards the end of the year because of falling oil prices. Before the policy change, analysts expected inflation to increase further in 2015 to values around 0.3%.

Appendix B

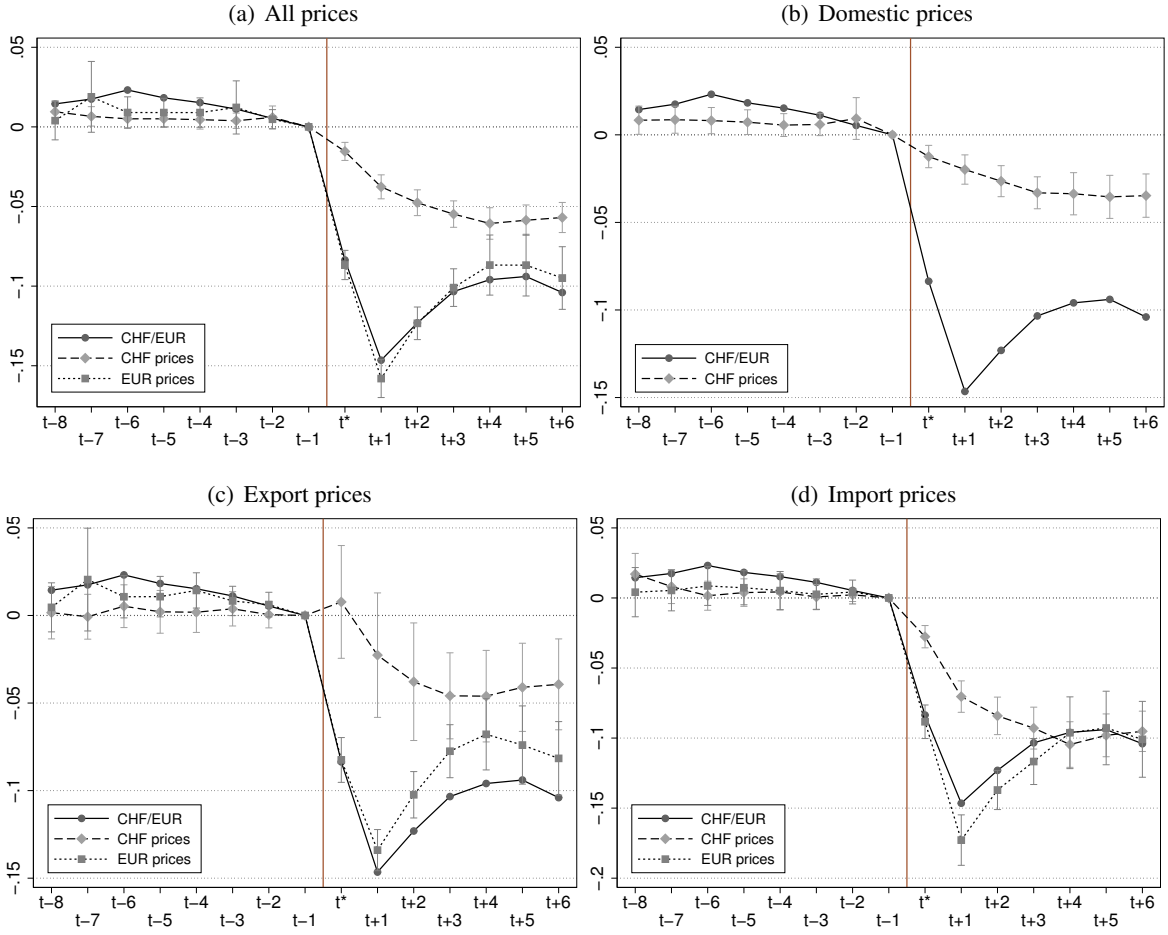
Additional results: Price-setting behavior

Figure B.1. Pre-shock trends of price response



Notes: Response of average log-prices transformed to CHF after the removal of the exchange rate floor in $t^* =$ Q1 2015. The solid line denotes the response of the CHF/EUR exchange rate, the dashed line the response of prices reported in CHF and the dotted line the response of prices reported in EUR. All regressions control for prices reported in USD (not shown). Vertical bars denote 95% confidence intervals based on standard errors clustered at the firm-level.

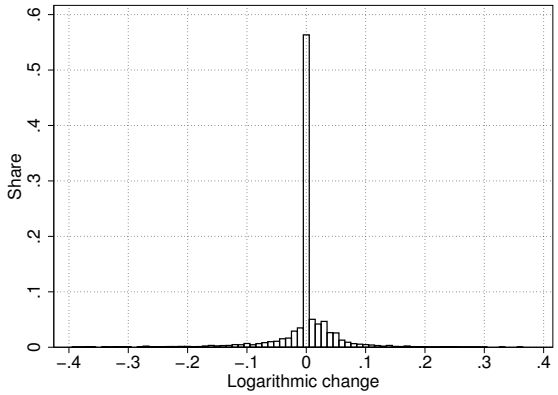
Figure B.2. Pass-through conditional on price change



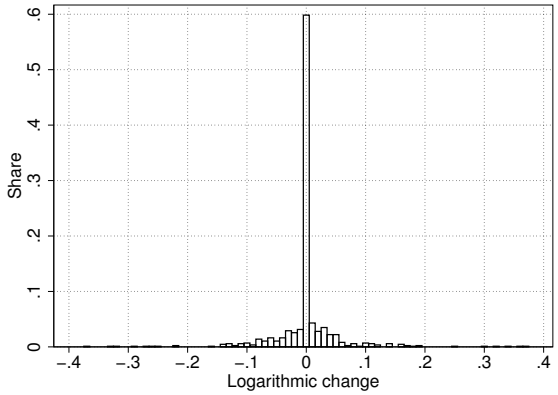
Notes: Response of average log-prices transformed to CHF after the removal of the exchange rate floor in $t^* =$ Q1 2015. The sample is restricted to prices that show a price change between the removal of the exchange rate floor and the end of the sample. The solid line denotes the response of the CHF/EUR exchange rate, the dashed line the response of prices reported in CHF and the dotted line the response of prices reported in EUR. All regressions control for event-dummies for prices reported in USD but are not shown for readability. Vertical bars denote 95% confidence intervals based on standard errors clustered at the firm-level.

Figure B.3. The distribution of price changes during the exchange rate floor

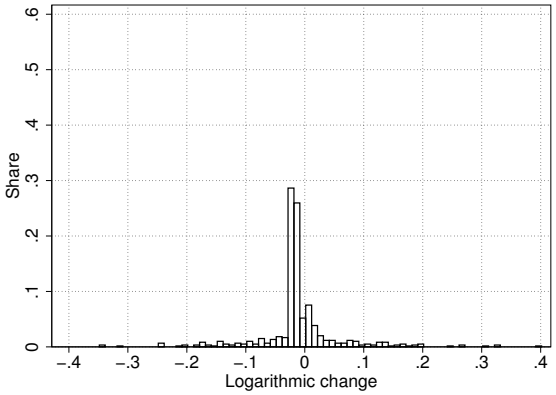
(a) Domestic CHF prices



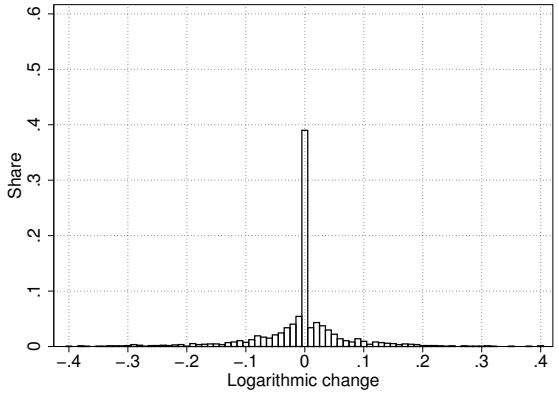
(b) Export CHF prices



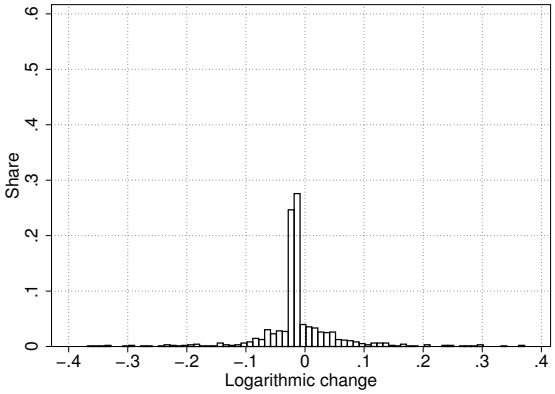
(c) Export EUR prices



(d) Import CHF prices



(e) Import EUR prices



Notes: Log-change in prices transformed to Swiss francs between Q4 2013 and Q4 2014. The left panels show prices set in CHF and the right panel prices set in EUR. The dashed line denotes the size of the appreciation of the CHF/EUR. The histograms are censored at a log-change of -0.4 and 0.4.

Table B.1. Currency choice by sector

	Domestic			Export			Import		
	in CHF	in EUR	in other	in CHF	in EUR	in other	in CHF	in EUR	in other
Food	99.8	0.2	0.0	64.2	33.1	2.7	73.0	25.0	1.9
Textiles	98.3	1.7	0.0	31.7	62.2	6.1	44.4	48.2	7.5
Wood	98.0	2.0	0.0	77.7	22.3	0.0	50.8	48.9	0.4
Paper	94.7	5.3	0.0	9.6	90.1	0.4	46.1	48.6	5.3
Print	99.9	0.1	0.0	47.7	50.8	1.6	71.1	28.9	0.0
Chemicals	97.1	2.9	0.0	57.4	39.5	3.1	33.6	63.8	2.6
Pharmaceuticals	99.4	0.0	0.6	53.5	33.0	13.5	47.0	42.5	10.5
Rubber and plastics	98.1	1.8	0.1	33.8	66.0	0.2	52.4	45.5	2.2
Minerals	99.6	0.4	0.0	84.9	15.1	0.0	57.8	39.2	2.9
Basic metals	100.0	0.0	0.0	44.3	55.5	0.2	77.7	22.0	0.3
Fabricated metals	98.1	1.9	0.0	35.3	59.4	5.4	38.4	57.9	3.7
Electrical equipment	98.7	1.3	0.0	78.2	20.9	0.9	66.0	31.7	2.3
Electronics	98.7	1.3	0.0	66.9	20.0	13.1	66.0	25.8	8.2
Other	99.1	0.9	0.0	40.4	52.2	7.4	52.1	41.1	6.8
Transport equipment	95.7	0.0	4.3	23.6	57.3	19.1	83.7	12.4	3.9

Notes: Average share of reported prices (in %) by market and sector.

Table B.2. Currency choice by product type

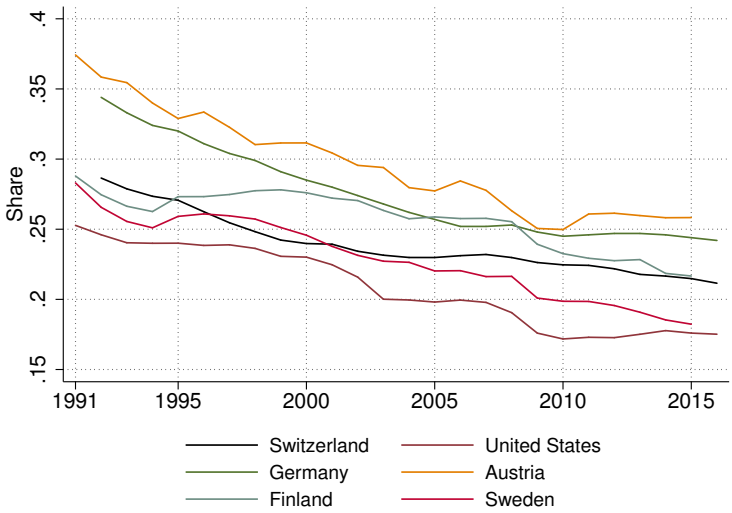
	Domestic			Export			Import		
	in CHF	in EUR	in other	in CHF	in EUR	in other	in CHF	in EUR	in other
Capital	98.2	1.7	0.1	62.6	25.1	12.3	68.3	26.0	5.7
Intermediate	98.2	1.8	0.0	48.7	47.5	3.8	53.4	42.8	3.8
Consumer	99.7	0.3	0.0	50.9	43.5	5.6	59.7	36.5	3.8

Notes: Average share of reported prices (in %) by market and product type.

Appendix C

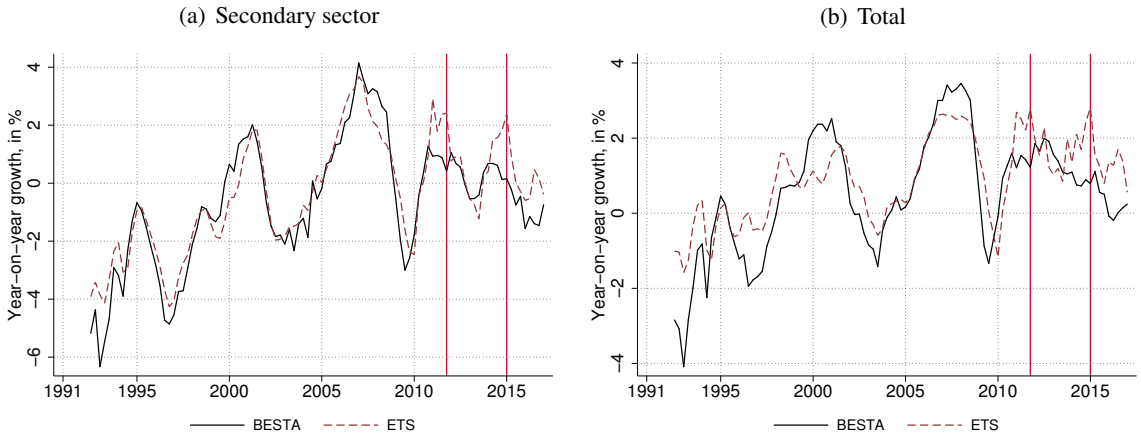
Additional results: Manufacturing employment

Figure C.1. International deindustrialization trends



Notes: Share of employees in secondary sector (Source: SFSO, OECD, DESTATIS).

Figure C.2. Aggregate manufacturing employment growth



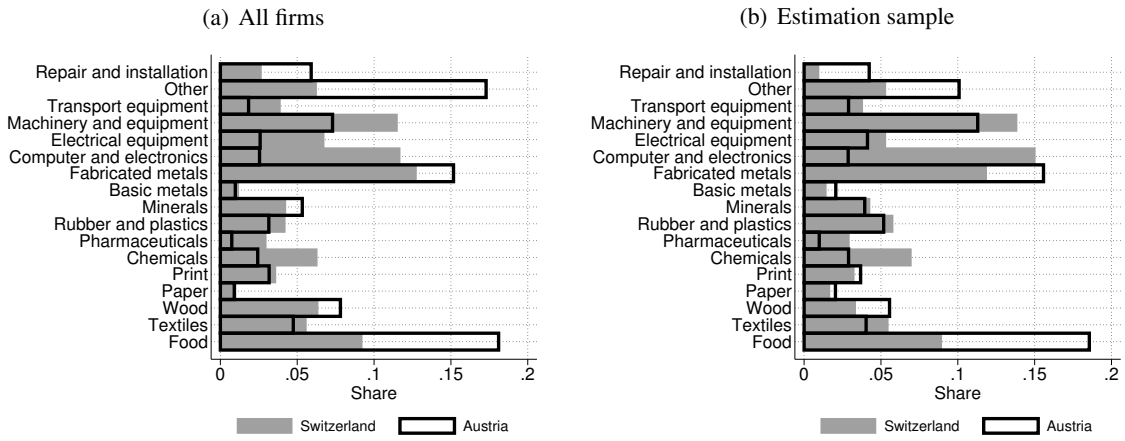
Notes: Our results are based on data from the BESTA that are known to deviate lately from an alternative employment statistic (*Erwerbstätigenstatistik*, ETS). In particular, the ETS exhibited substantially larger employment growth just before the removal of the exchange rate floor. This figure shows, however, that independent of the statistic used the growth rates fell substantially after the appreciation. The growth rate in the secondary sector employment declined even more strongly according to the ETS than according to the BESTA. Therefore, both statistics give a similar signal of a worsening labor market after the appreciation although employment kept growing somewhat according to the ETS.

Table C.1. Effective sampling rates by sector in the overall BESTA and the estimation sample

	BESTA			Balanced sample		
	Firms	Empl	N Firms	Firms	Empl	N Firms
Overall	0.12	0.71	5095	0.03	0.46	1401
Food and tobacco prod.	0.11	0.64	469	0.03	0.44	124
Basic metal prod.	0.22	0.86	60	0.07	0.45	18
Fabricated metal prod.	0.08	0.49	649	0.02	0.21	164
Computer and electronic prod.	0.28	0.94	595	0.09	0.63	199
Electrical equipment	0.4	0.9	343	0.09	0.67	75
Machinery and equipment	0.25	0.79	586	0.08	0.45	189
Transport equipment	0.43	0.73	198	0.12	0.57	57
Other manufacturing prod.	0.07	0.63	318	0.02	0.42	72
Repair and installation	0.05	0.4	135	0.01	0.29	15
Textiles and apparel	0.1	0.67	284	0.03	0.49	90
Wood prod.	0.04	0.26	323	0.01	0.1	49
Paper prod.	0.26	0.81	51	0.12	0.44	23
Printing	0.08	0.51	183	0.02	0.2	47
Coke, chemicals and chemical prod.	0.46	0.99	320	0.13	0.74	94
Pharmaceutical prod.	0.6	0.92	151	0.16	0.76	41
Rubber and plastic prod.	0.28	0.77	214	0.11	0.45	81
Non-metallic mineral prod.	0.15	0.6	216	0.04	0.37	63

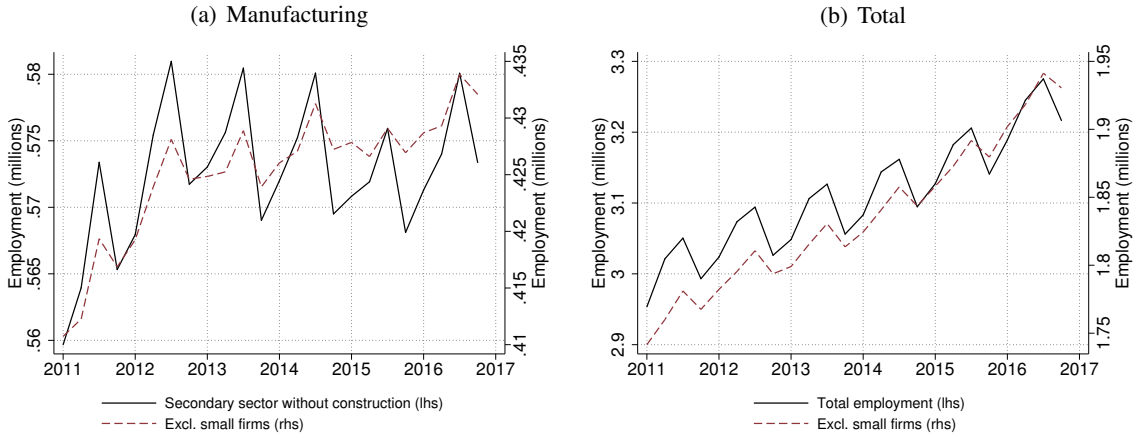
Notes: The table shows effective sampling rates of manufacturing firms and employees in Q4 2014 in the BESTA survey and in the balanced sample. Population values are taken from the 2014 census of the universe of Swiss firms (STATENT).

Figure C.3. Sectoral distribution in Switzerland and Austria in 2014



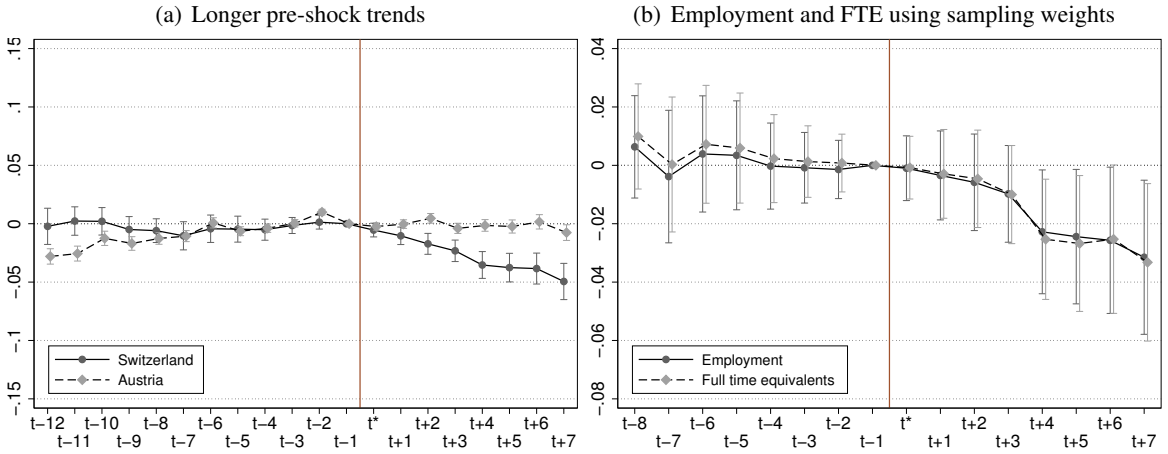
Notes: The figures show the share of firms in the corresponding sectors for the total samples (panel a) and the estimation sample excluding seasonal small firms and all micro firms (panel b). We see that our estimation sample has a larger share of firms in the sector computer and electronics, which actually includes watches. But also, more firms in Switzerland are operating in the the pharma and chemical sectors than in Austria. Comparing panels (a) and (b) we see that the sampling decisions do not strongly affect the relative sectoral composition of the two samples.

Figure C.4. Employment in Austria from 2011-2017



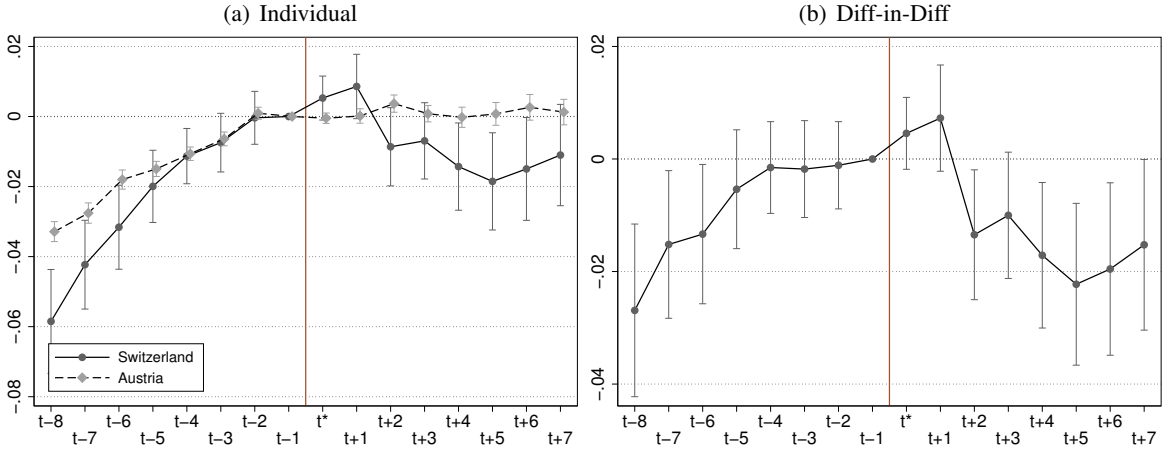
Notes: Employment count for last day of each quarter based on ASSD. Employment covers all workers (*Arbeiter*) and employees (*Angestellte*) subject to social security contributions, as well as apprencticeships and marginally employed people. The dashed line is calculated based on the sample excluding small firms (with average yearly employment of less than 50). We see that Austrian manufacturing employment is highly seasonal and this seasonality is mostly because of small firms. Therefore, we exclude only for small firms those with strongly seasonal employment.

Figure C.5. Pre-shock trends and sampling weights



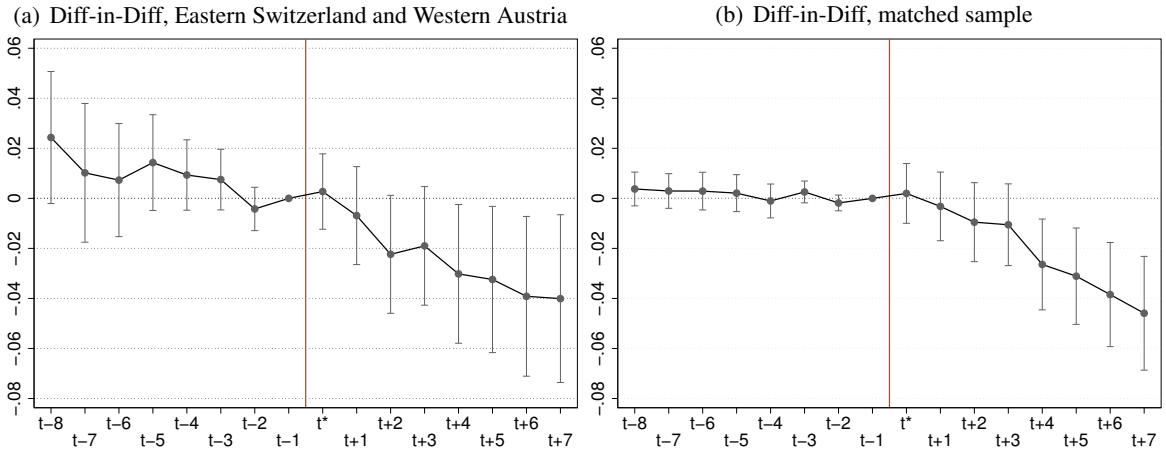
Notes: Impact on average employment extending the pre-shock period (panel a) and using sampling weights (panel b). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

Figure C.6. Impact on services employment relative to Austria



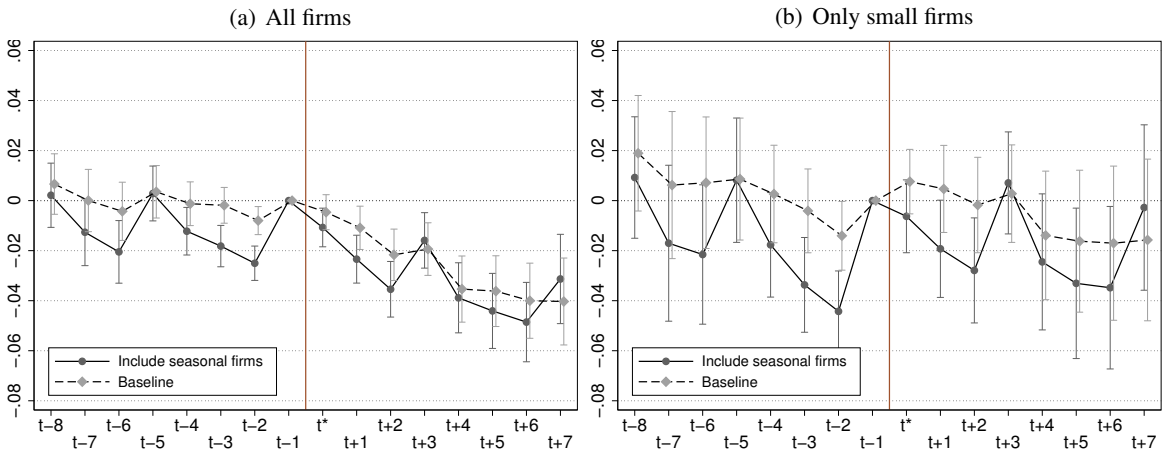
Notes: Impact on average employment in the tertiary sector for Switzerland and Austria (panel a) and diff-in-diff estimates (panel b). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. We observe a significant decline in services sector employment relative to the control group of about 2%. The pre-shock coefficients of the diff-in-diff are not significant for four quarters before the shock but are significant for two years before the shock. This indicates either that Austria is not an ideal control group or that services sector employment took more time to converge. Because employment in the Swiss services sector increased more strongly before the shock than in Austria, we may even underestimate the impact of the appreciation on employment in the services sector.

Figure C.7. Comparison with Western Austria and matched sample



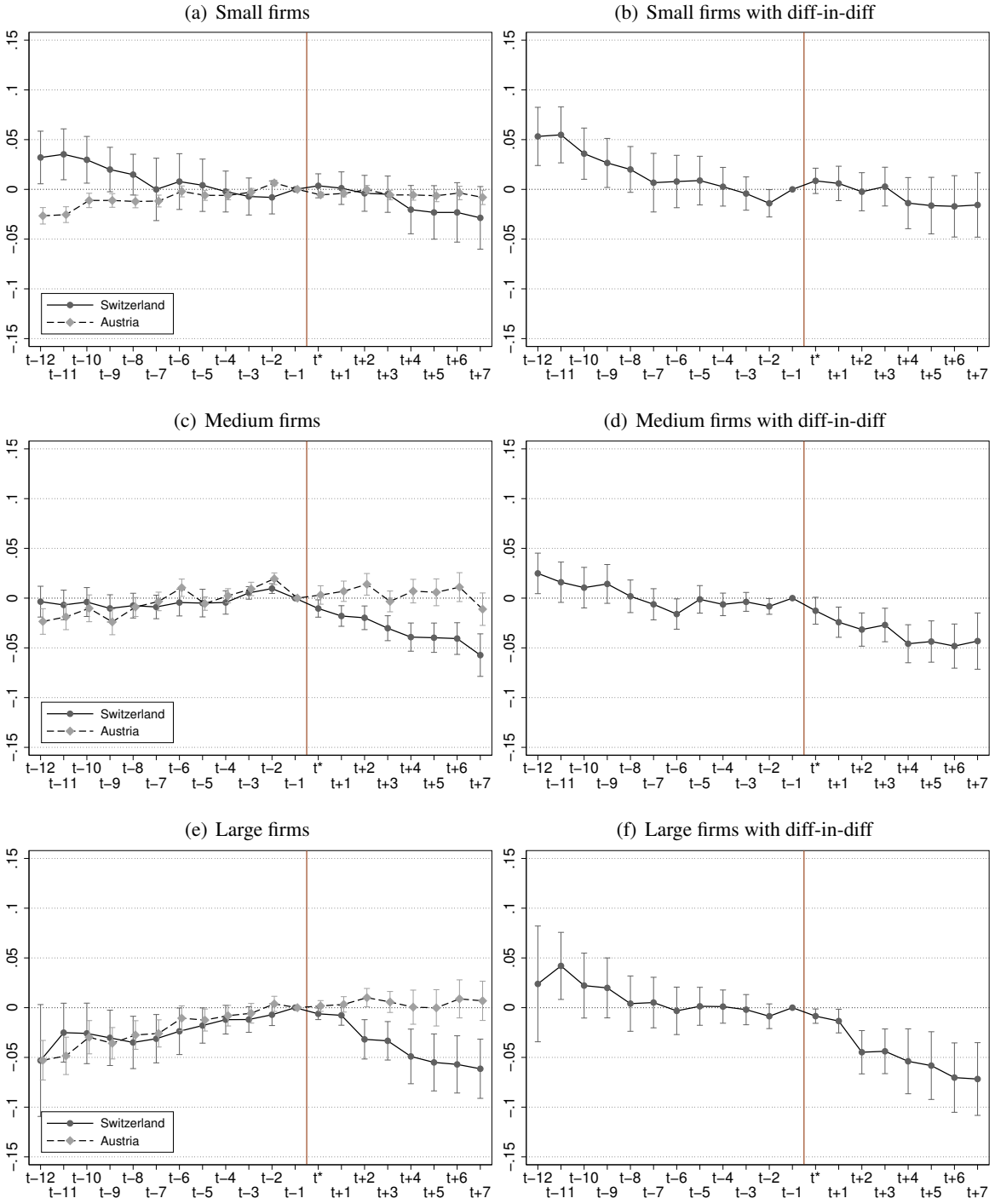
Notes: Diff-in-diff estimates for Eastern Switzerland and Western Austria (panel a) and with firm-level matched sample (panel b). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The results are robust and point towards a reduction relative to the control group of 4%-4.5%. Because of the smaller sample size, the standard errors of the estimates are larger, however.

Figure C.8. Impact on employment including seasonal firms



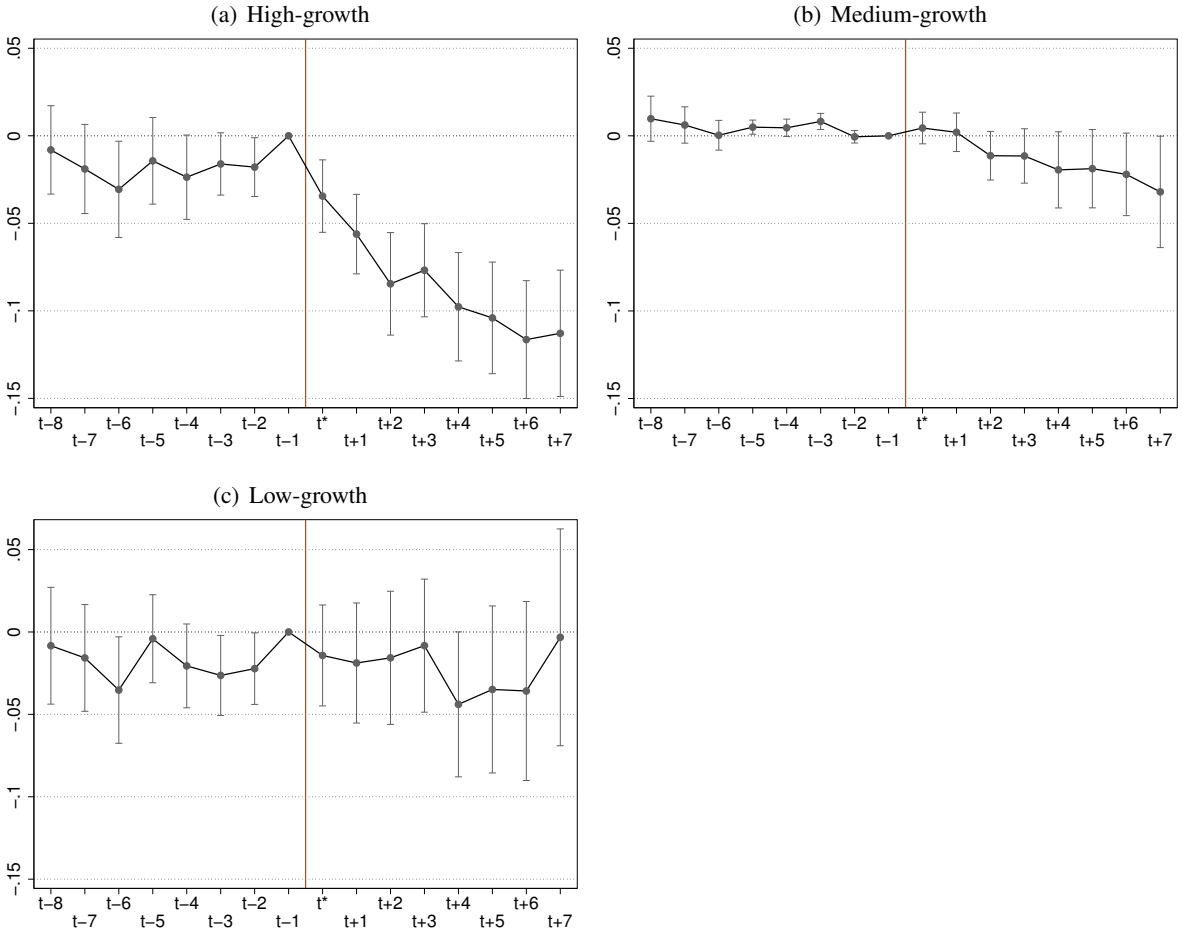
Notes: In our baseline estimation, we exclude small firms that exhibit excessive seasonality in employment. The figure illustrates the diff-in-diff results including all seasonal firms and compares them to the baseline estimates. The seasonality carries over into the diff-in-diff results. The fourth quarter coincides with the through of the Austrian seasonal cycle. As a result, employment in Swiss firms declines relative to Austrian firms during the rest of the year. However, the estimates for each fourth quarter are quite close in the estimation including all firms, and the estimation excluding seasonal firms. This is true for both the overall sample and when we restrict ourselves to just small firms. Because we do not exclude any medium-sized or large firms, the results for these firms are not affected by relaxing the seasonality exclusion. Our conclusions would remain the same if we included all firms in the baseline specification, however the results including seasonal firms seem harder to interpret.

Figure C.9. Pre-shock trends employment



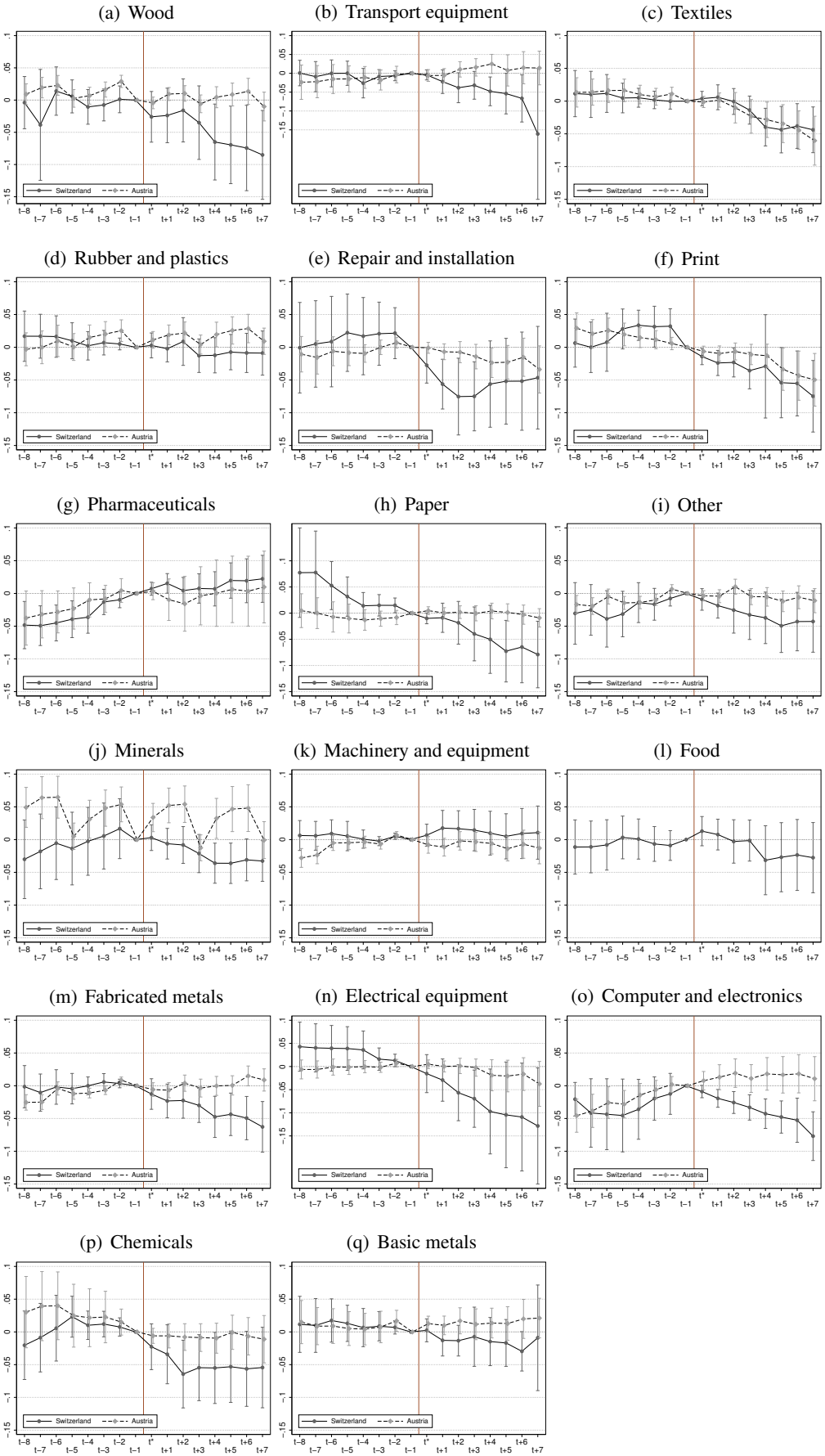
Notes: In this robustness check we include a longer pre-appreciation period in the analysis and extend the estimation period to the first quarter of 2012. The exchange rate floor is still in place for the entirety of the sample period before the shock, however it was introduced just two quarters before the beginning of our sample in September 2011. The Swiss franc went through a substantial appreciation before the introduction and we cannot rule out that some firms are still reacting to the appreciation. Some firms in Austria and Switzerland exhibit some significantly different dynamics during 2012. This is driven by small firms. For medium-sized and large firms, no systematic differences arise before the appreciation.

Figure C.10. Impact according to employment growth without small firms



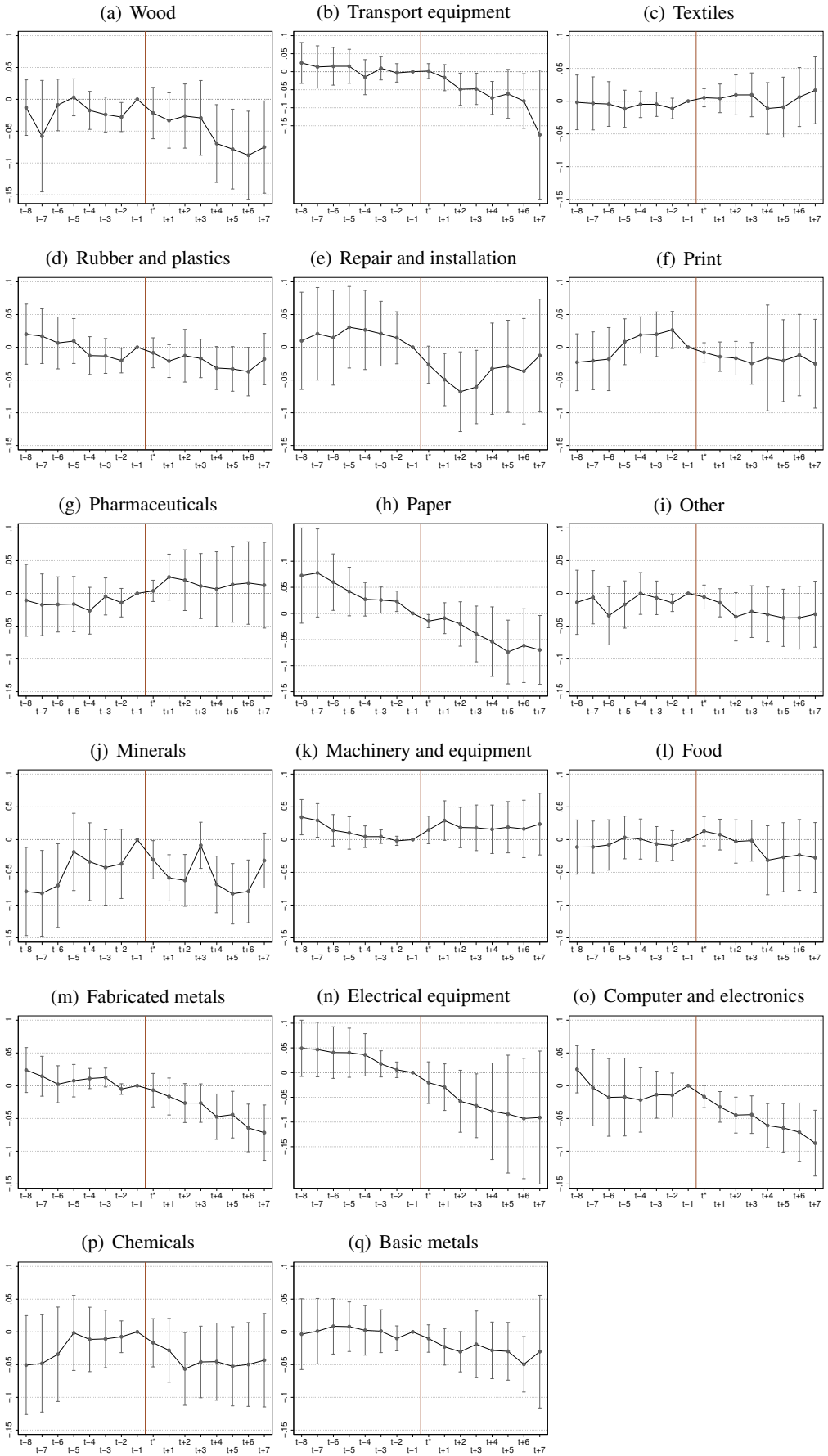
Notes: Diff-in-diff estimates according to employment growth in 2014 without small firms. We see that high-growth firms exhibit the strongest decline in employment.

Figure C.11. Impact on employment according to sectors



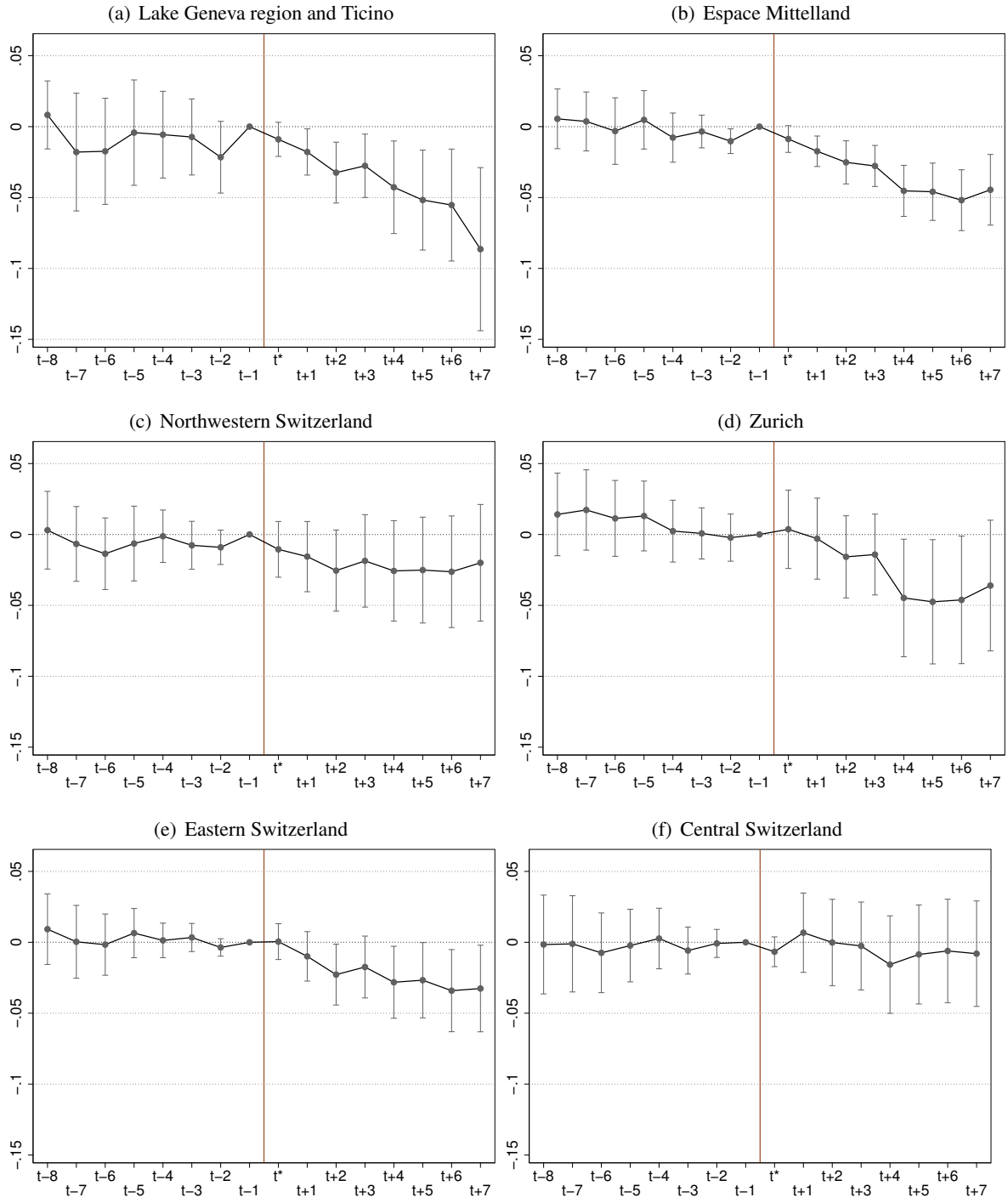
Notes: Impact on average employment according to sectors for Switzerland and Austria. The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals.

Figure C.12. Impact on employment according to sectors with diff-in-diff



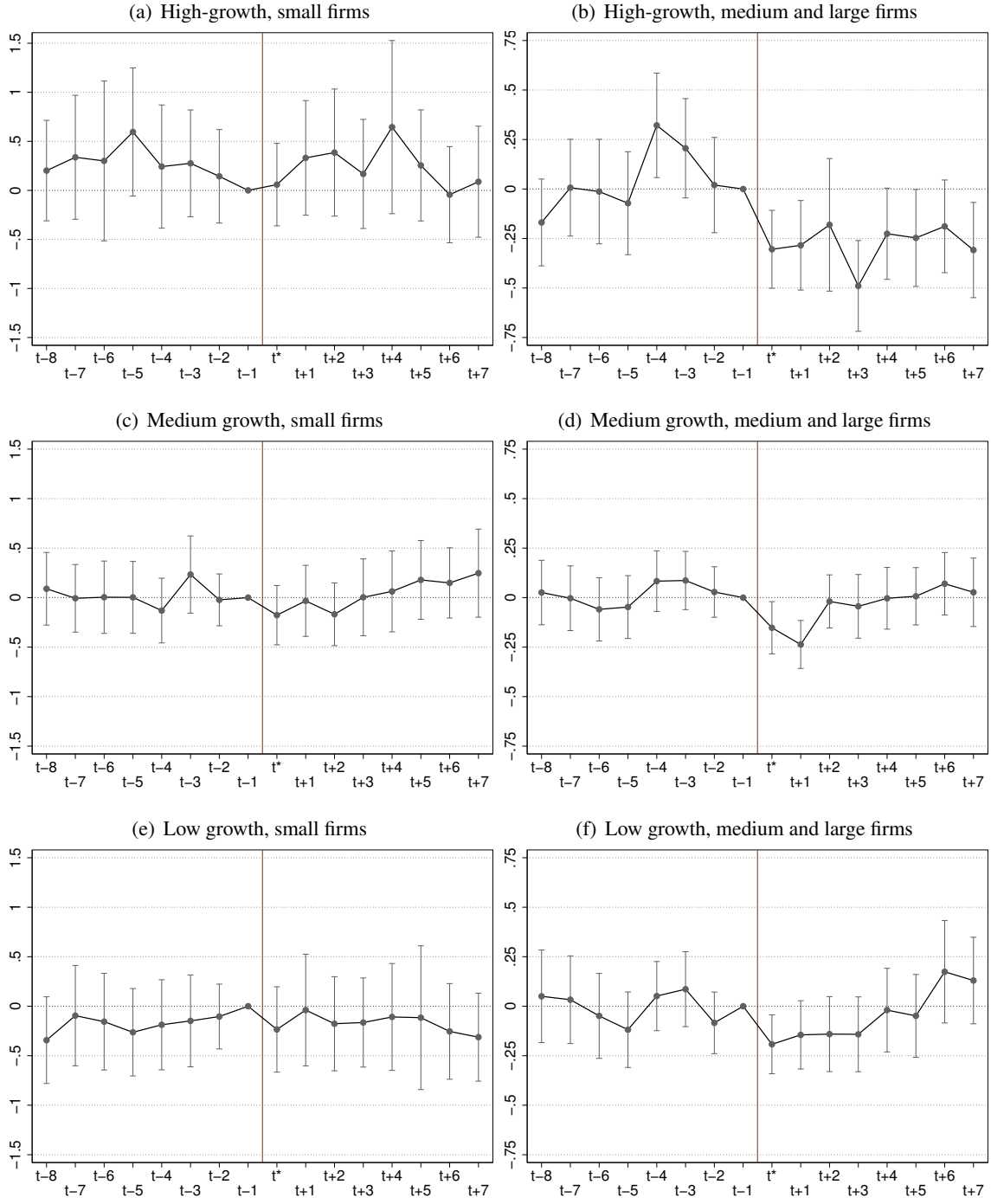
Notes: Impact on average employment according to sectors relative to Austria (diff-in-diff). The responses are measured in logarithms and normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals.

Figure C.13. Regional differences relative to Austria



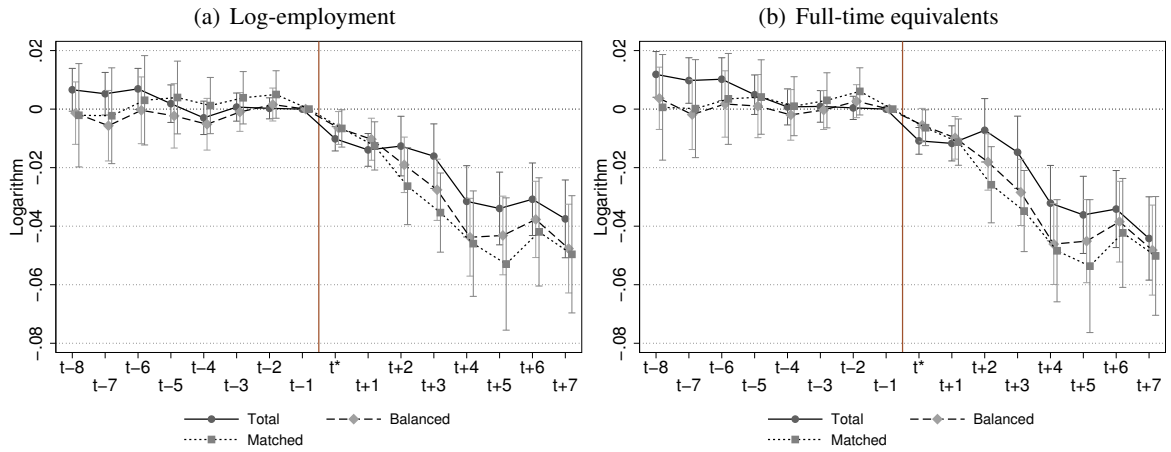
Notes: Diff-in-diff estimates for subsamples of different regions in Switzerland. The regional differences are relatively small or not statistically significant. The only exception is central Switzerland that appears to be less affected by the appreciation.

Figure C.14. Vacancies per 100 employees according to size and employment growth



Notes: Impact on the average number of vacancies per 100 employees according to various firm characteristics. The responses are normalized to zero in Q4 2014. Vertical bars represent 95% confidence intervals. The red vertical line denotes the removal of the exchange rate floor.

Figure C.15. Representativity checks employment



Notes: Representativity checks estimated on the original manufacturing sample, the balanced sample as well as the sample matched with the price data.

Appendix D

A simple model of employment and vacancies

Employment of firm i at the end of quarter t, e_{it}, is given by employment at the end of last quarter minus natural turnover, $e_{t-1}(1-\delta)$, plus vacancies posted and filled during the current quarter, rv_{it}:

$$e_{it} = (1-\delta)e_{it-1} + rv_{it} \tag{D.1}$$

This model has two parameters: the vacancy filling rate r, and the separation rate δ. The vacancy filling rate can also be interpreted as the inverse of average vacancy duration. Both parameters are the same for all firms. Note that we equate our measure of vacancies at the end of a quarter with total vacancies posted during the quarter. Let us assume that before the appreciation, the distribution of vacancies is stationary, and the mean firm is growing at rate $\mathbb{E}((rv_{it} - \delta e_{it-1})/e_{it-1}) \equiv g$. We can then approximate the dynamics of the mean deviation from employment in the reference quarter:

$$\mathbb{E}\left(\frac{e_{it} - e_{iR}}{e_{iR}}\right) \approx g(1-\delta) + (1-\delta)\mathbb{E}\left(\frac{e_{it-1} - e_{iR}}{e_{iR}}\right) + r\mathbb{E}\left(\frac{v_{it} - v_{iR}}{e_{iR}}\right) \tag{D.2}$$

This difference equation has the following interpretation. If the distribution of vacancies stays the same as in the reference quarter, then firms have a long run size defined by g and δ. If $g = 0$, this size is on average equal to the reference quarter. If $g > 0$, this size is larger and firms will tend to grow until they reach that size.[1] Shifts in the distribution of vacancies relative to the reference quarter will influence the dynamics of average firm employment. The vacancy filling rate r determines to which extent a given shift translates into current employment. The separation rate δ determines how permanent the impact of a one-time shift in the vacancy distribution on employment is. In the extreme case where $\delta = 1$, firm employment is only determined by current vacancies and shocks to vacancies affect current employment, but not future employment. If $\delta = 0$, then shocks to vacancies will have a permanent impact on employment.

For a given time path of deviation of vacancies from their reference period value, we can express the following development of employment after the reference period:

$$\mathbb{E}\left(\frac{e_{iR+k} - e_{iR}}{e_{iR}}\right) = g\sum_{s=1}^{k}(1-\delta)^s + r\sum_{s=1}^{k}(1-\delta)^{s-1}\mathbb{E}\left(\frac{v_{iR+s} - v_{iR}}{e_{iR}}\right) \tag{D.3}$$

[1] We present the model for the general case where $g > 0$, but assume $g = 0$ in our application.

We have estimated time paths for $\mathbb{E}((v_{iR+s} - v_{iR})/e_{iR})$ and $\mathbb{E}((e_{iR+k} - e_{iR})/e_{iR})$, which are illustrated for our baseline sample in figure 3.13 panel (b) for vacancies and 3.3 for employment. We can use our model to give a rough guess whether the decline in vacancies we observe after the appreciation would translate into the observed employment losses for given values for the separation rate δ and the vacancy filling rate r. Furthermore, we use the same model to assess the fit before the reference period, but normalize all values to be zero in the reference quarter.

Unfortunately, estimates for the vacancy filling rate do not exist for Switzerland, and we cannot reliably estimate this parameter using our own data. Davis et al. (2013) find that in US manufacturing, the average vacancy duration is 19.3 days on average between 2001 and 2006. Kettemann et al. (2017) find that in Austria, the average vacancy duration in manufacturing is 10 days between 2004 and 2014. Hobijn and Sahin (2009) estimate a monthly separation rate of about 0.012 in Switzerland. Converting these estimates to quarterly values would yield a value of r between 4.5 (USA) and 9 (Austria), and a value of δ of around 0.036. In our baseline, we use $r = 4.5$ and $\delta = 0.036$, $g = 0$.

We experiment with different values of the parameters. However, the baseline choice fits the data best before and after the appreciation. The results are quite sensitive to the choice of r and less so to the choice of δ. The fit of the model is good for values of r between 3.6 and 4.5 which imply a mean vacancy duration between 20 and 25 days. In this case, the model can explain about 50-68% of the decline in employment up to Q4 2016 for large and medium sized firms. If we use the value of $r = 9$ implied by Austrian data, we find that the employment decline predicted by the model is larger than the one in the data. However, the model fits the data poorly before the appreciation. The lowest vacancy filling rate we look at is $r = 3$, which implies an average vacancy duration of one month and in which case the drop in vacancies explains around 40-45% of the decline in employment.

Table D.1. Ratio between predicted and estimated employment response in Q4 2016

	$r = 9$	$r = 6$	$r = 4.5$	$r = 3.6$	$r = 3$
vacancy duration (days)	10	15	20	25	30
$\delta = 0.03$	1.36	0.91	0.68	0.55	0.46
$\delta = 0.035$	1.33	0.89	0.67	0.53	0.44
$\delta = 0.04$	1.30	0.86	0.65	0.52	0.43
$\delta = 0.045$	1.26	0.84	0.63	0.51	0.42
$\delta = 0.05$	1.23	0.82	0.62	0.49	0.41

Appendix E

Survey questionnaires

9999/99

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement des Innern EDI
Bundesamt für Statistik BFS

INLAND

Produzentenpreisindex

P.P. A CH-2010 Neuchâtel
BFS – PREIS

Name Unternehmen
Sachbearbeiter
Strasse & Nummer
Adresszusatz
PLZ / Ort

Bitte ausfüllen:

UID Nr.: CHE- ☐☐☐ · ☐☐☐ · ☐☐☐
(Unternehmens-Identifikationsnummer z.B. von MwSt.)

Produziert Ihre Firma für den Inlandmarkt oder kauft Sie auf dem Inlandmarkt ein?
Ja ☐ ➔ Weiterfahren
Nein ☐ ➔ Abbrechen, Formular zurücksenden

Mitarbeiter/-in des Unternehmens:
Herr/Frau: Peter Mustermann
Telefon: 058 463 99 99
E-Mail: peter.mustermann@bfs.admin.ch

BFS Mitarbeiter/-in:
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E-Mail: peter.mustermann@bfs.admin.ch

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AUSFÜLLBEISPIEL

AUSFÜLLBEISPIEL

1 Produkt und Artikelnummer Beispiel
Kurze Produktbeschreibung
z.B. Kabel zweipolig, flach, Artikelnummer 20-088

2 Lieferbedingungen
ab Werk

3 Preisangabe

Januar	Februar
63.40	65.30

4 Währung
CHF

5 Mengeneinheit
pro 10 m

6 Zusatzinformationen (Produkt, Lieferbedingungen, Preismeldungen usw.)
Siehe beiliegendes technisches Datenblatt (Ausg. Nov. 2010)
Zahlbar 20 Tage netto

ProdCode: (Bitte leer lassen) PosNr.: (Bitte leer lassen) LfNr.: (Bitte leer lassen)

PPI_Inland_form_33_PREIS_1d 05.2014 15800414O

Source: SFSO (2016)

9999/99

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement des Innern EDI
Bundesamt für Statistik BFS

EXPORT

Produzentenpreisindex

P.P. A CH-2010 Neuchâtel
BFS – PREIS

Name Unternehmen
Sachbearbeiter
Strasse & Nummer
Adresszusatz
PLZ / Ort

Bitte ausfüllen:

UID Nr.: CHE- ☐☐☐ · ☐☐☐ · ☐☐☐
(Unternehmens-Identifikationsnummer z.B. von MwSt.)

Produziert Ihre Firma für den Export?

Ja ☐ ➔ Weiterfahren
Nein ☐ ➔ Abbrechen, Formular zurücksenden

Mitarbeiter/-in des Unternehmens:
Herr/Frau: Peter Mustermann
Telefon: 058 463 99 99
E-Mail: peter.mustermann@bfs.admin.ch

BFS Mitarbeiter/-in:
Herr/Frau: Peter Mustermann
Telefon: 058 463 99 99 Fax: 058 463 63 41
E-Mail: peter.mustermann@bfs.admin.ch

AUSFÜLLBEISPIEL UND WICHTIGE ERKLÄRUNGEN

1 Produkt

– Mindestens ein umsatzstarkes, über längere Zeit hergestelltes Produkt angeben
– Bei Produktion nach Kundenspezifikation Grundversion angeben
– Falls nötig: Detaillierte Produktbeschreibung im Feld «Zusatzinformationen» eintragen oder Prospekt beilegen
– Bei Unklarheiten bitte BFS Mitarbeiter/-in kontaktieren

2 Lieferbedingungen/Exportdestination

– Preisrelevante Lieferbedingungen (Bezugsmenge, Zahlungsmodalität usw.), z.B. FOB, EXW, CPT (Incoterms)
– Pro Produkt maximal Preise für die zwei wichtigsten Exportdestinationen melden

3 Preisangabe

– Anfangs Monat geltende Preise, keine Listenpreise, abzüglich Rabatte
– Verkaufspreise FOB (free on board), exkl. MwSt.
– Preisdefinition über die Meldeperioden hinweg beibehalten

4 Währung

CHF oder Fremdwährung

5 Mengeneinheit

Mengeneinheit, auf die sich der Preis bezieht (z.B. 100 kg, 1 m^2, 1 Stück, 1000 Seiten, usw.)

6 Zusatzinformationen zum Produkt

– Detaillierte Produktbeschreibung: Angaben zu Qualität, technische Daten, Artikelnummer
– Zahlungsbedingungen, Rabatte, Erklärungen zu Versand- und Transportkosten oder -bedingungen (insbesondere falls keine FOB Preise angegeben werden können)
– Erklärungen für unveränderte oder stark schwankende Preise, fehlende Preisinformationen
– Aktueller Preis des alten Produkts, falls dieses ersetzt wurde, weil es nicht mehr umsatzstark ist
– Neue Exportdestination
– Der Vorperiodepreis (t-1) ist eine Schätzung

AUSFÜLLBEISPIEL

AUSFÜLLBEISPIEL

1 Produkt und Artikelnummer Beispiel
Kurze Produktbeschreibung
z.B. Kabel zweipolig, flach, Artikelnummer 20-088

2 Lieferbedingungen/Exportdestination
ab Werk
Export nach Deutschland

3 Preisangabe

Januar	Februar
63.40	65.30

4 Währung
€

5 Mengeneinheit
pro 10 m

6 Zusatzinformationen (Produkt, Lieferbedingungen, Preismeldungen usw.)
Siehe beiliegendes technisches Datenblatt (Ausg. Nov. 2010)
Zahlbar 20 Tage netto

ProdCode: (Bitte leer lassen) PosNr.: (Bitte leer lassen) LfNr.: (Bitte leer lassen)

PPI_Export_form_33_PREIS_1d 05.2014 156004146

Bitte Rückseite beachten

Source: SFSO (2016)

9999/99

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement des Innern EDI
Bundesamt für Statistik BFS

IMPORT

Produzentenpreisindex

P.P. **A** CH-2010 Neuchâtel
BFS – PREIS

Name Unternehmen
Sachbearbeiter
Strasse & Nummer
Adresszusatz
PLZ / Ort

✍ **Bitte ausfüllen:**

UID Nr.: CHE- ☐☐☐ · ☐☐☐ · ☐☐☐
(Unternehmens-Identifikationsnummer z.B. von MwSt.)

Importiert Ihre Firma aus dem Ausland?

Ja ☐ ➔ Weiterfahren
Nein ☐ ➔ Abbrechen, Formular zurücksenden

Mitarbeiter/-in des Unternehmens:
Herr/Frau: Peter Mustermann
Telefon: 058 463 99 99
E-Mail: peter.mustermann@bfs.admin.ch

BFS Mitarbeiter/-in:
Herr/Frau: Peter Mustermann
Telefon: 058 463 99 99 Fax: 058 463 63 41
E-Mail: peter.mustermann@bfs.admin.ch

AUSFÜLLBEISPIEL UND WICHTIGE ERKLÄRUNGEN

1 Produkt

– 1 bis 4 Produkte angeben, die bezogen auf die Häufigkeit und/oder den Wert Ihrer Importe repräsentativ sind
– Falls nötig: Detaillierte Produktbeschreibung im Feld «Zusatzinformationen» eintragen oder Prospekt beilegen
– Bei Unklarheiten bitte BFS Mitarbeiter/-in kontaktieren

2 Lieferbedingungen

Preisrelevante Lieferbedingungen (Bezugsmenge, Zahlungsmodalität usw.), z.B. CIF, franko Domizil

3 Preisangabe

– Anfangs Monat geltende Preise, keine Listenpreise, abzüglich Rabatte
– Einkaufspreise CIF, franko unverzollt Schweizergrenze, exklusive MwSt. und anderer staatlichen Abgaben wie Verbrauchssteuern
– Preisdefinition über die Meldeperioden hinweg beibehalten

4 Währung

CHF oder Fremdwährung

5 Mengeneinheit

Mengeneinheit, auf die sich der Preis bezieht (z.B. 100 kg, 1 m², 1 Stück, 1000 Seiten, usw.)

6 Zusatzinformationen zum Produkt

– Detaillierte Produktbeschreibung: Angaben zu Qualität, technische Daten, Artikelnummer
– Zahlungsbedingungen, Rabatte, Erklärungen zu Versand- und Transportkosten oder -bedingungen (insbesondere falls keine CIF Preise angegeben werden können)
– Erklärungen für unveränderte oder stark schwankende Preise, fehlende Preisinformationen
– Aktueller Preis des alten Produkts, falls dieses ersetzt wurde, weil es nicht mehr umsatzstark ist
– Der Vorperiodepreis (t-1) ist eine Schätzung

AUSFÜLLBEISPIEL

AUSFÜLLBEISPIEL

1 Produkt und Artikelnummer Beispiel
Kurze Produktbeschreibung
z.B. Kabel zweipolig, flach, Artikelnummer 20-088

2 Lieferbedingungen
CIF

3 Preisangabe

Januar	Februar
63.40	65.30

4 Währung
€

5 Mengeneinheit
pro 10 m

6 Zusatzinformationen (Produkt, Lieferbedingungen, Preismeldungen usw.)
Siehe beiliegendes technisches Datenblatt (Ausg. Nov. 2010)
Zahlbar 20 Tage netto

ProdCode: (Bitte leer lassen) PosNr.: (Bitte leer lassen) LfNr.: (Bitte leer lassen)

PPI_import_form_33_PREIS_1d 05.2014 156004143

Bitte Rückseite beachten

Source: SFSO (2016)

Beschäftigungsstatistik

BESTA
Espace de l'Europe 10
2010 Neuchâtel
Tel.: 0 800 000 345
E-Mail: besta@bfs.admin.ch
Internet: www.esurvey.admin.ch/ebesta

Fragebogen zurücksenden bis:
Per Post oder per Internet

Schwarzen oder blauen Kugelschreiber benützen,
Zahlen rechtsbündig eintragen 28,45

Felder bitte folgendermassen markieren: X

1a. Personalbestand am Ende des Vorquartals (inkl. Inhaber/innen, Geschäftsführer/innen, Lehrlinge, Heimarbeitende & Grenzgänger/innen)

	Vollzeitbeschäftigte (90 bis 100%...)	Teilzeitbeschäftigte (50 bis 89%...)	(15 bis 49%...)	(<15%)	Total der Beschäftigten	Vollzeitäquivalenten (Summe der Stellenprozente)
Männer					M	M ,
Frauen					F	F ,
	(... der betriebsüblichen Arbeitszeit)				Total	T ,

Anzahl Grenzgänger/innen ausländischer Nationalität am Ende des Vorquartals

Männer Frauen Total Keine Grenzgänger/innen ☐

1b. Personalbestand am Ende des Berichtsquartals (inkl. Inhaber/innen, Geschäftsführer/innen, Lehrlinge, Heimarbeitende & Grenzgänger/innen)

	Vollzeitbeschäftigte (90 bis 100%...)	Teilzeitbeschäftigte (50 bis 89%...)	(15 bis 49%...)	(<15%)	Total der Beschäftigten	Vollzeitäquivalenten (Summe der Stellenprozente)
Männer					M	M ,
Frauen					F	F ,
	(... der betriebsüblichen Arbeitszeit)				Total	T ,

Anzahl Grenzgänger/innen ausländischer Nationalität am Ende des Berichtsquartals

Männer Frauen Total Keine Grenzgänger/innen ☐

2. Anzahl offener Stellen am Ende des Berichtsquartals Keine offenen Stellen ☐

3. Personalrekrutierung im Berichtsquartal
Hatten Sie im Berichtsquartal Schwierigkeiten bei der Rekrutierung von Personal mit: (nur eine Antwort pro Zeile ankreuzen)

	Diese Personalkategorie wurde... ...leicht gefunden	...schwer gefunden	...nicht gefunden	nicht gesucht/ Suchprozess noch nicht abgeschlossen/ weiss nicht
- Hochschulabschluss (Universität, ETH, Fachhochschule oder gleichwertige Ausbildung)	☐	☐	☐	☐
- höhere Berufsbildung (Meisterprüfung, eidg. Fachausweis, höhere Fachschule etc.)	☐	☐	☐	☐
- Berufslehre oder gleichwertige Ausbildung (eidg. Fähigkeitsausweis, Maturität etc.)	☐	☐	☐	☐
- Obligatorische Schulbildung (ohne nachobligatorische Ausbildung)	☐	☐	☐	☐

4. Voraussichtliche Anzahl Beschäftigter im nächsten Quartal (nur eine Antwort ankreuzen)

Beibehaltung des Personalbestands ☐ Erhöhung des Personalbestands ☐ Reduktion des Personalbestands ☐

Im Falle einer Erhöhung oder Reduktion bitte die Veränderung in Anzahl Beschäftigter einschätzen

5. Kontaktperson in Ihrem Unternehmen für eventuelle Rückfragen

Name, Vorname:

E-Mail Adresse:

Telefon:

Datum und Unterschrift:

Firmenstempel

Source: SFSO (2017)

2941319076 **Innovationsaktivitäten in der Schweizer Wirtschaft**

KOF Konjunkturforschungsstelle
ETH Zürich, LEE F 105, 8092 Zürich
www.kof.ethz.ch

Tel. 044 632 85 33
Fax 044 632 12 18
inno@kof.ethz.ch

KOF

Branchenname:

Brancheklasse:

Umfrage

Unternehmens-ID

Kontakt-ID

Branchen-ID

- Alle Angaben werden streng vertraulich behandelt.
- Die Antworten beziehen sich, wenn nicht anders verlangt, auf den Standort Schweiz.
- Bei Unklarheiten bitte die Erläuterungen beachten.
- Zutreffendes Feld (☒) bitte ankreuzen oder Wert eintragen.
- Der Fragebogen ist für die Rückantwort auf der letzten Seite adressiert.

Bitte den Fragebogen zurücksenden bis:

22. Mai 2015

(Bitte Fragebogen auch dann zurücksenden, wenn Sie nicht alle Fragen beantworten oder nur Schätzwerte angeben können.)

1. Angaben zur Unternehmung und zu den Marktverhältnissen

1.1 **Gründungsjahr** der Unternehmung (ohne Berücksichtigung rein juristischer Statusveränderungen): ☐☐☐☐

1.2 Ihre Unternehmung ist mehrheitlich in **ausländischem** Besitz:

○ ja ○ nein

a) Falls **ja**: bitte Land angeben: _____

b) Falls **nein**: ist Ihre Unternehmung Teil einer Unternehmensgruppe? ○ ja ○ nein

1.3 Anzahl der Beschäftigten in der Schweiz (inkl. Lehrlinge; Teilzeitbeschäftigte auf **Vollzeitstellen** umrechnen):

Ende 2012	Ende 2014
☐☐☐☐☐	☐☐☐☐☐

1.4 Der Anteil folgender **Personalkategorien** an der Gesamtbeschäftigung betrug Ende 2014 schätzungsweise (Teilzeitbeschäftigte auf Vollzeitstellen umrechnen):

- Absolventen von Hochschulen (Universitäten, Fachhochschulen)	☐☐☐ %
- Personen mit einem Abschluss höher als Berufslehre	☐☐☐ %
- Gelernte (Berufslehre)	☐☐☐ %
- An- und Ungelernte	☐☐☐ %
- Lehrlinge	☐☐☐ %
Total Beschäftigte	1 0 0 %

1.5 **Umsatz** (ohne MWST) der Unternehmung ab Standort Schweiz:

(Banken: Erträge aus Zins-, Handels- und Kommissions-/ Dienstleistungsgeschäft;
Versicherungen: Bruttoprämien – Bruttozahlungen für Versicherungsfälle + Nettoertrag aus Kapitalanlagen;
Beratung etc.: Bruttohonorarertrag)

2012: CHF ☐☐ ☐☐☐ ☐☐☐ ☐☐☐

2014: CHF ☐☐ ☐☐☐ ☐☐☐ ☐☐☐

Source: Arvanitis et al. (2017)

4076319077

1.6 Ihre Unternehmung **exportiert Güter/Dienstleistungen**:

(Dienstleistungsexporte beinhalten auch die Dienstleistungen für ausländische Kunden, die in der Schweiz bezogen werden, z.B. Hotelaufenthalte von ausländischen Touristen)

○ ja ○ nein

Falls **ja**:

a) Anteil der **Exporte** am Umsatz 2014: ☐☐☐ %

b) **Hauptexportmarkt** (nur eine Antwort möglich):

○ EU ○ USA ○ Asien ○ Andere

1.7 Anteil des **Personalaufwandes** am Umsatz 2014:

☐☐☐ %

1.8 **Ausgaben für Vorleistungen**

Zu berücksichtigen sind Ausgaben für Vorleistungen für:
a) Waren (Materialien, Vor-/Zwischenprodukte, usw.) und
b) Dienstleistungen von Banken, Versicherungen, Telekommunikation usw., **nicht aber Ausgaben für Investitionsgüter**

a) Gesamtwert der Ausgaben für **Einkäufe** von Waren und Dienstleistungen **insgesamt** (ohne MWST) als Anteil am Umsatz 2014:

☐☐☐ %

b) Gesamtwert der Ausgaben für **Einkäufe** von Waren und Dienstleistungen vom **Ausland** (ohne MWST) als Anteil am Umsatz 2014:

☐☐☐ %

1.9 a) **Bruttoinvestitionen** (ohne MWST; notfalls Schätzwert angeben):

Erläuterung: Investitionen in eigengenutzten Betriebsbauten (neuerstellte Betriebsbauten, Umbauten, Renovationen etc.), Ausrüstungsinvestitionen (Fahrzeuge, Maschinen, Geräte, Büroausstattung etc.) und Softwareinvestitionen

2012: CHF ☐☐ ☐☐☐ ☐☐☐ ☐☐☐

2014: CHF ☐☐ ☐☐☐ ☐☐☐ ☐☐☐

b) Hat Ihre Unternehmung 2014 **Auslandinvestitionen** getätigt?

○ ja ○ nein

1.10 Mittelfristige Entwicklung der **Nachfrage** auf dem **Hauptabsatzmarkt:**

	starker Rückgang				starke Zunahme
	-2	-1	0	+1	+2
- in der Periode 2012-2014	○	○	○	○	○
- in der Periode 2015-2017	○	○	○	○	○

1.11 Anzahl in- und ausländischer **Hauptkonkurrenten** auf dem **Hauptabsatzmarkt**:

○ bis 5 ○ 6-10 ○ 11-15 ○ 16-50 ○ > 50

1.12 Beurteilung der Wettbewerbsintensität auf dem Hauptabsatzmarkt hinsichtlich:

	sehr schwach				sehr stark
	1	2	3	4	5
- Preis	○	○	○	○	○
- Nichtpreisliche Wettbewerbsdimensionen	○	○	○	○	○

Nichtpreisliche Wettbewerbsdimensionen: z.B. Produktdifferenzierung ("Customisation"), Produktqualität, (häufige) Einführung neuer Produkte, technischer Vorsprung, Flexiblilität bei Kundenwünschen, Serviceleistungen

2

Source: Arvanitis et al. (2017)

In der Reihe „Strukturberichterstattung“ des Staatssekretariats für Wirtschaft sind seit 2000 erschienen:

1	Arvanitis, S. u.a. (2000) Die preisliche Wettbewerbsfähigkeit der schweizerischen Wirtschafts-zweige	22.-
2	Arvanitis, S. u.a. (2001) Untersuchung der internationalen Wettbewerbsfähigkeit der schweizerischen Wirtschaftszweige anhand einer „Constant Market Shares“-Analyse der Exportanteile	18.-
3	Raffelhüschen, B. u.a. (2001) Zur Nachhaltigkeit der schweizerischen Fiskal- und Sozial-politik: Eine Generationenbilanz (ohne Software GAP)	21.-
4	Arvanitis, S. u.a. (2001) Unternehmensgründungen in der schweizerischen Wirtschaft	26.-
5	Arvanitis, S. u.a. (2001) Innovationsaktivitäten in der Schweizer Wirtschaft. Eine Analyse der Ergebnisse der Innovationserhebung 1999	34.-
6	Crivelli, L. u.a. (2001) Efficienza nel settore delle case per anziani svizzere	26.-
7	Hollenstein, H. (2001) Die Wirtschaftsbeziehungen zwischen der Schweiz und Osteuropa	23.-
8	Henneberger, F. u.a. (2001) Internationalisierung der Produktion und sektoraler Strukturwandel: Folgen für den Arbeitsmarkt	21.-
9	Arvanitis, S. u.a. (2002) Finanzierung von Innovationsaktivitäten. Eine empirische Analyse anhand von Unternehmensdaten	22.-
10	Arvanitis, S. u.a. (2002) Qualitätsbezogene und technologische Wettbewerbsfähigkeit der schweizerischen Industriezweige. Beurteilung auf Grund der Export- bzw. Importmittelwerte und der Hochtechnologieexporte	18.-
11	Ott, W. u.a. (2002) Globalisierung und Arbeitsmarkt: Chancen und Risiken für die Schweiz	28.-
12	Müller, A. u.a. (2002) Globalisierung und die Ursachen der Umverteilung in der Schweiz. Analyse der strukturellen und sozialen Umverteilungen in den 90-er Jahren mit einem Mehrländer-Gewichtsmodell	24.-
13	Kellermann, K. (2002) Eine Analyse des Zusammenhangs zwischen fortschreitender Globalisierung und der Besteuerung mobiler Faktoren nach dem Äquivalenzprinzip	18.-
14	Infras (2002) Globalisierung, neue Technologien und struktureller Wandel in der Schweiz	28.-
15	Fluckiger, Y. u.a. (2002) Inégalité des revenues et ouverture au commerce extérieur	20.-
16	Bodmer, F. (2002) Globalisierung und Steuersystem in der Schweiz	22.-
17	Arvanitis, S. u.a. (2003) Die Schweiz auf dem Weg zu einer wissensbasierten Ökonomie: eine Bestandesaufnahme	28.-
18	Koch, Ph. (2003) Regulierungsdichte: Entwicklung und Messung	23.-
19	Iten, R. u.a. (2003) Hohe Preise in der Schweiz: Ursachen und Wirkungen	36.-
20	Kuster, J. u.a. (2003) Tourismusdestination Schweiz: Preis- und Kostenunterschiede zwischen der Schweiz und EU	23.-
21	Eichler, M. u.a. (2003) Preisunterschiede zwischen der Schweiz und der EU. Eine empirische Untersuchung zum Ausmass, zu Erklärungsansätzen und zu volkswirtschaftlichen Konsequenzen	34.-
22	Vaterlaus, St. u.a. (2003) Liberalisierung und Performance in Netzsektoren. Vergleich der Liberalisierungsart von einzelnen Netzsektoren und deren Preis-Leistungs-Entwicklung in ausgewählten Ländern	37.-
23	Arvanitis, S. u.a. (2003) Einfluss von Marktmobilität und Marktstruktur auf die Gewinn-margen von Unternehmen – Eine Analyse auf Branchenebene	23.-
24	Arvanitis, S. u.a. (2004) Innovationsaktivitäten in der Schweizer Wirtschaft – Eine Analyse der Ergebnisse der Innovationserhebung 2002	28.-
25	Borgmann, Ch. u.a. (2004) Zur Entwicklung der Nachhaltigkeit der schweizerischen Fiskal- und Sozialpolitik: Generationenbilanzen 1995-2001	20.-
26D	de Chambrier, A. (2004) Die Verwirklichung des Binnenmarktes bei reglementierten Berufen: Grundlagenbericht zur Revision des Bundesgesetzes über den Binnenmarkt	19.-
26F	de Chambrier, A. (2004) Les professions réglementées et la construction du marché intérieur: rapport préparatoire à la révision de la loi sur le marché intérieur	19.-
27	Eichler, M. u.a. (2005) Strukturbrüche in der Schweiz: Erkennen und Vorhersehen	23.-
28	Vaterlaus, St. u.a. (2005) Staatliche sowie private Regeln und Strukturwandel	32.-
29	Müller, A. u.a. (2005) Strukturwandel – Ursachen, Wirkungen und Entwicklungen	24.-
30	von Stokar Th. u.a. (2005) Strukturwandel in den Regionen erfolgreich bewältigen	22.-
31	Kellermann, K. (2005) Wirksamkeit und Effizienz von steuer- und industriepolitischen Instrumenten zur regionalen Strukturanpassung	22.-

32	Arvanitis, S. u.a. (2005) Forschungs- und Technologiestandort Schweiz: Stärken-/Schwächen-profil im internationalen Vergleich	25.-
33E	Copenhagen Economics, Ecoplan, CPB (2005) Services liberalization in Switzerland	31.-
34	Arvanitis, S. u.a. (2007) Innovationsaktivitäten in der Schweizer Wirtschaft - Eine Analyse der Ergebnisse der Innovationsserhebung 2005	34.-
35/1	Brunetti, A., und S. Michal (eds.) - 2007 - Services Liberalization in Europe: Case Studies (vol. 1)	37.-
35/2	Brunetti, A., und S. Michal (eds.) - 2007 - Services Liberalization in Europe: Case Studies (vol. 2)	26.-
36/1	Balastèr, P., et C. Moser (éd.) - 2008 - Sur la voie du bilatéralisme: enjeux et conséquences (vol.1)	38.-
36/2	Balastèr, P., et C. Moser (éd.) - 2008 - Sur la voie du bilatéralisme: enjeux et conséquences (vol. 2	41.-
37	Kellermann, K. (2007) Die öffentlichen Ausgaben der Kantone und ihrer Gemeinden im Quervergleich	25.-
38	Ecoplan (2008) Benchmarking: Beispiel öffentlicher Regionalverkehr	15.-
39	Filippini, M. & M. Farsi (2008) Cost efficiency and scope economies in multi-output utilities in Switzerland	18.-
40	Kuster, J., und H.R. Meier (2008) Sammlung von Altpapier durch die Gemeinden - statistische Benchmarking-Methoden im Test	12.-
41	Frick, A. (2008) Benchmarking öffentlicher Leistungen anhand des Fallbeispiels "Berufsbildung": Vergleich der kantonalen Ausgaben für die Berufsbildung	14.-
42	Schoenenberger, A. e.a. (2009) Efficacité technique des exploitations forestières publiques en Suisse	25.-
43	Arvanitis, S. u.a. (2008) Innovation und Marktdynamik als Determinanten des Strukturwandels	14.-
44/1	Worm, H. u.a. (2009) Evaluation Kartellgesetz: Volkswirtschaftliche Outcome-Analyse	28.-
44/2	Hüschelrath, K. u.a. (2009) Evaluation Kartellgesetz: Fallstudien zu den Wirkungen des Kartellgesetzes	36.-
44/3	Baudenbacher, C. (2009) Evaluation Kartellgesetz: Institutionelles Setting Vertikale Abreden Sanktionierung von Einzelpersonen Zivilrechtliche Verfahren – with an English summary	36.-
44/4	Heinemann, A. (2009) Evaluation Kartellgesetz: Die privatrechtliche Durchsetzung des Kartellrechts	22.-
45	Hulliger, B. u.a. (2009) Erste Auswirkungen der Abschaffung der Buchpreisbindung - Technischer Bericht und Vertiefung	22.-
46	Arvanitis, S. u.a. (2010) Innovationsaktivitäten in der Schweizer Wirtschaft - Eine Analyse der Ergebnisse der Innovationsserhebung 2008	33.-
47/1	Arvanitis, S. u.a. (2011) Exportpotenziale im Dienstleistungssektor (Band 1)	31.-
47/2	Moser, P. u.a. (2011) Exportpotenziale im Dienstleistungssektor (Band 2)	16.-
47/3	Delimatsis, P. (2011) Exportpotenziale im Dienstleistungssektor (Band 3)	25.-
47/4	Egger, P., und G. Wamser (2011) Exportpotenziale im Dienstleistungssektor (Band 4)	14.-
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