DISCUSSION PAPER SERIES

DP12728

EXPORTS AND LABOR COSTS: EVIDENCE FROM A FRENCH POLICY

Clément Malgouyres and Thierry Mayer

INTERNATIONAL TRADE AND REGIONAL ECONOMICS



ISSN 0265-8003

EXPORTS AND LABOR COSTS: EVIDENCE FROM A FRENCH POLICY

Clément Malgouyres and Thierry Mayer

Discussion Paper DP12728
Published 16 February 2018
Submitted 16 February 2018

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

This Discussion Paper is issued under the auspices of the Centre's research programme in **INTERNATIONAL TRADE AND REGIONAL ECONOMICS**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as an educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Copyright: Clément Malgouyres and Thierry Mayer

EXPORTS AND LABOR COSTS: EVIDENCE FROM A FRENCH POLICY

Abstract

We investigate the role that labor costs hold in exporters' performance. To do so, we exploit a large-scale French reform that granted most firms a tax credit proportional to the wagebill of their employees paid below a given threshold. This policy effectively translated into a cut in labor cost whose magnitude varies depending on firm-specific wage structures. We use the predicted treatment intensity based on pre-reform composition of the labor force as an instrument for the actual policy-induced firm-level change in labor costs. Although our point estimates are consistent with commonly estimated firm-level trade elasticities combined with reasonable labor shares in total costs, coefficients are found to be very noisy, suggesting lack of robust evidence of a causal effect of the policy. We discuss several potential explanations for our results as well as their implications.

JEL Classification: H32, F14, F16, D04

Keywords: labor costs, firm-level exports, competitiveness

Clément Malgouyres - cmalgouyres@gmail.com
Banque de France

Thierry Mayer - thierry.mayer@sciences-po.fr
Sciences Po, Banque de France, CEPII and CEPR

Acknowledgements
This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the ``Investissements d'Avenir'' program within the framework of the LIEPP center of excellence (ANR11LABX0091, ANR 11 IDEX000502). This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the ``Investissements d'avenir'' program (reference : ANR10EQPX17, Centre d'accès sécurisé aux données CASD). This research has received funding from the European Research Council (ERC) under the Grant Agreement No. 313522. The views expressed here are those of the authors only and do not necessarily reflect the views of the Banque de France or the Eurosystem. We thank two anonymous referees as well as the editor for very helpful comments.

Exports and labor costs: Evidence from a French Policy.*

Clément Malgouyres† Thierry Mayer‡

February 14, 2018

Abstract

We investigate the role that labor costs hold in exporters' performance. To do so, we exploit a large-scale French reform that granted most firms a tax credit proportional to the wagebill of their employees paid below a given threshold. This policy effectively translated into a cut in labor cost whose magnitude varies depending on firm-specific wage structures. We use the predicted treatment intensity based on pre-reform composition of the labor force as an instrument for the actual policy-induced firm-level change in labor costs. Although our point estimates are consistent with commonly estimated firm-level trade elasticities combined with reasonable labor shares in total costs, coefficients are found to be very noisy, suggesting lack of robust evidence of a causal effect of the policy. We discuss several potential explanations for our results as well as their implications.

Keywords: labor costs, firm-level exports, competitiveness

JEL: H32, F14, F16, D04

*This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the "Investissements d'Avenir" program within the framework of the LIEPP center of excellence (ANR11LABX0091, ANR 11 IDEX000502). This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the "Investissements d'avenir" program (reference : ANR10EQPX17, Centre d'accès sécurisé aux données CASD). This research has received funding from the European Research Council (ERC) under the Grant Agreement No. 313522. The views expressed here are those of the authors only and do not necessarily reflect the views of the Banque de France or the Eurosystem. We thank two anonymous referees as well as the editor for very helpful comments.

†Banque de France

‡Sciences Po, Banque de France, CEPII and CEPR.

1 Introduction

Competitiveness is one of the most important concerns that is used by policy makers to justify policy reforms aimed at improving/restoring the ability of domestic firms to exhibit high performance on international markets. While the objective is usually macro-economic in nature, with a goal to ensure a sustainable path of trade balance, the policies involved are often micro-economic. This is especially true in currency unions such as the eurozone, where changes in the nominal exchange rate intended to reduce the consumer-relevant price abroad are not an option. Some of the remaining policy tools available are directed at non-price competitiveness (R&D tax breaks being one example, see e.g. Hombert and Matray, 2015). It is however likely that the impact of this type of measures only manifests itself in the long-run. Shorter-run policies are aimed at reducing the costs of domestic firms with respect to foreign competitors so as to strengthen price competitiveness. Numerous channels of action are possible. The basic idea is that export performance of firms is driven by the export price set by the firm, and that the pass-through of the cut in unit costs to lower export price is high enough to ensure that the market share captured by domestic firms on international markets increases. Any policy reducing the explicit or implicit cost of exports will work under those assumptions. Reducing the price of energy (or the regulations related to how clean the production process is) is an option that has been invoked by the recently elected US administration.[1] Cutting the costs of using domestic labor is another obvious candidate that can take different forms: wage moderation, flexibility in labor market regulations, or transferring the tax burden of social contributions (payroll tax) to other tax sources for instance.

Our paper focuses on the last of those policies. Since 2013, the French government implemented a tax credit aimed at boosting competitiveness and employment, named the CICE in French (standing for Competitiveness and Employment Tax Credit or *Crédit d'impôt pour la compétitivité et l'emploi* in French). The policy is intended to act as a cut in unit labor costs (see section 3 for all details on the policy change). The tax credit is set proportional to the share of the wagebill paid to workers under a certain threshold (2.5 times the national minimum wage). Each firm receives a transfer of 4% (raised to 6% since 2014) of the total wagebill that is under the threshold. This policy design gives us a natural experiment where we can match for each firm the intensity of labor cost reduction (that varies according to its original labor force composition), and

[1] The current US administration has mostly motivated its repeal of pre-existing environmental regulations on the ground of their supposed direct negative employment impact on the energy sector (Volcovici and Mason, 2017). There is a substantial evidence suggesting that environmental regulations, while possibly socially desirable, can reduce manufacturing industry's competitiveness (see e.g. Greenstone *et al.*, 2012) and trigger substantial displacement and reallocation of jobs across sectors (Walker, 2013).

its export performances (intensive and extensive margins) before and after treatment. Our results cast doubts on the effects to be expected from reductions in labor costs regarding export performance. While the magnitude of our point estimates are consistent with expectations, i.e. commonly estimated firm-level trade elasticities multiplied by reasonable values of the share of labor in total costs, coefficients are found to be very noisy, suggesting lack of robust evidence of a causal effect of the policy.

A recent paper with similar motivation to ours is Decramer *et al.* (2016), which looks at how unit labor costs affect export performance using Belgian firm-level data. This paper finds quite large and significant elasticities, when regressing the change in (log of) exports on the change in (log of) unit labor costs. When adopting the same specification, we also find that a 10% increase in unit labor costs is associated with around 2% lower exports. Another related paper is Gan *et al.* (2016), who evaluate how regionally-driven changes in the minimum wage faced by Chinese exporters affect their competitiveness. In contrast to Decramer *et al.* (2016), we evaluate a policy that specifically reduced labor costs in a heterogeneous manner depending on the initial wage structure of the firm. This offers a natural instrumentation strategy based on the administrative threshold that determines which employees are eligible to the policy. Compared to Gan *et al.* (2016), our work does not rely on the exogeneity of changes in the minimum wage decided by local authorities. The policy change is national, and heterogeneity in the treatment only comes through pre-treatment composition of the labor force across firms. The French government had an aim to bolster national competitiveness, not export performance of the subset of firms that had a specially high share of workers below a certain threshold. The choice of the precise threshold was itself not anticipated, and driven by a mix of considerations related to the impact on unemployment and to budgetary constraints rather than pre-trends of different groups of firms.[2]

In addition to evaluating the impact of a change in labor costs on the competitiveness of firms on export markets, our paper contributes to the literature on price elasticities in trade. The largest set of papers in this vein uses variation in tariffs and / or exchange rates as price shifters. Berman *et al.* (2012), Fitzgerald and Haller (2017), Bas *et al.* (2017), Berthou and Fontagné (2016) are recent contributions that all use firm-level response to ad valorem tariffs and exchange rate variation in export markets. Amiti *et al.* (2014) and Piveteau and Smagghue (2015) use a related approach, where they calculate the change in marginal cost implied by the initial composition or inputs imported by each firm, interacted with exchange rate changes in its sourcing country, which they use to

[2]It is telling that the initial recommendations of the report inspiring the policy were quite different, and in particular wanted to set a much higher wage threshold and target manufacturing, so as to maximize the benefits expected by the already large exporters (see Fabre, 2012, as well section 3.1 for an overview of the state of the debate as the legislative process was ongoing).

predict changes in export prices and therefore export values. One of the most important finding of that literature is the so-called international elasticity puzzle: the response of demand to changes in tariffs is much larger than the impact of changes in exchange rates, with elasticities typically being estimated (in absolute value) between 3 and 5 for tariffs, and often lower than 1 for exchange rates. This is a puzzle since most of our theoretical framework would predict those two (delivered) price shifters to have the same effect on trade flows. Fontagné *et al.* (2017) also use the reaction of firm-level exports to tariffs and exchange rates, but add the impact of changes in f.o.b prices at the firm level instrumented by a cost shifter based on how firms differ in their electricity bill. The idea is that changes in electricity prices are mostly driven by regulatory changes interacted with differences in contract dates and length, that are exogenous to the firm, and do not affect exports directly. This is one of the most proximate investigation to ours since the dimension of the estimating variable is firm-level, with a credible claim for exogeneity and therefore causality in the estimation of the price elasticity. Their results start by reproducing the international elasticity puzzle: the response of exports to changes in tariffs is much larger than the response to changes in exchange rates. They also show that the changes in f.o.b prices by the exporter have a large impact on demand, with an elasticity estimated around -5. Compared to this literature, we base our estimates of the trade elasticity on a policy change, that affected unit costs of different firms in a heterogeneous manner.

The remainder of the paper is as follows: Section 2 structures our analysis in terms of the underlying theoretical motivation. Section 3 describes the data used, in particular how we merge the different elements of firm-level data sources to calculate the intensity of treatment of different firms in terms of their labor costs. Section 4 proceeds with results for different margins of adjustment to changes in labor costs, before concluding with section 5.

2 Theoretical motivation

Our theoretical motivation is based on Crozet *et al.* (2012), who develop the firm-level export predictions of the Melitz (2003) model and in particular its implications in terms of empirical implementation. Firms, indexed i and characterized by their unitary cost α_i (the inverse of their TFP), operate under monopolistic competition to serve CES consumers in different markets n with their unique variety. Note that we work with exporters from a single origin country, France, and therefore have no origin country

subscript. The representative consumer in n has utility

$$U_n = \left(\int_{\Omega_n} (q_n(\alpha_i)/b_n(\alpha_i))^{\frac{\sigma-1}{\sigma}} d\alpha_i \right)^{\frac{\sigma}{\sigma-1}},$$

where $q_n(\alpha_i)$ is the quantity consumed of variety i. The $b_n(\alpha_i)$ term is an idiosyncratic demand shock which lowers utility of individuals in n when consuming this precise variety. The pricing part is the usual constant markup over marginal cost ($\mathcal{C}_i$): $p(\alpha_i) = \frac{\sigma}{\sigma-1}\mathcal{C}_i$. The delivered price incorporates an iceberg trade costs (τ_n), such that $p_n(\alpha_i) = p(\alpha_i)\tau_n$. With all those elements at hand, the equilibrium sales of firm i in n write:

$$x_n(\alpha_i) = \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} [\mathcal{C}_i \tau_n b_n(\alpha_i)]^{1-\sigma} \frac{X_n}{P_n^{1-\sigma}}, \tag{1}$$

where X_n and P_n respectively represent total expenditure and the ideal CES price index in n. Taking logs, we have an estimable equation where the log exports should react to any change in marginal costs with an elasticity reflecting the price elasticity of consumers $(1-\sigma)$:

$$\ln x_n(\alpha_i) = (1-\sigma)\ln\left(\frac{\sigma}{\sigma-1}\right) + (1-\sigma)\ln \mathcal{C}_i + (1-\sigma)\ln\tau_n + \ln\left(\frac{X_n}{P_n^{1-\sigma}}\right) + (1-\sigma)\ln b_n(\alpha_i). \tag{2}$$

Let us now enter into the details of this cost function. We assume functional form to be a Cobb-Douglas aggregator of several factors, one of which is labor. Among workers, we distinguish between low/medium skill workers who are eligible to CICE and high-skill workers who are not:

$$x_i = l_i^{\mu_i} \left(\prod_{k=1}^{J} v_{ik}^{\gamma_{ik}} \right)^{1-\mu_i} \frac{1}{\alpha_i}$$

where l_i represents labor employed, itself a Cobb-Douglas aggregation of eligible (l^e) and non-eligible (l^n) parts such that $l_i = (l_i^e)^{\eta_i}(l_i^n)^{1-\eta_i}$. Other factors k are used in quantities v_{ik} by firm i and we assume constant returns such that: $\mu_i + (1-\mu_i)\sum_k \gamma_{ik} = 1 \Leftrightarrow \sum_k \gamma_{ik} = 1$. A set of additional assumptions will greatly ease interpretation of results. Inside a sector s, we assume that (i) unit input requirements γ_{ik} and factor prices r_{ik} faced by firms are the same, (iii) the share of labor μ_s is constant inside an industry. Unit costs then take the following form:

$$\mathcal{C}_i = \alpha_i \underbrace{w_i^{\mu_s} \left(\prod_k r_{sk}^{\gamma_k} \right)^{1-\mu_s} B_s}_{=c_i} = \alpha_i c_i \tag{3}$$

where $B_s = \mu_s^{-\mu_s} \left(\prod_k \gamma_{sk}^{-\gamma_{sk}}\right)^{-(1-\mu_s)}$ and $w_i = (w_i^e)^{\eta_i}(w_i^n)^{1-\eta_i} \times (\eta_i)^{-\eta_i}(1-\eta_i)^{-(1-\eta_i)}$. It is critical here that (even though we do not model explicitly labor markets for different skills) we let firms have different labor costs. Particularly important will be the fact that different firms have different shares of their labor force eligible to the policy change (η_i), which we consider to be a constant technological parameter.

Substituting (3) in (2), and introducing a time dimension t, the export equation becomes:

$$\begin{aligned}\ln x_{int}(\alpha_{it}) = \text{cst.} + (1-\sigma)\mu_s \ln w_{it} + \underbrace{(1-\sigma)\left[\ln B_s + (1-\mu_s)\sum_k \gamma_{ks} \ln r_{kst}\right]}_{=\mathbf{FE}_{st}} \\ + \underbrace{(1-\sigma)\ln(\tau_{nt}) + \ln X_{nt} - (1-\sigma)\ln P_{nt}}_{=\mathbf{FE}_{nt}} + \underbrace{(1-\sigma)\ln\alpha_{it} + (1-\sigma)\ln b_{int}}_{=\varepsilon_{int}} \\ = (1-\sigma)\mu_s \ln w_{it} + \mathbf{FE}_{nt} + \mathbf{FE}_{st} + \varepsilon_{int} \qquad (4)\end{aligned}$$

Firm-level exports are therefore explained by a set of destination-time and sector-time fixed effects, and our variable of interest, i.e. the relevant wage at the firm-level, w_{it}. Setting aside for a moment measurement issues on w_{it}, the presence of α_{it} in the error term raises an obvious concern in the estimation of equation (4). It is quite likely that there exists a cross-sectional correlation between the TFP of firm i and the wages which it faces (for instance because of the average wage level in the area in which it is located). We solve this correlation by separating α_{it} between a time-invariant unobserved component and measured covariates that are allowed to vary over time: $\ln\alpha_{it} = \ln\overline{\alpha}_i + \mathbf{W}'_{\alpha_{it}}\delta + u_{it}$ where $\mathbf{W}_{\alpha_{it}}$ is a set of exogenous time-variant TFP determinants, and δ is a vector of associated parameters. First-differencing equation (4), we obtain:

$$\Delta \ln x_{int}(\alpha_{it}) = (1-\sigma)\mu_s \Delta \ln w_{it} + (1-\sigma)\Delta\mathbf{W}'_{\alpha_{it}}\delta + \mathbf{FE}_{nt} + \mathbf{FE}_{st} + (1-\sigma)(\Delta u_{int} + \Delta b_{int}) \qquad (5)$$

We model the CICE as a policy providing a subsidy on the eligible part of the labor force at a rate ν. The effective labor cost in logs writes:

$$\ln w_{it}[\nu] = \eta_i \ln(w_{it}^e[\nu](1-\nu)) + (1-\eta_i)\ln w_{it}^n[\nu] \qquad (6)$$

Notation $w_{it}^e[\nu]$, and $w_{it}^n[\nu]$) makes it explicit that the *pre-subsidy* wages can be affected by the policy. Equation (6) makes it clear that the direct negative effect of a rise in rate ν on the effective labor cost can be partly attenuated by a rise in equilibrium pre-subsidy wage. An advantage of our ex-post approach is to capture both direct and indirect effects

through which the CICE policy is likely to impact effective labor costs.[3]

One can decompose the change in effective labor costs between the part linked to the CICE policy, and the part that would have happened without the policy:

$$\begin{aligned}\Delta \ln w_{it+1} &= \ln w_{it+1}[\nu_{t+1}] - \ln w_{it}[\nu_t] \\ &= \ln w_{it+1}[\nu_{t+1}] - \ln w_{it+1}[\nu_t] + \ln w_{it+1}[\nu_t] - \ln w_{it}[\nu_t] \\ &= \eta_i \ln\left(\frac{1-\nu_{t+1}}{1-\nu_t}\right) + \eta_i \ln\left(\frac{w^e_{it}[\nu_{t+1}]}{w^e_{it}[\nu_t]}\right) + (1-\eta_i)\ln\left(\frac{w^n_{it}[\nu_{t+1}]}{w^n_{it}[\nu_t]}\right) \\ &+ \underbrace{\ln w_{it+1}[\nu_t] - \ln w_{it}[\nu_t]}_{\text{Change in labor costs that would have occurred without the policy}} \end{aligned} \tag{7}$$

We assume that the change in labor costs that would have taken place without CICE can be captured by a combination of sector-time fixed effects and a set of observables. Formally, we model $\ln w_{it+1}[\nu_t] - \ln w_{it}[\nu_t]$ such that :

$$\ln w_{it+1}[\nu_t] - \ln w_{it}[\nu_t] = \Delta \mathbf{W}'_{\alpha_{it}} \lambda + \mathbf{FE}_{st} + v_{it}, \tag{8}$$

where we assume that the sets of observables that drive the firm-level TFP and wages over time are the same. The direct effect of the CICE policy on labor costs is $\Delta[\eta_i \ln(1-\nu_t)] = \eta_i \ln\left(\frac{1-\nu_{t+1}}{1-\nu_t}\right)$, which will be our variable of interest in the regression analysis. Let us denote $e^{w^e}_{1-\nu}$ and $e^{w^n}_{1-\nu}$ the elasticities of eligible and non-eligible wages with respect to $1-\nu$. Inserting equation (7) and (8) in equation (5) yields, after a few manipulations,[4]

[3]The indirect effects are potentially important. The total elasticity of effective labor costs with respect to the subsidy rate ν writes:

$$\frac{d \ln w_{it}}{d \ln \nu} = -\eta_i \frac{\nu}{1-\nu} + \eta_i \frac{\partial \ln w^e_{it}}{\partial \ln \nu} + (1-\eta_i)\frac{\partial \ln w^n_{it}}{\partial \ln \nu}$$

Without the indirect effect, a 50 % increase in ν (which happened between 2013 and 2014, when the rate went from 4 to 6%) has a direct effect of -1.46% on labor costs if 70 % of the firm's wagebill is eligible ($\eta = 0, 7$). However, this fall will be largely dampened even for very low values of wage elasticities with respect to ν. For instance, for a 1% elasticity of eligible wages, the overall fall in labor costs is reduced to -1.1% (-0.96% if non-eligible wages also react with a 1% elasticity).

[4]Substituting (7) and (8) in (5), we obtain

$$\begin{aligned}\Delta \ln x_{int}(\alpha_{it}) =& (1-\sigma)\mu_s \Delta[\eta_i \ln(1-\nu_t)] \\ &+ (1-\sigma)\mu_s \eta_i \ln\left(\frac{w^e_{it+1}[\nu_{t+1}]}{w^e_{it+1}[\nu_t]}\right) + (1-\sigma)\mu_s(1-\eta_i)\ln\left(\frac{w^n_{it+1}[\nu_{t+1}]}{w^n_{it+1}[\nu_t]}\right) \\ &+ (1-\sigma)\Delta \mathbf{W}'_{\alpha_{it}} \rho + \mathbf{FE}_{nt} + \mathbf{FE}_{st} + (1-\sigma)(\Delta u_{int} + \Delta b_{int} + \Delta v_{it}),\end{aligned}$$

where $\rho \equiv \lambda + \delta$ combines the effects of the set of observables $\mathbf{W}$ on unit input coefficients and wages.

the final equation:

$$\begin{aligned}\Delta \ln x_{int}(\alpha_{it}) =&(1-\sigma)\mu_s(1+e^{w^e}_{1-\nu}-e^{w^n}_{1-\nu})\Delta[\eta_i \ln(1-\nu_t)]\\ &+(1-\sigma)\Delta\mathbf{W}'_{\alpha_{it}}\rho+\mathbf{FE}_{st}+\mathbf{FE}_{nt}+(1-\sigma)(\Delta u_{int}+\Delta b_{int}+\Delta v_{it}). \quad (9)\end{aligned}$$

If the policy has no impact on wages ($e^{w^e}_{1-\nu}=0$ and $e^{w^n}_{1-\nu}=0$), the coefficient estimated on our treatment variable identifies the product of two structural parameters: labor intensity in sector s multiplied by the price elasticity of demand: $(1-\sigma)\mu_s$. Considering a labor intensity such that μ_s is in a 20 to 25% range, and a value for σ around 5 or 6,[5] we expect a coefficient around -1 of the CICE policy on exported values in the absence of wage response.

Potential effects on wages complexify the interpretation of the coefficient on the treatment variable since it is then $(1-\sigma)\mu_s(1+e^{w^e}_{1-\nu}-e^{w^n}_{1-\nu})$. The heterogeneity in the effect then comes not only from the factor intensity of this sector, but also from the reaction of eligible vs non-eligible labor. The structural interpretation of coefficients is more difficult, although it does not affect the validity of the reduced form identification of the treatment effect.

A final issue in estimation of the CICE policy on exports is a selection bias. The flow, $\ln x_{int}(\alpha_i)$, is only observed for the combinations of firm-destinations that are profitable, i.e. when the following condition is met:

$$\pi_{int}(\alpha_{it}) = x_{int}(\alpha_{it})/\sigma - f_n > 0 \quad (10)$$

This introduces a selection in the sample likely to create a correlation between the error term and RHS variables. For instance, among the firms with high labor costs, only the ones having had a particularly strong draw on the idiosyncratic demand shock $1/b_n$ will be exporting to n. This will create an attenuation bias in estimated coefficients. A way to minimize the issue is to proceed to robustness checks using a subsample of firms large and productive enough to be considered sufficiently distant from the cost cutoff

Noting that $\ln\left(\frac{w^e_{it+1}[\nu_{t+1}]}{w^e_{it+1}[\nu_t]}\right) = e^{w^e}_{1-\nu}\ln\frac{1-\nu_{t+1}}{1-\nu_t} = e^{w^e}_{1-\nu}\Delta\ln(1-\nu_t)$, we can regroup terms such that:

$$\begin{aligned}\Delta \ln x_{int}(\alpha_{it}) =&(1-\sigma)\mu_s(1+e^{w^e}_{1-\nu}-e^{w^n}_{1-\nu})\Delta[\eta_i \ln(1-\nu_t)]\\ &+\underbrace{(1-\sigma)\mu_s e^{w^n}_{1-\nu}\Delta\ln(1-\nu_t)+\mathbf{FE}_{st}}_{=\mathbf{FE}_{st}}\\ &+(1-\sigma)\Delta\mathbf{W}'_{\alpha_{it}}\rho+\mathbf{FE}_{nt}+(1-\sigma)(\Delta u_{int}+\Delta b_{int}+\Delta v_{it}).\end{aligned}$$

[5] This corresponds to a central value in Bas *et al.* (2017) estimates on French exporters. Head and Mayer (2014) report 5.03 as a median value of such elasticities in the gravity literature.

for profitable exports so that the error term is unlikely to matter much for their entry decision. We follow this approach by focusing some of our analysis on a subsample of firms that serve continuously their markets (destination) during the entire sample period (2010-2015) and that belong to the top quartile in terms of number of markets served.[6]

3 Data

3.1 The genesis of the CICE reform

In this section, we describe the policy we are using in order to gauge to what extent labor costs matter for exporting firms. This policy, labeled CICE by the French authorities, was decided in 2012, in a period of challenging economic situation for the newly elected government. Corporate profits were considered to be at a historically low level[7] and French firms had been rapidly losing market share in foreign markets for several years (Bas *et al.*, 2015). In that context, the government ordered a report on the state of the manufacturing sector in France (Gallois, 2012). The report, often referred to as Rapport Gallois, named after its main author, advocated in favor of large cuts in payroll taxes for employees earning up to 3.5 times the amount of the current minimum wage. While there had been large cuts in payroll taxes since the early nineties, those were concentrated on low wages. At the time of CICE implementation, those pre-existing tax cuts were indeed concentrated on the bottom of the wage distribution (up to 1.6 times the minimum wage, see Figure 1). Extending the payroll tax cuts to workers higher up in the wage distribution was presented as a way to target manufacturing and exporting firms who tend to pay higher wages and therefore did not benefit from the pre-existing tax cut programs.

A debate engaged after the initial proposal of the Rapport Gallois, which was considered by many to be too costly and was criticized by labor economists who contended that the employment effects of cuts in payroll taxes are stronger when targeted on low wages where demand is more price elastic and unemployment is high (see Cahuc and Carcillo (2014) for an example of that view). As a compromise, a threshold of 2.5 times the minimum wage was chosen and passed into law. Finally, in order to ease the short-term

[6]This approach was adopted in Mulligan and Rubinstein (2008) when studying gender bias in the labor market. Fitzgerald and Haller (2017) and Paravisini *et al.* (2015) apply this method in the context of firm-level trade. The generalized Tobit approach proposed by Eaton and Kortum (2001) and applied by Crozet *et al.* (2012) to French exporters could be envisioned. However, the current state of this technique does not easily allow for panel data, which is central in our paper.

[7]The profit rate (defined as ratio of gross operating surplus to value added) was at 30.25% in 2012, a figure lower than in previous years (31.7% over the years 2008-2011 and 32.63% for the years 2000-2010. Source: INSEE, Comptes nationaux).

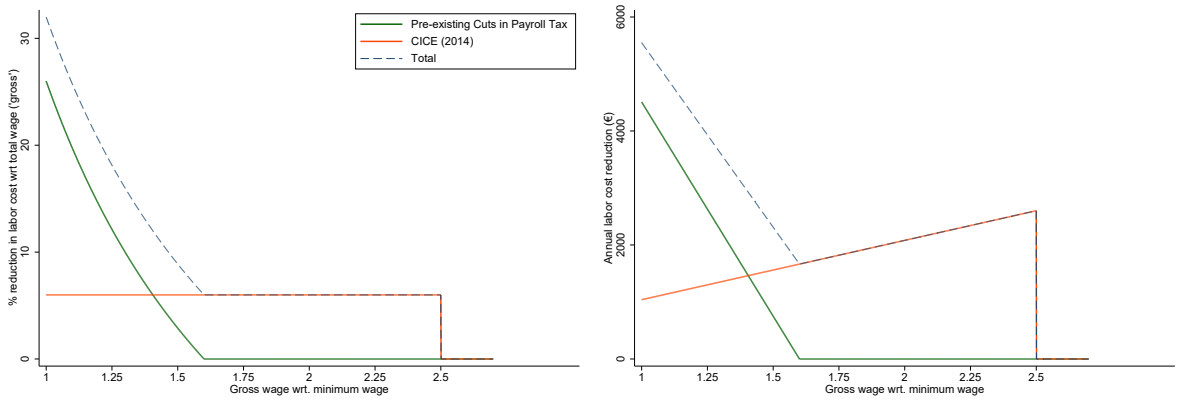
fiscal impact in a time of tight budgetary constraints, the government chose to opt for a tax credit system rather than a (direct) payroll tax cuts. Firms could claim a corporate tax credit at a rate proportional to the wagebill accrued to workers earning less than 2.5 minimum wages. The rationale for this choice was to change firms' incentives immediately while delaying the budgetary burden of the policy by a year. The policy was put in place in January 2013, with a tax credit rate of 4% (of the wagebill of all workers under 2.5 minimum wages). In January 2014, the rate was raised to 6%. Concretely, in the case of a financial year ending 31 December 2014, the CICE relating to remuneration paid in 2014 is deducted from the tax due for the financial year ending 31 December 2014. In case the CICE amount exceeds the tax that is owed by the firm, the tax credit can be used against taxes due for the next three financial years (e.g. 2015, 2016 and 2017). After three years, the tax credit is refunded to the firm. Interestingly for our purpose, we note that no other regulatory thresholds existed at 2.5 times the minimum wage prior to this reform.

Moreover the reform is unlikely to have been anticipated by firms. Indeed, as mentioned above, the government's decision to implement the CICE was taken in reaction to the Gallois report about the state of manufacturing in France which was released on November 5, 2012. The original proposal contained in the report was deemed excessively costly and the actual CICE ended up differing substantially from the proposal: it was implemented as a corporate income tax credit instead of a direct cut in social contribution and, most importantly, its threshold was set up to 2.5 instead of 3.5 times the minimum wage. Little time elapsed between the release of the report – November 5^{th} 2012 – and the implementation of the modified version of the CICE beginning January 1^{st} 2013 (from Finance Act of December 29^{th} 2012). This reduces the chances that firms could anticipate and adapt their wage policy in 2012 to maximize the amount of the tax credit to be received based on the 2013 wage structure.

3.2 The parameters of the policy

The schedule for the CICE in 2014 is presented in Figure 1. The x-axis features the ratio of the worker's wage over minimum wage, while the y-axis represents the reduction in labor cost due to the policy change. Panel (a) shows the reduction in terms of percentage of the total wage paid, while panel (b) expresses it in annual euros saved on each worker. There are two curves on each panel. The first one shows the schedule of payroll tax cut that existed before 2014, and which was maintained as is. The second one shows the tax cut schedule of the CICE: flat at 6% before the 2.5 threshold, 0 afterwards. Marginally, the firm receives a tax credit that is equal in 2014 to 6% (4% in 2013) of the total labor

Figure 1: The schedule of the 2014 CICE and of pre-existing payroll tax cuts



a: Labor cost reduction as share of gross wage **b**: Labor cost reduction in euros per year

Note: Prexisting payroll tax cuts refer to the general payroll tax cuts applicable prior to the CICE – so-called "exonérations générales de cotisations sociales" (see Bunel and L'Horty, 2012; Cahuc and Carcillo, 2014).

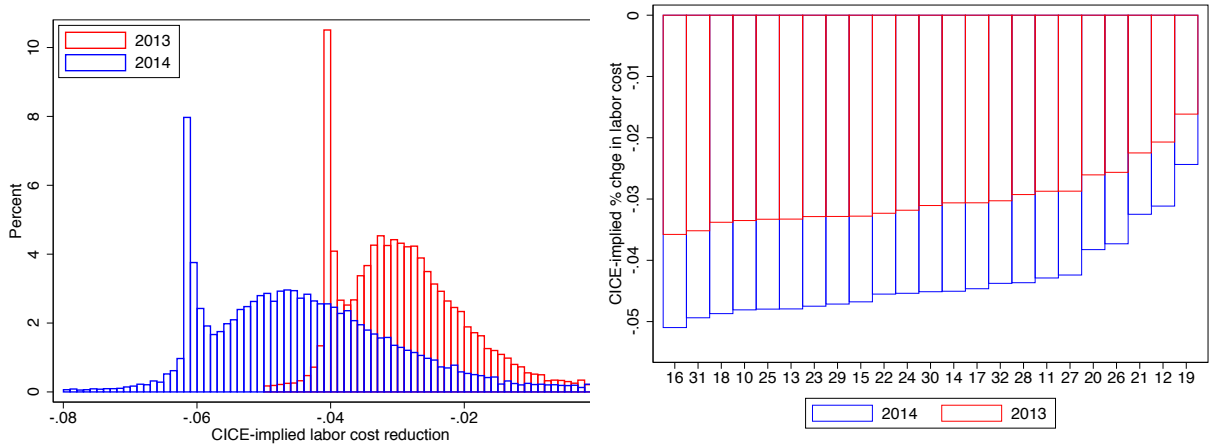
cost on each worker that is paid less than 2.5 times the minimum wage. At the threshold of 2.5 times the minimum wage, the firm gets a tax credit that amounts to about 2,500 euros per worker-year.

It is important to note that the discontinuity occurs at the worker level, while our variables of interest (export performance, labor cost) are intrinsically defined at the firm-level. We could exploit a discontinuity at the firm-level if we focused on those firms whose entire workforce is located slightly below the 2.5 minimum wage threshold (fully treated) versus firms paying all of its employees just above the threshold (untreated). However, all firms in our sample exhibit sufficient wage variation to make it impossible to implement a firm-level regression discontinuity design. Against this difficulty, we choose to rely on continuous variation in treatment – which is the sum of worker-level binary eligibility variables – within a difference-in-difference setting.

How much does each firm receive in terms of tax cuts therefore depends on the composition of its labor force. A firm that has all of its employees paid at the minimum wage sees its labor costs reduced by 4% between 2012 and 2013. At the other extreme, a firm where every employee earns more than the 2.5 threshold is not treated and has unchanged labor costs. Figure 2 shows the distribution of the treatment intensity in our sample of continuing exporters between 2010 and 2015. Panel (a) spans over firms, and shows a histogram of the CICE-implied labor cost reduction in the first two years of treatment, based on the amount truly received. While a substantial share of exporters

have all of their employees under the threshold,[8] and therefore have an overall treatment of 4% in 2013 and 6% in 2014, there is substantial variation of the intensity of treatment in the population of French exporters. Panel (b) shows the most affected industries in our sample, calculating the average intensity of treatment across the 2-digit manufacturing industries to which our exporters belong. Wood, Furniture, Food and Textile are among the industries where continuing exporters are the most heavily treated. Chemicals, Pharmaceuticals, Beverages, are representative examples of the other side of the spectrum, where wages are high enough for a large portion of the employees to be untreated.

Figure 2: The distribution of CICE-implied variation in labor cost



a: Overall distribution of treatment

b: Average treatment by sector (NACE 2-digit)

Note: The sample includes firms that export continuously from 2010 to 2014. Digits in the right panel refers to 2-digit NACE sectors whose labels are the following: 16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials ; 31 Manufacture of furniture ; 18 Printing and reproduction of recorded media ; 10 Manufacture of food products ; 25 Manufacture of fabricated metal products, except machinery and equipment ; 13 Manufacture of textiles ; 23 Manufacture of other non-metallic mineral products ; 29 Manufacture of motor vehicles, trailers and semi-trailers ; 15 Manufacture of leather and related products ; 22 Manufacture of rubber and plastic products ; 24 Manufacture of basic metals ; 30 Manufacture of other transport equipment ; 14 Manufacture of wearing apparel ; 17 Manufacture of paper and paper products ; 32 Other manufacturing ; 28 Manufacture of machinery and equipment n.e.c. ; 11 Manufacture of beverages ; 27 Manufacture of electrical equipment ; 20 Manufacture of chemicals and chemical products ; 26 Manufacture of computer, electronic and optical products ; 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations ; 12 Manufacture of tobacco products ; 19 Manufacture of coke and refined petroleum products. Source: NACE Rev. 2: Statistical Classification of Economic Activities in the European Community.

3.3 Firm-level trade and workers

Firm-level data come from a combination of four sources. The first one is produced by the customs office, and compiles the exported values and quantities for each firm-destination-product combination. The second one, produced by the French statistical institute (INSEE), contains balance-sheet data for firms. It uses the same identifier for

[8] A small share of firms seem to have received more tax credit than the maximum possible, which reflects some noise in the reporting of either the gross wagebill or of the amount of CICE received.

the firm, and is mostly used in our sample to obtain control variables, such as value-added or the capital stock. The third source is the employer-employee data also created by INSEE, and named DADS. All workers of a given firm (identified with same number as the two other sources) are recorded in DADS, which we use to obtain hourly wages. This very rich source is critical for calculating the predicted intensity of treatment at the firm level. The fourth source is an administrative file, named MVC, that contains the actual amount of tax credit claimed by each firm. We use it to compute the treatment intensity which we will then instrument with the predicted treatment intensity as computed using the DADS dataset.

We keep firms that are present in all four datasets and for which the main activity reported belongs to manufacturing. Furthermore, we exclude firms that are in the top percentile in terms of CICE intensity (those do report considerably more than that the maximum rate that should be possible to claim) in any given year. We finally focus on a balanced sample of firms present in the dataset over the 2010-2015 period.

Table 1: Descriptive statistics: Intensive margin sample

	mean	sd	p50	p5	p95
CICE over wagebill = $\frac{C_{it}}{W_{it}}$	0.036	0.017	0.037	0.000	0.060
Export over sales	0.250	3.102	0.124	0.003	0.788
ln(Exports per worker)	2.242	1.954	2.480	-1.293	4.915
ln VA per worker	11.028	0.526	11.000	10.322	11.859
ln Assets	14.588	1.970	14.431	11.610	18.105
ln Av. wage	10.481	0.285	10.447	10.118	10.944
ln Hours	10.873	1.447	10.812	8.629	13.389
# markets served (per year)	13.578	16.604	7.000	1.000	48.000
Observations	82998				

Notes: The sample includes all firms eligible for the CICE program which are reporting positive exports every year between 2010 and 2015. All monetary variables (value of exports, value-added, wages) are expressed in current euros.

The sample we use for the extensive margin analysis is the set of firms that are continuously present in the balance-sheet and employer-employee datasets over the 2010-2015 period. The one we use for the intensive margin analysis is the set of continuous exporters over the same period. We refer to the first and second samples with ME and

MI respectively. The MI sample (described in Table 1) exhibits a ratio of tax credit over wagebill that is smaller than the ME one (described in Table 2). This reflects the usually found overall exporter premium on variables such as value-added, size and wages also found here. Even though the MI firms constitute a sample of manufacturing firms that are productive enough to remain exporters over the whole sample, the ratio of exported value over total sales is still at a low 12.4% for the median firm, which typically serves 7 markets. The average ratio of exports to total sales is at 25%. Table 2) also shows that the proportion of exporters is 37%. Both numbers are higher than the usual figures for the US (18% for average exporter shares, 14% for ratio of export value over total sales) reported in Bernard *et al.* (2007). Note however that the sample here is manufacturing only, and constrained to continued presence in several firm-level datasets over 5 years, which probably selects larger firms. Mayer and Ottaviano (2007) report export participation rates and share of exports in total sales that are very comparable to ours for several European countries with samples constrained to have firms above a certain size.

Table 2: Descriptive statistics: Extensive margin sample

	mean	sd	p50	p5	p95
CICE/Wage bill	0.041	0.019	0.041	0.000	0.066
$\mathbf{I}(X_{it} > 0)$	0.372	0.483	0.000	0.000	1.000
ln VA per worker	10.905	0.521	10.882	10.195	11.728
ln Assets	13.167	1.829	12.924	10.607	16.570
ln Av. wage	10.427	0.348	10.393	9.964	11.016
ln Hours	9.698	1.450	9.567	7.549	12.317
Observations	280950				

Notes: The sample includes all firms eligible for the CICE program which are observed every year between 2010 and 2015, irrespectively whether they export or not. All monetary variables (value of exports, value-added, wages) are expressed in current euros.

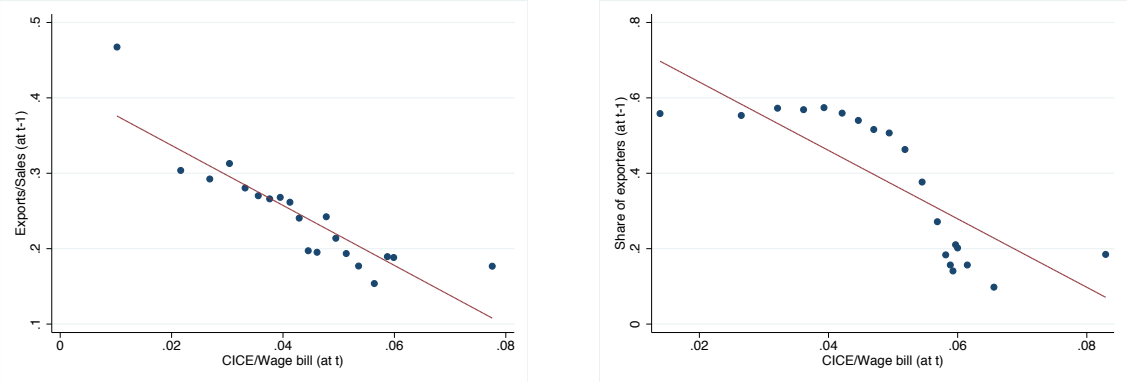
4 Results

4.1 Descriptive evidence

One important characteristic of the CICE policy is that it mostly affects firms that were initially less export-oriented. Firms that do export in positive amounts, and those that have the highest share of exports in their total sales tend to pay higher wages, and are therefore the ones where the treatment is less intense. Panels (a) and (b) of Figure 3 show those two negative relationships: export intensity and export probability both decline with the lagged amount of subsidy received in 2014.[9]

The top 5% CICE recipients (as a share of wagebill) in 2013 had an average ratio of exports over turnover of 17 % in 2012. The same ratio for the bottom 5% of recipients was 40 %. The extensive margin evidence is more complex, and clearly non-monotonous in the top part of the treatment intensity.

Figure 3: Initially export-oriented firms were less exposed to the policy - 2014



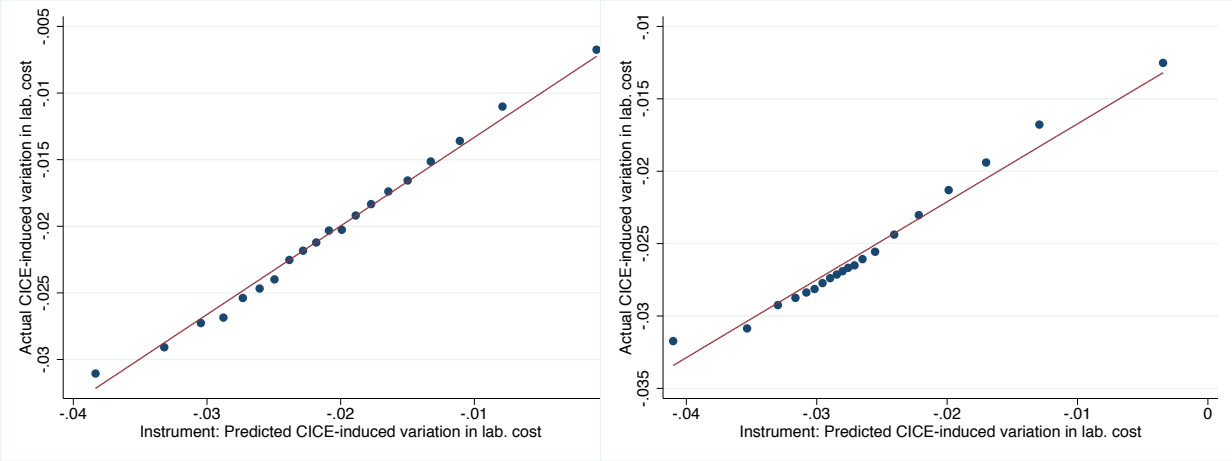
a: Intensive margin: exports / sales **b**: Extensive margin: probability of export

Note: Each dot corresponds to a quantile (20) of the treatment intensity in 2014. The x-axis reports treatment intensity, while the y-axis plots the average export intensity / share of exporters in the corresponding quantile.

We also present graphical evidence regarding the first-stage of our instrumentation strategy in Figure 4 among the sample of continuing exporters (left panel) and all firms (right panel). For both sample, we see a clear positive relationship between the instrumental and the endogenous variables that is approximately linear, when aggregating over 20 bins of the instrument.

[9] A very similar relationship holds for 2013 as is displayed in Figure A1 in the appendix.

Figure 4: First stage : among continuing exporters and among all firms



a: Continuing exporters **b**: All firms

Note: The x-axis corresponds to 20 quantiles of the predicted treatment intensity. The y-axis reports the average value of the actual treatment intensity in each quantile.

4.2 The impact of CICE on exports

Empirical approach

We implement the estimation of equation (9) at the destination × firm-level. We choose to retain the destination dimension despite the fact that our variable of interest only varies at the firm-level because destination-specific shocks that are potentially correlated with exposure to the labor cost reduction induced by the policy could cause bias in our estimates. The estimating equation writes as follows:

$$\Delta \ln x_{int} = \beta \Delta D_{it} + \Delta \mathbf{W}'_{\alpha_{it}} \rho + \mathbf{FE}_{nt} + \mathbf{FE}_{st} + \varepsilon_{int} \tag{11}$$

with $D_{it} \equiv \ln\left(1 - \frac{C_{it}}{W_{it}}\right)$ the empirical counterpart of the treatment variable $\Delta[\eta_{it} \ln(1 - \nu_t)]$. We denote with C_{it} the amount of CICE subsidy received and W_{it} as total (gross) wagebill.[10] $\mathbf{W}'_{\alpha_{it}}$ includes a list of controls likely to drive the evolution of firm-level unit

[10]We could have built the variable $\eta_{it} \ln(1 - \nu_t)$ using solely the DADS matched employer-employee, computing the wage share of eligible labor (η_{it}) and applying the rate of subsidy $\ln(1-\nu_t)$. The resulting variable should be equal to our measure C_{it}/W_{it} – where the denominator is computed using the DADS dataset and the numerator comes from a special administrative files on claimed tax credits. Nevertheless it is only approximately true due to the fact that minor components of labor earning to which the tax credit do not apply are included in the DADS measure of wages – e.g. work-related expenses. We therefore prefer to use the C_{it}/W_{it} ratio. The variable $\ln(1 - C_{it}/W_{it})$ is a very close counterpart to the variable relevant in the theoretical framework as both variables are equal up to a first-order approximation. Indeed we can see that $\eta_{it} \ln(1 - \nu_t) \approx -\eta_{it}\nu_t$ where the first order approximation is

costs, beyond the global evolution of the sector in France captured by $\mathbf{FE}_{st}$ – which is a 3-digit sector × year fixed-effect.

In order to causally assess the impact of the cut in payroll taxes, we use an instrumental variable Z_{it} corresponding to lagged *predicted* amount received $\eta_{i,t-1}\ln(1-\nu_{it})$, used either directly or as an instrument for D_{it}, and constructed as

$$Z_{it} = \frac{\text{eligible wagebill}_{i,t-1}}{\text{wagebill}_{i,t-1}} \times \ln\left(1-\nu_t\right), \tag{12}$$

where ν_t is the rate of payroll tax cut implied by the CICE policy, 4% in 2013, 6% since 2014.

OLS and IV results

Putting aside causality issues as a start, we first present regressions between the amount of subsidy received and export performance, that should be interpreted as correlations without taking a stance on the direction of causality. Results for several specifications are presented in Table 3.

The first three columns include all firms, while the last three limit attention to the set of firms considered far enough from the truncation point of profitable exports so that selection issues should be minimized. Those are the ones that serve continuously their markets over the entire sample period (2010-2015) and belong to the top quartile of exporters in terms of number of destination. We experiment with different sets of fixed effects and controls over columns. Columns (1), (2), (4) and (5) simply have sector-year effects, while columns (3) and (6) introduce destination-year effects. The treatment intensity variable has the expected negative sign but is too noisy to be significant in all columns. The magnitude of the coefficient is also smaller than expected, given reasonable estimates of consumers' price elasticity and the share of labor in production costs.

We now turn to instrumented results, meant to provide a better assessment of the causal effect of the subsidy. An example of endogeneity issue is the tendency of firms experiencing a boom in their exports to "share the rent" with workers through wage increases (see e.g. Carluccio *et al.*, 2015). These wage increases directly impact the CICE treatment variable, which is affected by the share of the wagebill under a certain threshold. This is only one of the many causes that could induce a correlation between the unobserved determinants of export performance (the error term of equation 11) and the subsidy received. Most of the endogeneity concerns suggest an attenuation bias. For instance, reverse causality could even be at work since a negative draw on export markets'

taken around $\nu_t = 0$ and that $\ln(1-C_{it}/W_{it}) \approx -C_{it}/W_{it} = -\eta_{it}\nu_t$ where the first order approximation is taken around $C_{it}/W_{it} = 0$.

Table 3: Received CICE and exports (OLS)

	All firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$
$\Delta \ln \left(1 - \frac{C}{W}\right)_{it}$	-0.239	-0.193	-0.198	-0.190	-0.146	-0.144
	(0.172)	(0.173)	(0.172)	(0.200)	(0.200)	(0.199)
$\Delta \ln$ VA per worker$_{i,t-1}$		0.0122	0.0118		0.0239*	0.0239*
		(0.00970)	(0.00971)		(0.0123)	(0.0123)
$\Delta \ln$ Assets$_{i,t-1}$		0.0792***	0.0796***		0.0502***	0.0511***
		(0.0124)	(0.0124)		(0.0170)	(0.0170)
$\Delta \ln$ Av. wage$_{i,t-1}$		0.00868	0.00919		-0.0264	-0.0255
		(0.0372)	(0.0372)		(0.0606)	(0.0601)
$\Delta \ln$ Hours$_{i,t-1}$		0.0620***	0.0613***		0.0302	0.0294
		(0.0211)	(0.0210)		(0.0290)	(0.0287)
Observations	758142	604573	604544	419503	331990	331950
R^2	0.002	0.002	0.006	0.005	0.003	0.010
Year × Sector FE	√	√	√	√	√	√
Destination × Year FEs			√			√
# firms	13829	13788	13788	4807	4795	4795

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable of interest (actual or instrumented) measures the change in labor costs implied by the CICE policy. The expected sign is therefore negative: a rise in labor cost should reduce exports. The balanced sample covers the years 2012 to 2014 (two period with first differences).

performance (losing a large contract for instance) could result in wage cuts, making the firm more eligible to CICE.

We therefore instrument the intensity of treatment by a variable that is using the wage structure of the firm *before* the policy was put in place. This IV is the level of subsidy that the firm was expected to receive from its historical wage distribution. Table 4 report results of the instrumented version of the regressions.

The coefficients obtained are both larger (in absolute value) and more statistically significant. The coefficients obtained for large firms (last 3 columns) are close to -1. Assuming a share of labor in total costs around 20 % implies a price elasticity of demand around 6, compatible with existing literature estimating this elasticity on firm-level exports (Fontagné *et al.* (2017) being a recent example, particularly relevant since it estimates the trade elasticity using a cost shifter–electricity prices–on French exporters). Adding controls at the firm level and fixed effects for destinations however reduces the magnitude and significance of the effect. This points to a lack of robustness in the effect of this policy on the intensive margin of exports.

Long-difference regressions

We have failed at this point to detect robust effects of the policy on export revenues. It is possible that the policy took time to be effective if, for instance, firms used the subsidy to invest in quality upgrading or in an improvement of the production process. We estimate a slightly different specification from Equation (11) in order to allow for both time-varying effects and potentially lagged effects of the policy. We keep one observation per firm and project directly the change in export revenue with respect to 2012 for several different time horizons onto the average policy-induced labor cost variation between 2012 and 2015. As above, the actual policy-induced labor cost variation received is instrumented using the treatment as predicted by the 2012 wage structure. This method has the advantage of allowing for time-varying effects and does not impose dynamic restrictions on the estimates (Jordà, 2005; Zidar, 2017). Results are presented in Table 5. Results are overall disappointing. In the largest sample, the magnitude of coefficients is comparable to the ones from Table 4, but estimates are noisy and sensitive to the period considered when estimating the effect. In the sample focusing on large firms, which is our preferred one for the selection issues mentioned at the end of the theory section, we again find volatile effects, with one coefficient even exhibiting a perverse positive sign.

To summarize, the policy under investigation has mostly shown no robust effect of the intensive margin of exporting patterns. We cannot completely discard the possibility that this policy aimed at reducing labor costs has a delayed effect being channeled through long-run investment decisions. However, with the data at hand, which is limited to 3

Table 4: Received CICE and exports (IV)

	All firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$
$\Delta \ln \left(1 - \frac{C}{W}\right)_{it}$	-0.968	-0.701	-0.557	-1.397**	-0.902	-0.809
	(0.680)	(0.684)	(0.693)	(0.698)	(0.713)	(0.723)
$\Delta \ln$ VA per worker$_{i,t-1}$		0.0124	0.0119		0.0241*	0.0241*
		(0.00970)	(0.00971)		(0.0123)	(0.0123)
$\Delta \ln$ Assets$_{i,t-1}$		0.0787***	0.0793***		0.0498***	0.0507***
		(0.0124)	(0.0124)		(0.0168)	(0.0169)
$\Delta \ln$ Av. wage$_{i,t-1}$		0.00900	0.00941		-0.0259	-0.0250
		(0.0373)	(0.0373)		(0.0609)	(0.0603)
$\Delta \ln$ Hours$_{i,t-1}$		0.0621***	0.0614***		0.0303	0.0295
		(0.0211)	(0.0210)		(0.0291)	(0.0287)
Observations	611449	604573	604544	335603	331990	331950
R^2	0.002	0.002	0.006	0.003	0.003	0.010
Year × Sector FE	√	√	√	√	√	√
Destination × Year FEs			√			√
First Stage Coeff	0.571***	0.578***	0.570***	0.614***	0.622***	0.616***
	(0.0177)	(0.0175)	(0.0177)	(0.0242)	(0.0241)	(0.0242)
K-P stat	1039	1089	1041	645	667	646
# firms	13827	13788	13788	4807	4795	4795

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable of interest (actual or instrumented) measures the change in labor costs implied by the CICE policy. The expected sign is therefore negative: a rise in labor cost should reduce exports. The balanced sample covers the years 2012 to 2014 (two period with first differences). K-P Statistic refers to the Kleibergen-Paap statistic for the first stage.

Table 5: Long differences: IV estimates

	All firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln x_{\prime 12,\prime 13}$	$\Delta \ln x_{\prime 12,\prime 14}$	$\Delta \ln x_{\prime 12,\prime 15}$	$\Delta \ln x_{\prime 12,\prime 13}$	$\Delta \ln x_{\prime 12,\prime 14}$	$\Delta \ln x_{\prime 12,\prime 15}$
$\Delta \ln \left(1 - \frac{C}{W}\right)_{12,15}$	-0.816	-1.138*	-0.423	-0.614	-0.708	0.297
	(0.504)	(0.621)	(0.754)	(0.520)	(0.696)	(0.897)
$\Delta \ln$ VA per worker$_{i,t-1}$	-0.00509	0.00250	-0.00688	0.0216	-0.00119	0.00313
	(0.0189)	(0.0220)	(0.0243)	(0.0191)	(0.0264)	(0.0325)
$\Delta \ln$ Assets$_{i,t-1}$	0.105***	0.170***	0.178***	0.0528*	0.133***	0.173***
	(0.0269)	(0.0331)	(0.0410)	(0.0282)	(0.0370)	(0.0490)
$\Delta \ln$ Av. wage$_{i,t-1}$	0.0818**	0.114**	0.130**	0.0290	0.0802	0.0448
	(0.0392)	(0.0451)	(0.0529)	(0.0433)	(0.0507)	(0.0624)
$\Delta \ln$ Hours$_{i,t-1}$	0.0772**	0.136***	0.170***	0.0449	0.0981**	0.132**
	(0.0390)	(0.0454)	(0.0550)	(0.0357)	(0.0452)	(0.0539)
Observations	150837	134238	129502	83090	83090	83090
R^2	0.005	0.008	0.014	0.006	0.009	0.019
Year × Sector FE	√	√	√	√	√	√
Destination × Year FEs	√	√	√	√	√	√
K-P stat	5436	5158	5052	2805	2805	2805
# firms	13487	13238	13089	4752	4752	4752

Notes: Each column corresponds to the same specification where only the horizon over which the growth of the dependent variable (average annual export growth) is computed varies (2012-2013 for the column 1 and 3, 2012-2014 for columns 2 and 5, 2012-2015 for columns 3 and 6). The variable $\Delta \ln \left(1 - \frac{C}{W}\right)_{12,15}$ represents the average decline in labor cost implied by the policy based over the years 2012-2015. It is instrumented by $[\eta_{2012} \Delta_{12-15} \ln(1 - \overline{\nu})]$ which represents the average decline in labor cost implied by the policy based on 2012 wage structure over the years 2012-2015.

years post treatment, our results do not strongly point in that direction.

4.2.1 Were more profitable firms more reactive to the policy?

As explained in section 3.1, the CICE is a corporate income tax credit aiming at "mimicking" the effects of a direct cut in payroll tax. Therefore, firms which do not report any taxable profits do not face the same incentives as the ones that can deduct from their corporate taxation the total amount they are entitled to. To enter the details of the policy: a firm with negative or near zero profits in year t does not benefit from the tax credit accrued based on its wagebill during year $t-1$ at year t but will instead need to wait until $t+1$ in case it generates enough taxable income during that period. Firms that are not profitable at any point past t will have to wait for three years until the tax authorities transfer the amount of the tax credit to the firm.

In order to investigate the heterogeneity of effects based on profitability, we introduce an interaction term between the intensity of treatment and a dummy variable which is set to one if the firm reported positive corporate income tax every year between 2010 and 2012 (TP_i). We expect this interaction term to have a negative sign, since it signals a larger impact of the policy for the firms that are likely to obtain the tax credit with the least lag. Results are somehow supportive of the idea that firms are sensitive to the lag between the payroll tax cut entitlement and its payment: all interaction terms are negative, although not significantly so. This points to the fact that the precise design of this type of policy matters: Blurring the connection between the labor cost determinants of the tax cut and the actual payment of the cut (through a delay in this case) seems to weaken the effects of the policy.

4.3 Other Outcomes

4.3.1 The impact of the CICE policy on export prices

The overall absence of statistically significant impact of the policy could come from two main causes. The first is that the fall in labor costs is not (or incompletely) passed by firms into their export prices. In that case, the price competitiveness of firms benefiting from the policy would not be affected. The second is that the price elasticity of demand is too low to enable detection of a statistically significant effect.

Our data enables us to calculate unit values which is the best we can do to measure (f.o.b) export prices, dividing value exported by quantities (measured in tons in the customs files). Some (firm $\times$ destination) couples have no quantity available which explains why there is a slightly lower number of observations compared to regressions from Table 4. We first investigate the statistical association between export prices and

Table 6: Received CICE and exports (IV), heterogeneity based on profitability

	All firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$	$\Delta \ln x_{int}$
$TP_i \times \Delta \ln \left(1 - \frac{C}{W}\right)_{it}$	-0.0689	-0.0793	-0.0548	-0.165	-0.242	-0.239
	(0.330)	(0.331)	(0.331)	(0.389)	(0.389)	(0.390)
$\Delta \ln \left(1 - \frac{C}{W}\right)_{it}$	-1.079	-0.801	-0.669	-1.486**	-0.962	-0.865
	(0.688)	(0.693)	(0.701)	(0.713)	(0.729)	(0.739)
TP_i	0.0219***	0.0192***	0.0203***	0.0261***	0.0230***	0.0233***
	(0.00537)	(0.00532)	(0.00532)	(0.00583)	(0.00577)	(0.00578)
$\Delta \ln$ VA per worker$_{i,t-1}$		0.0133	0.0129		0.0250**	0.0250**
		(0.00967)	(0.00968)		(0.0123)	(0.0123)
$\Delta \ln$ Assets$_{i,t-1}$		0.0772***	0.0777***		0.0473***	0.0482***
		(0.0123)	(0.0123)		(0.0165)	(0.0166)
$\Delta \ln$ Av. wage$_{i,t-1}$		0.00704	0.00735		-0.0284	-0.0275
		(0.0373)	(0.0373)		(0.0608)	(0.0603)
$\Delta \ln$ Hours$_{i,t-1}$		0.0603***	0.0594***		0.0279	0.0271
		(0.0209)	(0.0207)		(0.0287)	(0.0284)
Observations	611449	604573	604544	335603	331990	331950
R^2	0.002	0.002	0.006	0.003	0.003	0.010
Year × Sector FE	√	√	√	√	√	√
Destination × Year FEs			√			√
K-P stat	513	536	513	318	327	318
# firms	13827	13788	13788	4807	4795	4795

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable of interest (actual or instrumented) measures the change in labor costs implied by the CICE policy. The expected sign is therefore negative: a rise in labor cost should reduce exports. The balanced sample covers the years 2012 to 2014 (two period with first differences). K-P Statistic refers to the Kleibergen-Paap statistic for the first stage. TP is a binary variable equal to 1 if the firm reported positive corporate income tax during every year between 2010 and 2012. It does not vary over time and is therefore omitted in columns (4) and (6).

the policy without looking for the direction of causality. Results are reported in Table 7, with the same set of specifications as in our benchmark on export values. The expected magnitude of the coefficient is quite intuitive. With constant markups, the pass-through elasticity of changes in costs should be one. Therefore, the expected impact on unit values should reflect the share of labor in total marginal costs of the firms.

Table 7: Received CICE and unit values (IV)

	All firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln UV_{int}$	$\Delta \ln UV_{int}$	$\Delta \ln UV_{int}$	$\Delta \ln UV_{int}$	$\Delta \ln UV_{int}$	$\Delta \ln UV_{int}$
$\Delta \ln \left(1 - \frac{C}{W}\right)_{it}$	0.123	0.352	0.341	-0.141	0.0741	0.0637
	(0.423)	(0.421)	(0.427)	(0.431)	(0.439)	(0.444)
$\Delta \ln$ VA per worker$_{it}$		-0.00820	-0.00813		-0.00354	-0.00374
		(0.00631)	(0.00632)		(0.00678)	(0.00679)
$\Delta \ln$ Assets$_{it}$		0.00222	0.00220		-0.00298	-0.00269
		(0.00741)	(0.00741)		(0.00812)	(0.00810)
$\Delta \ln$ Av. wage$_{it}$		-0.0168	-0.0173		-0.0313	-0.0311
		(0.0152)	(0.0153)		(0.0202)	(0.0205)
$\Delta \ln$ Hours$_{it}$		-0.00798	-0.00828		-0.0148	-0.0153
		(0.00767)	(0.00772)		(0.00962)	(0.00974)
Observations	535759	529942	529914	344718	341250	341208
R^2	0.002	0.002	0.004	0.003	0.003	0.005
Year × Sector FE	√	√	√	√	√	√
Destination × Year FEs			√			√
# firms	11356	11323	11323	5904	5889	5889
K-P stat	858	910	884	705	732	716

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable of interest (actual or instrumented) measures the change in labor costs implied by the CICE policy. The expected sign is therefore negative: a rise in labor cost should reduce exports. The balanced sample covers the years 2012 to 2014 (two period with first differences).

Results show that the response of prices to the amount of labor cost subsidy received depends upon the size of firms. In the full sample, the coefficients imply labor costs shares between 12 and 35% which is reasonable, but none of those effects is significant. For larger firms, the implied shares are much lower, which is probably intuitive, but again the effect is not statistically different from 0. In sum, the pass-through into export prices is weak at best. One interpretation is that signs and magnitudes of the volume and price effects are coherent, and reasonably consistent with expectations, despite large amount of noise (perhaps due to the complex design of the policy). The other interpretation, is that firms did not consider this policy to be a "true" reduction in labor costs, that could

translate into lower prices and large export volumes, explaining that we find no robust effect at the intensive margin.

4.3.2 Impact on the extensive margin

It is possible (although unlikely and not fully consistent with the benchmark model of heterogeneous firms in trade) that the whole of the effects of the evaluated policy took place at the extensive margin, i.e. boosting the entry rate of French firms on different export markets. In order to allow for a rich structure of fixed effects that is needed in our context we use the Linear Probability Model (LPM) in order to investigate this extensive margin of adjustment to labor cost changes in first-difference. Our dependent variable in the first two columns is identifying entry (1 if the firm did not export in $t-1$ and does in t, and 0 if it did not change status and -1 if it ceased to export between $t-1$ and t). The last two columns re-estimate the model in levels, where the LHS is the export status each year. We find again no statistical evidence of a change in export status that could be attributed to the change in labor costs.

Table 8: Received CICE and export probability (IV)

	First Diff. model		Fixed effect model	
	(1)	(2)	(3)	(4)
	$\Delta\mathbf{I}(X_{it}>0)$	$\Delta\mathbf{I}(X_{it}>0)$	$\mathbf{I}(X_{it}>0)$	$\mathbf{I}(X_{it}>0)$
$\ln\left(1-\frac{C}{W}\right)_{it}$	0.133	0.0496	0.247	0.195
	(0.285)	(0.282)	(0.153)	(0.152)
Observations	187300	183314	234125	230477
R^2	0.002	0.002	0.876	0.877
Year × Sector FEs	√	√	√	√
Controls		√		√
Firm FEs			√	√
K-P stat	2583	2679	12678	13071
# firms	46825	46544	46825	46584

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable of interest (actual or instrumented) measures the change in labor costs implied by the CICE policy. The expected sign is therefore negative: a rise in labor cost should reduce exports. Controls include VA per worker, value of assets, average wage and total hours workers in the firm (lagged and log).

4.3.3 Comparing ex-post and ex-ante analysis

As an alternative to the ex-post analysis conducted until now, we consider the following ex-ante approach: 1) estimate the impact of unit labor costs on exports in the period immediately preceding the treatment (2010-2012), 2) combining those estimates with the percent change in the labor costs implied by the CICE policy, one can predict what is the expected change in export values linked to the policy.

We proceed with step 1 following closely the approach by Decramer *et al.* (2016), with the LHS being the change in logged export values, and the RHS being the change in unit labor costs (measured as wagebill over value added of the firm).[11]

Table 9 reports results and contrary to preceding tables, the overall picture is one of negative significant effect of unit labor costs on export patterns. The elasticities are quite robust in significance and magnitude over different specifications ranging from 17 to 20%.

Table 9: Unit labor cost and exports (2010-2012)

	(1) $\Delta \ln x_{it}$	(2) $\Delta \ln x_{it}$	(3) $\Delta \ln x_{it}$	(5) $\Delta \ln x_{it}$
ln(unit labor cost)	-0.171***	-0.170***	-0.168***	-0.200***
	(0.0152)	(0.0152)	(0.0152)	(0.0196)
Year FEs	√	√		
Sector FEs		√		
Year × Sector FEs			√	√
Controls				√

Notes: Robust standard errors reported in parentheses (clustered at the firm level). $\Delta x_t \equiv x_{t+1} - x_t$. * : p<0.10, ** : p<0.05, *** : p<0.01. Our explanatory variable is defined as the log of labor compensation over valued-added. The expected sign is therefore negative: a rise in labor cost should reduce exports. The balanced sample covers the years 2010 to 2012. Exports are aggregated at the firm-year level in level before computing the logarithm.

Column (4), which is the most comparable to the specification of Decramer *et al.* (2016), finds an elasticity of -0.20. Those coefficients are strikingly close to those obtained by Decramer *et al.* (2016), who also find -0.2 for manufacturing Belgian exporters between 1999 and 2010.[12] We can calculate the "mechanical" fall in labor costs due to the CICE policy by removing the received subsidy from the total wagebill. This reduction in the unit labor costs was around 1.9 % on average in our intensive margin sample between 2012 and 2013. Using this fall combined with coefficients from Table 9, one can quantify that the policy was ex-ante predicted to have a large effect on exports, raising its average

[11] Note that we aggregate exports across destinations at the firm and year level in order to make our specification as comparable as possible to Decramer *et al.* (2016). We refer precisely to their Table 6, panel a, where the dependent variable is the same as ours.

[12] We also ran this type of regressions for the years 1995 to 2010 on French data and found very comparable estimates.

growth rate by 0.34 percentage points between 2012 and 2013.

It is therefore a case where the ex-ante and ex-post analysis of a policy measure differ dramatically. In our view, those contrasting results suggest a need for careful interpretation of ex-ante approaches, in particular in terms of identification of the effect that is used in the first step and its relevance for the actual policy carried over.[13]

5 Conclusion

Our paper investigates the impact of a change in labor costs on export patterns. Using a large panel of French firms, we use a recent policy experiment where a share of gross wages is reimbursed to firms via a tax credit. Firms are treated according to a threshold applied to each employees' compensation. We use the variation in treatment implied by this rule to assess whether export values and/or the probability of participating in export markets is affected by labor costs.

We first find a negative albeit insignificant correlation between exported values and the intensity of policy treatment. This could be explained by issues of reverse causality, whereby firms experiencing negative demand shocks lower their employees' wage rate and therefore are targeted more generously by the tax credit. However, our instrumentation strategy also points to statistically insignificant effects. Essentially, signs and magnitudes of our estimates are as expected, but very noisy. This lack of precision is not related to a weak first-stage as our instrument is strongly predictive of the actual treatment. There are in our view two interpretations.

First, while our instrument solves the issue of reverse causation between the outcome and the policy treatment, it does not solve entirely the issue of unobserved heterogeneity. Time-varying controls and allowing sectors to be flexibly affected by the business cycle is the best we can do on that front but might still be insufficient. The second interpretation is that the policy itself failed to deliver the expected effect of a cut in labor cost. This could be explained by the complex design of the policy which took the form of a tax credit rather than a direct cut in payroll taxes.

We note that the transformation of the CICE from a tax credit into a payroll tax cut has been quite consensual among both government officials and employers' representatives. We interpret this convergence in opinions as evidence supporting the second interpretation. The likely transformation of the policy, due to take place in 2019, should offer a nice setup for future research to disentangle the respective influence of research

[13] In preceding versions of our paper, we conducted the ex-post analysis aggregating exports across destinations at the firm-year level. This does not improve the match between ex-post and ex-ante analysis in any discernible way.

versus policy design on the disappointing estimated results of the policy.

References

Amiti, M., Itskhoki, O. and Konings, J. (2014). Importers, exporters, and exchange rate disconnect. *American Economic Review*, **104** (7), 1942–1978.

Bas, M., Fontagné, L., Martin, P. and Mayer, T. (2015). In search of lost market shares. *Notes du conseil d'analyse économique*, (4), 1–12.

—, Mayer, T. and Thoenig, M. (2017). From micro to macro: demand, supply, and heterogeneity in the trade elasticity. *Journal of International Economics*.

Berman, N., Martin, P. and Mayer, T. (2012). How do different exporters react to exchange rate changes? *The Quarterly Journal of Economics*, **127 (1)**, 437–492.

Bernard, A., Jensen, J., Redding, S. and Schott, P. (2007). Firms in international trade. *Journal of Economic Perspectives*, **21 (3)**, 105–130.

Berthou, A. and Fontagné, L. (2016). Variable trade costs, composition effects and the intensive margin of trade. *The World Economy*, **39** (1), 54–71.

Bunel, M. and L'Horty, Y. (2012). The effects of reduced social security contributions on employment: An evaluation of the 2003 french reform*. *Fiscal Studies*, **33** (3), 371–398.

Cahuc, P. and Carcillo, S. (2014). Alléger le coût du travail pour augmenter l'emploi: les clés de la réussite. *Institut Montaigne*, **126**.

Carluccio, J., Fougère, D. and Gautier, E. (2015). Trade, Wages and Collective Bargaining: Evidence from France. *Economic Journal*, **0** (584), 803–837.

Crozet, M., Head, K. and Mayer, T. (2012). Quality Sorting and Trade: Firm-level Evidence for French Wine. *Review of Economic Studies*, **79** (2), 609–644.

Decramer, S., Fuss, C. and Konings, J. (2016). How do exporters react to changes in cost competitiveness? *The World Economy*, **39** (10), 1558–1583.

Eaton, J. and Kortum, S. (2001). Trade in capital goods. *European Economic Review*, **45** (7), 1195–1235.

Fabre, T. (2012). Le crédit d'impôt pour la compétitivité et l'emploi déçoit. *Challenges*.

Fitzgerald, D. and Haller, S. (2017). *Exporters and Shocks*. Staff Report 549, Federal Reserve Bank of Minneapolis.

Fontagné, L., Martin, P. and Orefice, G. (2017). *The International Elasticity Puzzle Is Worse Than You Think*. Working Papers 2017-03, CEPII research center.

Gallois, L. (2012). Pacte pour la compétitivité de l'industrie française. *Report on behalf of the Prime Minister*.

Gan, L., Hernandez, M. A. and Ma, S. (2016). The higher costs of doing business in china: Minimum wages and firms' export behavior. *Journal of International Economics*, **100**, 81–94.

Greenstone, M., List, J. A. and Syverson, C. (2012). *The Effects of Environmental Regulation on the Competitiveness of U.S. Manufacturing*. Working Paper 18392, National Bureau of Economic Research.

Head, K. and Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In E. Helpman, G. Gopinath and K. Rogoff (eds.), *Handbook of International Economics*, vol. 4, Elsevier, pp. 131–195.

Hombert, J. and Matray, A. (2015). Can innovation help us manufacturing firms escape import competition from china?

Jordà, s. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review*, **95** (1), 161–182.

Mayer, T. and Ottaviano, G. I. (2007). *The Happy Few: The internationalisation of European firms. New facts based on firm-level evidence. Bruegel blueprint series, Volume 3, 2007*.

Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, **71** (6), 1695–1725.

Mulligan, C. B. and Rubinstein, Y. (2008). Selection, investment, and women's relative wages over time. *The Quarterly Journal of Economics*, **123** (3), 1061–1110.

Paravisini, D., Rappoport, V., Schnabl, P. and Wolfenzon, D. (2015). Dissecting the effect of credit supply on trade: Evidence from matched credit-export data. *The Review of Economic Studies*, **82** (1), 333–359.

Piveteau, P. and Smagghue, G. (2015). Estimating firm product quality using trade data, manuscript.

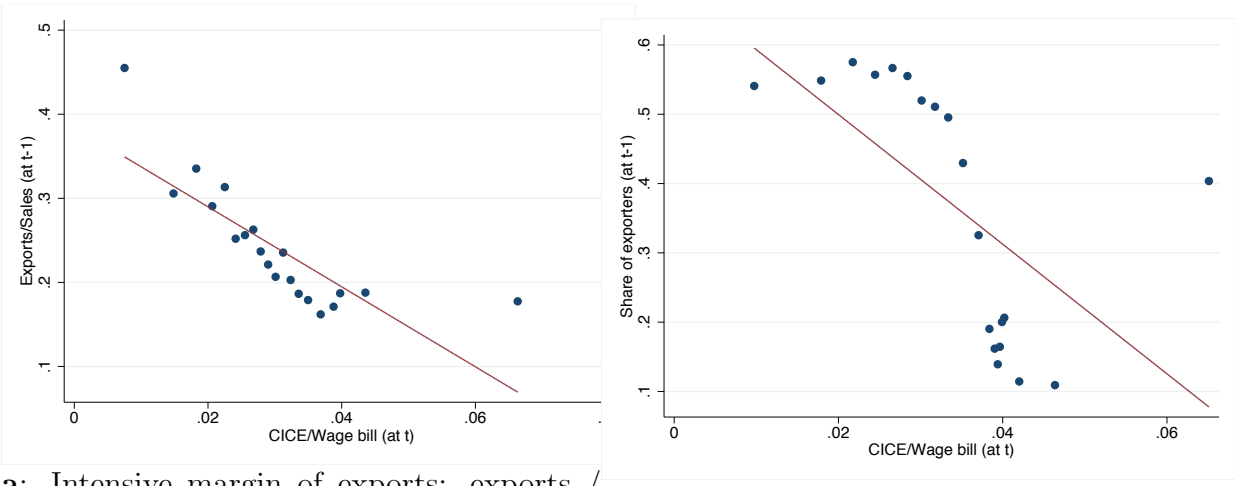
Volcovici, V. and Mason, J. (2017). Trump signs order dismantling obama-era climate policies. *Reuters*.

Walker, W. R. (2013). The transitional costs of sectoral reallocation: Evidence from the clean air act and the workforce. *The Quarterly journal of economics*, **128** (4), 1787–1835.

Zidar, O. M. (2017). Tax cuts for whom? heterogeneous effects of income tax changes on growth and employment. *Journal of Political Economy, forthcoming*.

A Additional Figure

Figure A1: Initially export-oriented firms in manufacturing were less exposed to the policy - 2013



a: Intensive margin of exports: exports / sales

b: Extensive margin: probability of export

Note: Each dot corresponds to a quantile (20) of the treatment intensity in 2013. The height of each dot is determined by the average export intensity in the matching quantile.