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How are firms affected by exchange rate shocks? Evidence from survey based impulse responses

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Abstract

This paper studies the effects of a change in the Swiss franc/euro exchange rate floor, as introduced by the Swiss National Bank in September 2011 using a survey based impulse responses analysis. Survey based impulse responses incorporate experimental settings into representative firm surveys, expose firm executives to treatment or shock scenarios and evaluate the effects of the shocks on executives' expected firm-level outcomes. Our results suggest that a change in the exchange rate floor from 1.20 to 1.10 Swiss francs per euro and a subsequent appreciation of the Swiss franc by the same magnitude considerably decreases expected turnovers, costs and profits of Swiss firms. Manufacturing turnover decreases by 3.3% within six months and by 4.3% within 18 months. Total costs decline by 1.3% within six months and 2.0% within 18 months, while profits shrink by 3.3% within six months. The effects are substantially lower for the service and the construction sector, but exhibit large variation across sub-sector industries. Panel regression analysis reveals that firm-specific export shares and intermediate goods import shares are key determinants of firms' turnover, costs and profits reactions.

JEL classifications: C83, C99, E37, F31
Keywords: Swiss franc/euro exchange rate floor, survey based impulse responses, macroeconomic shock identification, structural micro data, disaggregation

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1 Introduction

On January 15, 2015 the Swiss National Bank (SNB) announced to repeal the Swiss franc/euro exchange rate floor of 1.20 francs per euro. Immediately following the announcement the Swiss franc appreciated strongly against the euro and other currencies with high volatility. Two trading days after the event the Swiss franc/euro exchange rate settled slightly above nominal parity. What are the consequences of such policy interventions and how does such a shock pass-through to prices and profits of firms? This is currently of utmost interest to policy makers, economists, and the media.

Figure 1 suggests that this shock is quite substantial: The swift appreciation of the Swiss franc on January 15th 2015 by almost 20% against the euro is large in comparison with most exchange rate movements since the mid 1990s. Though the Swiss franc strongly appreciated starting with the Great Recession in September 2008 and ending with the introduction of the 1.20 francs per euro floor in September 2011, it is not clear whether, or to what extent, this appreciation was unexpected and, hence, constitutes a macroeconomic shock.[1] The repeal of the exchange rate floor and the subsequent currency appreciation are likely to have considerable effects on the Swiss economy. However, given the particularity of the event and its presumably non-linear nature it is difficult to derive effects based on historical time series. We propose survey based impulse response analysis as an alternative method to measure the effects of macroeconomic shocks.

The effects of exchange rate fluctuations on import prices and profits have been so far studied at the aggregate as well as on the firm level. The primary objective of these studies is to find the size and speed of the adjustments to exchange rate movements. Most studies find an incomplete pass-through of exchange rates to prices. For instance, Campa and Goldberg (2005) perform a cross-country study on the effects of exchange rates on import prices. They present evidence for an incomplete pass-through in the short-run and an significant higher one in the long-run. Interestingly, their results are very heterogeneous across countries. Much lower effects are detected for the U.S. in the short run and the long-run, whereas the pass-through for small open economy countries is significantly higher.

Recently, by using micro data for U.S. Gopinath and Rigobon (2008) and Gopinath *et al.* (2010) deliver additional evidence on the transmission of exchange rate fluctuations. They find a decisive role for the currency choice of firms in the exchange rate pass through. The pass-through is largely different for goods priced in dollars versus goods priced in an other currency. Both articles also conclude that the pass-through is rather low for the U.S. Lassmann (2013) provides empirical results for the correlation between exchange rate movements and imports prices and profits using time series survey data for Switzerland. She reports an increase in the probability of deteriorating profits, costs, and prices after an appreciation of the Swiss franc. She also finds heterogeneous effects across firms, varying with the degree of international exposure.

The endogenous nature of exchange rates makes it difficult to identify causal effects, or

[1] Also, it is not clear whether the strong and sudden depreciation following the introduction of the exchange rate floor constitutes a macroeconomic shock.

to specify an exchange rate shock being orthogonal to any other economic innovation. It is apparent that VARs are well suited to analyze aggregate multivariate time series. They provide a framework with which potential endogeneity between the different time series can be tackled. Hahn (2003) and Faruqee (2004) apply structural VARs to aggregate euro area data. They both find evidence for an incomplete pass-through of exchange rates on prices. Moreover, Hahn (2007) uses more disaggregated data studying the effects of exchange rate shocks for sub-sectors of industry. She observes that the sub-sector with the strongest response price-wise is electricity, gas and water supply. By using a large scale macro model Abrahamsen and Simmons-Süer (2011) analyze the effects of exchange rate fluctuations on many different macro variables. Among other things, their simulations imply a positive reaction of prices after a depreciation of the Swiss franc. However, the size of this effect indicates a rather incomplete pass-through.

We contribute to existing literature in several ways. First, we provide firm level dynamic causal effects, with which we analyze the size and speed of the price adjustments in response to an exchange rate shock at the firm level. Survey based impulse response analysis provides a convenient way to identify macroeconomic shocks. They create structural microeconomic data allowing to shed light on the heterogeneity of economic agents and allow to easily capture any kind of non-linearities. Survey based impulse response analysis is "on the spot", i.e. it determines the effects of shocks at the time when the survey was conducted rather than being based on historical time series. This feature makes the approach especially valuable in times of a structural break.

This a novel feature, given that we introduce the exogenous variations already at the firm level, retrieving the conditional and unconditional expectations of the firms directly. The method at hand produces dynamic causal effects (impulse responses) without imposing any identifying (parametric) restrictions. Also a very general class of non-linearities across time and the cross-section can be handled easily. For example, we are able to analyze the heterogeneity of firms' responses to an exchange rate shock due to different export and import shares, size, industries. Moreover, the firm level approach also attenuates any omitted variable bias.[2] More importantly, our approach allows to dissect the causal effects of exchange rates on firms costs and profits using panel regression analysis, which allows us to draw inference on possible heterogeneity and non-linearity of the impulse responses to an exchange rate shock. Drechsel *et al.* (2015) provide a more detailed discussion of the survey based impulse response approach.

In July 2012 we conducted a survey based impulse response analysis on the effects of a change in the Swiss franc/euro exchange rate floor as introduced by the Swiss National Bank in September 2011. We attached a questionnaire to the regular KOF Swiss Economic Institute Investment Survey, a major quantitative and qualitative statistical survey on firms' financial outcomes and plans in Switzerland. In a first step, firm representatives, mostly Chief Financial Officers (CFOs), Chief Executive Officers (CEOs) or heads of controlling, were reminded that the SNB had communicated to defend the exchange rate floor of 1.20 francs per euro and were asked to indicate their exchange

[2]By conditioning on the actual information set of economic agents the scope of the information set is not an issue in survey based impulse response analysis; selection of the right variables, under- or overidentification do not pose problems (see, e.g. Rudebusch, 1998)

rate expectations for the second half of 2012 and for 2013. In a second step, we asked firm representatives to evaluate the effects of – under else unchanged macroeconomic circumstances – a change of the exchange rate floor from 1.20 francs to 1.10 francs per euro and a subsequent appreciation of the Swiss franc by the same magnitude on expected firm-specific turnovers and costs 6 months and 18 months ahead. Almost 900 firms completed the special questionnaire and our data constitute representative samples of the populations of Swiss manufacturing, service and construction sector firms. Consequently, we can aggregate the resulting firm-specific impulse responses to higher levels via standard procedures for building of macroeconomic time series from representative micro data samples.

80% of all firm representatives forecasted the exchange rate floor of 1.20 francs per euro to be still in place in 2013. To be more specific, 60% of all firm representatives forecasted a Swiss franc/euro exchange rate of 1.20 in 2013 whereas 20% forecasted an exchange rate depreciation up to 1.30 Swiss francs per euro. Interestingly, 11% of all firm representatives forecasted an exchange rate of 1.15 in 2013 and 9% of all firm representatives predicted an exchange rate of 1.10 in 2013. As firm representatives had been, directly prior to the survey questions, explicitly reminded of the 1.20 Swiss francs per euro exchange rate floor and of the SNB's (communicated) willingness to defend this exchange rate floor, these forecasts can hardly result from being unaware about the exchange rate floor. The only possible explanation is that the aforementioned firm representatives did, at the time of the survey in July 2012, indeed expect a repeal or a change of the exchange rate floor for 2013.

As far as firm representatives had forecasted the Swiss francs/euro exchange rate to be above 1.10, the aforementioned scenario means an exchange rate appreciation shock. We find that expected aggregate turnovers of the manufacturing sector decrease by 3.3% in the first six months after the exchange rate shock. After 18 months the expected decrease of aggregate manufacturing turnovers reaches 4.3% compared to a no shock state. The expected decrease in aggregate turnovers of the service sector is less severe, 1.6% six months after the shock and 2.1% after 18 months. The construction sector is comparatively little affected (0.4% and 0.8%). According to our findings, the exchange rate shock not only affects firms' turnovers but also firms' total costs, which is an approximate measure for import prices. Expected aggregate total costs of the manufacturing sector decline, compared to a no shock scenario, by 1.3% within six months and by 2.0% within 18 months. The respective expected aggregate total costs reductions for the service sector (construction sector) are 0.6% and 0.9% (0.2% and 0.5%). Furthermore, according to our findings the exchange rate shock leads to a substantial reduction in firms' profits. Expected total aggregate profits of the manufacturing sector decline by as much as 3.3% within six months due to the shock.[3] The service sector experiences a reduction in expected total aggregate profits of 1.24%. The profit reduction in the construction sector is less severe (–0.2%). The substantial negative profit effects, especially for the manufacturing sector, are an indication of an incomplete pass-through as for instance also observed by Campa and Goldberg (2005).

[3]we did not ask for 18-months unconditional forecasts on turnover and costs, thereby we cannot compute unconditional profit expectations for 18 months and cannot derive expected profit responses within 18 months in response to an exchange rate shock.

Notably, we find a lot of heterogeneity on the (sub-sector) industry level and on the firm level. For instance, the turnovers of firms in the hotel industry (being part of services) are strongly negatively affected by the exchange rate appreciation shock (despite the service sector aggregate effects being muted). Most of the distributions over firms' turnover and costs responses within a sector have fat tails and are skewed. A firm-level regression analysis reveals that a higher euro area export share is associated with a stronger reduction in expected turnovers in response to the exchange rate shock. Also, a higher import share from the euro area as well as a higher import share from the rest of the world are associated with a stronger reduction in expected total costs in response to the exchange rate shock.

Figure 1: Swiss franc to euro exchange rate

The graph depicts daily CHF / euro exchange rates. The displayed timespan ranges from January 1999 to January 2015. Source: Datastream.

The remainder of the paper is structured as follows. The following section gives a brief review of the literature on exchange rate shocks. Section 2 describes the implementation of the survey based impulse response approach. Section 3 presents the empirical results obtained from our survey based impulse response analysis. Section 4 concludes.

2 The survey based impulse response approach

We conducted a survey based impulse response analysis in July 2012 to appraise the effects of a possible change in the Swiss franc/euro exchange rate floor as introduced by the Swiss National Bank in September 2011. This section describes the implementation of our survey based impulse response approach. Drechsel *et al.* (2015) gives a more general exposition and discussion of the survey based impulse response approach.

2.1 Survey setup

Our data stem from a questionnaire attached to the semi-annual KOF Swiss Economic Institute Investment Survey, a major quantitative and qualitative statistical survey on firms' financial outcomes and plans in Switzerland, during the summer 2012 wave. Part of the survey has been paper based, the other part was conducted online via LimeSurvey. The characteristics of the underlying sample are representative of the Swiss economy. Detailed information on the sampling procedure can be found in Appendix 5.2.

893 Swiss firms completed the additional set of exchange rate related questions, out of which 83 are from the construction sector, 398 from manufacturing and 412 from services. Our data constitute representative samples of the populations of Swiss construction, manufacturing and service sector firms. However, the data do not provide us with a representative sample of the total population of Swiss firms. The aforementioned sectors cover only $60\% - 70\%$ of economy-wide value added, other sectors (including private households, public administration, social services and health care) are not included in our survey. Firms' responses come mostly from CFOs, CEOs, or heads of controlling. Respondents are taking part in KOF enterprise surveys on a regular basis and are accustomed to KOF questionnaire design. In order to ensure relevance of our questions to practitioners we conducted an interviewer pre-test among a group of selected firms.

The participating firms received an invitation letter and the questionnaires in paper and electronic format in order to facilitate participation. Anonymity of responses has been guaranteed. All KOF surveys are subject to Swiss statistics law. If addressed participants did not respond within 2.5 weeks they received a reminder. If they still did not participate after an additional period of another 2 weeks, we initiated a telephone reminder. Questionnaires were sent out in German, French and Italian.

2.2 Experimental design

Prior to asking scenario questions, firm representatives stated realized key financial figures for 2010, 2011 and the 1st half of 2012 as well as expected figures for the 2nd half of 2012 and 2013. This task is helpful in setting a benchmark for the scenario analysis. Also, representatives were asked for unconditional exchange rate forecasts

after reminding them that the SNB had communicated to defend an exchange rate floor of 1.20 Swiss franc per euro.

In a next step, the questionnaire confronted firm representatives with the counterfactual situation of an exchange rate innovation, namely – all else being equal – a change in the exchange rate floor from 1.20 to 1.10 Swiss francs per euro and a subsequent appreciation of the Swiss franc. Firm representatives were then asked to evaluate the effect of the innovation on their firms:

> Suppose, the SNB shifts the Swiss franc/euro exchange rate floor to 1.10 Swiss francs per euro under else constant economic circumstances. As a consequence the exchange rate moves to 1.10 Swiss francs per euro, which is an appreciation of the Swiss franc. Please indicate how your financial figures change compared to your previous expectations regarding these figures.

As an excerpt of the questionnaire, the answer options for total turnover are as follows (the complete questionnaire can be found in Appendix 5.3):

Importantly, the counterfactual exchange rate innovation constitutes a shock to the firm only if the firm representative unconditionally forecasts the exchange rate to be different from 1.10 Swiss francs per euro. In contrast, if the firm representative forecasts the Swiss franc to appreciate to 1.10 francs per euro, the innovation just meets his expectation and can thus not be considered as a shock. However, to anticipate our empirical results, since more than 90% of all firm respondents unconditionally forecasted the exchange rate to be above 1.10 Swiss francs per euro, the above scenario does indeed mean an exchange rate appreciation shock to most of the firms. The scenario question is designed such that answers equal the firm-specific dynamic causal effect, or treatment effect, of this exchange rate shock. This effect can be expressed formally as

$$\delta_{i,s} = E(y_{i,t+s}|\eta_{i,t} = 1) - E(y_{i,t+s}|\eta_{i,t} = 0), \qquad \text{for } s = 6 \text{ months}, 18 \text{ months}$$

$\eta_{i,t}$ is the treatment variable with $\eta_{i,t} = 1$ when firm i receives the shock treatment at time t (treatment scenario) and $\eta_{i,t} = 0$ when the firm has not received the shock treatment at time t (control scenario). Further, $E_t(y_{i,t+s}|\eta_{i,t} = 1)$ is firm i's at time t expected total turnover for horizon s given the exchange rate shock occurred at time t and $E_t(y_{i,t+s}|\eta_{i,t} = 0)$ is its at time t expected total turnover for horizon s given the exchange rate shock did not occur ceteris paribus. The dynamic causal effect described in the above equation is equivalent to the definition of impulse responses that exists in the time series literature, where the treatment is an unanticipated (aggregate) shock at time t with its effects s periods after the shock has occurred (see, e.g. Hamilton, 1994). Thus, we refer to $\delta_{i,s}$ as the *survey based impulse response*.

In the same manner the questionnaire asked firm representatives to evaluate the effect of the exchange rate shock on total costs for the second half of 2012 (within 6 months) and for 2013 (within 18 months). The questionnaire further asked for firms' exports in terms of total turnover ("export share") and imports in terms of total expenses ("import share"), to/from the euro area and to/from the rest of the world. Appendix 5.4 gives a comprehensive list of variables used in this study.

By asking the *same* firm representative about a control scenario and a treatment scenario, the survey impulse response analysis follows a within subject design (see Charness *et al.*, 2012). One might also follow a between subjects design by randomly assigning different scenarios to firms. Pre-tests yielded that it is more convenient for firms to indicate the change in projections under the treatment scenario compared to the control scenario, rather than indicating projections under the treatment scenario and once again under the control scenario.

Can firm representatives know how projections would change if their firm was hit by an exchange rate shock? As argued by, e.g., Gaines *et al.* (2006) the treatment scenario must be realistic in the sense that respondents have been confronted with similar scenarios already in the past and/or that they already considered the scenario and its effects before. We consider this to be the case given that firm executives had to cope with recurring swift and at at partly unanticipated exchange rate movements in the past. Appendix 5.1 discusses further validity issues.

2.3 From firm-level to aggregate impulse responses

The data generated from our firm-level impulse response analysis constitute representative samples of the populations of Swiss construction, manufacturing and service sector firms. Aggregate survey based impulse responses are derived via standard procedures (European Commission, 2007). First, individual impulse responses are aggregated to the industry level (based on NACE classifications) with firms' number of employees as weights. The number of employees is a proxy for the value added of a company. Firms with a larger value added are more likely to also employ more workers.

Second, aggregate impulse responses for the manufacturing, the service and the construction sector are built from sub-sector industry groups by using gross value added shares as provided by the Swiss Federal Statistical Office.[4] We refrain from building economy-wide aggregate impulse responses since the aforementioned sectors cover only $60\% - 70\%$ of economy-wide value added and other sectors are not included in our survey (see Section 2.1). The aggregation scheme can be found in Appendix 5.5. By weighting the firm level data first for subsector industry groups and second for sectors we ensure generalizability of our sector samples.

As a robustness check we investigated the dependency of our sector-level aggregate results in relation to applied weighting schemes. The sector-level aggregate results are robust to different weighting schemes, unweighted results are only marginally different from weighted results. Results from the robustness check are available on request.

[4]See Bundesamt für Statistik, Produktionskonto nach Branchen, Table 3a.3.

3 Results

The following sections contain the empirical results obtained from our survey based impulse response analysis. In a first step we present firm respondents' unconditional exchange rate expectations. Second, we focus on industry and sector level aggregate impulse responses in reaction to the exchange rate shock. Third, we discuss heterogeneity on the firm level. The final section is devoted to a regression analysis trying to explain the firm level impulse responses in more depth. Recall from Section 2 that we study the effects of the following counterfactual exchange rate shock: an unexpected change in the Swiss franc/euro exchange rate floor from 1.20 to 1.10 Swiss francs per euro all else being equal, and a subsequent appreciation of the franc from 1.20 to 1.10 franc per euro.

3.1 Exchange rate expectations

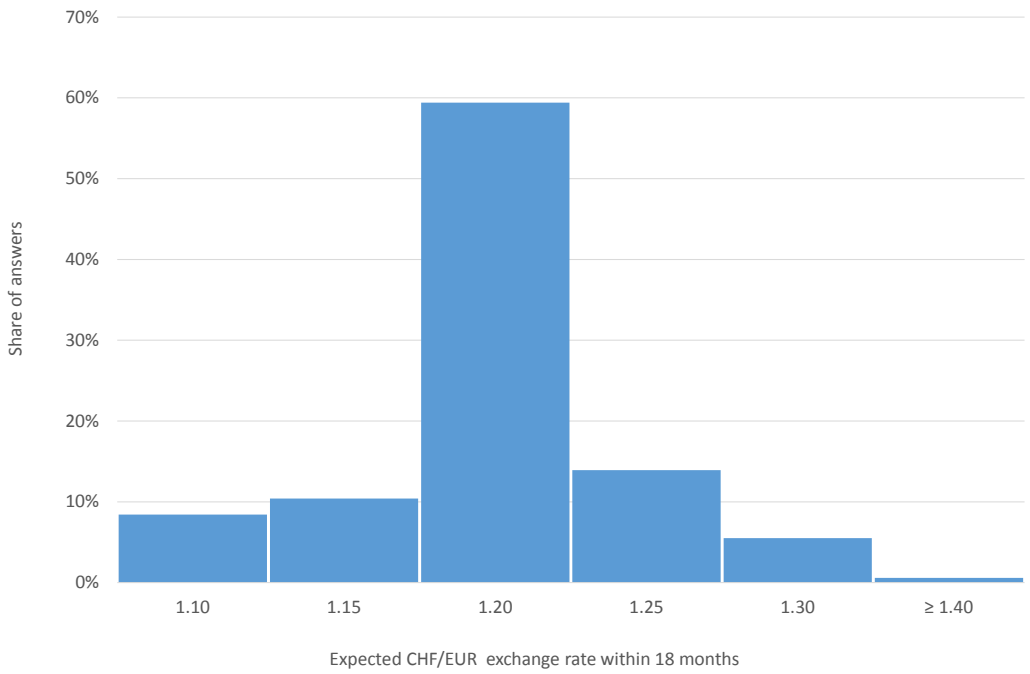
Our survey started with reminding firm respondents of the 1.20 Swiss francs per euro exchange rate floor and of the SNB's (communicated) willingness to defend this exchange rate floor. Next, we asked firm respondents to indicate their exchange rate expectations for the second half of 2012 and for 2013. For the second half of 2012 the overall majority of firm representatives expected the exchange rate to stay at or closely above 1.20 Swiss francs per euro.

Figure 2 depicts the distribution of the (unconditional) exchange rate expectations for 2013. 80% of all firm respondents forecasted the exchange rate floor of 1.20 francs per euro to be still in place in 2013. To be more specific, 60% of all firm respondents forecasted a Swiss franc/euro exchange rate of 1.20 in 2013 whereas 20% forecasted an exchange rate depreciation up to 1.30 Swiss francs per euro. Interestingly, 11% of all firm respondents forecasted an exchange rate of 1.15 in 2013 and 9% of all firm respondents predicted an exchange rate of 1.10 in 2013. It might be the case, that those firms expecting a repeal of the exchange rate lower bound and an appreciation of the Swiss franc against the euro did not experience an appreciation of the Swiss franc as a shock. Therefore, there turnover, costs and profit responses might be muted in comparison with those firms being surprised by an franc appreciation. A panel regression analysis in 3.4 will shed light on vulnerability of Swiss firms relative to their exchange rate expectations.

3.2 Industry and sector level effects

Table 1 shows aggregate survey based impulse responses for turnovers. Manufacturing turnover is expected to decrease by 3.3% in the first six months after the exchange rate shock as compared to a no shock scenario. After 18 months the expected decrease of aggregate manufacturing turnovers reaches 4.3% compared to a state of the world in which no shock has happened. The expected decrease for the service sector six months after the shock is 1.6%, after 18 months it reaches 2.1%. The construction sector is

Figure 2: Exchange rate expectations within 18 months



The bar chart shows the relative share of firms' expectations with respect to the average CHF / euro exchange rate within 18 months. The X-axis displays exchange rate CHF / euro exchange rates and the Y-axis depicts the share of firms' answers.

less affected, within six months expected turnover only declines by 0.4% and within 18 months by 0.8%. The manufacturing sector strongly depends on exports to the euro area, its (aggregate) export share is 36.3% in the sample. With a sample export share of 7.2% the service sector depends less on exports to the euro area, and the construction sector with a sample export share to the euro area of only 2.2% depends even less. All described weighted averages are statistically different from zero at the 1% significance level.

An appreciation of the exchange rate not only causes reductions in turnovers compared to a no shock scenario, also import costs and thereby total costs will be reduced. For the manufacturing sector total costs are expected to decline, compared to a no shock scenario, within six months as well as within 18 months after the timing of the exchange rate shock. The expected decline for the 18 months ahead period (2.0%) is stronger than for six months ahead (1.3%). Both effects are statistically different from zero at the 1% significance level. Given an (aggregate) sample import share from the euro area of 30.1% an appreciation of the Swiss franc helps manufacturing firms to save on costs. The service sector and the construction sector depend less on imports from the euro area, their (aggregate) sample import shares are 14.5% and 6.2%, respectively. Consequently, there is less room to reduce costs in response to the exchange rate shock.

For the service sector, expected total costs decrease by 0.6% within six months and by 0.9% within 18 months. Construction sector expected costs decline by 0.2% within six months and 0.5% within 18 months. With the exception of the 6-month effect for the construction sector all responses are statistically different from zero at the 1% significance level.

Notably, our findings do not mean that the specific sector expects an overall decline in turnovers or costs. Instead the figures indicate a reduction in turnovers and costs compared to the turnovers and costs that would have been expected to materialize in case of the no shock scenario (= exchange rate floor stays at 1.20 Swiss francs per euro). An example: If turnover increases by 2% within six months in case of no shock, a decline as a response to the specified exchange rate shock by 1% within six months leads to an overall turnover growth of 1.02*0.99 – 1 = 0.98%.

The effect on profits is a priori not clear. If turnover effects outweigh costs effects a reduction in profits might be expected and vice versa. We derive profits for the within 6 months period as the absolute value of profits to be expected after the exchange rate shock within 6 months divided by unconditionally (before the exchange rate shock) expected absolute profits within 6 months (i.e. until by the end of 2012).

$$\Delta\Pi_{i_{s=6}} = \frac{Y^{unc}_{i_{s=6}} \times \Delta Y^{c}_{i_{s=6}} - C^{unc}_{i_{s=6}} \times \Delta C^{c}_{i_{s=6}}}{Y^{unc}_{i_{s=6}} - C^{unc}_{i_{s=6}}}$$

with firms $i = 1, \ldots I$. $Y^{unc}_{i_{s=6}}$ and $C^{unc}_{i_{s=6}}$ are the unconditionally expected absolute turnover (Y) or costs (C) of firm i at horizon $s = 6$ months. $\Delta Y^{c}_{i,s=6}$ and $\Delta C^{c}_{i,s=6}$ are the survey based impulse response in either turnover or costs of firm i at horizon $s = 6$ months conditional on the exchange rate shock. Superscript c indicates conditional forcasts (on shock occurence), superscript *unc* unconditional forecasts, i.e. no shock occurs. $\Delta\Pi_{i_{s=6}}$ is the growth rate of profits Π for firm i at horizon $s = 6$ months (i.e. by the end of 2012) conditional on the exchange rate shock.

It turns out that negative turnover effects outweigh reductions in costs within 6 months on the sectoral level. Profits of manufacturing firms decline by -3.3%. Profits of service sector firms decrease less, the negative effect is -1.24%. The construction sector is not affected in terms of profit, the aggregated value is statistically not different from zero.

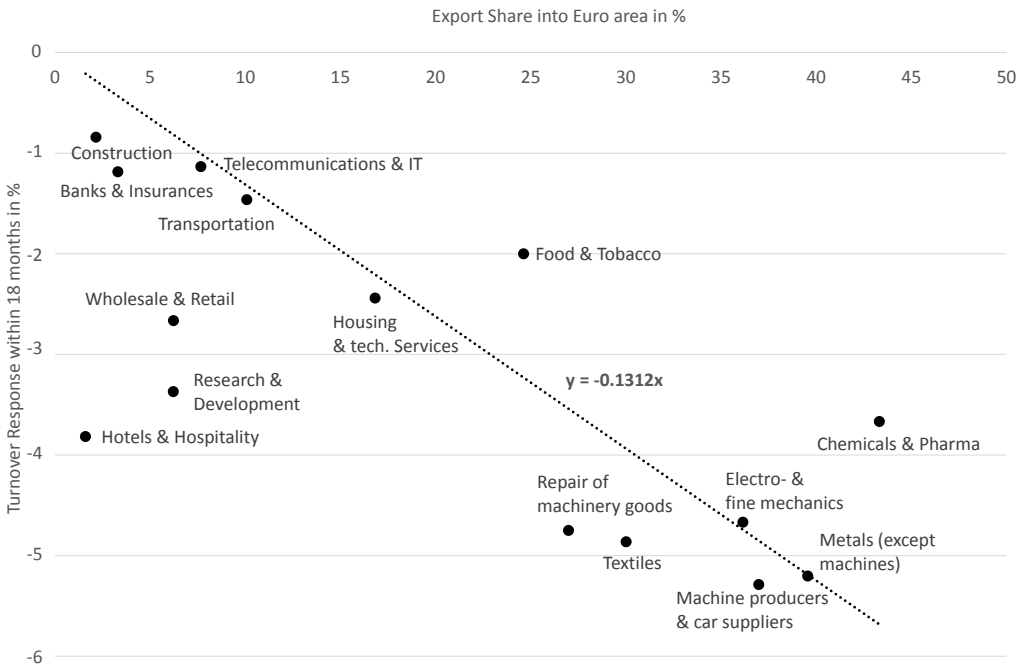
While service sector aggregate impulse responses showed only a limited effect of the exchange rate shock, heterogeneous effects might be present on a subsector level (see Table 1). Within the service sector we focus on the hotel industry which – given Switzerland's position as a famous tourist destinations in Europe – depends also on foreign tourists. The exchange rate shock decreases total turnovers in hotels & restaurants by 2.9% within six months. Within 18 months total turnovers decline by 3.8%. These effects are very strong and highly significant.

Heterogeneity in responses can be observed also within the manufacturing sector. Figure 3 displays a simple relationship between aggregated industry turnover responses 18 months after the jump in the exchange rate versus the aggregated export shares for each industry. Without controlling for any co-variates a negative relationship between

export shares and turnover responses becomes apparent.

The industries reacting the strongest in terms of expected total turnover are machine producers & car suppliers (–4.0% within six months, –5.3% within 18 months) as well as metal producers (–4.2% within six months, –5.2% within 18 months). This is not surprising given that euro area export shares in the sample are also large, with 37% for machine producers & car suppliers and 40% for metal producers. Strong effects can also be observed for chemical & pharmaceutical firms (sample export share euro area: 43%), firms of the electro-technical & fine mechanics industry (sample export share euro area: 36%), as well as firms belonging to the textile industry and firms maintaining machinery goods (sample export share euro area: 30% and 27%). The negative expected turnover effects compared to a no shock scenario for chemical & pharmaceutical firms are 3.3% within six months and 3.7% within 18 months. Most of the negative effect in chemicals & pharmaceuticals is due to a large negative effect for chemical firms, while pharmaceutial firms only report a minor loss in total expected turnovers. The expected turnover reduction for the electro-technical & fine mechanical firms amounts to 2.7% within six months and 4.7% within 18 months. The negative expected turnover effects for textile firms and firms maintaining machinery goods reach 4.1% or 4.0% within six months and 4.9% or 5.3% within 18 months.

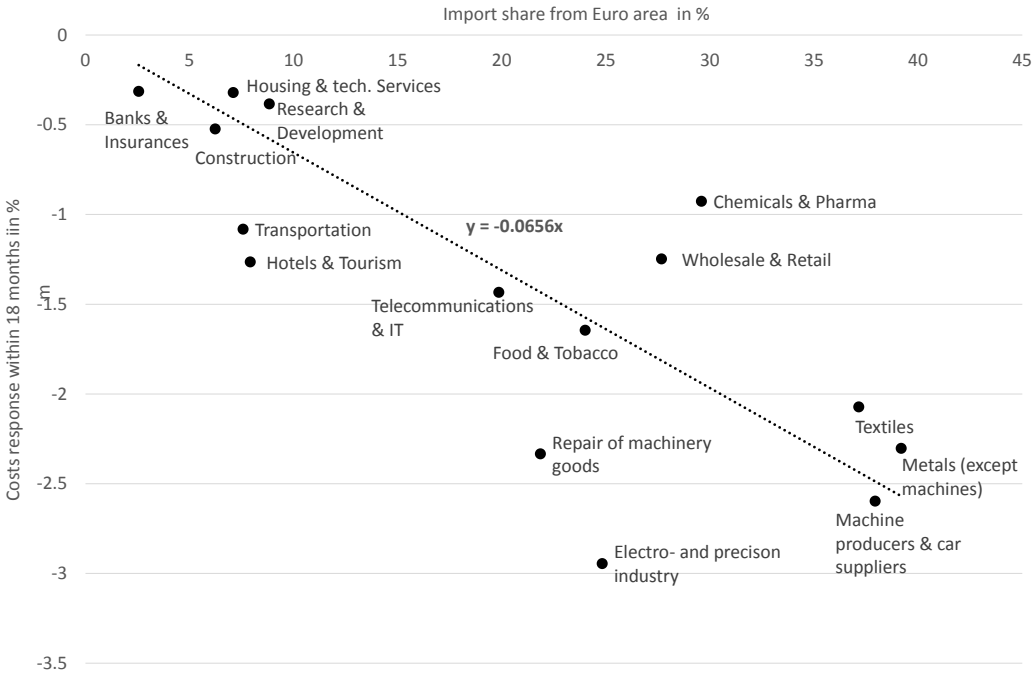
Figure 3: Turnover 18 months vs. export shares



The figure plots the correlation of expected turnover and sectors' export shares to the euro area for a 18 month ahead horizon. The dots represent single sectors while the dotted line shows the general correlation.

Those firms expecting to suffer strongly from the exchange rate shock in terms of total turnover often also expect to benefit substantially from reduced total costs. Figure 4 displays the relationship between aggregated industry cost responses 18 months after the jump in the exchange rate versus the aggregated import shares for each industry. A negative relationship between import shares and aggregated cost responses can be observed. Machine producers & car suppliers, with a sample import share from the euro area of 38%, expect considerable costs reductions, namely 1.9% within six months and 2.6% within 18 months. Metal producers' expected costs (sample import share euro area: 39%) decline by 1.9% within six months and by 2.3% within 18 months. Chemical & pharmaceutical firms' expected costs (import share euro area: 30%) reduce by 0.7% within six months and by 0.9% within 18 months. Further, the expected costs of the electro-technical & fine mechanical firms (sample import share euro area: 24.8%) decrease by 1.2% within six months and by 3.0% within 18 months. Firms belonging to the textile industry or firms maintaining machinery goods (sample import shares euro area: 29.6% or 21.9%) expect to benefit from reduced costs by 1.5% or 2.2% within six months and by 2.1% or 2.3% within 18 months. As stated above all figures give the change in expected costs due the shock as compared to the no shock scenario.

Figure 4: Costs 18 months vs. import shares



The figure plots the correlation of expected costs and sectors' import shares from the euro area for a 18 month ahead horizon. The dots represent single sectors while the dotted line shows the general correlation.

Turning to profits, again, as on the sectoral aggregation level, it is a priori not obvious

if negative turnover effects dominate over reductions in costs, or if an exchange rate appreciation is beneficial for an industry in terms of profits. The results in table 1 show, that for every subgroup within the manufacturing sector and for every industry within the service sector the negative turnover effects outweigh reductions in costs. All industries within the manufacturing sector expect substantial reductions in profits within 6 months. Profits are expected to decline by 4.2% for machine producers & car suppliers, by 4.4% for firms repairing machinery goods, by 3.8% in the textile industry, by 3.7% for metal processing, by 3.1% for chemical & pharmaceutical firms and by 2.8% and 2.7% for food & tobacco as well as electronics and fine mechanics. While all industries within the service sector expect a reduction in profits within 6 months, the effects are less pronounced than for manufacturing firms. The only exception are hotels and restaurants. Their profits are expected to decline by 2.8% within 6 months. Wholesale trades and retailers expect profits to decrease by -1.9% within 6 months, transportation and logistic companies expect a decline by -1.4%. All other service sector industries (media, telecommunication & IT; banking, financial services & insurance; housing, freelancing, advisory, architects, tech. services) expect reduced profits between 0.6% and 0.9%. The effect for research and development is statistically not different from zero.

3.3 Firm level heterogeneity

We observe a lot of heterogeneity within the collected data set. Figure 5 shows the empirical distributions of turnover changes in response to the exchange rate shock over all manufacturing sector firms and over all service sector firms. Distributions are presented in form of empirical probability mass functions (pmf) and in form of smoothed kernel densities calculated from the pmf. While the overall weight of the distributions lies in negative territory for both sectors, the shift is more pronounced for the manufacturing sector than for the service sector. All distributions have fat tails and are skewed to the right. While the 6- and 18-months distributions for service sector firms might still be classified as skewed normal distributions with fat tales, the 6- and 18-months distributions for manufacturing sector firms are far away from any normal distribution. As can be seen from Figure 6 cost impulse responses also show substantial dispersion. However, the distributions are less skewed than it is the case for turnover responses.

3.4 Firm level regression analysis

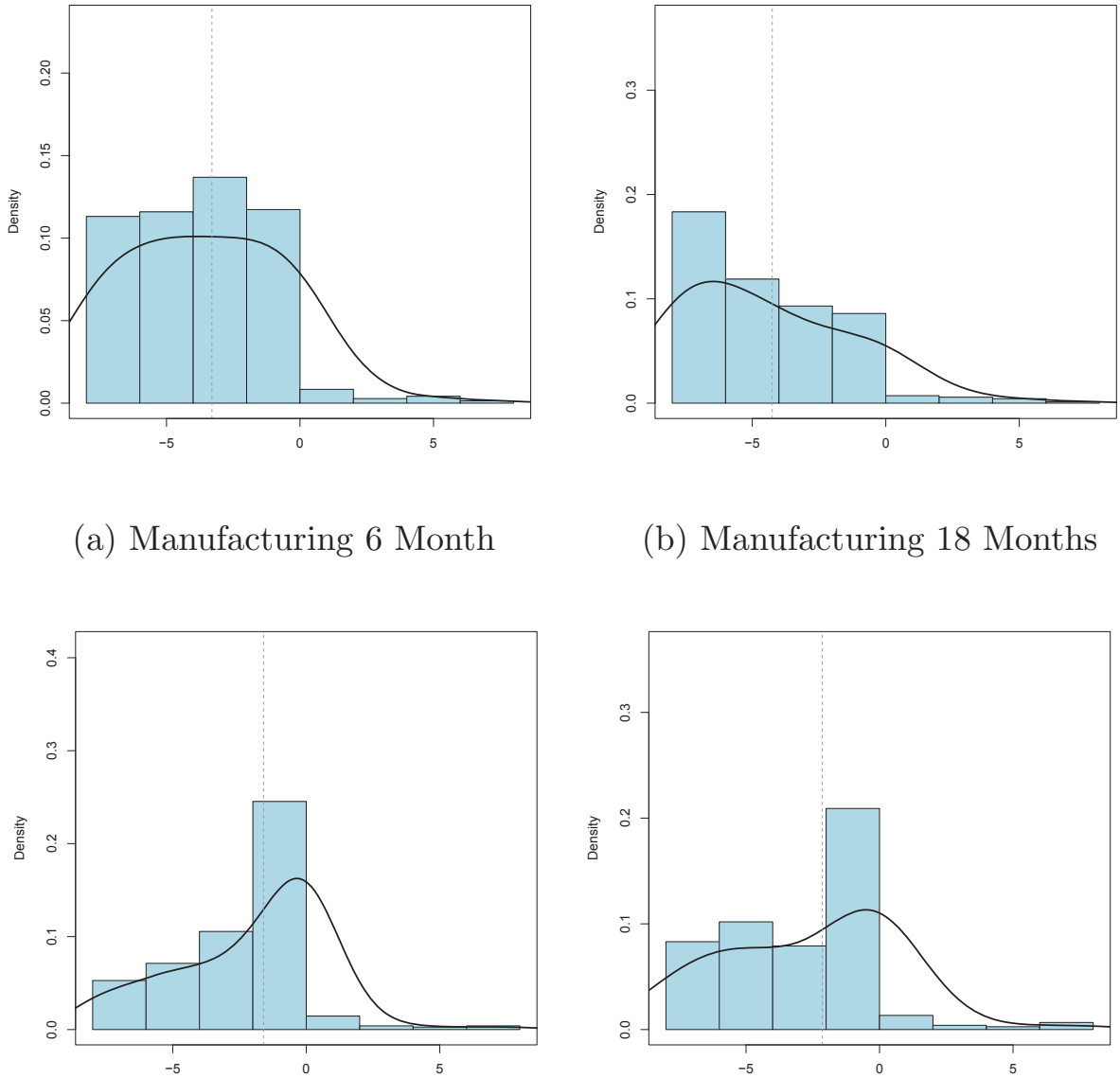
In order to investigate the driving forces behind the survey based impulse responses of firms to the exchange rate shock we conduct a panel regression analysis. Controlling for industry membership and previously expressed exchange rate expectations, we find a significant effect of the euro area export share on expected turnover impulse responses to the exchange rate shock. Furthermore we find significant effects for import shares and exchange rate expectations on costs impulse responses and significant effects for trade surpluses with against the euro are and the rest of the world for profit impulse responses to an exchange rate shock.

Table 1: Industry and sector level survey based impulse responses

Industry/sector	Turnover		Costs		Profits	Euro area share		CHF/EUR
	6 months	18 months	6 months	18 months	6 months	Exports	Imports	18 months
Food & tobacco	-1.96	-2.00	-0.95	-1.65	-2.77	24.62	24.01	1.20
	(0.45)	*(0.42)*	*(0.36)*	*(0.51)*	*(0.49)*	*(3.39)*	*(3.17)*	*(0.007)*
Textiles	-4.10	-4.86	-1.53	-2.07	-3.83	30.01	37.15	1.19
	(0.52)	*(0.55)*	*(0.44)*	*(0.53)*	*(0.58)*	*(4.03)*	*(4.18)*	*(0.007)*
Chemicals & pharma	-3.29	-3.67	-0.74	-0.93	-3.05	43.32	29.59	1.20
	(0.43)	*(0.47)*	*(0.27)*	*(0.31)*	*(0.43)*	*(2.76)*	*(3.01)*	*(0.002)*
Metals (except machinery)	-4.19	-5.20	-1.85	-2.30	-3.72	39.55	39.18	1.21
	(0.30)	*(0.31)*	*(0.33)*	*(0.40)*	*(0.36)*	*(3.02)*	*(3.15)*	*(0.007)*
Electronics & fine mechanics	-2.73	-4.67	-1.16	-2.95	-2.69	36.14	24.82	1.20
	(0.39)	*(0.30)*	*(0.32)*	*(0.38)*	*(0.46)*	*(2.95)*	*(2.46)*	*(0.006)*
Machinery & automobiles	-4.02	-5.29	-1.91	-2.60	-4.18	36.98	37.93	1.20
	(0.27)	*(0.28)*	*(0.26)*	*(0.34)*	*(0.31)*	*(2.18)*	*(2.18)*	*(0.006)*
Repair of machineries	-4.13	-4.75	-2.19	-2.33	-4.36	26.99	21.86	1.19
	(0.46)	*(0.41)*	*(0.45)*	*(0.47)*	*(0.57)*	*(4.21)*	*(2.13)*	*(0.010)*
Manufacturing sector	-3.30	-4.25	-1.27	-2.04	-3.27	36.32	30.11	1.20
	(0.16)	*(0.16)*	*(0.13)*	*(0.16)*	*(0.17)*	*(1.2)*	*(1.17)*	*(0.002)*
Wholesale & retail	-2.09	-2.66	-0.68	-1.25	-1.86	6.23	27.67	1.20
	(0.22)	*(0.25)*	*(0.15)*	*(0.17)*	*(0.27)*	*(1.28)*	*(2.48)*	*(0.003)*
Transport	-1.31	-1.46	-0.96	-1.08	-1.35	10.08	7.58	1.18
	(0.22)	*(0.24)*	*(0.19)*	*(0.2)*	*(0.24)*	*(1.69)*	*(2.61)*	*(0.009)*
Hotels & restaurants	-2.88	-3.82	-0.81	-1.26	-2.81	1.60	7.92	1.22
	(0.51)	*(0.66)*	*(0.29)*	*(0.36)*	*(0.56)*	*(1.51)*	*(2.02)*	*(0.013)*
Media & IT services	-1.07	-1.13	-1.90	-1.43	-0.85	7.66	19.86	1.20
	(0.15)	*(0.16)*	*(0.38)*	*(0.33)*	*(0.34)*	*(1.20)*	*(3.69)*	*(0.005)*
Banking & insurance	-1.00	-1.19	-0.34	-0.31	-0.59	3.31	2.56	1.20
	(0.22)	*(0.26)*	*(0.19)*	*(0.21)*	*(0.24)*	*(1.28)*	*(0.66)*	*(0.003)*
Housing & tech. services	-1.25	-2.44	-0.28	-0.32	-0.74	16.82	7.10	1.20
	(0.23)	*(0.31)*	*(0.20)*	*(0.19)*	*(0.25)*	*(2.47)*	*(2.14)*	*(0.003)*
Research & development	-2.06	-3.37	0.05	-0.38	-0.33	6.22	8.83	1.13
	(0.38)	*(0.53)*	*(0.54)*	*(0.68)*	*(0.68)*	*(2.96)*	*(2.65)*	*(0.012)*
Service sector	-1.60	-2.14	-0.64	-0.85	-1.24	7.19	14.48	1.19
	(0.11)	*(0.13)*	*(0.09)*	*(0.10)*	*(0.13)*	*(0.72)*	*(1.15)*	*(0.002)*
Construction sector	-0.41	-0.84	-0.15	-0.52	-0.23	2.15	6.23	1.20
	(0.18)	*(0.23)*	*(0.09)*	*(0.18)*	*(0.15)*	*(0.55)*	*(0.92)*	*(0.006)*

The table depicts survey based impulse responses of firms to an exchange rate shock in percent aggregated at industry or sector level. Values in parenthesis are standard deviations (see Appendix 5.5). Aggregation has been conducted as described in Section 2.

Figure 5: Turnover distributions



(a) Manufacturing 6 Month

(b) Manufacturing 18 Months

(c) Service Sector 6 Months

(d) Service Sector 18 Months

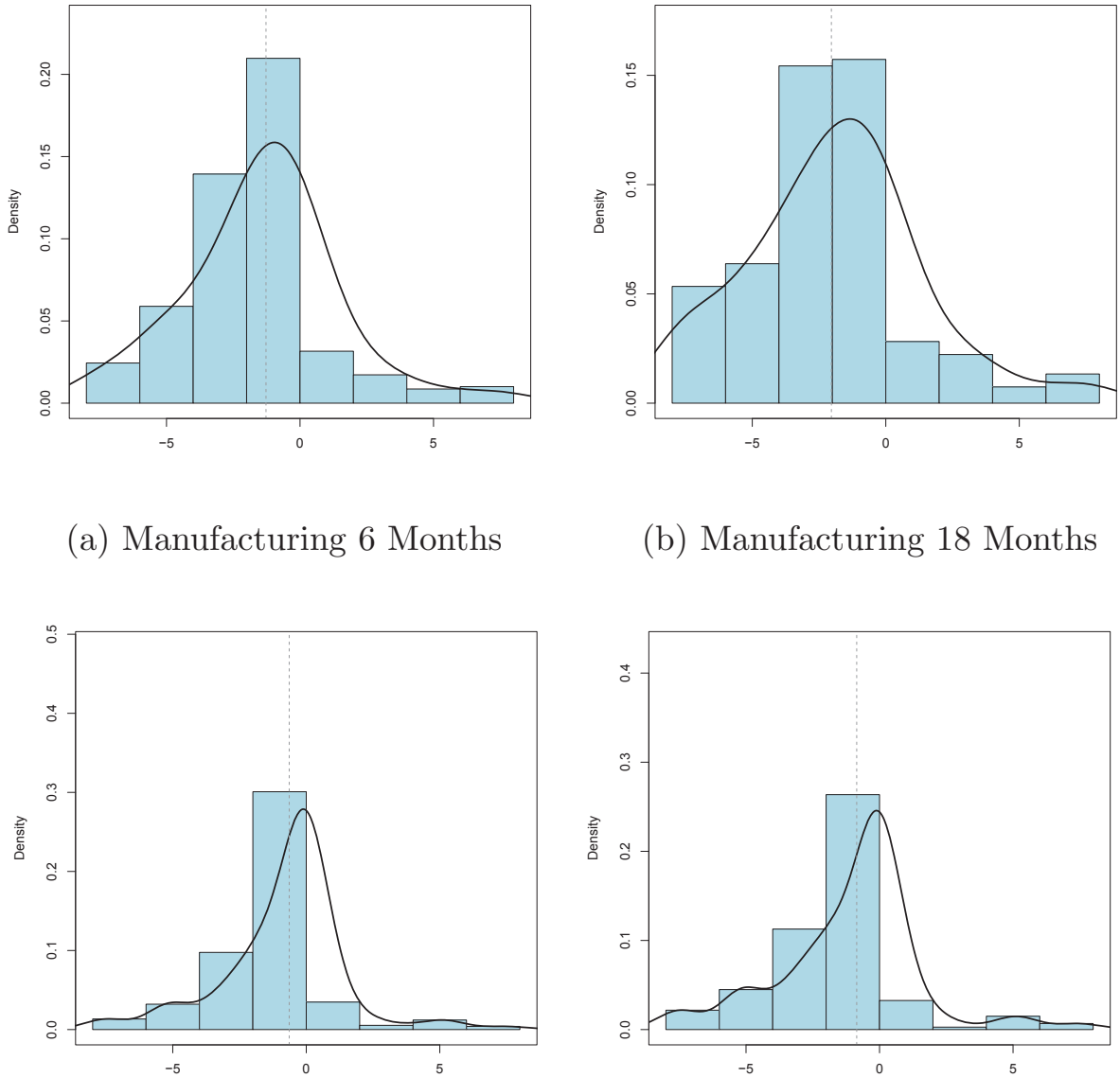
The histograms show the expected change in turnover for a 6 month ahead horizon as well as a 18 month ahead horizon. The light blue bars show the relative frequency of firms' expectations ranging from $\leq -7.5\%$ to $\geq 7.5\%$. The upper row depicts expected changes in the manufacturing industry while the bottom row shows expectations of the services sector. The solid black line represents the smoothed kernel density.

The basic regression equation is as follows:

$$\delta_{i,s} = \beta \mathbf{x}_i + \gamma \mathbf{z}_i + \psi \mathbf{d}_s + \xi_{i,s}$$

with $i = 1, \ldots I$ and $s = 6$ months, 18 months. $\delta_{i,s}$ is the survey based impulse response in either turnovers, costs or profits of firm i at horizon s to the exchange rate shock. $\mathbf{x}_i$ is a row vector of firm-specific explanatory variables and $\mathbf{z}_i$ is a row vector of J

Figure 6: Costs distributions



(a) Manufacturing 6 Months

(b) Manufacturing 18 Months

(c) Service Sector 6 Months

(d) Service Sector 18 Months

The histograms show the expected change in costs for a 6 month ahead horizon as well as a 18 month ahead horizon. The light blue bars show the relative frequency of firms' expectations ranging from $\leq -7.5\%$ to $\geq 7.5\%$. The upper row depicts expected changes in the manufacturing industry while the bottom row shows expectations of the services sector. The solid black line represents the smoothed kernel density.

industry dummy variables where the $j\text{-}th = 1st, \ldots, J\text{-}th$ dummy variable takes value 1 if firm i is in industry j and zero otherwise. $\mathbf{d}_s$ represents a time dummy which is 1 if $s = 18$ months and zero otherwise. $\mathbf{x}_i$ includes the following variables: firm i's size as measured by its number of employees, firm i's (non-shock scenario) export shares to the euro area and to the rest of the world, firm i's (non-shock scenario) import share from the euro area, firm i's trade surplus with against the euro are and the rest of

the world, firm i oil dependency defined as the share of expenditures on oil relative to total costs, firm i's market power as measured by its profit margin, i.e. (total sales – total costs)/total sales, on average over 2010–2012 and and firm i's unconditional Swiss franc/euro exchange rate forecast for 2013. β is a row vector of coefficients attached to $\mathbf{x}_i$ and γ can be seen as a vector of industry-specific intercepts or industry-specific fixed effects that control for unobserved heterogeneity between industries. ψ is the 18 months time fixed effect. A summary of all variables can be found in Appendix 5.4. $\xi_{i,s}$ is the error term. The regression coefficients are estimated by ordinary least squares.

As can be seen from column 1 of Table 2, a higher euro area export share is associated with a stronger reduction in expected turnovers in response to the exchange rate shock. This effect is statistically different from zero at the 5% significance level. Further, the time fixed effect is negative and statistically different from zero at the 1% significance level. This statistical finding implies that the reduction in expected turnovers in response to the exchange rate shock is stronger at the 18 months horizon than at the 6 months horizon. Neither firm size, market power nor the unconditional exchange rate forecast have an effect on firm-level impulse responses.

Column 2 of Table 2 shows the regression results for the cost impulse responses. Both a higher import share from the euro area as well as a higher import share from the rest of the world are associated with a stronger reduction in expected total costs in response to the exchange rate shock. The effects are statistically different from zero at the 5% significance level at least. Regarding economic significance, the euro area import share effect is more than twice as big than the rest of the world import share effect. Hence, importing firms clearly benefit from the exchange rate shock, and the more they import from the euro area. Again, the time fixed effect is negative and statistically different from zero at the 1% significance level implying that the reduction in expected costs in response to the exchange rate shock is stronger at the 18-months horizon than at the 6-months horizon. Neither firm size, market power nor oil dependency have an effect on firm-level impulse responses. The unconditional exchange rate forecast turns out negative and significant at the 5% significance level. This finding is reassuring: the higher a firm's expected depreciation of the Swiss franc for the year 2013, the bigger is the size of the exchange rate appreciation shock that results from the change in the exchange rate floor and the subsequent appreciation from 1.20 to 1.10 Swiss francs per euro in July 2012. And the bigger the size of the shock, the bigger is the expected reduction in costs in response to the shock as compared to the no shock scenario. That said, the overall majority of firms expects the Swiss franc/euro exchange rate to stay at or slightly above 1.2 Swiss francs per euro.

Column 3 of Table 2 contains our regression results for the profit impulse responses, i.e. the changes in profits in response to the exchange rate shock. The export and the import share are highly correlated, hence, taking them into the regression separately would result in multicollinearity issues. In order to prevent this problem we use trade surpluses with trading partners in the euro area and with trading partners in the rest of the world.

Trade surplus is calculated as the ratio between the difference of nominal exports ($X_{i_{s=6}}^{euro,world}$) and nominal imports ($IM_{i_{s=6}}^{euro,world}$) and nominal unconditional turnover

($Y^{unc}_{i_{s=6}}$) of firm i at horizon $s = 6$ months:

$$\frac{X^{euro,world}_{i_{s=6}} - IM^{euro,world}_{i_{s=6}}}{Y^{unc}_{i_{s=6}}}$$

with firms $i = 1, \ldots, I$. Assuming that the export share stays constant nominal exports $X^{euro,world}_{i_{s=6}}$ are calculated as

$$X^{euro,world}_{i_{s=6}} = \frac{X^{euro,world}_{i_{s=0}}}{Y_{i_{s=0}}} \times Y^{unc}_{i_{s=6}}$$

$\frac{X^{euro,world}_{i_{s=0}}}{Y_{i_{s=0}}}$ is the mid-2012 (euro or world) export share with respect to turnover and has been provided by the participating firms. In the same manner, nominal imports $IM^{euro,world}_{i_{s=6}}$ are approximated as

$$IM^{euro,world}_{i_{s=6}} = \frac{IM^{euro,world}_{i_{s=0}}}{C_{i_{s=0}}} \times C^{unc}_{i_{s=6}}$$

where $C^{unc}_{i_{s=6}}$ are the unconditional costs forecast of firm i for 2012. $\frac{IM^{euro,world}_{i_{s=0}}}{C_{i_{s=0}}}$ is the mid-2012 import share with respect to total costs and has been provided by the participating firms.

As can be seen from Table 2, a higher trade surplus with respect to trade with trading partners in the euro area is associated with a stronger reduction in expected profits in response to the exchange rate shock. This holds also for trade surplus with respect to trade with trading partners in the rest of the world, albeit the negative effect being smaller both economically and statistically.

Table 2: Response of nominal turnover, costs and profits to a Swiss franc/euro exchange rate shock

	Nominal turnover	Costs	Profits 6m
No. of employees	−0.00001	0.0002	0.0004
	(0.973)	(0.269)	(0.145)
Marketpower	−0.322	0.598	0.268
	(0.411)	(0.196)	(0.665)
CHF/EUR expectations 18m	−0.632	−0.658***	−3.418
	(0.646)	(0.016)	(0.106)
Year dummy	−0.430***	−0.658***	
	(0.005)	(0.000)	
Export share euro	−0.009**		
	(0.021)		
Export share world	0.003		
	(0.413)		
Import share euro		−0.035***	
		(0.000)	
Import share world		−0.015**	
		(0.029)	
Oil share		−0.008	0.011
		(0.694)	(0.674)
Trade surplus euro 6m			−0.061***
			0.000
Trade surplus world 6m			−0.012*
			0.067
Industry fixed effects	Yes	Yes	Yes
Observations	1,156	967	412
Adjusted R^2	0.233	0.574	0.602

p-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4 Conclusion

In this paper, we have presented an application of survey based impulse responses to analyze the effects of an exchange rate shock on Swiss firms' turnovers, total costs and profits. Survey based impulse response analysis provides a convenient way to identify macroeconomic shocks without the need to impose parametric restrictions. They create structural microeconomic data allowing to shed light on the heterogeneity of economic agents and allow to easily capture any kind of non-linearities. Survey based impulse response analysis is "on the spot", i.e. it determines the effects of shocks at the time when the survey was conducted rather than being based on historical time series. This feature makes the approach especially valuable in times of a structural break.

In July 2012, we applied a macroeconomic treatment scenario to a representative sample of nearly 900 Swiss firms. We asked firm representatives to evaluate the effects of a hypothetical change of the exchange rate floor from 1.20 to 1.10 Swiss francs per euro – and a subsequent appreciation of the Swiss franc by the same magnitude – on expected firm-specific turnovers, total costs and profits 6 months and 18 months ahead. Our findings suggest an incomplete exchange rate pass-through to firms' costs. Moreover, exchange rate shocks seem to be absorbed by firms given that their turnovers decrease more than their costs. There is also evidence that impulse responses are diverse across firms and industries. The manufacturing sector reacts stronger than the service sector or the construction sector in terms of expected turnover reductions as well as expected total costs reductions. Yet, within the service sector firms belonging to the hotel industry also report strong negative expected turnover effects in response to the exchange rate appreciation shock. The industries being affected the most within manufacturing are machine producers & car suppliers as well as metal producers. At the same time however, especially firms of these industries benefit the most from costs reductions in consequence of lower import prices, thereby dampening the potentially negative short-term effect on the economy caused by the exchange rate appreciation shock. It further turns out that the exchange rate shock leads to a substantial reduction in firms' expected profits. While profit reductions are stronger for the manufacturing sector aggregate than for the service sector aggregate, we again find a high variation on the (sub-sector) industry level and on the firm level. Firm-level panel regression analysis allows us to control for unobserved industry effects. We find that a higher euro area export share is associated with a stronger reduction in expected turnovers in response to the exchange rate shock. Moreover, both a higher import share from the euro area and a higher import share from the rest of the world are associated with a stronger reduction in expected total costs in response to the exchange rate shock. A higher trade surplus with the euro area and the rest of the world leads to a more pronounced negative impulse response to the exchange rate shock.

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5 Appendix

5.1 Survey experimental validity

In this section, we discuss possible challenges that emerge when conducting surveys, specifically survey based impulse responses. In general, we follow the total survey error approach of Weisberg (2005), analyzing the measurement error due to interviewers and respondents, the coverage error, the non-respondense bias, and the postsurvey error.[5]

Measurement error due to interviewer

Interviewer-related error occurs to the extent that responses are different because of the interviewer. Measurement errors due to interviewer are hardly relevant in our application. The utilized modes of survey data collection contain internet surveys, paper questionnaires, and telephone reminders. The internet survey access codes have been sent by mail, as has been the chosen way for the paper questionnaires. Respondents might become influenced by the interviewing institute KOF Swiss Economic Institute at ETH Zurich. Given our academic reputation (business sentiment surveys have been conducted since the early 1970s), long term participation of respondents in other KOF surveys and Swiss data secrecy laws we do not think that respondents would try to withhold their true answers. Telephone reminders were about reminding respondents to participate, not about filling out the questionnaires via telephone. Therefore, we also think that the extent of interviewer influence is limited.

Measurement error due to respondent

Measurement error due to respondents might be the consequence of question wording and question order. In order to reduce measurement error due to not understandable question formulations we conducted pre-tests with six randomly selected companies. Those companies have been asked in personal interviews if they understand our question framework and if they are able to answer these questions. Based on the pre-test we reformulated some questions. Given the pre-test feedback we are convinced that most company respondents should be able to understand our questions and should be able to answer correctly. Companies might technically know the answers to our questions, but might be unwilling to lay open their true considerations. In a similar line of arguing, companies might technically be restrained to answer relevant questions, or the person being addressed might not possess the required knowledge and position to answer the questions. Our survey is an add-on to the KOF investment survey. Respondents of the investment survey (and thereby our survey) are members of the board of participating firms, or heads of accounting/controlling. They have proven their capability to answer questions relating to their companies in the past. Nowadays, business tendency surveys are an important source of information for economic forecasting. Business tendency

[5] Druckman *et al.* (2006), Kinder (2007), Gaines *et al.* (2006), Barabas and Jerit (2010), and Guterbock and Nock (2010) carefully examine possible pitfalls of survey experiments.

surveys drive stock exchange outcomes and contain relevant information for forecasting exercises. Therefore, we conclude that these kinds of KOF surveys have been answered truthfully in the past, and we also expect our respondents to answer scenario questions truthfully. An important condition for being able to respond to our questions is their relevance. Groves (1989, p. 422) writes that the recall of past events depends on the length of the recall period, the salience of the event to be recalled, the task difficulty of the event, the respondents attention or motivation. More recent events are recalled better than earlier events.

Fatigue effect leads to NA or unconscious answers the longer the questionnaire is. The questionnaire (together with the investment survey) fits on two pages. During our pre-test we asked for the estimated duration to complete the questionnaire. Roundabout 10-15 minutes were mentioned by most pre-test participants. Exchange rate shock questions are first in order. We observe a lot of variation for the exchange rate shock questions. Additionally, paper questionnaire respondents could take a break while filling out the questions, internet participants could save the results and continue later on. Therefore we think that we do not suffer from a fatigue effect.

Coverage error

Coverage error occurs when there is a bias due to the omission of noncovered units (Weisberg, 2005, p. 206). In our context this might be the case if we underrepresent certain industry types while overrepresenting others. In order to correct for such misalignments, we give extra weight to hard-to-obtain respondents. The answers are weighted twofold (see Appendix 5.5). First, individual responses within an industry group (based on NACE classification scheme) are weighted based on firms' number of employees. This weighting scheme yields the distribution of answers for each industry category. Second, the industry categories are aggregated to an industry average by utilizing gross value added shares as provided by Swiss Statistical Office. The number of employees is a proxy for the value added of a company. Industrial firms with a larger value added are more likely to also employ more workers. By weighting the answers first for the industry categories and second for industry total we ensure representativity of our sample. This aggregation scheme is in line with international standards for aggregation business sentiment surveys (European Commission, 2007).

Accounting for Non-Response Bias

Potentially our results could be biased by self-selection or non-response. If our questionnaire was highly relevant to a particular group of firms, these firms may systematically select themselves into the sample, while firms to which the questionnaire is less relevant choose to drop out. In that sense, if our questionnaire was only relevant to firms with a large export share, our result might over-estimate the effects of an exchange rate shock for the entire economy because highly export dependent firms were over-represented by selecting themselves into the sample.

To ensure our estimation results are not biased by the fact that firms with a high export share were more likely to respond than others, we apply the "surrogate" approach of Wallace and Mellor (1988). We compare the firms that responded on time, i.e. by July 9, 2012, with those that did not answer the survey until that date. Regarding the late respondents we enforced them to participate with phone calls. Hence, the late respondents can be interpreted as a sample from the non-response population. Following Wallace and Mellor (1988), we create two sub-samples by selecting the first 50 observations from the early respondents and the last 50 observations from late respondents. Given that subsample participants submitted in random order, both subsamples should be random draws from the total population and thus should not differ in their means and distribution. Based on this idea we test for differences in means for the export share variable. Note that, in principle, this could be done for differences in any of our variables, yet we focus on the export share because of its focal role. We also perform a Kolmogorov-Smirnov test to check whether distributions of both subsamples are equal. The following paragraphs present the results.

Table 3 shows the results of a simple t-test testing for equality of means in both groups: late respondents and early respondents. The differences in mean export shares are not significant at the 10 percent level.

Table 3: Mean export shares of early and late respondents

Test	Mean export share of early respondents	Mean export share of late respondents	p-value
t-test	15.10638	22.32558	0.1866

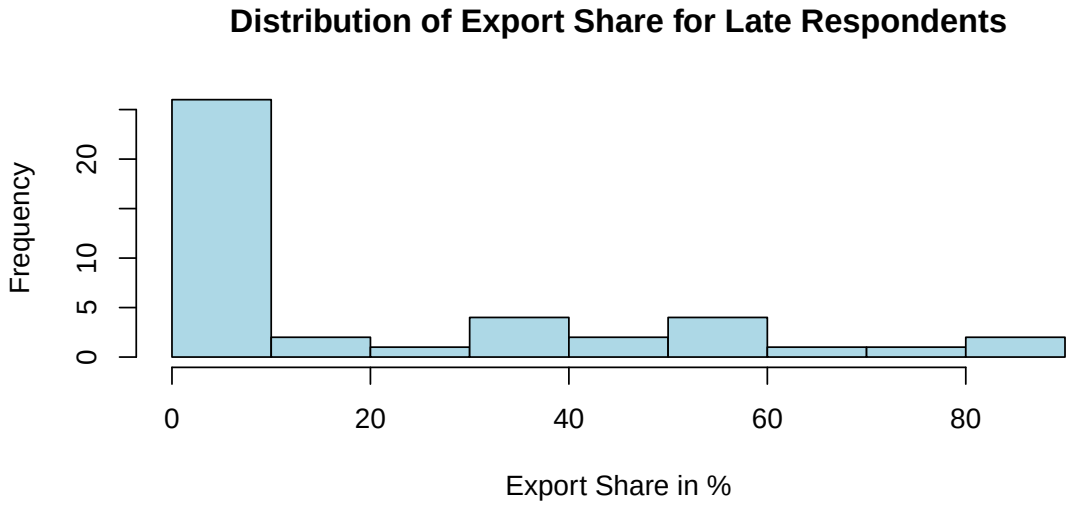
The sample mean helps to get a first idea of the export share variable but does obviously not fully represent differences in sampling distributions. Thus, we also look at the sampling distributions of both samples. Figure 7 shows histograms for both groups.

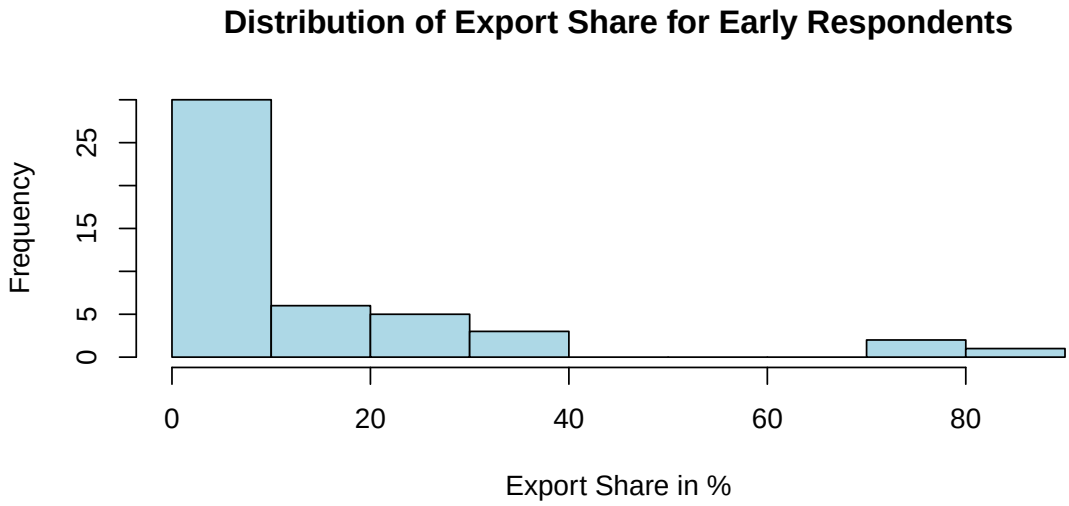
The Kolmogorov-Smirnov (KS) tests fails to reject the hypothesis of equal distributions for both the weighted and the unweighted sample. Table 4 summarizes the results of the KS test. Note that the p-value is not exact when ties occur in the KS-test. However, with the p-value not close to alpha this does not seem to be an issue here. Thus the test confirms the intuition gained from looking at the histograms in Figure 7: results happen not to be biased by varying relevance of questions to firms.

Table 4: Kolomogorov-Smirnov test results for equality of distributions

Test	Test statistic D	p-value
KS-test	0.1979	0.3426

Figure 7: Distributions by samples





The two histograms shown in the above figure compare the distribution of export shares for the 50 latest and the 50 earliest answers. Intuitively both distributions should be the same if the results are not biased by selection into treatment.

Postsurvey error

Postsurvey errors can be manifold. The most relevant postsurvey error we consider in terms of our application is the mistreatment of respondents' answers. The scanning process and type-in process as well as homepage, database and online questionnaire programming might have led to wrong entries in the database. We checked all entries, looking for outliers, asked the respondents if uncertainties existed and made sure that our database contains reliable information.

5.2 Enterprise panel

The enterprise panel at KOF Swiss Economic Institute is based on a sample of 7000 firms taken from the Business Register (BR) of the Federal Statistical Office. The sample, which covers manufacturing, construction and the commercial area of the service sector, is stratified according to sectors and sector-specific variables and is adjusted regularly. The corresponding address database, which in addition to numerous structural features of the firms, contains all information that is required to ensure that panel surveys run smoothly (specific contact points, checking of replies, recalls, and incomplete surveys etc.), was developed continuously and updated regularly throughout the project.

Based on the KOF enterprise panel, regular collections of data on the structural changes, innovative activities and on investment plans of Swiss companies are conducted. The enterprise panel draws from a population of 60270 companies. These companies are part of the entire collection of firms within Switzerland. Out of all firms within Switzerland only those with a business register number (assigned in year 2001) and with at least 5 employees have been selected. Companies belonging to agricultural activities or public administration have been included. In contrast to the sample used for structural investigations of the Swiss economy the utilized investment sample also contains firms being active in education, health, waste disposal, entertainment, cultural and sports activities.

The sample of 7000 firms has been drawn out of the population of 60270 companies by utilizing stratified random sampling. While simple random sampling would assign the same probabilities to be drawn to each observation (or firm), stratified random sampling allows adjustments to the sampling weights. Stratification is important in order to achieve representation on sector and industry level, as well as in terms of size classes. Size classes are measured by number of employees as a proxy. Larger companies are assigned higher sampling weights compared to smaller companies, firms being active in less represented industries also become assigned higher weights. The population of 60270 has been divided within industry groups into three size classes, small, medium, and large, based on the number of employees. Within each industry the cut-offs between small, medium and large differ. The cut-offs have been determined based on the distribution of firms sizes within an industry. Take for instance the financial industry and carpenters. In Switzerland the smallest banks have more employees compared to the smallest carpenter. Also, the largest banks have more employees than the largest carpenter. Therefore each industry requires individual cut-offs, based on the distribution of employees within an industry. These cut-off values are determined according to Dalenius and Gurney (1951).

Once cut-offs of size classes within industries have been determined, the sampling weights within each industry size class are assigned. The sampling weight, i.e. the drawing probability, of large firms within each industry has been set to 100%. All large firms shall be included (this increases the number of employees the survey is based on). The sampling weights of medium categories are a mixture between 100% drawing probability and random sampling. The medium sized firms which have been drawn with 100% drawing probability belong to the chemical industry, metal production,

machinery, electrical engineering, electronics and instruments, watches, cars, energy, retail, transportation, banking and insurance, and communication. Industries with a priori assumed higher tendency to innovate have been assigned a higher drawing probability in the medium size category. Drawing probabilities for small size classes and remaining medium size classes are based on the number of firms within each industry size class multiplied by a weighting factor and divided by the sum of all other number of firms again multiplied by the same weighting factor. Thereby, the relative weight of each industry size class (small and medium), belonging to those classes not being assigned a 100% drawing probability, can be determined. This drawing probability is furthermore multiplied by the number of remaining firms to be drawn. The number of remaining firms to be drawn is the difference between the target sample size (i.e. 3000 for manufacturing, 600 for construction, 3400 for services) and the number of firms with 100% drawing probability (i.e. for manufacturing 3000–929=2071). Larger weighting factors have been assigned to the remaining medium size firms compared to the weighting factors for small firms. These are determined endogenously based on the number of full time worker equivalents. Within each industry size class the sampling weights are the same. The attribution of sampling weights for each industry size class is based on Cochrane (1977).

The sample size of individual industries has been adjusted according to

$$\tilde{n}_i = (N - C) * \frac{n_i s_i}{\sum n_i s_i} \tag{1}$$

with $\tilde{n}_i$ being the adjusted sample size of different industries in a sector, separated by size, and N the target sample size of a sector. C represents the correction of the target sample size, calculated as the sum of all estimated samples that are not adjusted. n_i represents the size of an industry that has to be adjusted and s_i its standard deviation (Cochrane, 1977, p. 104). The sampling weights w_i are then calculated as

$$w_i = \frac{\tilde{n}_i}{n_i} \tag{2}$$

The utilized sample contains 7000 firms. Out of these 7000 a total of 3000 firms belongs to manufacturing, 3000 belong to services, 600 to construction and 400 to health services, waste disposal, education, cultural activities and sports. Within each of these categories the distribution of weights is optimal (see Cochrane, 1977).

5.3 Questionnaire

KOF **Investment Survey**

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ETH Zürich, WEC D 15, 8092 Zürich
www.kof.ethz.ch

Tel. 044 632 85 33
Fax 044 632 13 52
ivu@kof.ethz.ch

Please note

- Do not use a red pencil.
- Please tick relevant boxes or enter figures.
- Data applies to all production facilities in Switzerland.
- See explanatory information on the back side.
- Please return the questionnaire by: **29 June 2012**

KOF is subordinated to the Federal Statistics Act (FStatA).
All information will be treated strictly confidentially.

Spring Questionnaire

1. Total Investment Activity

a) Our gross fixed capital formation excluding VAT (construction, machinery, equipment and other investments) amounted to/is expected to amount to

2010 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2011 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2012 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

b) In comparison to 2012, our gross fixed capital formation in 2013 are expected to

– –	-	=	+	++	NA
☐	☐	☐	☐	☐	☐

– – decrease strongly; – decrease slightly; = remain unchanged; + increase slightly; ++ increase strongly; NA no answer

2. Investment Activity by Kind

	Equipment and other Investments		Construction Investments	
2010	☐☐☐ %	+	☐☐☐ %	= 100%
2011	☐☐☐ %	+	☐☐☐ %	= 100%
2012	☐☐☐ %	+	☐☐☐ %	= 100%

3. Employees

Our number of employees in Switzerland (converted into full-time equivalent positions) at year end amounted to

2011 ☐☐☐,☐☐☐

4. Turnover

a) Our domestic and foreign sales (excluding VAT) originating from Switzerland amounted to/will amount to according to our expectations

Banks and insurances please refer to explanations on the back

2010 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2011 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2012 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

1st half of 2012

☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2nd half of 2012

☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

b) We consider the realization of our sales forecast for **2012** to be

very certain	rather certain	rather uncertain	very uncertain	NA
☐	☐	☐	☐	☐

c) Compared to 2012, we expect our sales to change in **2013** as follows (approximately)

⩽-10%	-7.5%	-5%	-2.5%	0%	2.5%	5%	7.5%	10%	⩾20%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5. Expenditures

Our domestic total costs (including personnel expenditures, intermediate input, other expenses; excluding investments) amounted to/will amount to (according to our expectations)

2010 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2011 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2012 ☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

1st half of 2012

☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

2nd half of 2012

☐☐,☐☐☐,☐☐☐,☐☐☐.- CHF

This questionnaire has been completed by:

Name: .....

Function: .....

Telephone: .....

In future we would like to answer the questionnaire via the internet. Our e-mail-address:

.....

Many thanks for your participation

Explanations

General remarks

The Investment Survey is an instrument for the early recording of planned investment trends.

Definition «Investment»

The investments addressed by this questionnaire mean inflows minus outflows of fixed capital assets. These should be recorded before depreciation on the basis of their purchase price (gross investment). It is irrelevant whether the equipment which is being used for the first time is new or second-hand, and whether it has been bought, hired or created in-house.

Fixed capital formation thus encompasses:

Construction

- New construction, conversion work and renovation of commercial premises.

Machinery and equipment

- Machinery, mechanical plants, conveying equipment and warehouse equipment, office machines incl. IT (hardware and software), furniture and equipment, vehicles used for business purposes, and (only) such services which are designed to preserve, to improve or to renovate plants.

This means that fixed capital formation does not include:

- Financial investment (e.g. equity holdings, securities)
- Investment in residential property
- Real estate costs
- Buildings and plants which are intended for hire by the lessor, where the lessor acts merely as a (third-party) financier
- Inventory investment (inventory increases)
- Intangible assets (e.g. expenditure on marketing concepts, for human capital, for research & development, for patents and licences)

Definition «Turnover»

The turnover addressed by this questionnaire conforms with the definition of the Swiss Federal Statistical Office:

«Turnover comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties. Turnover includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit vis-a-vis its customer and other similar deductible taxes directly linked to turnover. Turnover also includes all other charges (transport, packaging, etc.) passed on to the customer, even if these charges are listed separately in the invoice.

Reduction in prices, rebates and discounts as well as the value of returned packing must be deducted. Price reductions, rebates and bonuses conceded later to clients, for example at the end of the year, are not taken into account.»

Banks:
Earnings from interest revenue and trading, services and commission business.

Insurances:
Gross premiums minus gross payments for insurance claims plus net earnings from capital investments; gross fees for consulting services.

Definition «Expenditures»

Expenditures are defined as expenses for material, goods and services, wages and labor costs, social security contributions, other personnel and operating expenditures.

No expenditures are therefore:
Investments, financial expenses, depreciation, other write-downs, additional costs, nonoperating and extraordinary expenses, taxes.

Remarks

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Tel. 044 632 85 33
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An approximate estimation based on experience is sufficient. Precise figures are not required.

6. Exchange Rate

a) The Swiss National Bank (SNB) announced to defend the lower limit of 1.20 CHF/EUR. The current exchange rate of Euro to Swiss Franc is 1.20 CHF/EUR. Which average exchange rate do you expect?

2nd half of 2012

⩽1.00	1.10	1.15	1.20	1.25	1.30	⩾1.40	NA
☐	☐	☐	☐	☐	☐	☐	■

2013

⩽1.00	1.10	1.15	1.20	1.25	1.30	⩾1.40	NA
☐	☐	☐	☐	☐	☐	☐	■

b) How large are your current exports as a percentage of total turnover?

Exports to Euro Area

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

Exports to Rest of the World

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

c) How large are your current imports as a percentage of total turnover?

Imports from Euro Area

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

Imports from Rest of the World

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

7. Scenario «Exchange Rate»

Suppose the SNB reduces the lower limit of the exchange rate to 1.10 CHF/EUR under else constant economic circumstances. Suppose this leads to an exchange rate of 1.10 CHF/EUR, which corresponds to a revaluation of the Swiss franc. How your financial figures change under these circumstances as compared to your previous expectations for these figures?

a) Total Turnover

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

b) Total Expenditures (incl. staff, inputs, other expenses; excl. investments)

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

8. Oil Price

How large are your expenses for oil (e.g. fuel, gasoline, diesel, oils, grease, plastics, chemical products) as a percentage of total expenditures?

0%	1%	2%	3%	4%	5%	7.5%	10%	12.5%	15%	20%	⩾30%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

9. Scenario «Oil Price»

Suppose the oil price increases by 30% within the next month under else constant economic circumstances and will remain 30% above your previous expectations regarding the oil price development. How do your financial figures change compared to your previous expectations regarding these figures?

a) Purchase Prices (average of all purchases of goods and services)

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

b) Total Expenditures (incl. staff, inputs, other expenses; excl. investments)

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

c) Domestic Sales Prices

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

d) Foreign Sales Prices

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

e) Total Turnover

2nd half of 2012

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

2013

⩽-7.5%	-5%	-3%	-2%	-1%	0%	1%	2%	3%	5%	⩾7.5%	NA
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	■

5.4 Data

The dataset generated by our survey and by external data sources contains the following variables:

Table 5: Data

Variable	Description	Scale
Export Share Euro Area	The share of exports to Euro area countries relative to total turnovers	0% to +100%
Export Share World (excluding Euro Area)	The share of exports to countries outside the Euro area	0% to +100%
Import Share Euro Area	The share of imports from Euro area countries relative to total turnovers	0% to +100%
Import Share World (excluding Euro Area)	The share of imports from countries outside the Euro area	0% to +100%
Employees	Number of employees (full time equivalents) in Switzerland at the end of 2011	Absolute values
Turnover Nominal	Turnover nominal excl. VAT generated by the Swiss parts of the company (including sales to foreign countries) in Swiss Francs. Reported balance sheet values for 2010 and 2011, projected values for 2012	Absolute values
Total Costs	Total costs including wages, intermediate goods, other expenses, excluding investments, in Swiss Francs. Reported balance sheet values for 2010 and 2011, projected values for 2012	Absolute values
Total Costs Response	Total costs response to a repeal of the Swiss Franc/Euro lower bound an an appreciation of the Swiss Franc from 1.20 Francs per Euro to 1.10: Total costs response including wages, intermediate goods, other expenses, excluding investments	<= –7.5% to >= +7.5%
Nominal Turnover Response	Nominal turnover response to a repeal of the Swiss Franc/Euro lower bound an an appreciation of the Swiss Franc from 1.20 Francs per Euro to 1.10	<= –7.5% to >= +7.5%
Value Added	Gross value added figures for 2011 for all Swiss industries based on international NACE classification scheme. Source: Swiss Statistical Office, www.bfs.admin.ch	Absolute values
Exchange rates	Expected exchange rates ex ante	<= –1.00 to >= +1.40

Responses based on judgement in June/July 2012 for expected effects by end of 2012 (6 months ahead) and by the end of 2013 (18 months) ahead. All responses have been transformed to continuous scale.

5.5 Aggregation Scheme

We aggregate firms' responses to the sector level (manufacturing sector or service sector) by calculating a weighted mean,

$$\bar{y} = \sum_{i=1}^{N} w_i y_i.$$

where y_i is the response of firm $i = 1, \ldots N$ and w_i is the specific weight attached to firm i. The corresponding weighted standard deviation writes

$$\sigma_{y_i} = \sqrt{\sum_{i=1}^{N} (y_i - \bar{y})^2 w_i}$$

The weights w_i are derived from an aggregation scheme such that any coverage error does not induce a bias in the results and representativeness is ensured. Specifically,

$$w_i = w_i^{Emp} * w_i^{VA},$$

where w_i^{Emp} is the number of employees of firm i divided by the cumulated number of employees of all firms within firm i's industry group and where w_i^{VA} is the gross value added of firm i's industry group divided by the cumulated gross value added of all industry groups together in the respective sector. The value added data have been taken from the 2011 Value Added Statistics of the Swiss Statistical Office. Figure 8 depicts the aggregation scheme. The accumulated gross value added of all industry groups in the respective sector has been adjusted by omitting those industry groups, for which we did not observe a sufficient number of firms/firm employees. The aim was to have at least 30 observations within each group (with the exception of motor vehicles and furniture and repair & installation works).

Figure 8: Aggregation scheme