Dynamic effects of changes in cost competitiveness*

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Abstract

We study the dynamic effects of relative changes in unit labour costs on export market performance in a panel of 18 manufacturing industries from OECD countries. We find a modest but statistically significant negative effect of increases in unit labour costs on exports. This effect is larger in the euro area and relative changes in labour compensation have a larger impact on exports than relative changes in productivity. We also study the effects of a nationwide competitiveness pact that aimed at reducing relative unit labour costs in Finland. Relative unit labour costs in Finnish manufacturing decreased significantly following the announcement of the pact. We do not find a corresponding significant effect on relative export performance, albeit the analysis is complicated by simultaneous other events affecting exports of Finnish industries.

Keywords: cost competitiveness, unit labour cost, exports, panel local projection

JEL Codes: F14, J30, E65

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1 Introduction

In a globalized world, where barriers to trade have been to a large extent curtailed over time, policymakers regularly see their country's success in international trade as crucial to economic prosperity. Cost competitiveness, which is commonly measured in either real effective exchange rates (REER) or in unit labour costs (ULC), is often considered as a key determinant of export market performance in the medium-term.[1] The role of cost competitiveness is highlighted especially inside a currency union where exchange rates between member states are fixed and external adjustment has to occur through other margins. External imbalances inside the euro area and the role played by cost competitiveness remain a topical issue (Bayoumi et al., 2011; Carlin, 2012; Wyplosz, 2013).

In this paper, we provide new evidence on the effects of changes in relative ULC on exports by using industry level data on production and exports from OECD countries between 1995 and 2018. Firstly, we replicate a closely related analysis of Carlin et al. (2001) using our newer and less aggregated dataset. In addition to this, we contribute to the literature by employing a panel local projection (LP) approach (Jordà, 2005) to study the dynamic effects of changes in cost competitiveness. This approach allows us to look at the relationship between relative changes in ULC and exports across different time horizons. It also helps us to transparently control for other determinants of current changes in ULC since we are concerned that changes in ULC are likely to be endogenously driven by past dynamics in labour costs, productivity and exports. Obviously, we would prefer to use exogenous variation in ULC if available. LP pre-trends indicate that, without control variables, changes in ULC indeed are endogenous as ΔULC is correlated with past values of variables relevant to the analysis. Using lagged exports and ULC components along with unit and industry-year fixed effects as controls we are able to extract a part of ΔULC that is plausibly more exogenous in the sense that LP pre-trends are not significantly different from zero. While the lack of pre-trends does

[1] Dustmann et al. (2014) for example emphasise the role of improved competitiveness in the relative economic success of Germany since late 1990s. For a case against competitiveness thinking at the level of national economies, see Krugman (1994, 1996).

not imply exogeneity, we use it as a diagnostic since exogeneity would imply the absence of pre-trends (in population) as exogenous changes would not correlate with lagged covariates.

We find a statistically significant but modest negative effect of unit labour costs on exports. Our estimates on the medium-term elasticity on ULC on exports are roughly between -0.05 and -0.1 depending on the exact specification and time horizon that are used. The estimated size of the effect is somewhat smaller than suggested by earlier estimates in the literature that typically finds elasticities in the range from -0.2 to -0.4. The effect of ULC on exports is smaller in the first few years and seems to materialise fully only roughly 3 years after the initial increase in ULC. We find larger point estimates when the analysis is restricted only to countries in the euro area, as theory would predict to be the case in a monetary union. When looking at the ULC components of labour compensation and productivity individually, we find that relative changes in labour compensation have a larger absolute impact on exports than relative changes in productivity.

In addition to the more general panel analysis, we study the effects of a reform that aimed at lowering costs of employment in Finland during the late 2010s. In an effort motivated by a perceived loss of cost competitiveness and a period of lackluster economic growth since the financial crisis, a newly elected center-right government pursued policies that would help reduce Finnish unit labour costs. This initiative resulted in what came to be called the Finnish competitiveness pact that took effect in 2017. The reform, even if it consisted of multiple smaller measures that were agreed upon with social partners, was effectively a co-ordinated internal devaluation within a monetaty union.

Using an event study approach that builds on our more general panel LP analysis, we find that ULC of Finnish manufacturing industries decreases by nearly 10% relative to the control group of other OECD economies in the years following the reform. The change in relative ULC is driven by both a decline in relative labour compensation and an increase in relative productivity. We do not find a significant positive effect on exports. However, this analysis is complicated by large drop in Finnish exports just before the competitiveness pact took place.

This drop is very likely, at least to some extent, to be related to the Russian aggression in Ukraine during and after 2014 and the associated economic effects that followed. Industries in other countries, i.e. the control group, were not similarly affected by this simultaneous event. On the other hand, given the estimates from the more general panel analysis, we would not expect very large export effects in the first place. In this sense the result on the effects of the Finnish competitiveness pact on exports does not run against the more general panel estimates.

Several papers study the effects of ULC on exports.[2] Carlin et al. (2001) use a distributed lag model of changes in relative ULC to explain changes in export market shares and find a long-run elasticity of approximately -0.27.[3] In our replication with newer data, we however find a long-run elasticities between -0.06 and -0.09. Using firm-level data from Belgium Decramer et al. (2016) find a negative relationship between unit labour costs and exports with estimates on the elasticity of exports at the intensive margin ranging from -0.2 to -0.4. They also find that more labour-intensive firms are more sensitive to changes in ULC and that changes in ULC also have an effect on the extensive margin of exports. Malgouyres and Mayer (2018) study the effects of a large-scale reform that affected labour costs of French firms. Using variation in treatment intensity of the policy across firms, they find negative point estimates on the effect of labour costs on exports but these estimates are found to be noisy and thus statistically insignificant.

This paper is structured as follows. In section 2, we describe the dataset and explain the key variables used in the analysis. In section 3, we first replicate the analysis of Carlin et al.

[2]Our paper is also related to a larger literature that studies trade elasticities. Estimates on the price elasticity of exports tend to typically be larger than estimates on ULC elasticities and empirical literature seems to find heterogeneous trade elasticities across different variables (Fontagné et al., 2018), countries (Imbs and Mejean, 2017) and products (Fontagné et al., 2020). In a recent paper, Boehm et al. (2020) estimate trade elasticites by exploiting variation in tariffs and using an LP approach similar to ours. They find short-run elasticity of -0.76 and long-run elasticities close to -2.

[3]In earlier literature, Kaldor (1978) found using data on manufacturing as a whole that growing relative unit labour costs are associated with growing rather than decreasing market shares in the long-run. This positive correlation, which went against what is predicted by standard theory, has afterwards become known as the Kaldor's paradox. Similar empirical findings are found for instance in Fagerberg (1988, 1996) where the importance of non-price competitiveness is emphasized in comparison to cost competitiveness.

(2001) in 3.1 and then motivate an alternative approach based on panel local projections in 3.2 that also contains our main results. Section 4 provides an event study analysis of the Finnish competitiveness pact. In conclusion, Section 5 summarizes the analysis.

2 Data

We construct a country-industry-year panel by using data from the OECD STAN database (Horvát and Webb, 2020) similarly to Carlin et al. (2001). Data for industry-level exports are retrieved from the STAN Bilateral Trade Database while rest of the indicators are from the STAN Database for Structural Analysis. While STAN provides data for various economic variables for OECD countries, crucial for the analysis at hand is that the data is disaggregated by industry level. The use of this database therefore allows to study the impact of unit labour costs on export performance across industries and countries over time.

Sample

To ensure a balanced panel for the replication of Carlin et al. (2001), the analysis is limited to 23 OECD countries and the time period to 1995-2017. As the country coverage is significantly larger than was available in Carlin et al. (2001), we also present the results for a restricted sample of 13 more advanced countries that more closely resembles the sample used in the original paper. A list of countries in the full and restricted samples can be found in Table A2 in the Data Appendix.

For studying the effect of changes in cost competitiveness on exports, our analysis is naturally limited to manufacturing industries by the fact that industry-level trade data is available almost exclusively for the manufacturing industries. As the STAN data is based on the ISIC Rev. 4 industry classification at the two-digit level, the most detailed disaggregation of total manufacturing available is by 24 sub-sectors. Yet, at this level disaggregation, we find that data on many of the key variables are missing, making the use of such detailed level of disaggregation disadvantageous for the analysis. Therefore, we use a higher level of aggregation for some industries in order to cover as much of the total manufacturing as possible.[4] We take the two-digit disaggregation as a starting point but opt for the more aggregated sub-sector data for those sectors where data is sparse at the most detailed two-digit level. As a consequence, we end up with a total of 18 manufacturing sectors. Table A1 displays a list of these sectors.[5] For the replication part, which requires a balanced panel within each industry in order to calculate relative measures, we drop those country-industry combinations from the sample where there are missing values within specific industries. Table A2 contains a list of the dropped sectors for each country.

Variables

Exports

Trade performance is measured by industry-level exports to the rest of the world. In our data, exports of all countries are reported in US dollars and we only observe the total value of exports by industry, that is, we do not observe trade volumes. For the replication part, we follow the steps of the analysis in Carlin et al. (2001) and use a relative measure of these exports, the export market share (XMS). It is defined as the share of country j's exports in industry i to the whole world divided by the total exports from the sample of countries within that industry at time t:

$$XMS_{ijt} = \frac{exports_{ijt}}{\sum_I exports_{ijt}} \tag{1}$$

It thus measures the exporting performance of a single country in relation to the other countries within each industry. Crucially, as the sample covers only a limited number of countries, trade performance is measured relative to other sample countries and not against

[4]In Carlin et al. (2001) as well, some aggregation of the sub-sectors was done, as the total number of manufacturing industries within the analysis was 13.

[5]By using this level of disaggregation, we are able to cover the total manufacturing industry, except for "repair and installation of machinery and equipment" (D33) that includes only specialised repair and installation activities, in which exports are not reported.

the rest of the world. Carlin et al. (2001) justify the choice of considering only OECD country exports by their dominance in world exports. Within the last decades however, patterns of international trade in manufactures have evolved, not by least by the rise of China's share in the world trade. Although we expand the dataset by a number of European countries, this updated dataset cannot be considered to represent the same share of world manufacture trade as in Carlin et al. (2001) due to the considerable rise of other countries. Reagrdless, the comparison of relative performance as explained by changes in relative cost competitiveness is valid.

Unit labour costs

Following the strategy of Carlin et al. (2001), we use unit labour costs (ULC) as a measure of cost competitiveness. ULCs are defined as the ratio of average labour costs with respect to unit of output produced and can be calculated by dividing employee compensation per worker by labour productivity. Equation (2) presents a common way of calculation of ULCs, used for instance by the OECD:

$$ULC_{ijt} = \underbrace{(W_{ijt}/E_{ijt})}_{\text{Labour compensation}} \quad / \quad \underbrace{(Q_{ijt}/N_{ijt})}_{\text{Productivity}}, \tag{2}$$

where W is compensation of employees (nominal) measured in national currency, E is the number of employees, Q is value added in real terms and N is total employment. By considering the difference between the number of employees and total employment, this method adjusts for self-employment yet therefore also implicitly assumes labour costs to be equal between wage workers and self-employed. As all numeric variables within this measure are expressed in national currencies, there is no separate component for the exchange rate. Yet, in Carlin et al. (2001), exchange rate is included as its own component, in which case the formula to calculate unit labour costs can be expressed as follows:

$$ULC_{ijt}(\$) = \underbrace{\frac{(W_{ijt}/E_{ijt})}{exc_{jt}}}_{\text{Labour compensation (\$)}} \quad / \quad \underbrace{\frac{(Q_{ijt}/N_{ijt})}{exc_{j2015}}}_{\text{Productivity (\$}_{2015})} \quad , \tag{3}$$

where exc is the dollar exchange rate (national currency per one dollar). This expression of unit labour costs then accounts also for changes in the exchange rate. Effectively, compensation of employees W is converted into nominal dollars and real value added Q into 2015 dollars as 2015 is used as the base year for variables measured in real values in the data. The analysis is carried out by using both definitions of ULC expressed in Equation (2) and (3) in parallel. For clarity, we call the first definition the domestic unit labour costs and the latter dollar the denominated unit labour costs.

For the replication of Carlin et al. (2001), we need to calculate relative unit labour costs (RULC). These are calculated by dividing the dollar denominated unit labour costs in industry i in country j, by the respective industry's average unit labour costs $\overline{ULC_{it}(\$)}$:

$$RULC_{ijt}(\$) = ULC_{ijt}(\$) \;/\; \overline{ULC_{it}(\$)}. \tag{4}$$

Following the method of Carlin et al. the average unit labour cost in an industry is a weighted average, with countries weighted according to their export market shares in the respective industry. Instead of using fixed export market shares of a single base year as weights, we use the previous year's export market shares, implying that the weights are always adjusted for the prevailing market shares in the industry.

3 Empirical approach and results

This section provides estimates on the dynamic effects of unit labour costs and its components on the export performance of manufacturing industries in OECD economies. In order to facilitate a better comparison of our results to prior literature, we start by a model identical to that of Carlin et al. (2001). We then proceed to use a panel local projection approach

(Jordà, 2005), a method we consider more suitable for this setting. Our main results are thus based on the latter approach.

3.1 Replication of Carlin et al. (2001)

Econometric model

Carlin et al. (2001) estimate the dynamic effects of changes in relative unit labour costs on export market share with a distributed lag (DL) model where log-changes in export market shares (XMS) are explained by lags from 0 to 5 of log-differences in $RULC(\$)$. Including multiple lags of $\Delta log(RULC(\$))$ to the model allows for analysing the gradual response of the dependent variable since the reaction of exports to changing labour costs might not be immediate. In addition, the model only includes either a constant or country fixed effects, such that the model can be written as:

$$\Delta log(XMS_{ijt}) = \sum_{k=0}^{5} \beta_k \Delta log(RULC(\$)_{ij,t-k}) + \alpha_j + u_{ijt}, \tag{5}$$

where α_j capture the country fixed effects and coefficients β_k are the coefficients of interest that capture the dynamic effects. In the model without country fixed effects α_j are replaced by a constant α. Naturally, export market shares at a given time are an outcome of various other factors too. Choosing to estimate first order differences should according to the authors of the original paper efficiently correct for the omitted factors in their model. The remaining country specific trends that are omitted, are presumed to be controlled by the inclusion of country specific dummy variables.

Results

Table 1 reports the OLS estimates from the replication of Carlin et al. (2001) using our newer dataset.[6] Following the authors' estimation strategy, the first two columns show the

[6] We are not able to fully replicate the original results of Carlin et al. (2001) as we do not have the original dataset at our disposal (nor do we have the original computer programs for the analysis).

results from estimating the model in Equation (5) where industries are weighted by their relative size. Size of the industry is measured by sample average of exports to the world from sample countries. The latter two columns present unweighted estimates. Columns 2 and 4 include country fixed effects as controls. We use the dollar denominated measure of ULC (Equation (3)) to calculate $RULC(\$)$ and hence the exchange rate component is included as in the original analysis.

When it comes to individual coefficients on the lag terms, we find that only some of them are statistically significant. Coefficients on the contemporaneous change in $RULC(\$)$ are close to zero (all slightly positive) while coefficients on the lagged $\Delta log(RULC(\$))$ terms are all negative with some of them significantly so. Following Carlin et al. (2001) we calculate the long-run elasticity of $RULC(\$)$ by aggregating the individual coefficients over the lags 0 to 5 and testing this sum of coefficients against the null. This estimate is taken to represent the long-run effect of $\Delta RULC(\$)$ on ΔXMS in the original study.[7] From the model with observations weighted by size of the industry we get a long-run elasticity of -0.071 for the model without and -0.066 for the model with country fixed effects. Estimates from the unweighted models are slightly more negative at -0.086 and -0.077 respectively. Both of these estimates are significant at the 0.05-level while estimates from the weighted model are significant only at the 0.1-level. Overall, the estimates obtained from the replication with our newer dataset are significantly smaller than that of Carlin et al. (2001) who find a long-run elasticity of -0.266 in their baseline specification with country dummies.

The interpretation of the results from the DL model of Carlin et al. (2001) relies much on the exogeneity of lags of $\Delta log(RULC(\$))$, as other determinants of export market shares that correlate with $RULC(\$)$ can bias the estimates. The authors argue that $\Delta log(RULC(\$))$ can be considered exogenous, since even if determinants other than $RULC(\$)$ explain export market shares, the first-differencing of data will sweep out these effects if they are relatively

[7] The implicit assumption behind this is seemingly that after 5 years the effect is permanent and constant. Carlin et al. (2001) do robustness analysis by increasing the number of lags but find that the estimated long-run effect does not materially change.

fixed over time. However, the validity of the exogeneity assumption in the model still remains a bit opaque. To better assess the exogeneity of $\Delta RULC(\$)$ we, in the next subsection, take another empirical approach to study the dynamic effects, namely, we estimate the dynamic effects using local projections.

3.2 Panel local projection

Econometric model

Local projections (LP) à la Jordà (2005) have become a popular approach to estimate impulse responses. Using this approach the impulse responses of the dependent variable due to current changes in the explanatory variable are estimated by a series of regressions where the outcome variable is directly projected at different horizons on current covariates. The benefits this approach embodies are the easy implementation in different settings and that the inclusion of possible control variables is flexible and straightforward. Moreover, the approach allows for the inspection of possible pre-trends by extending the projection horizon to negative values as is done for example in Acemoglu et al. (2019) or in Boehm et al. (2020).

For unbiased estimates on the response of exports to changes in (relative) unit labour costs, changes in unit labour costs should be exogenous. Even if in this paper we are not attempting to make strong causal claims about the structural relationship between exports and unit labour costs, we would like to have the estimated impulse response to be as unbiased as possible from the endogeneity of changes in ULC in order to answer your research question. By using LPs we are able to both flexibly choose the control variables such that the residualised explanatory variable is less likely endogenous as well as to assess the presence of possible pre-trends in outcomes and covariates given this choice.

Thus, in the following we use a panel local projection model to estimate dynamic effects. Our baseline model can be written as:

$$log(y_{ij,t+h}/y_{ij,t-1}) = \beta^{(h)}\Delta log(x_{ijt}) + \lambda_{ij}^{(h)} + \tau_{it}^{(h)} + \gamma^{(h)}X_{ijt}^{c} + u_{ijt}^{(h)}, \tag{6}$$

where y_{ijt} is the outcome variable, $\Delta log(x_{ijt})$ is the current change in explanatory variable and X^c_{ijt} is a vector of control variables. In addition λ_{ij} and τ_{it} capture unit (industry $\times$ country) and industry specific time (industry $\times$ year) fixed effects respectively. Superscripts (h) highlight the fact that the estimated response $\beta^{(h)}$ is a result of multiple individual regressions where the outcome variable is projected at different horizons h where h is running from H_{min} to H_{max}. Here we choose to use $H_{min} = -6$ and $H_{max} = 8$. By specifying the outcome variable to be a log-difference between $t + h$ and $t - 1$ we are effectively making $t - 1$ the reference period which naturally implies that $\beta^{(-1)} = 0$ across our LP results.

As already noted, Carlin et al. (2001) basically claim that $\Delta log(RULC(\$))$ can be considered as exogenous. If this was indeed the case, then one could estimate the model in equation (6) where the explanatory variable is $\Delta log(RULC(\$))$ without any control variables and consider the resulting estimates of the impulse response valid. In Figures 1a and 1b we provide just these estimates for outcome variables $RULC(\$)$ and XMS respectively. From these figures it is quite clear that current values of $\Delta log(RULC(\$))$ correlate with its own lags as the LP estimates for $h < 1$ are significantly different from zero when $RULC(\$)$ is the outcome variable. This indicates that current changes in $RULC(\$)$ are partly driven by its past dynamics. For XMS, there is not such a clear pre-trend to be seen, although the point estimate for $t - 2$ is slightly negative and for t slightly positive which is perhaps signaling that in this specification $\Delta log(RULC(\$))$ is correlated with improvement in XMS around $t - 1$.

We can also turn the DL model in equation (5) into a LP specification. The DL model contains 5 lags of $\Delta log(RULC(\$))$ in addition to its current value. We can consider the lagged values as control variables in the LP model. In addition, the model contains country fixed effects. Figures 1c and 1d provide LP estimates for the dynamic responses of $RULC(\$)$ and XMS using this specification. For reference, these figures also include impulse responses implied by the estimates in Table 1 (column (4)) of the model in equation (5) as blue (shortdashed) line for an assumed transitory change in $RULC(\$)$ and as red (longdashed) line for an assumed permanent change in $RULC(\$)$.

As the LP model contains 5 lags of $\Delta log(RULC(\$))$, this mechanically brings the coefficients of the $RULC(\$)$ response to zero for $-6 \leq h \leq -2$. Other than that, the estimates are quite similar to the model with no controls at all, although the pre-trend for XMS deviates a bit more from zero as does the response for $h > 1$. It is also noteworthy that in comparison to the DL model, we are able to get the LP estimates for the response of $RULC(\$)$ to changes in $RULC(\$)$. These estimates on the response of $RULC(\$)$ are what is implied by the data and not imposed. When DL coefficients are turned into impulse responses it is typical to impose either a transitory change, whereby the response of $RULC(\$)$ would be 1 at $t = 0$ and zero elsewhere, or a permanent change that imposes a unit response in $RULC(\$)$ for $t \geq 0$. In the former case the individual coefficients from DL yield the impulse response of XMS and in the latter it is uncovered as a function of all the coefficients. While the response of $RULC(\$)$ is persistent in Figure 1c, the change in $RULC(\$)$ is not permanent as is assumed when calculating the long-run elasticity in Table 1.

Figures 1e and 1f provide the impulse response estimates of $RULC(\$)$ and XMS from LP model that includes our baseline control variables which are, in addition to industry-year and industry-country fixed effects, 3 lags of exports as well as all of the individual components of ULC($): labour compensation W/E, productivity Q/N and the dollar exchange rate exc/exc_{2015} (all measured in log-levels). These control variables aim to control for the past dynamics in these variables so that the remaining change in $RULC(\$)$ is not driven by these trends. We use the possibly remaining pre-trend in periods $t-6$, $t-5$ and $t-4$ as one measure on the success of this strategy as controlling for endogeneity in $\Delta log(RULC(\$))$.[8] A check for remaining pre-trends is also used as a guidance in the selection of lag length 3 for the baseline specification. Choosing a shorter lag-length for the control variables, for example, does not seem to robustly remove remaining pre-trends.

[8]Ideally, however, one would like to have a credibly exogenous element in $\Delta log(RULC(\$))$ that could be used in identification. Even in this case, the checking for pre-trends using LP would also be a useful diagnostic.

From Figures 1e and 1f it can be seen that the shape of the $RULC(\$)$ response is markedly different from the two previous specifications. The use of a more comprehensive set of control variables seems to capture a different type of shock in $\Delta log(RULC(\$))$ — one that is less persistent. Following an initial 1% increase in $RULC(\$)$ at time t, $RULC(\$)$ declines more quickly towards its prior level at time $t-1$. At the same time, the response of XMS does not exhibit a similar upward trajectory around time t than in the two previous specifications although the initial response to an increase in $RULC(\$)$ is zero and not negative. Overall, the response of XMS shows a gradual but persistent decline that seems to plateau after $t+3$ at around -0.07% whereas the other two specifications yield a more long-lasting decline in XMS.

In general, we can draw a few conclusions from Figure 1. Firstly, treating $\Delta log(RULC)$ as exogenous seems unsuitable in our LP framework as it is quite clear that changes in $RULC$ are driven by other factors as well. The endogenous elements should, to some extent, be captured by the inclusion of control variables to the model. Secondly, the choice of the set of control variables matters for the analysis. Using simply the lags of $RULC$ yields different estimates than using a set of more comprehensive controls that would enable to control for the dynamics of other variables as well.

Before we turn to the actual results from the LP analysis it is worth pointing out that by using an LP model we can carry out the analysis without first calculating the relative measures $RULC(\$)$ and XMS. Estimates obtained using $ULC(\$)$ and $Exports$ instead of $RULC(\$)$ and XMS as explanatory/outcome variables yield the same results (in the same sample) since the fixed effects in the baseline model make sure that we are comparing relative changes within each industry. In addition to simplicity, this brings the added benefit that we do not have to make sure that the panel is perfectly balanced within each industry over the sample period like it has to be when calculating changes in $RULC(\$)$ and XMS. Therefore we choose to use the actual variables $ULC(\$)$ and $Exports$ rather than their derivatives $RULC(\$)$ and XMS from here on.

Results

While Figure 1 gives a preview of our results, the main results using the LP approach are provided in Figure 2. This figure first plots the responses of $ULC(\$)$ and *exports* to a 1% change in $ULC(\$)$ over horizons $-6 \leq h \leq 8$. As noted before, given the specification of the panel LP model, Figures 2a and 2b yield basically the same estimates as what Figures 1e and 1f do in the case of $RULC(\$)$ given that the panel LP model compares relative changes and our sample is restricted to the same set of countries. In Figures 2c and 2d we replace $ULC(\$)$ with ULC, that is, we consider changes in unit labour costs denominated in domestic currency rather than in US dollars while Figures 2e and 2f present the results when including only euro area (EA) countries of the restricted sample. Naturally within the euro area, changes in the exchange rate play no role in relative unit labour costs, allowing us to exclude this effect. At the same time, we are interested in observing whether the effects of changes in relative costs are larger when there is no adjustment through the exchange rate as is the case in the European Monetary Union.

On the whole, using either $ULC(\$)$ or ULC seem to yield largely similar results, displayed in Figure 2. The overall pattern is that on average, following a 1% increase in unit labour costs at time t, ULC tends to gradually approach the level it would have achieved in the absence of the initial change which is indicated by the LP estimates approaching zero and becoming insignificant as the projection horizon increases. At the same time, the effect on exports is gradual, modest in size and yet quite persistent. We find that a 1% increase in $ULC(\$)$ is associated with a -0.07% decrease in *exports* after 3 years and an increase in ULC is associated with a -0.06% decrease.[9] These negative effects seem to persist although the estimates using ULC are somewhat closer to zero and turn insignificant as the projection horizon increases. Table 2 offers more detailed results on the effects on *exports* in the form of regression tables for horizons $h \in (0, 3, 6)$. In Table 2 the baseline results for $ULC(\$)$ and ULC of Figure 2 are presented in columns (3) and (6), respectively.

[9] These results are similar in size to those obtained from the replication analysis presented in Table 1.

One qualitative difference between the effects of $ULC(\$)$ and ULC on *exports* in Figure 2 is that the initial ($h = 0$) response, while insignificant in both cases, is negative only for ULC. It is worth noting that this difference is likely to be driven partly by a purely mechanical effect: a change in dollar exchange rate is embodied in both $ULC(\$)$ and *exports* as they are both measured in nominal dollar terms. Thus, in the absence of real effects, a depreciation in dollar exchange rate at time t would result in a simultaneous decrease of both $ULC(\$)$ and *exports*. This likely attenuates the estimated short-run effect when using $ULC(\$)$ as a measure of cost competitiveness.[10] Partly because of these mechanics, we also report results using ULC as well as for the euro area where relative changes in the exchange rate are absent.

In comparison to the full baseline (restricted) sample, the estimates when using only euro area data indicate a more sudden reversion in ULC. That is, changes in relative unit labour costs seem to be less persistent in the euro area sample as the estimated effect on ULC returns to zero already 4 years after the initial increase. When looking at the response of *exports* we can also see a larger effect in the euro area sample than in the baseline sample. We find that the estimated effect of a 1% increase in ULC on *exports* is roughly -0.13% after 4 years. For longer projection horizons, the estimate is somewhat closer to zero. The mechanism behind these patterns is beyond the scope of this paper but one could conjecture that as the exchange rate is not an adjustment channel present within the euro area, changes in cost competitiveness (ULC) are more costly in terms of lost export market share and therefore a more important factor within a currency union. The absence of the exchange rate as an adjustment mechanism can lead to an increased pressure for ULC to adjust and the reversion in ULC is more rapid as well. As ULC adjusts faster, the initially larger effect on *exports* is perhaps attenuated at longer horizons.

While Figure 2 reports the results at individual horizons h following a initial increase in the explanatory variable, we would like to get a sense of the elasticity of exports with respect

[10] The same mechanism is perhaps also at play in Carlin et al. (2001) where the initial response is positive although the relation to exchange rate is not explicitly stated.

to unit labour costs over the medium-term. In order to capture these aggregated medium-term effects, we follow a strategy similar to Ramey and Zubairy (2018) who specify the LP model as a projection of the cumulative change in the outcome variable on the cumulative change in the explanatory variable in the context of estimating fiscal multipliers. Following this strategy in the present context, our model can be expressed as:

$$\sum_{h=0}^{\bar{H}} log\left(\frac{exports_{ij,t+h}}{exports_{ij,t-1}}\right) = \beta^{(\bar{H})} \sum_{h=0}^{\bar{H}} log\left(\frac{ULC_{ij,t+h}}{ULC_{ij,t-1}}\right) + \lambda_{ij}^{(\bar{H})} + \tau_{it}^{(\bar{H})} + \gamma^{(\bar{H})} X_{ijt}^{c} + u_{ijt}^{(\bar{H})}, \quad (7)$$

where $\beta^{(\bar{H})}$ now captures the elasticity estimate up to horizon $\bar{H}$. This model is estimated by 2SLS and to instrument the cumulative change in either $ULC(\$)$ or ULC we use the initial change in the respective variable, that is, $\Delta log(ULC(\$)_{ijt})$ or $\Delta log(ULC_{ijt})$. Control variables are as previously specified in equation (6). This model should not be considered as a more structural specification than the previous ones even though it is an IV specification. We are merely using this estimation strategy to aggregate the impulse responses in both the dependent and the explanatory variable up to a certain horizon in order to obtain estimates of the medium-term elasticity.

Table 3 presents results from the model in equation (7) for horizons $\bar{H} \in (3, 6)$. Again, the baseline specifications can be found in columns (3) and (6). For $ULC(\$)$ we find an elasticity of -0.049 and for ULC an elasticity of -0.060 at horizon $\bar{H} = 3$. For horizon $\bar{H} = 6$ we find elasticities of -0.105 and -0.100, respectively. These results reflect the pattern seen in Figure 2: the initial response is found to be smaller when using $ULC(\$)$ as the explanatory variable, yet, as the horizon increases the larger effect that $ULC(\$)$ has on exports starts to weigh on the aggregated measure. Again, this result is likely to be somewhat affected by a purely mechanical effect that a change in exchange rate has on variables in both sides of the equation.

We are also interested in the effects of the individual components of ULC: labour compensation and productivity. We exclude the exchange rate since it is not determined at the industry-level. Figure 3 presents the results from this analysis of ULC components when using the model in equation (6), but with the explanatory variable now being either labour compensation or productivity. Figures 3a and 3b present the estimated effects on $ULC(\$)$. As expected, we find that an increase in labour compensation increases $ULC(\$)$ and an increase in productivity vice versa decreases $ULC(\$)$. It is however noteworthy that an increase in labour compensation is not fully transmitted to a similar change in ULC as the estimated effect is less than one whereas the estimate on the initial effect of a change in productivity on $ULC(\$)$ is close to -1. This perhaps suggests that increases in labour compensation are associated with simultaneous increases in productivity that to some extent offset the effect on ULC. In both Figures 3a and 3b we also see that the effect on $ULC(\$)$ is transitory for both components as estimates get closer to zero and insignificant as the projection horizon increases.

Figures 3c and 3d present the estimated effects on $exports$. We find a negative peak effect of roughly -0.2% at horizon $h = 4$ from a 1% change in labour compensation on exports. This negative effect is noticeably larger than found on the average effects of ULC on $exports$ in Figure 2. After the negative peak at $t + 4$, estimates start to get closer to zero and become insignificant. The response of exports to a 1% change in productivity is much smaller in absolute terms at around 0.04% but perhaps more persistent. Given these results, relative increases in labour compensation thus seem to be more costly in terms of relative exports than relative declines in productivity over the medium-term.

4 Event study: Finnish competitiveness pact

Following the financial crisis of 2008 and the simultaneous fall of Nokia as a global leader in the mobile phone industry, Finland saw a prolonged period of weak output growth in the early 2010s. At the same time, many observers pointed to worsening cost competitiveness as a key factor in this situation. This led the newly-elected coalition government in 2015 to pursue policies that would improve Finnish cost competitiveness against its competitors. After long negotiations with social partners, the end result of this political process was an unconventional pact that aimed to significantly reduce relative unit labour costs of Finland. Against this background, this section studies the effects of this nationwide competitiveness pact that took effect at the start of 2017.[11]

At its core, the competitiveness pact was an agreement between social partners — the central organizations on both the employer and employee sides of the table — on measures that would lower the cost of employment in order to improve competitiveness and thus help boost the economy over the medium-term. The pact included a number of different measures such as an extension to collective agreements with a freeze on wage increases, working time extensions without a corresponding increase in earnings and gradual reductions in the employer's social security contributions between 2017-2020. Some of the measures were implemented through collective agreements which cover a large majority of Finnish workforce while some were implemented through government policies. Government also used changes in income taxes to compensate workers for the losses caused by increases to employee's social security contributions and to help facilitate the agreement. Government has traditionally had some role to play in Finnish national income policy agreements with government's tax and transfer policy often being a variable.[12]

Even though the pact was formally an agreement between the social partners, the reform can be seen to have its roots in the political initiative of the then leading candidate for prime minister Juha Sipilä during his election campaign in the spring 2015. In April 2015, Sipilä and his Center Party won the Parliamentary elections and the government programme included an explicit mention of the target to reduce unit labour costs by the so-called social contract. Specifically, it states that: "By no later than 30 July 2015, the Government will make a

[11] In the panel analysis of subsection 3.2 we do not find different effect sizes for Finland as adding an interaction between change in ULC and Finland in the baseline specification does not yield statistically significantly different estimates for Finland.

[12] While government's role in labour market negotiations has arguably declined and varied over the years, centralised national income policy agreements (*tupo* in Finnish) have played a large role in Finnish industrial relations in the past (see for example Vartiainen (1998) or Asplund (2007)).

proposal to social partners on measures (social contract) to reduce unit labour costs by at least 5%" (Sipilä, 2015). Eventually, this original deadline was not met but the negotiations continued during the fall of 2015. At the same time, prime minister Sipilä's government also pressured social partners to reach an agreement by threatening to pursue a legislative path to achieve its target of improving cost competitiveness. It also conditioned its future fiscal policy decisions on whether an agreement was achieved: no agreement would have led to additional consolidation of public finances later in the government's term. Finally after long negotiations, social partners reached an agreement on the competitiveness pact on 29 February 2016 and implementation of the pact was confirmed by mid-June 2016 when a large enough share of industries had approved the plan.

Given this backstory to the reform, we are concerned that economic outcomes we are interested in might be affected by the reform already in years before the reform actually took place in 2017. In other words, we are concerned about potential anticipation effects. To help us dissect this possibility, Figure 4 plots the relative search intensities of three Finnish terms that are related to the competitiveness pact. We see that the rise of the term "Yhteiskuntasopimus" (social contract) in Google searches is associated with the election campaign and negotiations of the government programme that followed during the spring of 2015. "Yhteiskuntasopimus" was the term candidate Sipilä used during the campaign. In early fall there is another peak that coincides with an intensifying labour market situation following a fall in negotiations at the end of summer 2015. In early 2016, as agreement on the pact was reached, searches for "Yhteiskuntasopimus" reach their peak. Following the agreement on the competitiveness pact, the pact's Finnish name "Kilpailukykysopimus" shows up in Google searches and searches for "Yhteiskuntasopimus" wane. However, rather quickly "Kilpailukykysopimus" is overtaken by its more folksy and later generally adopted short version "Kiky". Searches for "Kiky" peak at the beginning of 2017 as the competitiveness pact took effect. As anticipation effects seem quite plausible, we treat year 2015 as the first year of the reform year in the following, rather than year 2017.

Econometric model

To study the dynamic effects of the Finnish competitiveness pact we build on the preceding panel analysis.[13] In comparison to subsection 3.2, the explanatory variable is now replaced by a treatment dummy for the industries that were affected by the competitiveness pact, namely, Finnish industries.[14] Effectively then, the counterfactual for Finnish manufacturing industries is based on the predicted values from the panel local projection model, including the same controls as previously. Therefore, only the continuous explanatory variable has been changed into a treatment dummy. As, in what follows, we will also use exports excluding Russia as an outcome variable of interest, we include 3 lags of that variable into the model as well.

Formally, our model for estimating the effects of the Finnish competitiveness pact can be written as:

$$log(y_{ij,t+h}/y_{ij,t-1}) = \beta^{(h)} D_{ijt} + \lambda_{ij}^{(h)} + \tau_{it}^{(h)} + \gamma^{(h)} X_{ijt}^{c} + u_{ijt}^{(h)}, \tag{8}$$

where D_{ijt} is a treatment dummy that gets value 1 for Finnish industries post 2015 and is zero otherwise. Coefficient $\beta^{(h)}$ now captures the average effect on the Finnish manufacturing industries at horizon h. We exclude all observations where treatment status changes during the projection horizon in order to not bias estimates of the treatment effect. In our case this effectively means that we censor the outcomes for Finnish industries after the year 2014 ($t + h > 2014$) since they might be affected by the treatment, unless they are projections from $t = 2015$ which is the event we want to study. We also exclude 3 industries from this analysis. Food products, beverages and tobacco (ISIC 10-12) is dropped since Finnish Food Workers' Union rejected the competitiveness pact. Coke and refined petroleum products

[13]In Appendix B we provide supplementary analysis on the effects of the competitiveness pact at a more aggregate level using the synthetic control method.

[14]Using the approach of combining local projections and treatment dummies is similar to the approach of Acemoglu et al. (2019) who study the effect that transitioning to a democracy has on GDP by utilising a country-year panel of democratic transitions.

(ISIC 19) and Computer, electronic and optical products (ISIC 26) are dropped as the high variance these industries exhibit seems to have an undue influence on estimates in this small cross-section of Finnish industries that includes 18 industries in total and 15 after making these exclusions.

Results

Figure 5 plots panel LP estimates from the model in equation (8) for 6 different outcome variables: labour compensation (5a), productivity (5b), ULC (5c), $ULC(\$)$ (5d), exports (5e) and exports excluding Russia (5f). We plot estimates for years 2009-2020 and use 2014 as the reference year, meaning that all estimates are relative to 2014 levels. At the end of the time frame we have some missing data as only exports are available for the year 2020. We have also extended the original data outlined in section 2 with data from Eurostat for labour compensation and productivity for the year 2019 and in some cases for the year 2018.[15] To highlight the fact that the data for these variables are available only for a subset of the countries in 2019, we plot the estimates for year 2019 separately in some of the panels of Figure 5.[16]

We find that both ULC and $ULC(\$)$ in Finnish manufacturing industries decreases following the year 2014 and that the decline starts already before the actual implementation of the reform in 2017. By 2017 the estimates suggest that the decline in ULC is approximately -8.7% and in $ULC(\$)$ approximately -7.5% relative to the counterfactual. This change stems mainly from an increase in relative productivity rather than in labour compensation, although it is noteworthy that the relative labour compensation also declines. Since our measure of productivity is value added per employment, the rise in relative productivity can be partly explained by the competitiveness pact as it included an increase in annual working time without a corresponding rise in annual compensation. Were we to measure productivity

[15]Eurostat data are retrieved from the national accounts aggregates by industry database.

[16]We use the restricted sample as the baseline as in the previous section. As Eurostat focuses on European countries, we don't have data on countries that are not included in Eurostat for the year 2019.

as value added per hours worked and labour compensation similarly as hourly defined, this part of the effect should show up in labour compensation instead. We don't measure these variables in hourly terms, since data on hours worked is considerably more sparse compared to employment data.

Estimates on the effect to exports imply a negative or insignificant effect depending on the projection horizon. However, much of this negative effect stems from a large drop in exports in the year 2016 relative to the counterfactual. That is, the large negative effect occurs just before the reform takes place. It seems implausible that competitiveness pact caused this drop. Instead, it is quite likely that another shock was behind these events. In Figure 5f we plot estimates for exports excluding exports to Russia. That is, we have subtracted exports to Russia from the total exports for all observations, and now consider this variable as another outcome. We see that the drop prior to reform is smaller using this measure of exports and that at the end of the sample point the estimates even turn positive (yet not to statistically significant). This suggest that perhaps the extensive exposure of Finnish industries to Russian export demand is partly behind these estimates and that some of this drop in exports prior to the competitiveness pact may be explained by events related to Russian aggression in Ukraine during and after 2014.

Another plausible explanation for the negative estimates seen prior the actual reform took place is that the reform is not strictly exogenous with respect to future developments in exports. If the creation of the pact was partly motivated by a bad economic outlook for Finland in comparison to other economies for the coming years, then part of the estimated effect can simply explained by be the realization of this unfavorable economic forecast. Nevertheless, using both exports and exports excluding Russia we see that the trend shifts when the competitiveness pact takes effect in 2017.

5 Conclusion

This paper provides new and updated evidence on the relationship between changes in relative unit labour costs and export market performance. By using industry-level data from OECD countries, we find that relative increases in unit labour costs are associated with decreases in relative exports. This effect is however found to be smaller than estimates in earlier literature, including Carlin et al. (2001) whose analysis we also replicate. Relative increases in labour compensation seem to be more costly in terms of lost export market shares than relative decreases in productivity. Moreover, changes in relative ULC are found to have larger effects on relative exports when the analysis is restricted only to euro area economies suggesting that cost competitiveness is a more important factor in export market performance inside a monetary union.

We also study the industry-level effects of a rather unusual policy in Finland that directly aimed to reduce unit labour costs in the economy. Here we find that ULC of Finnish manufacturing industries decreased by nearly 10% relative to the control group of other OECD economies in the years following the reform. However, quite possibly because of other simultaneous events affecting Finnish exports, we are not able to find a significant effect on exports in the fairly small cross-section of Finnish industries. Medium-term elasticities based on our more general panel analysis between -0.05 and -0.1 would predict that a 10% decrease in relative ULC would increase relative exports by $0.5\% - 1\%$.

If the effect of changes in unit labour costs on exports is rather limited at the industry-level, this calls into question the benefits of policies that put a high emphasis on the role of cost competitiveness. Finnish competitiveness pact was exactly this kind of a policy measure and we do not find convincing evidence to support the view that it had a large positive effect on exports. However, future research could still revisit this reform using more disaggregated data—perhaps at the firm-level—in order to provide a more conclusive result on the matter.

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Tables

Table 1: Estimates from the replication of Carlin et al. (2001).

	Dependent variable: $\Delta log(XMS_{ijt})$			
	Weighted		Unweighted	
	(1)	(2)	(3)	(4)
$\Delta log(RULC(\$)_{ijt})$	0.002	0.001	0.006	0.006
	(0.014)	(0.013)	(0.012)	(0.012)
$\Delta log(RULC(\$)_{ij,t-1})$	-0.018	-0.018	-0.015	-0.013
	(0.014)	(0.014)	(0.011)	(0.011)
$\Delta log(RULC(\$)_{ij,t-2})$	-0.022*	-0.021*	-0.031***	-0.029**
	(0.012)	(0.012)	(0.011)	(0.011)
$\Delta log(RULC(\$)_{ij,t-3})$	-0.008	-0.006	-0.018*	-0.016
	(0.012)	(0.012)	(0.011)	(0.011)
$\Delta log(RULC(\$)_{ij,t-4})$	-0.017	-0.015	-0.013	-0.011
	(0.012)	(0.012)	(0.010)	(0.010)
$\Delta log(RULC(\$)_{ij,t-5})$	-0.008	-0.007	-0.015	-0.014
	(0.013)	(0.013)	(0.012)	(0.011)
Long-run elasticity of $RULC(\$)$	-0.071*	-0.066*	-0.086***	-0.077**
	(0.038)	(0.037)	(0.030)	(0.031)
N	4534	4534	4534	4534
Adj. R^2	0.001	0.012	0.002	0.011
Country FE		✓		✓

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Notes: Each column presents OLS estimates of the effects of changes in relative unit labour costs on export market shares, based on the baseline model of Carlin et al. (2001) given in Equation (5). Sample is restricted to advanced economies as listed in the main text or in Table A2. Regressions in the first two columns are weighted by the size of the industry as in Carlin et al. (2001) while the latter two columns present unweighted estimates. Size of the industry is measured by sample average of exports to the world from sample countries. Long-run elasticity estimate is obtained from a Wald test on the sum of the above coefficients. Standard errors are two-way clustered at the industry-country and country-year levels.

Table 2: Panel local projection estimates on the effects of changes in unit labour costs on exports.

Panel A	**Dependent variable:** $\Delta log(exports_{ijt})$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta log(ULC_{ijt}(\$))$	0.024	0.026	0.003			
	(0.017)	(0.018)	(0.016)			
$\Delta log(ULC_{ijt})$				-0.016	-0.015	-0.026
				(0.018)	(0.019)	(0.016)
N	5353	5353	4716	5353	5353	4716
Adj. R^2	0.520	0.506	0.564	0.520	0.506	0.564

Panel B	**Dependent variable:** $log(exports_{ij,t+3}/exports_{ij,t-1})$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta log(ULC_{ijt}(\$))$	-0.036*	-0.032	-0.071***			
	(0.019)	(0.020)	(0.020)			
$\Delta log(ULC_{ijt})$				-0.049***	-0.044**	-0.062***
				(0.019)	(0.019)	(0.020)
N	5353	5353	4716	5353	5353	4716
Adj. R^2	0.589	0.604	0.736	0.589	0.604	0.736

Panel C	**Dependent variable:** $log(exports_{ij,t+6}/exports_{ij,t-1})$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta log(ULC_{ijt}(\$))$	-0.058**	-0.051*	-0.076***			
	(0.026)	(0.026)	(0.026)			
$\Delta log(ULC_{ijt})$				-0.045**	-0.036*	-0.054**
				(0.022)	(0.021)	(0.025)
N	4646	4646	4011	4646	4646	4011
Adj. R^2	0.663	0.709	0.853	0.663	0.709	0.853
Industry × Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓			✓		
Industry × Country FE		✓	✓		✓	✓
Controls			✓			✓

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Notes: Each column represents the panel local projection estimates of the dynamic effects of 1 % change in unit labour costs, based on the two definitions expressed in Equations (2) and (3). Sample in each column is restricted to advanced economies as listed in the main text or in Table A2. The set of controls includes three lags of labour compensation, productivity and exports, measured as log levels. Standard errors are two-way clustered at the industry-country and country-year levels.

Table 3: Estimates on the medium term elasticities of exports w.r.t. to unit labour costs.

Panel A	**Dependent variable:** $\sum_{h=0}^{3} log\left(\frac{exports_{ij,t+h}}{exports_{ij,t-1}}\right)$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\sum_{h=0}^{3} log\left(\frac{ULC_{ij,t+h}(\$)}{ULC_{ij,t-1}(\$)}\right)$	-0.005	-0.002	-0.049***			
	(0.017)	(0.019)	(0.018)			
$\sum_{h=0}^{3} log\left(\frac{ULC_{ij,t+h}}{ULC_{ij,t-1}}\right)$				-0.033**	-0.033*	-0.060***
				(0.015)	(0.017)	(0.019)
N	4779	4779	4144	4779	4779	4144
Adj. R^2	-0.090	-0.086	0.271	-0.088	-0.085	0.274
First-stage F-stat.	499.7	396.5	553.1	497.9	403.1	497.8

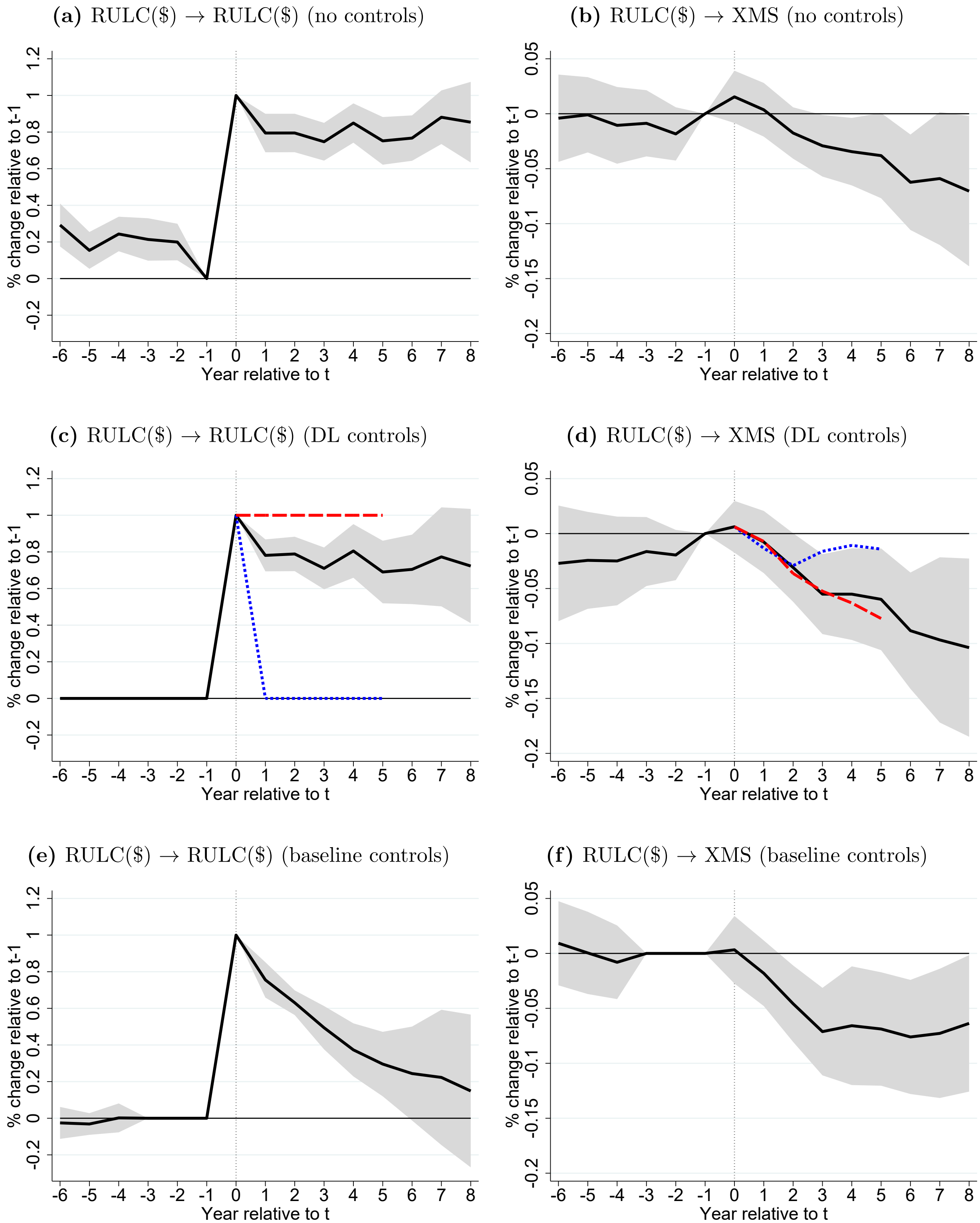
Panel B	**Dependent variable:** $\sum_{h=0}^{6} log\left(\frac{exports_{ij,t+h}}{exports_{ij,t-1}}\right)$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\sum_{h=0}^{6} log\left(\frac{ULC_{ij,t+h}(\$)}{ULC_{ij,t-1}(\$)}\right)$	-0.030	-0.023	-0.105***			
	(0.024)	(0.028)	(0.040)			
$\sum_{h=0}^{6} log\left(\frac{ULC_{ij,t+h}}{ULC_{ij,t-1}}\right)$				-0.046**	-0.041	-0.100**
				(0.022)	(0.026)	(0.043)
N	4071	4071	3436	4071	4071	3436
Adj. R^2	-0.093	-0.089	0.454	-0.089	-0.085	0.456
First-stage F-stat.	293.4	329.0	108.1	291.6	375.5	93.1
Industry × Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓			✓		
Industry × Country FE		✓	✓		✓	✓
Controls			✓			✓

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Notes: Each column represents 2SLS estimates of the elasticity of exports w.r.t. unit labour costs (ULC) as measured by the cumulative change in (log) exports up to $t + h$ explained by the cumulative change in (log) ULC up to $t + h$, where the cumulative change in ULC is instrumented by its initial contemporaneous change at time t, i.e. $\Delta log(ULC_{ijt})$. Sample in each column is restricted to advanced economies as listed in the main text or in Table A2. The set of controls includes three lags of labour compensation, productivity and exports, measured as log levels. Standard errors are two-way clustered at the industry-country and country-year levels. First-stage F-statistics are Kleibergen-Paap Wald F-statistics.

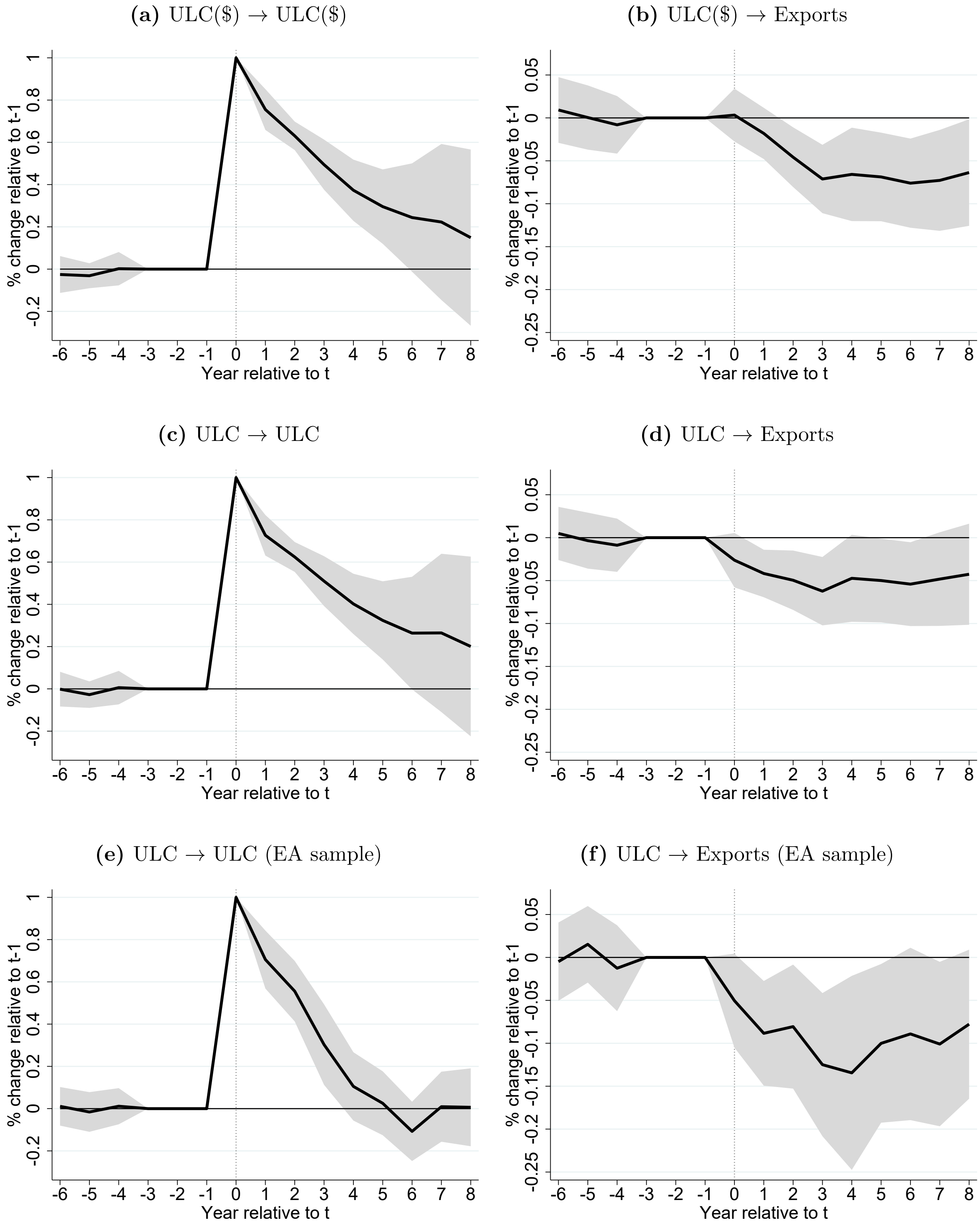
Figures

Figure 1: Dynamic effect of 1% increase in relative unit labour costs at time t.



Notes: This figure plots panel local projection estimates of the dynamic effect of 1% change in relative unit labour costs. Sample in each figure is restricted to advanced economies as listed in Table A2. Top two subfigures have no control variables in the model, middle two have 5 lags of $\Delta log(RULC(\$))$ and the bottom two the baseline set of control variables: 3 lags of exports and ULC components. Blue (shortdashed) line gives the impulse response to a transitory change in $RULC(\$)$ implied by the estimates in Table 1 (column (4)) of the distributed lag model in equation (5) while red (longdashed) line gives the implied response to a permanent shock from the same model. Shaded area represents pointwise 0.95 confidence intervals with standard errors two-way clustered at the industry-country and country-year levels.

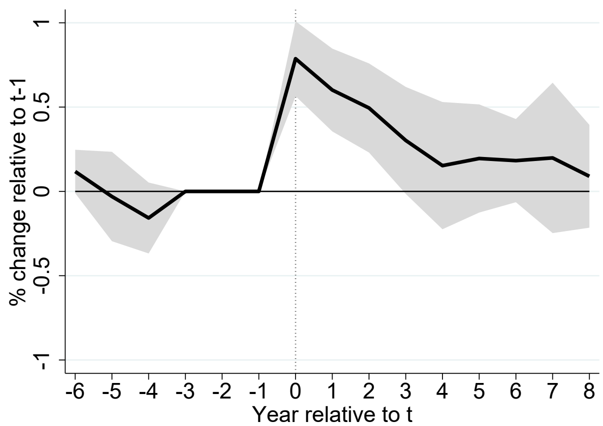
Figure 2: Dynamic effect of 1% increase in unit labour costs at time t.



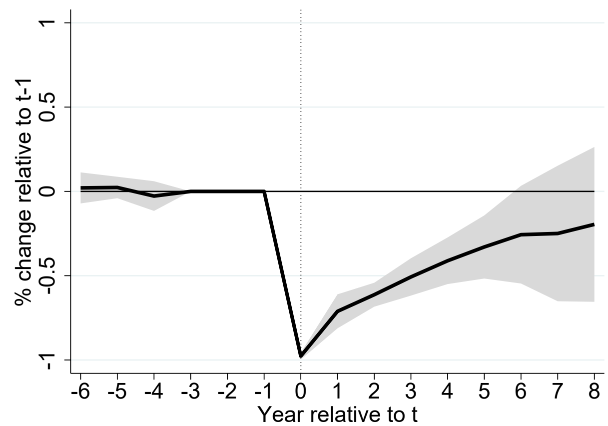
Notes: This figure plots panel local projection estimates based on the model in (6) of the dynamic effect of 1% change in unit labour costs on itself and exports at different horizons. Sample in each figure is restricted to advanced economies as listed in Table A2 and in the lower two panels EA sample refers to sample being restricted to euro area. Shaded area represents pointwise 0.95 confidence intervals with standard errors two-way clustered at the industry-country and country-year levels.

Figure 3: Dynamic effect of 1% relative increase in labour compensation per worker and productivity in year t on ULC and on exports.

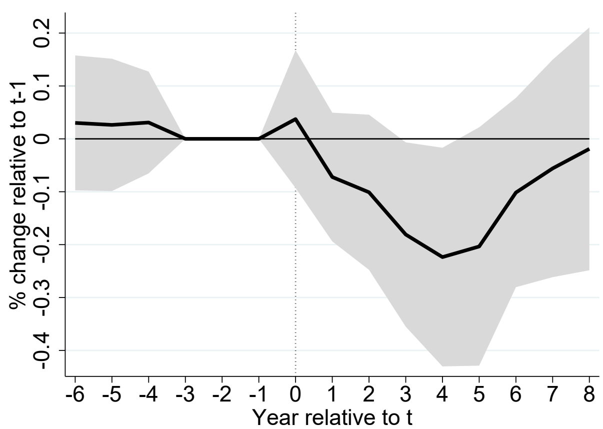
(a) Labour Compensation → ULC($)



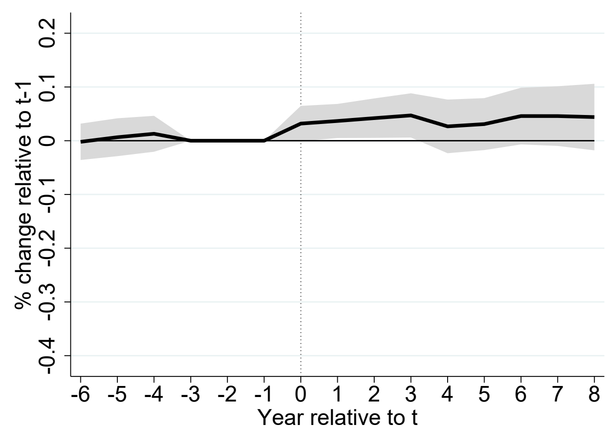
(b) Productivity → ULC($)



(c) Labour Compensation → Exports

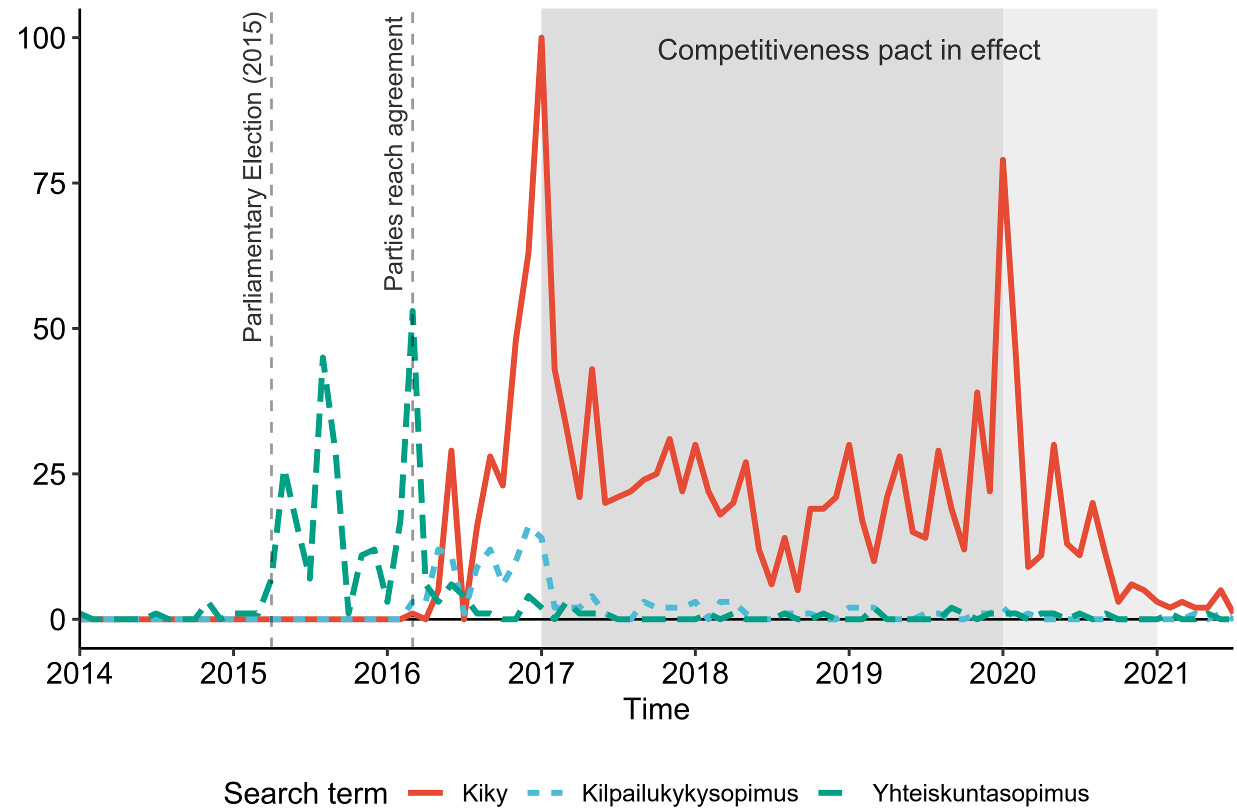


(d) Productivity → Exports



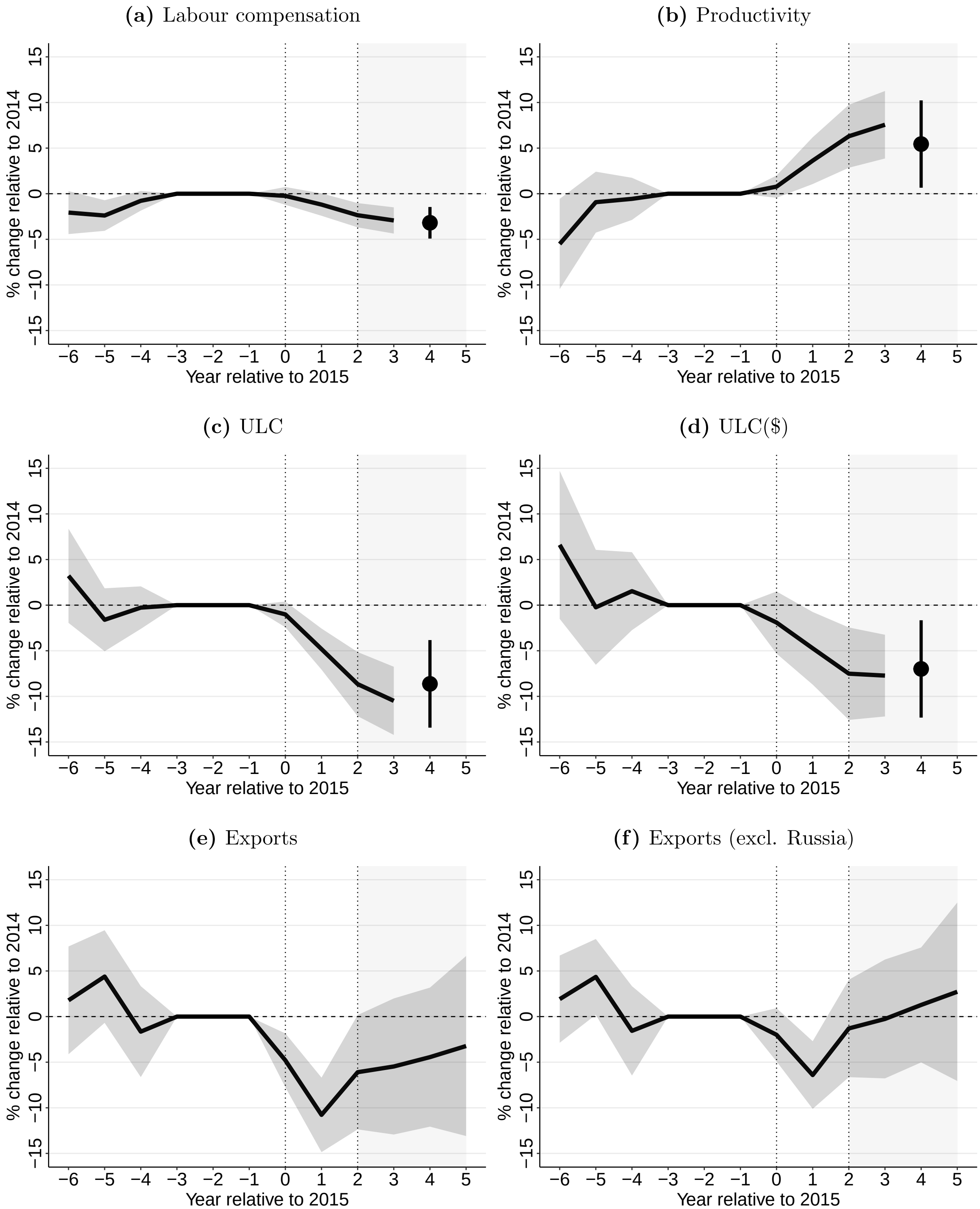
Notes: This figure plots panel local projection estimates based on the model in (6) of the dynamic effects of 1% change in either labour compensation or productivity. Sample in each figure is restricted to advanced economies as listed in Table A2. Shaded area represents pointwise 0.95 confidence intervals with standard errors two-way clustered at the industry-country and country-year levels.

Figure 4: Monthly search intensities from Google Trends (2014M1-2021M7).



Notes: This figure plots the monthly search intensities of Finnish Google searches for three different terms related to the Finnish competitiveness pact. Term *Yhteiskuntasopimus* has a clear-cut English translation in Social contract, while the term *Kilpailukykysopimus* is the Finnish name for the competitiveness pact and *Kiky* is the generally adopted short version of it. Highest monthly search frequency is normalized to 100 by Google. Darker shaded area represents the main part of the reform period as parts of the competitiveness pact were phased out in collective agreements for the year 2020 (lighter shaded area). Google Trends data accessed on 8 August 2021.

Figure 5: Panel LP estimates on the dynamic effects of the Finnish competitiveness pact.



Notes: This figure plots panel local projection estimates on the dynamic effects of the Finnish competitiveness pact. Estimates are coefficients from the model in (8). Sample in each figure is restricted to advanced economies as listed in Table A2. Three industries: ISIC 10-12 (Food products, beverages and tobacco), ISIC 19 (Coke and refined petroleum products) and ISIC 26 (Computer, electronic and optical products); have been excluded from the analysis. At the end of the sample data are sparse and to highlight this the coefficients relating to 2019 are plotted separately. Shaded area represents pointwise 0.95 confidence intervals with standard errors two-way clustered at the industry-country and country-year levels.

Appendix

Appendix A. Data Appendix

Table A1: Manufacturing industries

ISIC Rev.4	Description
10-12	Food products, beverages and tobacco
13-15	Textiles, wearing apparel, leather and related products
16	Wood and products of wood and cork, except furniture
17	Paper and paper products
18	Printing and reproduction of recorded media
19	Coke and refined petroleum products
20	Chemicals and chemical products
21	Basic pharmaceutical products and pharmaceutical preparations
22	Rubber and plastics products
23	Other non-metallic mineral products
24	Basic metals
25	Fabricated metal products, except machinery and equipment
26	Computer, electronic and optical products
27	Electrical equipment
28	Machinery and equipment n.e.c.
29	Motor vehicles, trailers and semi-trailers
30	Other transport equipment
31-32	Furniture, other manufacturing

Table A2: List of countries, number of observations and the missing sectors

Country	Observations	Missing sectors
Belgium	414	-
Denmark	414	-
Finland	414	-
France	391	31-32
Germany	414	-
Italy	414	-
Japan	230	13-15, 16, 20, 21, 22, 29, 30, 31-32
Netherlands	414	-
Portugal	414	-
Spain	414	-
Sweden	368	20, 21
United Kingdom	368	19, 20
United States	345	20, 21, 31-32
Austria	414	-
Czech Republic	414	-
Estonia	414	-
Greece	414	-
Hungary	414	-
Latvia	414	-
Lithuania	414	-
Norway	414	-
Slovakia	414	-
Slovenia	391	19

Notes: Top 13 countries above the line are the restricted sample that is used in most of the analysis.

Descriptive statistics

Table A3 shows the mean manufacturing export market shares by country, averaged by time periods. Since export data is not available for the total manufacturing (ISIC. Rev. 4: 10-33), we present the mean export market shares, which are calculated based on the industries for which that data is available for the respective country. Although the time variation in the individual industries is large and cannot be disclosed by these mean statistics, these measures do capture some overall changes in manufacturing export market shares through the time period. While in the late 90s, a larger number of countries reached an average of 8-9 % export market share, more recently the dominance of two big actors, Germany and US, has become more evident. Notable is also the relative changes that smaller exporting countries have experienced over the latest decades. Although the export market share within this country group remains small, these changes become large when they are compared to the size of the economy.

Table A3: Average industry export market shares in manufacturing, 1995-2017

	Avg. Export market share in manufacturing (%)				
Country	(1) 1995-1999	(2) 2000-2004	(3) 2005-2009	(4) 2010-2014	(5) 2015-2017
Austria	2.4	2.6	2.9	2.8	2.7
Belgium	5.8	6.4	6.5	6.2	5.9
Czech Republic	1.0	1.3	1.9	2.3	2.5
Denmark	1.8	1.6	1.6	1.4	1.4
Estonia	0.1	0.2	0.3	0.3	0.3
Finland	2.0	1.9	1.8	1.5	1.4
France	9.0	8.7	8.0	7.4	6.8
Germany	15.6	16.4	18.4	18.3	18.0
Greece	0.4	0.4	0.4	0.5	0.5
Hungary	0.6	0.8	1.1	1.3	1.3
Italy	8.6	8.5	8.2	7.5	7.3
Japan	9.3	8.5	7.8	7.6	6.8
Latvia	0.1	0.2	0.2	0.3	0.3
Lithuania	0.2	0.2	0.3	0.5	0.5
Netherlands	5.7	5.5	5.8	6.3	6.3
Norway	1.0	0.9	0.8	0.7	0.6
Portugal	1.0	1.0	1.1	1.1	1.2
Slovakia	0.4	0.5	0.9	1.0	1.0
Slovenia	0.4	0.4	0.5	0.4	0.5
Spain	3.3	3.6	3.8	3.7	3.9
Sweden	3.3	3.1	2.9	2.7	2.5
United Kingdom	8.0	7.4	6.3	5.5	5.7
United States	19.0	18.2	16.2	17.7	19.2

Appendix B. Additional results: Finnish competitiveness pact

Augmented LP-model

Figure A1 provides panel local projection estimates from model:

$$log(\frac{y_{ij,t+h}}{y_{ij,t-1}}) = \beta^{(h)} D_{ijt} + \nu^{(h)} \mathbb{1}(t = 2015) \frac{exports^{Russia}_{ij,2014}}{exports_{ij,2014}} + \lambda^{(h)}_{ij} + \tau^{(h)}_{it} + \gamma^{(h)} X^{c}_{ijt} + u^{(h)}_{ijt}, \quad \text{(A1)}$$

which in comparison to the model in equation (8) includes an interaction term of a year 2015 dummy and the share of exports to Russia in total exports in industry i of country j in year 2014.

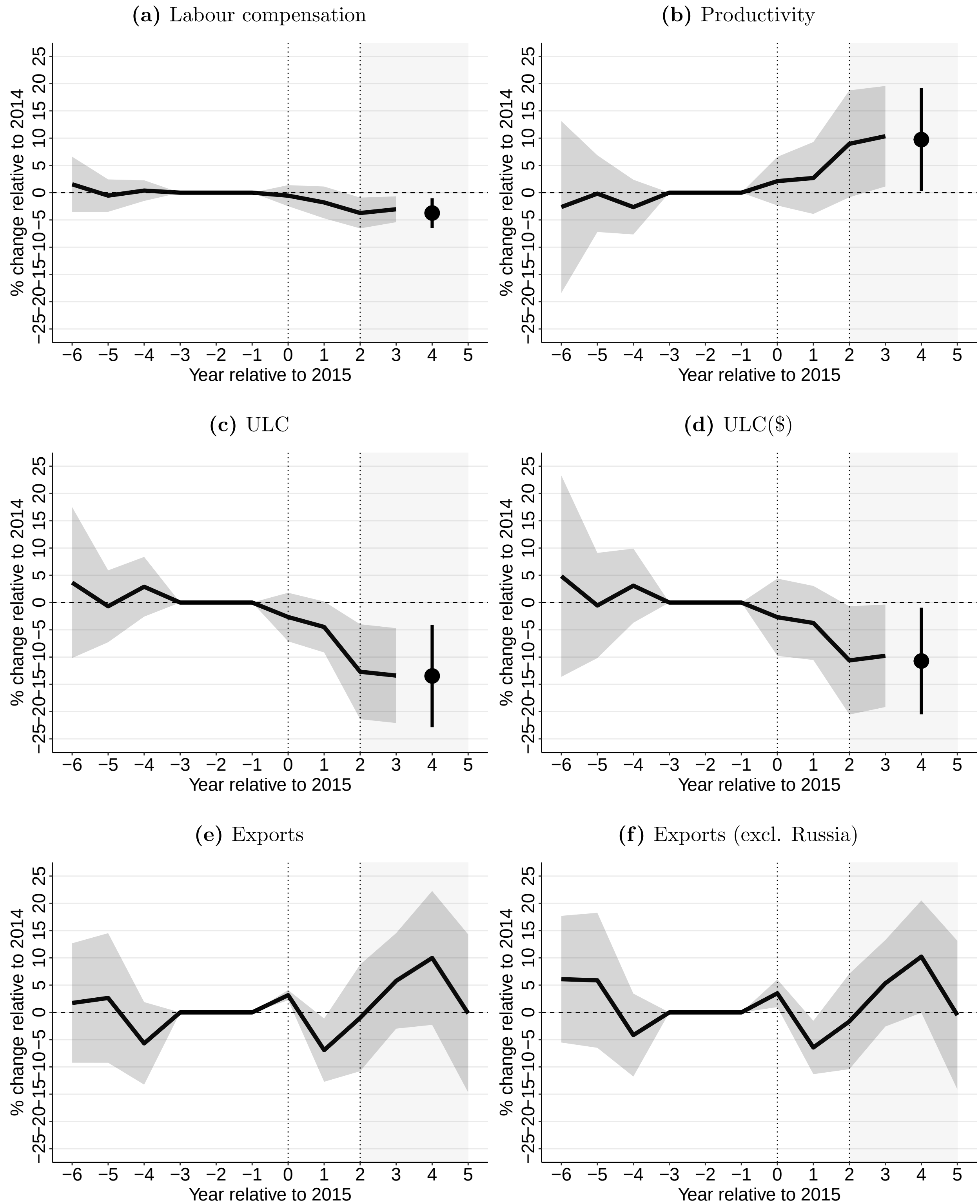
Synthetic control

Figure A2 provides additional results on the effects of the Finnish competitiveness pact using the synthetic control method (Abadie and Gardeazabal, 2003; Abadie et al., 2010). In this figure Finland is compared to a synthetic control group that is constructed as a weighted average of other advanced economies using data from the OECD Economic Outlook 109. Here the focus is on aggregate data on the level of national economies instead of industry-level data. The weighting is done so as to best match the trajectories in compensation per employee and productivity of Finland over the years 2010-2014. We also use exports in 2014. The competitiveness pact took effect in 2017 but 2015 could be seen as the first year of the event as the pact was arguably anticipated since 2015 which is why matching is done using prior observations.

In Figure A2 we can see a clear gap appearing in ULCs of Finland and the control at around 2017. This gap is driven mainly by compensation per employee although Finnish productivity also improved during this time. In exports there is improvement around the same time, but again Finnish exports seem to be affected by other events prior to the competitiveness pact and it is very difficult to build a control that closely matches the path of Finnish exports. However, even though there is growth in Finnish exports, they seem to only reach the path of the synthetic control even as cost competitiveness improves when compared to the control. Interestingly both employment and output that started to deviate from control during 2014-2015 seem to improve as the competitiveness pact took effect. It is possible that the pact sped up the adjustment of the Finnish economy towards higher employment and output from an economic downturn but evidence that it boosted Finnish exports in a substantial way seems somewhat weak.

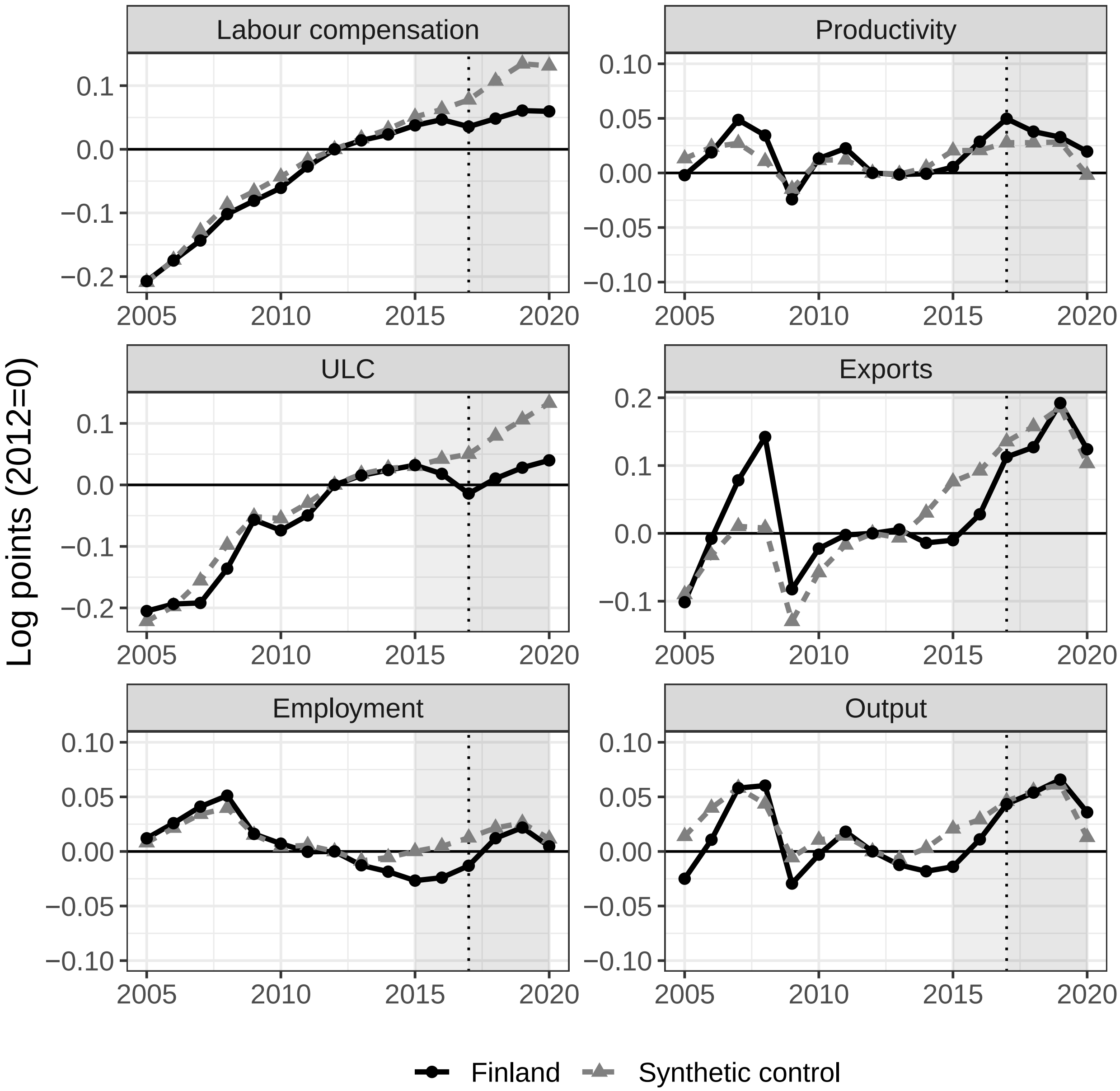
Finnish output starts to deviate from the path of synthetic control already in 2014. This difference in trends has been labeled as ”the Finnish divergence” by Anttonen et al. (2019).

Figure A1: Panel LP estimates on the dynamic effects of the Finnish competitiveness pact using the augmented LP-model in Equation (A1)



Notes: This figure plots panel local projection estimates on the dynamic effects of the Finnish competitiveness pact. Estimates are coefficients from the model in (8). Sample in each figure is restricted to advanced economies as listed in Table A2. Three industries: ISIC 10-12 (Food products, beverages and tobacco), ISIC 19 (Coke and refined petroleum products) and ISIC 26 (Computer, electronic and optical products); have been excluded from the analysis. At the end of the sample data are sparse and to highlight this the coefficients relating to 2019 are plotted separately. Shaded area represents pointwise 0.95 confidence intervals with standard errors two-way clustered at the industry-country and country-year levels.

Figure A2: Synthetic control estimates on the Finnish competitiveness pact.



Notes: Synthetic control is constructed by weighing other economies to best match the trajectories of compensation per employee and productivity in Finland over the years 2010-2014 and exports for the year 2014 as compared to base year 2012. Highest weights in the synthetic control are for Sweden (0.375), Italy (0.295), Norway (0.275) and Greece (0.054). All other countries are given weights close to zero by the algorithm. Data is from the OECD Economic Outlook 109. Exports are measured in USD, 2015 prices. Employment and Output (real GDP) are per working-age population (15-74 year olds).

Appendix C. Additional results

Table A4: Estimates from the replication of Carlin et al. (2001) using full-sample.

	Dependent variable: $\Delta log(XMS_{ijt})$			
	Weighted		Unweighted	
	(1)	(2)	(3)	(4)
$\Delta log(RULC(\$)_{ijt})$	-0.002	-0.009	-0.001	-0.009
	(0.015)	(0.014)	(0.011)	(0.011)
$\Delta log(RULC(\$)_{ij,t-1})$	0.008	0.001	0.000	-0.007
	(0.013)	(0.012)	(0.010)	(0.010)
$\Delta log(RULC(\$)_{ij,t-2})$	-0.021*	-0.025**	-0.022**	-0.028**
	(0.013)	(0.012)	(0.011)	(0.011)
$\Delta log(RULC(\$)_{ij,t-3})$	0.003	0.001	-0.007	-0.012
	(0.011)	(0.010)	(0.011)	(0.010)
$\Delta log(RULC(\$)_{ij,t-4})$	-0.000	-0.005	-0.008	-0.015
	(0.013)	(0.011)	(0.011)	(0.010)
$\Delta log(RULC(\$)_{ij,t-5})$	0.011	0.002	0.017	0.009
	(0.016)	(0.014)	(0.014)	(0.012)
Long-run elasticity of $RULC(\$)$	-0.001	-0.035	-0.021	-0.062*
	(0.052)	(0.042)	(0.037)	(0.033)
N	7340	7340	7340	7340
$Adj.\ R^2$	0.001	0.069	0.001	0.041
Country FE		✓		✓

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Notes: Each column presents OLS estimates of the effects of changes in relative unit labour costs on export market shares, based on the baseline model of Carlin et al. (2001) given in Equation (5). Regressions in the first two columns are weighted by the size of the industry as in Carlin et al. (2001) while the latter two columns present estimates obtained without using weights in estimation. Size of the industry is measured by average exports to the world from sample countries. Long-run elasticity estimate is obtained from a Wald test on the sum of the above coefficients. Standard errors are two-way clustered at the industry-country and country-year levels.

Supplementary References

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