Who Benefits From Free-Trade Agreements?

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Abstract

Trade policies might affect firms' market power and their ability to reap product-market mark-ups. Thus, potentially they influence not only firms' economic performance, but also worker pay. Utilising panel-data on Norwegian Manufacturing exporters from 2005-18 and multi-product production function-estimation techniques and recent development within the literature on dynamic treatment effects in event studies with heterogeneous treatment effects, we show that free-trade agreements increase the average mark-ups of Norwegian incumbent exporters, and exposed firms experience higher return-on-assets. Workers in established firms, however, benefit less from free-trade agreements, particularly workers in non-unionised firms, management and sales workers lose money.

Keywords: Free-trade agreements, price-cost markups, profits, wages, multiproduct-function-estimation, dynamic treatment effects

JEL-codes: D24, F14, L11, J31, J42

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1 Introduction

Increased globalisation through trade liberation is often associated with efficiency gains. Reduced import tariffs reduce the marginal costs of foreign firms and the most productive of these will then enter the market. Domestic firms face increased import competition, and they will respond by cutting their prices and price-cost mark-ups. Still, trade liberalisation in the form of reduced tariffs will thus reallocate market share away from less productive (domestic) firms to more productive imports, and thus improve aggregate welfare (Melitz, 2003; Egger and Kreickemeier, 2009). These procompetitive effects of trade liberalization have been thoroughly surveyed by Tybout (2008), De Loecker and Goldberg (2014) and De Loecker and Van Biesenbroeck (2018). The robust finding is that globalization improves industry performance, but it is less clear how (De Loecker and Goldberg, 2014).

In this paper, we study the impact of free-trade agreements on Norwegian exporters price-cost-margins on and return-on-assets, as well the impact on wages for workers employed by these firms. The notion that free-trade agreements can affect the price-cost margin of exporters should not be controversial. Even within a country, Dhynes et al (2022) have shown (and modelled) that firms markups increase in the average input share among their buyers. During our period of observation, Norway established free-trade agreements with several countries. The establishment of these agreements provide exogeneous variation over time in the costs of exporting goods for Norwegian exporters, and allow us to answer the question: Do these incumbent exporters and their workers benefit from these free-trade agreements? By answering this question, we also shed light on the relationship between potential market power in the product market and market power in the labour market. As such, albeit in a simpler fashion, we address similar issues as Kroft et al.(2022) analysis of the U.S. construction industry, where they conclude that the incentives of firms to mark down wages and reduce employment due to wage-setting power are attenuated by their price-setting power in the product market.

Early literature on trade liberalisation mixed physical efficiency and price/markup effects. For example, Amiti and Konings (2007) found that lower input tariffs raise firm-level total factor productivity in Indonesia, but this might comprise price effects. Later literature does not share this shortcoming. For example, De Loecker et al. (2016) find that a similar result for India is not due to higher efficiency but an incomplete pass-through of input price reductions. On the other hand, the productivity raising impact of reduced output tariffs in China even survives controls for input tariffs and price changes (Brandt et al., 2017), although this does not imply that tariff reductions have switched firms away from exercising product and labour market power (Dobbelaere and Wiersma, 2020). Motivated by the pricing-to-market (PTM)-literature, Asprilla et al. (2019) find that PTM is observed, particularly for large firms. However, trade policies yield ambiguous effects, since non-tariff measures yield more PTM, while tariffs reduce PTM. Several of these studies referred above apply the ratio estimator of De Loecker and Warzynski (2012) to identify the price-cost margins.[1]

However, recently the ratio estimator has come under critique (Bond et al., 2020; Doraszelski and Jaumandreu, 2021), which particularly emphasize identification issues arising from using a revenue elasticity in place of the output elasticity, and that product demand might be sensitive to changes in the input bundle.

Instead of relying on the ratio estimator, in our study we explicitly model the firms' markups on the output elasticity relative to the revenue elasticity. Thus, we avoid both the Bond et al.-critique and the point made by many authors (e.g., Dobbelaere and Kiyota, 2018; Syverson, 2019; Dobbelaere and Wiersma, 2020) that the product-market mark-up of the ratio-estimator, might be influenced by factor-market market power. For example, Du and Wang (2020) find that the minimum wage in China increases firm markup. Soares (2019) estimates price-cost margins and bargaining power in the European Union, finding that product and labour market imperfections

[1] The ratio estimator of a firm's mark-up is the ratio of the output elasticity of a variable input to that input's cost share in revenue.

are positive and strongly correlated. Our estimations utilise the recent development of multi-product production function estimation (Dhynes et al., 2021), based on the Ackerman et al. (2015) approach to estimation of production functions. Furthermore, our analysis pertains to Norwegian exporters only, thus avoiding the danger that input changes in Norway affect the product demand in foreign countries. Given consistent estimates of exporting firms' mark-up on their exporting products for the period 2007-15, we then relate these mark-ups to public trade policies such as the free-trade agreement.

Next, we explore the relationship between the establishment of free-trade agreements on classical firm performance measures such as the operating margin and return on assets. We even provide insights into how these free-trade agreements have changed the structure of Norwegian exports.

Finally, we study how these free-trade agreements influence firms' pay policies and affect workers' hourly wages. To answer this question, we draw on insights from the theoretical models of Dobbelaere and Kiyota (2018) and Kaplan and Zoch (2022), while using empirical job level wage information for those employed by these Norwegian exporters.

We do not argue that Norwegian exporters constitute a random sample of firms. For example, De Loecker and Warzynski (2012) observed that exporters tend to have higher markups than non-exporters, and they related this to higher productivity of exporters compared to other firms. Firms in the food-processing sector with a greater ability to discriminate across markets mark their products up even more (Gullstrand et al., 2013). Dobbelaere and Kiyota (2018) observe that Japanese exporters are more likely to be found in product markets characterised by imperfect competition, and they are more likely to share rents based on the bargaining power of workers. However, for our purpose they seem ideal since by restricting analyses to these firms one solves the identification issues as well as can address highly important policy questions. Usually when addressing firm responses to public policy reforms, one faces the potential endogeneity arising from the fact that the reforms are responses to problems expressed by firms, thus the reforms follow from the behaviour of firms. In our case, public policy reforms and business cycle variations in foreign export markets can hardly be attributed to the behaviour of Norwegian firms. Thus, we can measure the impact of these on Norwegian exporting firms' markup without having to worry about a potential endogeneity bias. To summarise, we argue that these benefits by far out-weight the cons of non-random-sampling, and we have no intention of drawing inference on domestic non-exporting firms.

The structure of the remainder of the paper is as follows: Section 2 briefly reviews the previous literature. Section 3 describes the institutional background and free-trade agreements. Section 4 describes the data. The theoretical motivation is presented in Section 5. Section 6 presents the empirical strategy related to estimation of mark-up of price over marginal costs. Section 7 presents the result regarding the impact of free-trade agreement on mark-ups, while Section 8 present the corresponding results on firm performance. In Section 9, we then study the impact of free-trade agreements on hourly wages. Section 10 briefly concludes.

2 Previous literature

The impacts of trade liberations have been widely analysed in the trade economics literature. However, also exchange rate fluctuations and business cycle variations have received considerable attention. Both these phenomena might cause changes to the price-cost margin, i.e., firms' mark-ups. Usually one identifies low degree of exchange rate pass-through to consumers (e.g., Feenstra et al., 1996), but this have for decades been linked to imperfect competition and market power (Krugman, 1987; Goldberg and Knetter, 1999; Gross and Schmitt, 2000; Brissimis and Kosma, 2007). Recently, however, Amiti et al. (2014) have linked this low degree of exchange rate pass-through to the fact that large exporters are simultaneously large importers, and that firms with high import shares and high market shares have low exchange rate pass-through. On Belgian data, they actually find that small non-importing firms have almost complete pass-through. These small firms exhibit also no strategic complementarities in price setting, in contrast to a typical firm which adjust its price with an elasticity of 0.4 in response to it competitors' prices changes and an with an elasticity of 0.6 in response to its own shocks (Amiti et al., 2019). Finally, regarding the issues of exchange rates, motivated by the pricing-to-market (PTM)-literature, Asprilla et al. (2019) find that a depreciation of 10 percent on a given market yields a 1.4 percent cut in home-currency price for export, implying incomplete pass-through to prices.

There appears a consensus in the literature that increased stringency of product market regulations are associated with smaller firm size, lower productivity and less investments (Egbert, 2016; Andrews and Cingano, 2014; Alesina et al., 2015), but the empirical evidence beside the impact of entry barriers is not overwhelming. Using Ethiopian census data, Damoah et al. (2021) show that increased product-market markup dispersion is associated with lower entry rates into the markets. However, entry barriers are clearly bad for productivity (Schivardi and Viviano, 2011; Maican and Orth, 2015, 2018), bad for employment (Bertrand and Kramarz, 2002; Viviano, 2008) and strongly influence market structure (Sadun, 2015).

Several authors have pointed out that regulations governing labour market and product markets are interconnected in how they affect the economy. For example, Griffith et al (2007) find that increased competition reduces unemployment, more so in countries with labour market institutions that increase worker bargaining power. Fiori et al. (2012) similarly observe that product market deregulations are more effective at the margin in raising employment, when labour market regulation is high.

Product-market markups are also increasing over time. For example, a recent study on US data from 1950 to today, De Loecker et al. (2020) identify that the mark-ups of firms started to increase over time from the 1980s, and this increase has been particularly driven by the growth in prevalence of high mark-up firms. Van Reenen (2018) argues that this follows from a "winner take most/all" transformation of industries, due to globalisation and technology, and is not caused by weakened competition, relaxed anti-trust rules or rising regulation. This argument is further elaborated by Autor et al. (2020), who find that industries will be increasingly dominated by superstar firms and the aggregate mark-up will rise more than the typical firm's mark-up.

Finally, who benefits, if any, from rising product-market mark-ups? The empirical evidence is limited. In many models, the product-market mark-up appears negatively related to wages (Syverson, 2019; DeLoecker et al., 2020). Even when taking into consideration efficient bargaining and monopsonistic wage setting by employers, such a negative relationship appears. Kaplan and Zoch (2022) develop and test empirically a model implying that increasing mark-ups benefits downstream expansionary workers, while those defined as upstream production workers are less lucky.

3 Institutional background

Norway negotiated free trade agreements with other countries primarily through the European Free Trade Association (EFTA). Of 29 bilateral agreements with 41 countries, 27 are negotiated with the other EFTA-countries. EFTA is an inter-governmental organisation established in 1960. Since then, the European Union (EU) has absorbed six of ten EFTA members. Today, EFTA consists of Iceland, Liechtenstein, Switzerland and Norway. All except Switzerland are members of the European Economic Agreement (EEA) with EU. EFTA was founded on the premise of free trade as a means of achieving growth and prosperity amongst its Member States as well as promoting closer economic co-operation between the Western European countries. Furthermore, EFTA was created to be an alternative to the EC's (EU) ambitions on economic integration. EFTA's negotiations with third party countries secure that EFTA businesses enjoy the same rights and privileges as businesses from the EU in third country markets. In recent times, the EFTA states have prioritised negotiations based on economic considerations, regardless of the EU's trade relations with the third party country in question. The free trade agreements secure Norwegian access to international markets and facilitate trade with partner countries. Therefore, they are an important part of the Norwegian trade policy.

One of the main priorities of Norwegian trade policy is to increase market access for manufactured goods, fish, and services. Norway exports about 40 per cent of its goods and services. The main export products are oil, gas, minerals and seafood. Norway is among the world leaders in a wide range of industries such as energy, environment technology, aquaculture, maritime industries, hydropower, technology and telecommunications. Norway's highly educated population and the development of pools of expertise make the export of services increasingly important for the Norwegian economy. By 2020, Norway has trade agreements, partly together with the other EFTA-countries, with Albania, Bosnia-Hercegovina, Canada, Chile, Colombia, Costa Rica, Guatemala og Panama, Equador, Egypt, Philippines, Gulf Cooperation countries, Hong Kong, Indonesia, Israel, Lebanon, Jordan, North-Makedonia, Mexico, Montenegro, Palestine, Peru, Serbia, Singapore, South-Korea, Botswana, Lesotho, Namibia, South-Africa, Swaziland, Tunis, Turkey, Ukraine and the EU countries. During our period of observation, 2005-2018, Norway entered into free trade agreements with many countries. Information on Norwegian free trade agreements taken from the web pages of the Norwegian government.[2] Table 1 lists information on these agreements.

Finally, our period of observation is 2005-2018, and we are to study the impact of Norway entering into free trade agreements during this period. Norway is a small open economy, and Norway have established free-trade agreements since World War II with many countries. In our analyses, we have excluded firms exporting to countries where Norway has established agreement in the nineties and earlier in the 2000s. Our control group thus comprises firms exporting to

[2] See https://www.regjeringen.no/no/tema/naringsliv/handel/nfd---innsiktsartikler/frihandelsavtaler/partner-land/id43884.

countries where trade agreements were put in place for over 30 years ago (eg., the original EU-countries, EFTA-countries) or those that do not have an agreement. In addition to the time argument, a separate argument for this, is that the integration of Norway and the other EFTA-countries into the inner market of EU is something different than a standard trade agreement.

Table 1 Free-Trade Agreements between Norway and trading countries outside the European Economic Area 1990-2018

Country	Signed	In force	Country	Signed	In force
Albany	17.12.2009	1.8.2011	Lebanon	24.6.2004	1.1.2007
Bosnia-Herzegovina	24.6.2013	1.1.2015	North-Macedonia	19.6.2000	1.5.2002
Canada	26.1.2008	1.7.2009	Morocco	19.6.1999	1.12.1999
Chile	26.6.2003	1.12.2004	Montenegro	14.11.2011	1.11.2012
Colombia	25.11.2008	1.9.2014	Palestine	30.11.1998	1.7.1999
Costa Rica	24.6.2013	19.8.2014	Panama	24.6.2013	19.8.2014
Ecuador	25.6.2018	(1.11.2020)	Mexico	27.11.2000	1.7.2001
Egypt	27.1.2007	1.8.2007	Peru	24.6.2010	1.7.2012
Philippines	28.4.2016	1.6.2018	Serbia	17.12.2009	1.7.2011
Georgia	27.6.2016	1.9.2017	Singapore	26.6.2002	1.1.2003
Guatemala	24.6.2013	19.8.2014	South Korea	15.12.2005	1.9.2006
Bahrain	27.6.2009	1.7.2014	South Africa	1.6.2006	1.5.2008
United Arabic Emirates	27.6.2009	1.7.2014	Botswana	14.7.2006	1.5.2008
Kuwait	27.6.2009	1.7.2014	Lesotho	7.8.2006	1.5.2008
Oman	27.6.2009	1.7.2014	Namibia	14.7.2006	1.5.2008
Qatar	27.6.2009	1.7.2014	Swaziland	7.8.2006	1.5.2008
Saudi-Arabia	27.6.2009	1.7.2014	Tunis	17.12.2004	1.8.2005
Hong Kong	21.6.2011	1.12.2012	Turkey	10.12.1991	1.4.1992
Indonesia	16.12.2018	(1.11.2021)	Ukraine	24.6.2010	1.6.2012
Israel	17.9.1992	1.1.1993			
Jordan	21.6.2001	1.9.2002			

Note: The European Economic Area (EEA) unites the EU member states and the three EEA-EFTA states (Iceland, Liechtenstein and Norway). In the early 2000, EU comprised the following countries: Denmark, Ireland, UK, Greece, Portugal, Spain, Austria, Belgium, France, Italy, Luxembourg, Netherlands, Germany, Finland (1995) and Sweden (1995). In the first round of EU enlargement, in 2004, the following countries joined the EU: Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Slovenia, Hungary, Malta, and Cyprus. In 2007, Bulgaria, Rumania and Croatia joined the union.

4 Data

The primary data set we use is the Statistics Norway's Structural Statistics linked to the Accounting Registers. The Structural Statistics provide information on value added (operating income less operating costs, wage costs, depreciation and rental costs) and industry for almost all workplace and firms in Norway. Most private-sector firms are required to report to the Accounting registers (all limited liability firms, not single-person firms and foundations). From this register, we get information on capital assets, investments, depreciation, and return-on-assets. Capital is measured as total assets. From the merged data set we then information on key firm characteristics such as value added, capital, different kinds of costs and revenues, employment and industry-code (5-digit). It is linkable to the other data by a firm-specific identifying number

Then, we link these data to the Export and Import Register, comprising information on exporting and importing goods. Each transaction (import or export) is registered, type of product, the value, with the destination country (exports) and the country of origin (imports). For each product, we always know weight of the exported goods, sometimes the quantum if this is the relevant unit (for a couple of percent of the transactions, the transactions are measured in volume), depending on the product. For example, although product such as air compressors, optical instruments, bras and bathing suits are measured in quantum in addition to weight, products such as copper debris, flour, butt-welding pipe-fittings are measured by weight. Close to 80 percent of the export has weight-based units. Thus, in the regression analysis, we use weight in kilo as our universal measure of the quantum. For goods imported, we know the transportation costs, thus from the importers declarations, we can measure the transportation cost per kilo to each country and use this measure in our analyses of the exporters.

By linking these data to the Central Population Register and the Tax Authorities Registers of jobs (through the firm identifying number), our data comprise a full panel of firms and their employees, with detailed information on workers and firms. For example, data comprise weekly working hours and job-spell specific earnings, thus making it possible to derive hourly wages. Note also that the earnings reported to the Tax Authorities comprise taxable fringe benefits.

In auxiliary regressions before our analyses, all firm level variables are a priori residualized taking into account year and detailed industry variation (based on the Frisch-Waugh-Lovell theorem).

Finally, we utilise data from OECD, World Bank and ILO. From the OECD (https://stats.oecd.org), we use information on product market regulation index (PMR index) and the Labour Force Employment index (100=2015). The PMR index is described in detail in Koske et al (2015). It is based on questionnaires responded by OECD-countries and 21 major non-OECD countries 2008 and 2013, comprising several hundred questions on different aspects of product market regulations. The economy-wide PMR indicator is constructed by first assigning numerical values assigned to each question and aggregate these into 18 low-level indicators. These low-level indicators are then aggregated into seven mid-level indicators, which are in turn aggregated into three high-level indicators. At each step of aggregation, the composite indicators are calculated as weighted averages of their components. The aggregate PMR indicator is the simple average across the three high-level indicators state control, barriers to entrepreneurship and barriers to trade and investment. From the World Bank (https://data.worldbank.org/indicator/PA.NUS.FCRF) we use yearly average data on official exchange rates (LCU per US$). Annual country employment (in 1000) is downloaded directly from ILO (https://ilostat.ilo.org/topics/employment/).

5 The relationship between wages and price-cost mark-ups

In a simple competitive model of wage determination, where employers set wages equal to the value of marginal product of labour, the product-market mark-up appears negatively related to wages (Syverson, 2019; DeLoecker et al., 2020).

Consider a firm producing an output Y by factors of production, L, K, and M, with a technology F, i.e., $Y=\min\{F(L,K,\omega), \beta M\}e^{\xi}$. L and K will typically represent labour and capital, respectively, while ω expresses a productivity term. The function βM expresses intermediates and transport associated with export, which together with F expresses a Leontief-production function. Thus, we impose a strong complementarity between intermediates and labour, while labour and capital characterised by substitutability. F is continuous and twice differentiable with respect to its arguments. While L, and M are free of adjustment costs, K is predetermined in the short run. The firm buys these factors in perfectly competitive markets, paying w and r for each unit of labour and capital, while m expresses the unit cost of intermediates and transport abroad. Assuming a competitive labour market, w is taken for granted and the firm maximises short-run profits by choosing L (due to the Leontief-function, every solution will have to satisfy M=Y/β).

In addition, the firm faces an inverse product demand curve, P(Y). This implies that the firm's revenue can be expressed by: R(Y)=P(Y)Y. Furthermore, this also means that the firm's output elasticity with respect to L can be expressed $\epsilon_L^R = \frac{\partial R}{\partial L}\frac{L}{R}$ but that since Y is a function of L (and K in the long run) and P depends on Y, this expression can be rearranged to $\epsilon_L^R = \epsilon_L^Y + \epsilon_L^P = (1+\epsilon_Y^P)\epsilon_L^Y$, i.e., one term expressing the output elasticity w.r.t. labour ($\epsilon_L^Y = \frac{\partial Y}{\partial L}\frac{L}{Y}$) and one term expressing the elasticity of the inverse demand curve ($\epsilon_Y^P = \frac{\partial P}{\partial Y}\frac{Y}{P}$). A cost minimizing firm will determine L (and K) by minimizing C(Y)=wL+rK w.r.t. the constraint Y≤F(L,K). From the first order conditions (standard Lagrange-cost minimization approach) and applying the envelope theorem, one can derive the standard price to marginal cost ratio: $\epsilon_L^R = \frac{\partial C(Y)/\partial Y}{P}\epsilon_L^Y$. Similarly, a profit maximizing firm chooses L to equate marginal profit to marginal costs, i.e, : $\frac{\partial R(Y)}{\partial L} = \frac{\partial C(Y)}{\partial L}$, or rather $\frac{\partial C(Y)/\partial Y}{P} = 1+\epsilon_Y^P$. Thus, the markup of price relative to marginal costs is $= \frac{P}{\partial C(Y)/\partial Y} = \frac{1}{1+\epsilon_Q^P}$. Finally, this also show an alternative expression for the markup of price relative to marginal costs as the output elasticity of labour relative to the revenue elasticity of labour, i.e., $\mu = \frac{\epsilon_L^Y}{\epsilon_L^R}$. This also means that if λ expresses the standard Lagrange-cost minimization multiplier, which can be interpreted as $\partial C(Y)/\partial Y$, then wages can be expressed by the first order condition Equation 1):

1) $$W_C = \lambda\frac{\partial F(L,K)}{\partial L} = (1+\epsilon_Y^P)P\frac{\partial F(L,K)}{\partial L} = \frac{1}{\mu}P\frac{\partial F(L,K)}{\partial L} = \frac{1}{\mu}\frac{PY}{L}\epsilon_L^Y.$$

We see that by differentiating Equation 1) by μ then we find $\frac{\partial W_C}{\partial \mu}$<0, i.e., as the mark-up increases, the share that goes to workers is reduced. This is the standard result (Syverson, 2019; DeLoecker et al., 2020).

What if wages are not set competitively? Dobbelaere and Kiyota (2018) derive wages both under the assumption of efficient bargaining with risk-neutral workers and risk-neutral employers and for wages set by monopsonistic employers.[3] The wage-setting in Norway is defined by Oecd (2018) as *Organised decentralised and Co-ordinated*. Sector-level agreements are important, with coordination across sectors and bargaining units, but with room for lower-level agreements. Local bargaining in addition to sector-level bargaining is particularly common in manufacturing, and it is reasonable to assume that our exporting firms set wages through bargaining.

In the case of efficient bargaining, Dobbbelaere and Kiyota derive the two first order conditions by maximizing the generalised Nash product w.r.t. wages and labour. The first order condition for wages can be expressed as:

2) $$W_B = W_A + \frac{\gamma}{1-\gamma}\left[\frac{R - W_B L}{L}\right],$$

where γ expresses the part of the economic rents that goes to the workers, and W_A expresses these workers outside options. The first order condition for labor can be expressed as:

3) $$W_B = \frac{\partial R}{\partial L} + \gamma\left[\frac{R - \frac{\partial R}{\partial L} L}{L}\right].$$

Solving Equation 2) and 3), yields an equilibrium condition of $W_A = \frac{\partial R}{\partial L}$. Inserting this in Equation 2), makes it possible to re-express Equation 1) as:

4) $$W_B = \left\{\frac{1}{\mu}\epsilon_L^Y + \theta\right\}\frac{1}{1+\theta}\frac{PY}{L}, \theta = \frac{\gamma}{1-\gamma}.$$

We see that by differentiating Equation 4) by μ, then we find $\frac{\partial W_B}{\partial \mu} = \frac{1}{1+\theta}\frac{\partial W_C}{\partial \mu}<0$, i.e., as mark-ups increases, the share that goes to workers is reduced, but the negative impact is offset by stronger workers during the bargaining process.

[3] In their case, they do not apply the Leontief function, but let intermediate factors enter the production function as a substitute to labour in the short run.

What if wages are set by monopsonistic employers? In this case, Dobbbelaere and Kiyota (2018:202) derive an expression for wages (using the same notation as above) given by Equation 5) as:

$$W_M = \frac{1}{\mu} \epsilon_L^Y \frac{PY}{L} \left\{ \frac{\epsilon_W^L}{1+\epsilon_W^L} \right\}, \qquad (5)$$

where ϵ_W^L expresses the elasticity of labour supply w.r.t. wages facing the firm. Under monopsony, ϵ_W^L is finite and the labour supply curve is upward sloping. Under a perfectly competitive labour market, ϵ_W^L goes towards infinity, and Equation 5) is reduced to Equation 1). By differentiating Equation 5) by μ, then we find $\frac{\partial W_M}{\partial \mu} = \left\{ \frac{\epsilon_W^L}{1+\epsilon_W^L} \right\} \frac{\partial W_C}{\partial \mu} < 0$, i.e., as mark-ups increases, the share that goes to workers is reduced, but the negative impact is offset the less elastic the labour supply facing each firm is.

In these wage-setting scenarios, the mark-up of firms is negatively related to the level of wages. It is possible to provide a contrasting view. The Kaplan and Zock (2022)-model describes an economy comprising two kinds of producers: a wholesaler producing upstreams and a retailer, selling goods downstream, which both set wages competitively (the model can easily be adapted to taking into account employer monopsonistic wage setting behaviour or one firm determining wages differently upstreams and downstreams). The key point is that the downstream seller is able to sell the products to consumers at a mark-up on marginal costs, while this is not possible for the upstream producers. This "hurts" wages of the upstream workers, while the wages of downstream workers benefits.

Finally, how do we expect our exporters react to the establishment of free-trade agreements with countries that these exporters already export to? We can model this as if the price of intermediates drops. In a more evolved model, Kroft et al (2022: A2), the derive the profit-maximising first-order condition solved as a function of labour only. Let p_m denote this price, and let F be given by a Cobb-Douglas function. From the standard cost minimization problem given

Cobb-Douglas production function and competitively set wages, we know that $W_C/r=(\alpha_L K/\alpha_K L)$. Thus, F can be expressed as F(L, K)= $A\left[\frac{\alpha_L W_C}{\alpha_K r}\right]^{\alpha_K} L^{\alpha_L+\alpha_K}$. Utilising the Leontief-structure and the demand for intermediates, we can write total costs as a function of labour only, i.e.,

6) $$W_C L + rK + p_M M = \left[1+\frac{\alpha_K}{\alpha_L}\right] W_C L + \frac{p_M}{\beta_M}\Phi L^{\rho},$$

where $\Phi= A\left[\frac{\alpha_L W_C}{\alpha_K r}\right]^{\alpha_K}$ and $\rho = \alpha_L + \alpha_K$. From Kroft et al. (2022), the inverse product demand function can be expressed as $P = pQ^{-\varepsilon}$, where P and Q denote the product price and the product demand, respectively, p is a parameter expressing aggregate price index in the importing country, and $\varepsilon>0$. Thus, firm profits, Π, in terms of labour can be expressed as:

7) $$\pi = p[\Phi L^{\rho}]^{1-\varepsilon} - \left[1+\frac{\alpha_K}{\alpha_L}\right] W_C L - \frac{p_M}{\beta_M}\Phi L^{\rho},$$

which yields first-order condition:

8) $$p\Phi^{1-\varepsilon}\rho(1-\varepsilon)[L]^{\rho(1-\varepsilon)-1} - \rho\frac{p_M}{\beta_M}\Phi L^{\rho-1} = \left[1+\frac{\alpha_K}{\alpha_L}\right] W_C$$

Note that Equation 8) can be rearranged into:

9) $$\left\{p\Phi^{1-\varepsilon}\rho(1-\varepsilon)[L]^{-\rho\varepsilon} - \rho\frac{p_M}{\beta_M}\right\}\Phi L^{\rho-1} = \left[1+\frac{\alpha_K}{\alpha_L}\right] W_C,$$

which implies that when differentiating Equation 9) yields:

10) $$\frac{dL}{p_M} = -\frac{L^{\rho\varepsilon+1}}{(1-\varepsilon)\beta_M p\rho(1-\varepsilon)\Phi^{-\varepsilon}} < 0,$$

i.e., higher price of intermediates such as transportation, reduces the demand for labour. Thus, if the establishment of a free-trade agreement only affects the price of intermediates by reducing this price, then we would expect labour demand to increase and production (export) to rise. However, a free-trade agreement between two or more countries, might also affect the number of competitors present in the importing country, thereby not only affecting the aggregate price index p but also ε. At the end of the day, this will have to be resolved empirically.

6 The estimation of the mark-up of price over marginal cost

In a single product-setting, De Loecker and Warzynski (2012) estimate Cobb-Douglas- and Translog-production function based on revenues using the control function approach of Ackerberg et al (ACF)(2015), as the starting point when they derived their empirical measure of firm's mark-up, which has been applied in numerous studies (e.g., Dobbelaere and Kiyota, 2018; Peters, 2020; De Loecker et al.., 2020; De Ridder et al., 2021). They simply divided the estimated parameter associated with labour on the labour cost share of sales, and then multiplied an adjustment factor based on the residuals from the estimation of the production function. By doing so they established an empirical measure of firms' mark-up without having to introduce any assumption on product market competition except that the firms should be cost minimizing. This estimator is called the *Ratio estimator*.

Recently, however, this approach has been criticized (Bond et al, 2020; Doraszelski and Jaumandreu, 2021) since it rests on price. Although a universal aggregate across products, firm revenues comprise aggregated over prices and quantum. Since we analyze the markups of exporters and thus have explicit knowledge of the weight that is produced or more specifically, the weight of what is exported, we can utilize weight as another aggregate across products, and this avoids the critique above.

To derive an empirical measure of the mark-up, our starting point is, as pointed out by Bond et al. (2022), that the markup of price relative to marginal costs can always be expressed as the output elasticity of labour relative to the revenue elasticity of labour, i.e., $\mu = \frac{\epsilon_L^Q}{\epsilon_L^R}$. Similarly, if the production function F(.) introduced in Section 5 had comprised other freely adjustable factors of productions, the relative elasticities of these could have expressed the mark-up. We propose to measure the mark-up as $\mu = \frac{\epsilon_\omega^Q}{\epsilon_\omega^R}$, i.e., the weight total factor productivity relative to the revenue total factor productivity.

In a single product-setting, estimation of revenue total factor productivity is fairly established. For example, we can estimate a simple Cobb-Douglas production function, expressed as Equation 11):

$$lnY_{it} = \beta^L lnL_{it} + \beta^k lnK_{it} + \gamma_t + \omega_{it} + \varepsilon_{it}, \quad (11)$$

Y is value added for firm i at time t, ω_{it} is a firm-specific productivity level known to the workplace as they choose the level of transitory inputs and make decisions depending union density, but not observed by us, γ_t represents technological change, L expresses labour, K is capital, and ε is a stochastic term representing idiosyncratic shocks that are unknown to the firm when it makes its decisions.

The classical estimation problem associated with 11) is the *endogeneity of transitory inputs*. This is solved by the control function approach of ACF, where we include a proxy for time-varying productivity, ω_{it} , using lagged values of capital and materials (including exporting/transport costs) and their interactions (third order polynomial) directly in the production function (as implemented by Rovigatti and Mollisi (2018). ACF consistently estimates 11) even if labour and materials are allocated simultaneously at time t, after the productivity shock. Implicitly it is assumed that firms observe their productivity shock and adjust intermediate inputs such as materials according to optimal demand conditional on the productivity shock and the state variable(s).[4] Capital is treated as the state variable, where capital evolves following an investment policy, determined at time t-1. Time varying productivity, ω_{it}, evolves following a first-order Markov process: $\omega_{it} = E(\omega_{it} \mid \Omega_{it-1}) + \xi_{it} = E(\omega_{it}, \mid \omega_{it-1}, u_{it-1}) + \xi_{it} = g(\omega_{it-1}, u_{it-1}) + \xi_{it}$.

However, free-trade agreements affect exporters only when they export to the involved countries, and exporters might export to many countries (most do so). This create a multi-product

.[4] Gandi et al. (2020) show that applying this approach to the estimation of gross production function (in contrast to value added production functions) requires additional sources of variation in the demand for flexible inputs (e.g., prices) to successfully achieve identification. In our regressions later, our analyses utilise information on the country-specific export/import transportation costs.

setting. We follow Dhynes et al (2021), who show how to apply the ACF-framework to estimation of multiproduct production functions. This replace Y with a transformation g(Y_1, .., Y_n), which in the case of three products, can be represented by $A_y Y_1^{\theta 1} Y_2^{\theta 2} Y_3^{\theta 3}$ (θ_1=export to country c, θ_2=export to all other countries, and θ_3 =domestic sales). Then we transform Equation 11) to Equation 12), where we have normalized the output with respect to the export value to country c to 1:

$$(12) \qquad lnR_{cit}^{exp} = \beta^L lnL_{it} + \beta^k lnK_{it} + \beta^{RD} lnR_{it}^{dom} + \beta^{RE} lnR_{E\not\ni c,it}^{export} + \gamma_t + \omega_{cit}^R + \varepsilon_{cit}$$

where lnR_{cit}^{exp} , $lnR_{E\not\ni c,it}^{export}$ and lnR_{it}^{dom} express log export value to country c, log aggregated export value to all other countries than c and log sales to domestic marked, respectively. The latter two are obviously endogenous variables, and we instrument these by their lagged values. Otherwise, the estimation follows a standard approach, but note that our proxy based on intermediate goods incorporate country-specific export and transport costs, i.e., it varies over both across firms and within firms between export countries. The time varying productivity, ω_{cit}, evolves following a first-order Markov process: ω_{cit} = E(ω_{cit} | Ω_{it-1}) + ξ_{it} = E(ω_{cit}, | ω_{cit-1}, lnR_{it-1}^{dom}, $lnR_{E\not\ni c,it-1}^{export}$) + ξ_{cit}=g(ω_{cit-1}, lnR_{cit-1}^{dom}, $lnR_{E\not\ni c,it-1}^{export}$)+$\xi_{cit}$. Thereby we can measure productivity changes conditional on the level of the endogenous variable. The estimation of 12) yields a set of estimated parameters, among others also the country-specific total factor productivity, $\widehat{\omega_{cit}^R}$, for each firm at time t.

From the exporting declaration, we know whether the product that is exported, is sold as truly quantum (cars, computers, bras), as weight (e.g., flour, grain, ferro-silicon) or volume (oil- and gas). 80 percent of the export is primarily by weight, and we know the export weight even when the declaration indicates that the product is sold in quantum or volume. For our purpose this does not matter, the important distinction is that this is not expressed in the form of revenue, which comprises prices.

Thus, we re-estimate Equation 13), but where we replace lnR_{cit}^{exp} with lnQ_{cit}^{exp}, i.e., log weight exported to country c. Thus, we estimate Equation 13):

$$13) \qquad lnQ_{cit}^{exp} = \alpha^{L} lnL_{it} + \alpha^{k} lnK_{it} + \alpha^{Q} lnQ_{it}^{dom} + \beta^{Q} lnQ_{E\not\ni c,it}^{export} + \gamma_t + \omega_{cit}^{Q} + \varepsilon_{cit},$$

where lnQ_{cit}^{exp} , $lnQ_{E\not\ni c,it}^{export}$ and lnQ_{it}^{dom} express log export weight to country c, log aggregated export quantum to all other countries, and log approximated weight to domestic marked (approximated by the average weight-revenue relationship across all export countries for a firm), respectively. The estimation of 13) yields a set of estimated parameters, among others also the country-specific total factor productivity, $\widehat{\omega_{cit}^{Q}}$, for each firm at time t.

Table 1 presents the results from estimating the Cobb-Douglas production functions applying the approach of Ackerman et al. (2015) and Dhynes et al. (2021). Descriptive statistics on key measures on the firmXexport country panel data set is presented in Table A1.

The first three models present the results from where the dependent variable expresses log exporting revenue. Model 1 shows the parameter estimates of the basic Cobb-Douglas production function excluding log domestic sales and log export to other countries. In Model 2, we add log domestic sales and log export to other countries to the regression as exogenous controls, while in Model 3 we treat log domestic sales and log export to other countries as endogenous variables instrumented by their lagged values.

We see that adding log domestic sales and and log export to other countries to the regressions, increases the elasticities of labour and capital. As expected, the parameter associated with log domestic sales and log export to other countries are negative, significant, implying a positive contribution to total production. Under an assumption of constant elasticity of scale, $1=\theta_1+\theta_2+\theta_3$, thus our estimates from Model 3 imply $\theta_1=0.66$, $\theta_2=0.26$ and $\theta_3=0.07$.

The final three models present the results from where the dependent variable expresses log exporting weight. These parameters resemble the estimated parameters associated with revenue, but particularly the parameter associated with log export to other countries is clear more negative.

Table 1 Estimation of firms' Cobb-Douglas production functions

		Revenue			Weight	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Ln L	0.336**	0.456**	0.513**	0.442**	0.542**	0.588**
	(0.002)	(0.037)	(0.001)	(0.007)	(0.103)	(0.001)
Ln C	0.259**	0.239**	0.367**	0.169**	0.468**	0.398**
	(0.016)	(0.036)	(0.002)	(0.045)	(0.127)	(0.013)
$LnR^{all\ other\ countries}$	0.336**	-0.252**	-0.395**			
	(0.002)	(0.023)	(0.002)			
$LnQ^{all\ other\ countries}$	0.259**				-0.293*	-0.508**
	(0.016)				(0.121)	(0.001)
$LnR^{domestic}$		-0.030**	-0.107**			
		(0.004)	(0.006)			
$LnQ^{domestic}$					-0.003	-0.120**
					(0.061)	(0.007)
Instruments:			Lagged LnR^{dom} Lagged $LnR^{all\ other\ countries}$			Lagged LnQ^{dom} Lagged $LnQ^{all\ other\ countries}$
FXC	20071	20071	20071	20071	20071	20071
N (FxT)	109545	109545	109545	109545	109545	109545

Note: Unit of observation: export destination country(C)Xfirm(F). Population: All exporting manufacturing firms 2005-2018 with at least 3 employees. All variables are apriori residualized taking into account year and detailed industry variation (based on the Frisch-Waugh-Lovell theorem). Dep. Variable: Model 1-3: Log revenue from exports to country C; Model 4-6: Log quantum exported to country C. Controls: lnL and lnC express log employment and log capital, respectively. $LnR^{domestic}$ expresses log domestic revenue. $LnQ^{all\ other\ countries}$ expresses log aggregated quantum exported to other countries. $LnQ^{domistic}$ expresses log aggregated domestic quantum. $LnR^{all\ other\ countries}$ expresses log aggregated export revenue to other countries. In Model 3 and 6 these is instrumented by their lagged values. Method: Estimation of the production function is based on Ackerberg et al (2015) and Dhymes et al (2020) control function approach for multiproduct production (see text). Standard errors are adjusted for firm clustering and presented in parentheses. ^{x}, * and ** denote 10, 5 and 1 percent level of significance, respectively.

The estimates from Model 3 and 6 can then be used to derive a measure expressing the market power of firm i in country c. More specifically, from Model 3 and 6 (Equations 7 and 8), we get country-specific estimates of revenue and weight total factor productivity, i.e., $\widehat{\omega}^R_{cit}$ and $\widehat{\omega}^Q_{cit}$, respectively. Then, we define the firm-and export country-specific mark-up as:

14) $$\hat{\mu}_{cif} = \frac{\widehat{\omega}^Q_{cit}}{\widehat{\omega}_{cit}},$$

i.e., the mark-up of price on marginal costs related to the country the goods are exported as the output total factor productivity relative to the revenue total factor productivity.

This approach does not require information on the market structure in the country that these firms' goods are exported to. Furthermore, data are often limited in that they do not split cost into the different markets. This approach does not require such splitting.

In Table 2 we show the development over time in the how the average mark-up develops over time, as well as some other key explanatory variables such as product market regulations, log exchange rate, free trade agreements and information on firms' exports. We also present yearly statistics on key variables from the firm- panel and job panel data, which will be applied to analyses in Sections 8 and 9. Since the estimation of the markup rest on lagged values and our observation period begins in 2005, Table 2 starts in 2006.

Table 2 Development of firm and worker outcomes, market conditions and free trade agreements

	FirmXexport country							Firm			Job
Year	TFP-export units	TFP-export revenue	Export Mark-up	Product market regulation	Log exchange rate	Log destination-country employ-ment	Free-trade agree-ments	Return-on-assets	Free-trade	Export-share to free-trade country	Log hourly wages
2006	0.349	0.301	1.130	1.748	1.348	9.176	0.000	0.091	0.000	0.000	5.447
2007	0.472	0.423	1.131	1.749	1.380	9.219	0.018	0.116	0.069	0.005	5.481
2008	0.414	0.371	1.143	1.656	1.435	9.259	0.006	0.098	0.085	0.004	5.500
2009	0.215	0.174	1.174	1.669	1.411	9.276	0.012	0.033	0.109	0.007	5.517
2010	0.310	0.279	1.170	1.674	1.490	9.299	0.019	0.071	0.136	0.010	5.527
2011	0.371	0.327	1.162	1.684	1.573	9.339	0.000	0.068	0.117	0.008	5.565
2012	0.353	0.315	1.135	1.691	1.534	9.375	0.002	0.070	0.115	0.008	5.594
2013	0.388	0.360	1.110	1.693	1.559	9.388	0.018	0.061	0.0138	0.010	5.605
2014	0.381	0.329	1.111	1.693	1.565	9.400	0.000	0.077	0.127	0.008	5.613
2015	0.343	0.318	1.148	1.705	1.451	9.396	0.041	0.067	0.162	0.018	5.678
2016	0.448	0.390	1.126	1.704	1.531	9.384	0.000	0.060	0.153	0.015	5.651
2017	0.523	0.465	1.122	1.699	1.514	9.409	0.000	0.044	0.144	0.014	5.665

Note: Population: All exporting Manufacturing firms 2005-2017 with at least 3 employees. Cells of columns 2-4 of the table report yearly median across the export-to-countryXfirms-distribution. Cells of columns 5-7 of the table report yearly median across the export-to-countryXfirms-distribution. Cells in columns 8, 9 and 10) report the yearly mean across firms. Cells in the last column reports the yearly mean across jobs (workerXfirm). The country-specific mark-up expresses the firms' product market mark-up in a country based on TFP elasticities following Equations 7) and 8). Product market legislation is based on OECD stat PMI-index. Log exchange rate is measured in US $. Destination-country employment is based on ILO's employment figures for the country for which towards the products are exported (https://ilostat.ilo.org/topics/employment/). Information on free trade agreements, see https://www.regjeringen.no/no/tema/naringsliv/handel/nfd---innsiktsartikler/frihandelsavtaler/partner-land/id43884. . See https://stats.oecd.org for OECD data.

No strong pattern appears when it comes to the median mark-up on the exporting goods for these exporters, it varies roughly between 1.11 and 1.17. The product market regulations of the country these exporters export to appear similarly to be slightly diminishing indicating less regulations, while both the log destination-country exchange rate (in dollar) and the destination-country employment appear to increase, albeit weakly. New free trade agreements are not common, but the average number of affected firms at the firm-level increases over time. On one hand, the average return on-assets appears to diminish over time, particularly affected by the financial crisis in 2009. On the other hand, wages appear to grow. However, at this stage, we cannot infer a clear pattern between the free-trade agreements and the mark-ups, return-on-assets and wages. This will be the topics of the next sections.

7 The impact of free-trade agreements on firms' export and mark-ups

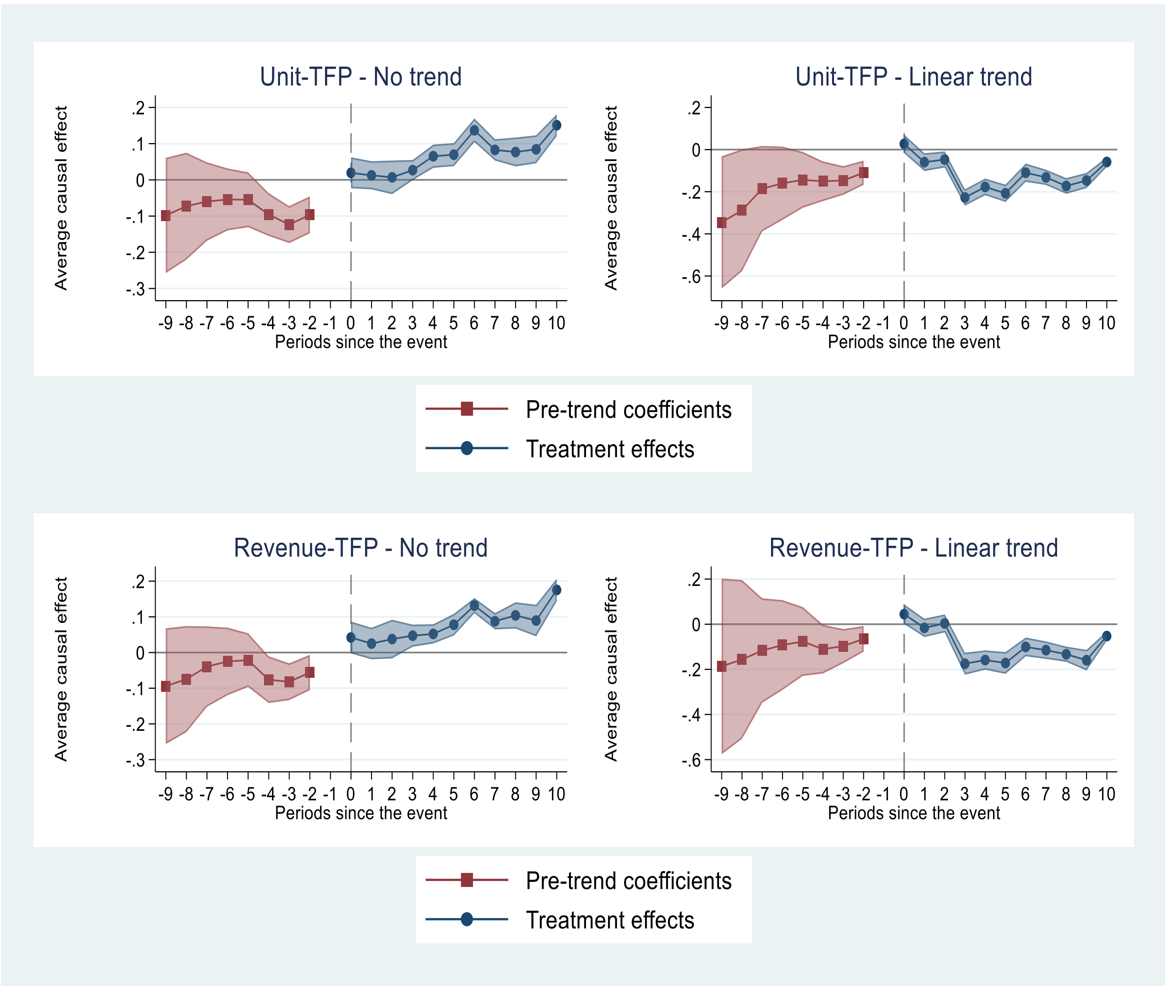
In this section, first we turn to the regression-analysis of mark-ups, i.e., the estimation of linear regressions of the firm's log mark-up on controls using detailed export data, i.e.

15) $$ln\hat{\mu}_{cft} = \delta_0 + \sum_{t=y-8}^{t=y-2} \delta_t B_{cft} + \sum_{t=0}^{t=y+8} \delta_t P_{cft} + \delta_c X_{cft} + t_t + \Delta_{ct} + \varphi_i + \nu_{cit},$$

where B_{cft} expresses a vector of dummies taking the value 1 for the 8 years before if a new free trade agreement with country c has come into action (we are excluding the year before the free trade agreement is signed), P_{cft} expresses a vector of dummies taking the value 1 for the 8 years after a new free-trade agreement with country c has come into action, , X_{cft}comprises a vector of other potential firm and country characteristics (if) needed for balancing, t_t expresses time dummies, Δ_{ct} express export market country fixed effects and linear time trends, φ_i expresses firm fixed effects, while ν_{cit} expresses a normal distributed error term. Thus, Equation 15) depicts a standard difference-in-difference regression in an event study form, with the additional complication that the free trade agreements (or treatments) are introduced staggered. Recently, the standard approach has been criticized for not taking into account spurious correlations arising when the same objects are part of both the control and treatment group over time (de Chaisemartin and D'Haultfœuille, 2020; Borusyak et al., 2021; Callaway and Sant'Anna 2021, Sun and Abraham, 2021). Our regressions are based on the IW-estimator of Sun and Abraham (2021).

We start our analysis by looking closer on how the total factor productivities from Section 6 are related to the establishment of free-trade agreements. These results are presented in form of Figure 1 and Figure2, which summarize the regression results presented in Table A4.

Figure 1 Free-trade agreements and the development of total factor productivity



Note: Population: All exporting Manufacturing firms 2005-2017 with at least 3 employees. Panel unit: FirmXImport Country. Figures are constructed from regression results presented in Table A4. The top half of the figure is based on models 1 and 2, while the bottom half is based on models 3 and 4.

In the first two models in Table A4, we estimate Equation 15) where we replace log mark-up as the endogenous variable by the total factor productivity from the weight regression in Table 1. Model 1 discards the export-country-specific linear trends, while Model 2 is identical to the one presented in Equation 15). In Figure 1, these results are presented in the upper half of the figure.

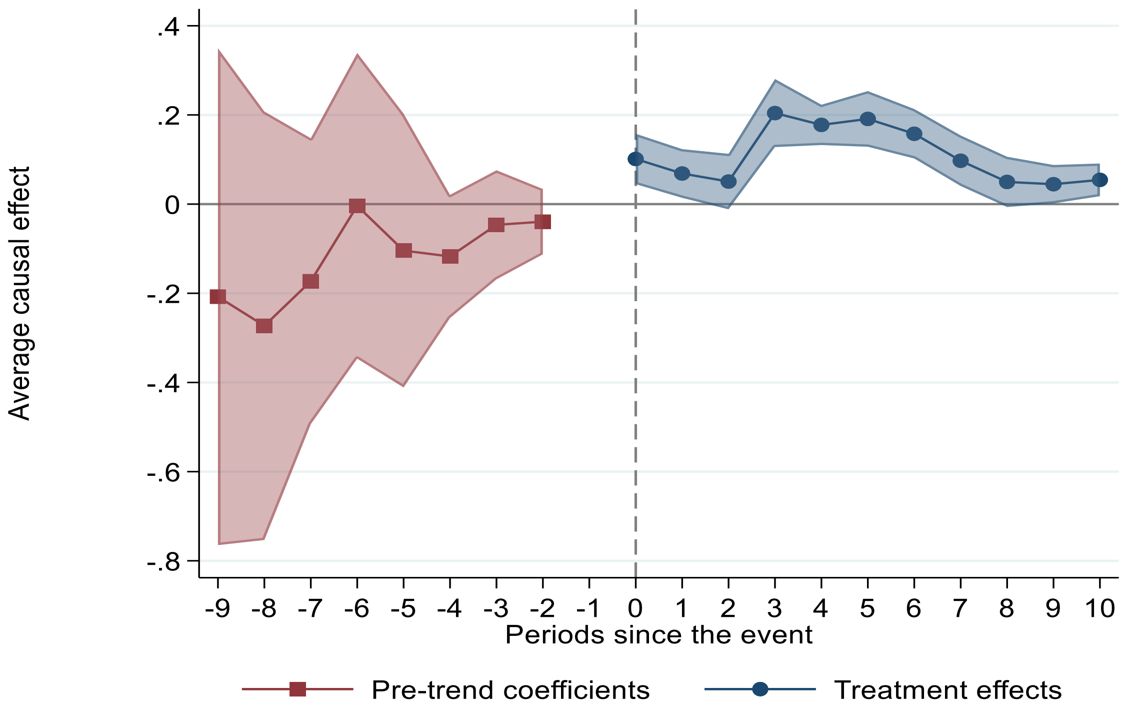
In the next two models in Table A4, we estimate Equation 15) where we replace log mark-up as the endogenous variable by the total factor productivity from the revenue regression in Table 1. In Figure 1, these results are presented in the lower half of the figure. Both for unit-tfp and revenue-tfp, we see tendency for upwards trends, which continue after the establishment of a free-trade agreement, but the pre- treatment-trends do not support this specification. When we take into account linear time trends, the linear trends after treatment disappear, and the impact of the free-trade agreement appears rather negative on both export revenues and export weight. This means that while the free-trade agreements make it easier (and thus cheaper) to export to these countries, firms already established as exporters to these countries apparently benefit less and react by less efficient export.

Finally, in Models 5 and 6 in Table A4, we address our key focus – how sensitive is firms' mark-up to free-trade agreements - by estimating Equation 15).[5] In Figure 1, we only present the results incorporating country-specific linear time trends. The six years before the free-trade agreements were established, we see no clear trend. When the free-trade agreement is introduced, the mark-up increases slightly to begin with, but after 3 years these firms receive a mark-up increase of nearly 20 percent. After 7-8 years, the markup diminishes once again. Still, this means that for several years after the establishment of a free-trade agreement, the firms to these agreements by increasing their markup. Thus, although the free-trade agreements should reduce the costs of exports implying reduced markups, the exporters at the same time potentially face stronger

[5] As a robustness check and for balancing purposes, we have estimated Model 6 in Table A2 incorporating control covariates associated with the destination country (product market regulation, log currency rate, log employment). This does not qualitatively change our results. Since these controls might be influenced by free-trade agreements, these analyses were conducted only for robustness reasons.

competition after the establishment of the free-trade agreement, and this would reduce the demand for their products, and they respond by increasing their markups.

Figure 2 Free-trade agreements and the development of the markup. Linear trend



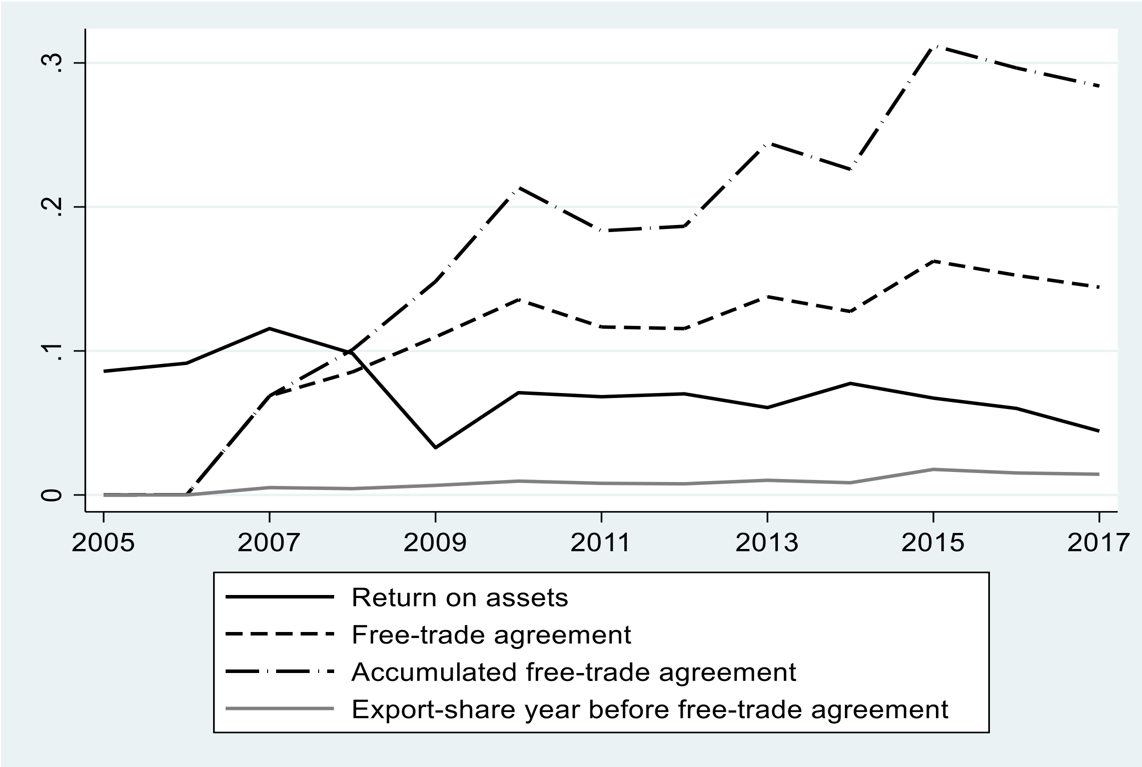
Note: Population: All exporting Manufacturing firms 2005-2017 with at least 3 employees. Panel unit: FirmXExport destination country. Figures are constructed from regression results presented in Table A4, Model 6.

8 The impact of free-trade agreements on the performance of exporting firms

In this section we look closer on how the free-trade agreements affect the performance of firms, as it is expressed by the return-on-assets. Thus, we have collapsed our firmXcountryXtime-data utilized in the previous section to firmXtime-dimension. Descriptive statistics on key measures on the firm panel data set is presented in Table A2.

Figure 3 shows how the return on assets develops over time as well the share of firms affected by free-trade agreements. The figure reveals the sharp drop in return on assets caused by the financial crisis in 2009.

Figure 3 The development of exporting firms' return on assets and free-trade agreements

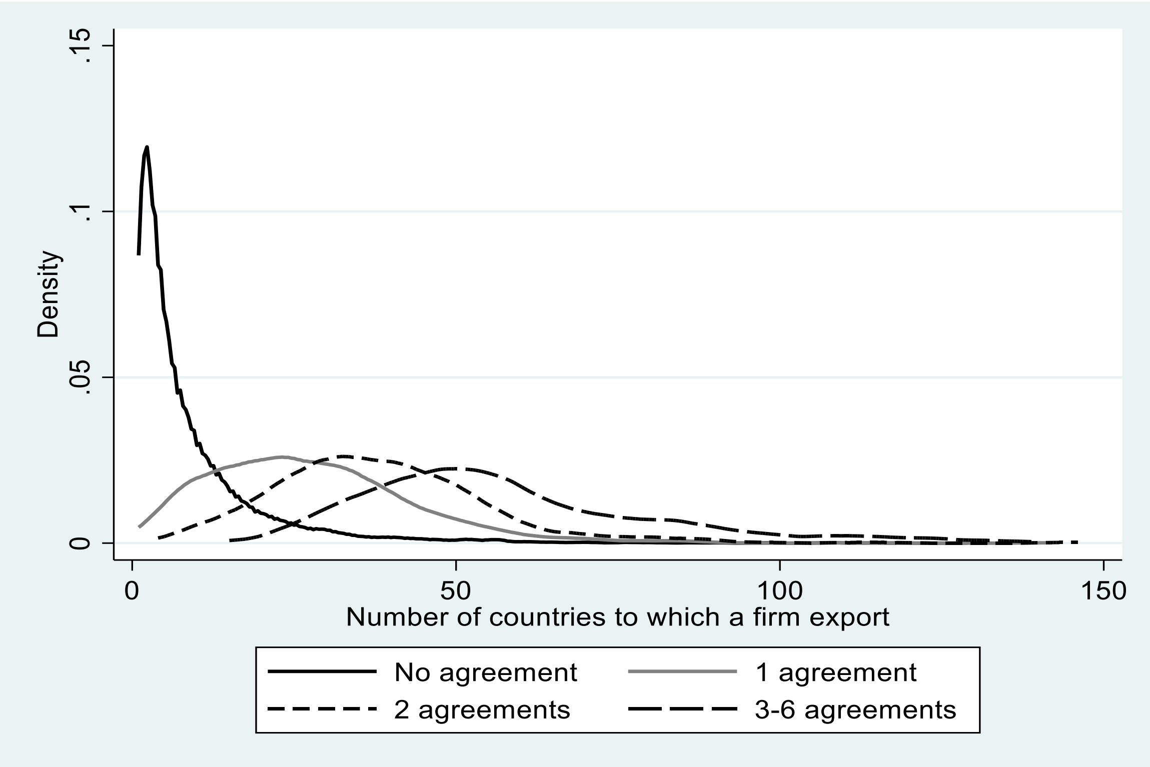


Note: Population: All exporting Manufacturing firms 2005-2017 with at least 3 employees.

While the average share of export to countries affected by free-trade agreements remains small (it still grows), we see that the share of firms experiencing export to a country where a free-trade agreement is established grows to 15 percent in our period of observation. Several of these firms are exposed to more than one round of free-trade agreements, thus the accumulated value increases to over 30 percent.

These exporters reveal huge variation with respect to their involvement in different countries. Some exporters are big, exporting to most countries in the world, while other are small, exporting to only a few countries. This makes the probability of being affected by the free-trade agreements vary across exporting size, as is easily seen in Figure 4. This figure depicts the kernel densities for four groups of firms across the number of countries that which the firm export to.

Figure 4 The distribution of the number of countries to which a firm export



Note: Population: All exporting Manufacturing firms 2005-2017 with at least 3 employees.

We see that those firm not affected by a free-trade agreement export usually only to a few countries, while as the number of free-trade agreements the firm is affected by increases, the distributions shift towards the right, i.e., towards being larger exporters. This provides a challenge when determining how the establishment of a free-trade agreement affect the return-on-assets for these firms.

Our strategy is fourfold. First, we present the results from simple regressions based on all firms (model 1). Second, we add to these regressions admittedly potentially endogenous controls to balance the data (model 2). Third, we establish a sample of firms based on matching[6], and conduct regressions using information from this matched sample of firms (model 3). Fourthly, we

[6] We conduct matching on the 5-closest neighbors based on pre-free-trade agreement information on the number of countries the firm export to, log import price per kilo, total number of years the firm is observed, log workforce size, log capital intensity). Details on the firm matching is presented in Table A5. In Table A6, we present pre-period averages before matching and after matching. After matching, only minor insignificant pre-period differences remain with respect to the probability of experiencing a free-trade agreement.

conduct regressions based on observations from firms exporting to no more than 2 countries (model 4). Descriptive statistics on the matched sample and these firms exporting to not more than two countries are presented in Table A2 under Panel B) and Panel C), respectively. All the models take into account firm FE, firm-specific linear trends, and year dummies.

Table 3 presents our results. In Panel A), we regress log return on assets on a dummy for free-trade agreements. In Panel B), we regress log return on assets on the accumulated number of free-trade agreements firms experience (from 1 to 6). In Panel C), we regress log return on assets on the export share to the free-trade countries measured the year before the free-trade agreement is established.

Table 3 The relationship between log return on assets and free trade agreements

	All firms		Matched sample	Export to max 2 countries
	Model 1	Model 2	Model 3	Model 4
Panel A)				
Free-trade agreement	0.123[x]	0.123[x]	0.130[x]	0.241[x]
	(0.074)	(0.074)	(0.077)	(0.143)
Panel B)				
Accumulated number of free-trade agreement rounds	0.130*	0.130*	0.124*	0.241[x]
	(0.059)	(0.060)	(0.059)	(0.143)
Panel C)				
Export share to free-trade agreements countries the year before agreement	0.160	0.157	0.120	1.041*
	(0.349)	(0.346)	(0.345)	(0.418)
Additional controls in all panels:				
Log number of export countries		Yes		
Log transport (import) price per kilo		Yes		
Log workforce size		Yes		
Year FE (13)	Yes	Yes	Yes	Yes
Firm FE+linear time trends (176417)	Yes	Yes	Yes	Yes
F	2079	2079	641	704
N (FXT)	12588	12588	5374	3108

Note: Population: manufacturing exporting firms 2005-2017 with at least 3 employees. Unit of observation: firm. Dependent variables: log operating margin and log return-on-assets. Standard errors are adjusted for firm clustering and presented in parentheses. [x], * and ** denote 10, 5 and 1 percent level of significance, respectively.

In both Panel B) and C), we utilize the fact that a firm is to a varying degree exposed to such a treatment a new free trade agreement constitutes. This means we can apply a treatment intensity approach, which can be considered an extension of a difference-in-difference approach with heterogeneous treatment effects (Angrist and Imbens, 1995). In B) we focus on the accumulated treatment over time, while C) focus on treatment intensity when the free-trade agreement is established.

The general picture provided by Table 3 is that the establishment of a free-trade agreement with a country appears to weakly increase the return-on-assets for those firms that export to this country. On average, the return-to-assets increases by roughly 12 percent. Furthermore, the return-on-assets of firms that only export to few countries appear to be much more sensitive than other firms when the treatment intensity increases. Thus, employers, firms and owners appear to benefit from the establishment of free-trade agreements. In the next section, we ask whether this is also true for workers as well.

9 The impact of free-trade agreements on workers' wages

We start in this section by analysing the overall impact on wages from the introduction of new free trade agreements. Descriptive statistics on key measures on the workerXfirm panel data set is presented in Table A3. We start out with a simple difference-in-difference approach, estimating simple linear log hourly wage regressions on different fixed effects and controls (year fixed effects, log seniority, log weekly working hours, year dummies, 1-digit sic occupational dummies, firm-specific linear time trends, and job fixed effects). Thus, we follow each worker within their job and study the impact of the free-trade agreement. The results of these regressions are presented in Table 4.

We follow the strategy from Section 8, and establish the same three samples: all workers, matched sample and workers employed by firms exporting to two countries at the most. These samples are indicated by the column head.

Table 4 The impact of free-trade agreements on log hourly wages

	All workers		Matched sample	Export to max 2 countries
	Model 1	Model 2	Model 3	Model 4
Panel A)				
Free-trade agreement	0.002	0.001	0.001	-0.133
	(0.008)	(0.007)	(0.010)	(0.102)
Panel B)				
Accumulated number of free-trade agreement rounds	-0.002	-0.003	-0.003	-0.115
	(0.006)	(0.006)	(0.007)	(0.103)
Panel C)				
Export share to free-trade agreements countries measured the year before the agreement is established	-0.076*	-0.074*	-0.084*	-0.986**
	(0.038)	(0.037)	(0.042)	(0.249)
Additional controls in all panels:				
In all models, controls for log seniority, log weekly working hours, age vigintile dummies, dummies for 1-digit sic occupation.				
Log number of export countries		Yes		
Log workforce size		Yes		
Year FE	Yes	Yes	Yes	Yes
Linear firm-specific time trends	Yes	Yes	Yes	Yes
Job FE	Yes	Yes	Yes	Yes
F	1798	1798	641	10
N (WXFXT)	1044174	1044174	657432	1357

Note: Population: manufacturing exporting firms 2005-2017 with at least 3 employees. Unit of observation: Jobs (workerXfirm). Dependent variable: log hourly wage. Standard errors are adjusted for firm clustering and presented in parentheses. x, * and ** denote 10, 5 and 1 percent level of significance, respectively.

In addition to utilising the firm-matched sample, we also match workers for these matched firms on 1-digit occupation, log seniority, log weekly working hours and years observed in the data (see Tables A5 and A6 in the appendix for more detail on the matching). Thus, our matched worker sample comprises not only very similar firms but also very similar workers. Descriptive statistics on the matched sample and on those workers employed by firms exporting to not more than two countries are presented in Panel B) and C) of Table A3, respectively. We apply the same free-trade agreement measures as in Section 8: a dummy taking the value of 1 when the firm is affected by a free-trade agreement (dd-parameter)(Panel A), an accumulated measure expressing the number of free-trade agreement rounds the firm has been affected (Panel B), and the export share to the free-trade countries measured the year before the free-trade agreement is established(Panel C).

These regressions reveal a more mixed picture than what we saw in our firm-analysis. The results in Panels A) and B) are largely insignificant. However, for all samples, the estimations in Panel C) indicate significant negative impact of free-trade agreements on hourly wages. Except for the sample based on firms exporting to max two countries (a sample comprising very few workers since these firms are small), the estimates are very similar across the samples. Increasing the exposure to the free-trade agreement by 10 percentage points (i.e., increasing the export share), yields 0.7-0.8 percent reduced wages. These results are as expected given that the free-trade agreements increase firms' markups. These estimates yield average effects among workers across the manufacturing sectors. However, as indicated by Section 5, we expect our estimates to be sensitive to union bargaining power and how elastic the labour supply facing these firms is.

In Table A7 in the appendix, we present the regression results from a similar regression as Model 1 in Table 4 under Panel C), but where we have added measures of firm union density, log occupational vacancy/unemployment rate, and interactions between these and the export share. Then, we can estimate the marginal effects at different points in the union density distribution and in the log vacancy/unemployment rate-distribution. This is of course not a perfect approach, since although log occupational vacancy/unemployment rate reflects the labour market tightness for these occupations, it does not fully capture the elasticity of labour supply facing our firms. However, we surmise that log occupational vacancies per unemployed is positively correlated with the elasticity of labour supply, and negatively with employers' monopsonistic powers. Hirsch et al. (2017) observe this on German data. Similarly, it is also clear that union density does not fully capture union bargaining power. Our hypotheses from Section 5 are that stronger unions should reduce the negative impact of an increased markup, while a more elastic labour supply should enforce the negative impact arising when mark-ups increase. Table 5 presents our results.

Table 5 How the relationship between log hourly wages and free trade agreements varies with union bargaining power and the elasticity of labour supply?

		All	Matched			All	Matched
Union density	0.27	-0.154**	-0.145**	Log vacancies per unemployed	0.02	-0.067	-0.067
		(0.049)	(0.051)			(0.058)	(0.058)
	0.67	-0.055	-0.068		0.72	-0.077 x	-0.077x
		(0.040)	(0.047)			(0.045)	(0.045)
	0.89	-0.001	-0.026		2.37	-0.098 **	-0.098**
		(0.063)	(0.077)			(0.033)	(0.034)

Note: Population: manufacturing exporting firms 2005-2017 with at least 3 employees. Unit of observation: Jobs (workerXfirm). Dependent variable: log hourly wage. Table elements report the estimated marginal effects associated with export share, union density and interaction, and with export share, log occupational vacancies per unemployed and interaction, in four log hourly wage regression with fixed job effects and firm-specific linear time trends. The marginal effects are estimated at 10th, median and 90th percentile value of union density- and log vacancies per unemployed-distributions. Table A5 presents the full set of estimates. Standard errors are adjusted for firm clustering and presented in parentheses. x, * and ** denote 10, 5 and 1 percent level of significance, respectively.

Since we in the previous sections have shown that the free-trade agreements are empirically associated with an increase in firms' export-product markups, the results from these simple regressions presented in Table 5 provide support of the models' theoretical predictions. It does indeed appear that increased union bargaining power, as expressed by union density, reduces the negative impact on wages from free-trade agreements, while a tighter labour market enforces the negative impact on wages.

Another way of addressing this issue, is to look closer on specific occupational groups and see how these free-trade agreements are affecting the occupations differently. In Table 6, we estimate fixed job effect linear log hourly wage regressions on export share the year before the establishment of a free-trade agreement, similarly to those presented in Model 1 of Table 4 under Panel C) but conduct the estimation separately for six broad occupational groups. These occupational groups range from management and sales-oriented occupations of white-collar workers to more typical production occupations of blue-collar workers and includes even unskilled workers. Table 6 reveals an unambiguous picture: exposure to these free-trade agreements clearly affect the workers negatively, or for some groups not at all. But all point estimates are negative. For sales workers the negative impact is considerable, since 10 percentage point increase in the export rate, implies 1.8 percent wage reduction.

Table 6 The impact of free-trade agreements on log hourly wages for different occupational groups

	Manage-ment	Sales workers	Other professionals/ technicians	Lower administrative/ service	Skilled trades and operators	Unskilled
Export share to free-trade agreements countries measured the year before the agreement is established	-0.091* (0.043)	-0.182** (0.080)	-0.033 (0.040)	-0.094** (0.042)	-0.073 (0.060)	-0.111 (0.113)
WXFXT	82952	49099	261707	84208	494382	4374

Note: Population: manufacturing exporting firms 2005-2017 with at least 3 employees. Unit of observation: Jobs (workerXfirm). Dependent variable: log hourly wage. Each table cells report the result from a linear fixed effect regression of log hourly wages similar to Model 1 in Table 4, Panel C). Full regression results presented in Table A6. Standard errors are adjusted for firm clustering and presented in parentheses. x, * and ** denote 10, 5 and 1 percent level of significance, respectively.

10 Conclusion

In this paper, we have studied how public trade policies affect the price-to-marginal cost mark-ups of Norwegian exporting firms, their performance and pay to workers. Increased globalisation through trade liberation is often associated with efficiency gains. Reduced import tariffs through free-trade agreements in foreign markets will reduce the marginal costs of all exporters to these markets. New productive exporters would also enter the market reallocating the market share away from less productive domestic firms to more productive exporters (Melitz, 2003; Egger and Kreickemeier, 2009). This process affects the price. For the Norwegian exporting firms already present in the foreign market this alter their markups.

Our analyses show that these free trade agreements increase Norwegian firms' mark-up in exporting markets. These free trade agreements comprise both tariff- and non-tariff-measures, which in the literature have been identified to have contrasting effects, but in our case, the overall impact implies increased exercised market power for Norwegian firms. Furthermore, we find that return-to-profits increases as well. Thus, employers, firms and owners appear to benefit from the establishment of free-trade agreements.

However, as expected, we find fewer positive impacts for workers. Several worker groups such as sales workers and even management experience reduced wages following the establishment of free-trade agreements. Blue-collar workers seem less affected. This differences between blue- and white-collar workers could, however, reflect other labour market characteristics. We know that blue-collar workers are often unionised, and the demand for certain white-collar workers is quite high. Thus, when we observe that increased union bargaining power, as expressed by union density, reduces the negative impact on wages from free-trade agreements, while a tighter labour market enforces the negative impact on wages, these relationships could affect our occupational findings.

Finally, we should point out that one cannot draw inference from these analyses to how free-trade agreements in general affects economies. First, our data are restricted to Norwegian exporters, and Norway is just one part of these agreements. Second, we cannot even draw inference on the Norwegian economy in general, neither for firms nor workers. We limit the analyses to Manufacturing sector only. Furthermore, and equally important, we limit the analyses to the incumbent firms. This means that only firms already exporting to these countries are included in the analyses. Potentially these new entries might behave very differently than the incumbents. Thus, markups, return-on-assets and pay might deviate considerably when comparing new entries with old incumbent firms. Future research should remedy this shortcoming.

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Appendix

Table A1 Descriptive statistics – firmsXcountry panel

LnR^{ex}-direct	LnQ^{ex}-direct	LnR^{ex}-others	LnQ^{ex}-others	LnR^{dom}	LnQ^{dom}	LnL	LnC	LnInt	Log transport cost per kilo	LnInt +transport
13.591 (2.428) [109795]	8.347 (3.592) [109795]	17.366 (3.397) [109795]	12.492 (3.707) [109795]	17.767 (5.008) [93598]	12.602 (5.397) [109795]	4.284 (1.268) [109795]	11.756 (1.741) [109795]	18.278 (1.922) [109795]	1.4691 (1.4984) [109795]	18.307 (1.826) [109795]
TFP-revenue	TFP-weight	Markup	New free trade	PMI	Ln Exchange rate	LnE				
0.060 (1.220) [86089]	0.0677 (1.332) [86089]	1.388 (85.414) [86089]	0.008 (0.091) [86089]	1.701 (0.452) [86089]	1.369 (2.068) [86089]	9.173 (1.591) [86089]				

Note: Population: All exporting Manufacturing firms 2007-2017. Table elements report mean, standard deviation (in parentheses) and number of observations (in brackets). LnR^{ex} -direct and LnR^{dom} –direct express log export revenue and log domestic revenue to the specific country, respectively. LnR^{ex} -others and LnR^{dom} –others express log export revenue and log domestic revenue to all other export countries, respectively. LnQ^{ex} expresses log export quantum. LnL , LnK and Ln Int express log workforce size, log capital and log intermediates, respectively. Log country export share expresses the log share of export of a firm towards main exporting country. Log # of export-to countries expresses the log number of countries towards a firm export. Product market legislation is based on OECD stat PMI-index. Log exchange rate is measured in US $. Log Export-to-country employment (LnE) is based on ILO's figures for the country for which towards the products are exported. See https://stats.oecd.org for OECD data. Information on new free trade agreements, see https://www.regjeringen.no/no/tema/naringsliv/handel/nfd---innsiktsartikler/frihandelsavtaler/partner-land/id43884.

Table A2 Descriptive statistics –firm panel

Return-on-assets	Log workforce size	Log number of export countries	Log transport (import) price per kilo	Log total assets	Free-trade agreement	Accumulated rounds of free-trade agreements	Export share to free-trade agreement countries
Panel A) All firms							
0.072 (0.355) [17852]	3.517 (1.215) [17852]	1.9830 (1.134) [17852]	1.625 (1.726) [17852]	10.822 (1.589) [17852]	0.096 (0.295) [17852]	0.161 (0.591) [17852]	0.008 (0.055) [17852]
Panel B) Matched sample of firms							
0.091 (0.178) [17852]	4.035 (1.356) [7260]	3.138 (0.796) [7260]	1.676 (1.463) [7260]	11.761 (1.665) [7260]	0.276 (0.447) [7260]	0.462 (0.929) [7260]	0.022 (0.092) [7260]
Panel C) Firms only exporting to no more than two countries							
0.071 (0.271) [17852]	2.981 (0.900) [4561]	0.631 (0.618) [4561]	1.730 (1.876) [4561]	9.921 (1.186) [4561]	0.002 (0.039) [4561]	0.002 (0.039) [4561]	0.001 (0.016) [4561]

Note: Population: Population of private sectors firms 2007-2017 with at least 3 employees. Descriptives: Table elements report mean, standard deviation (in parentheses) and number of observations (in brackets).

Table A3 Descriptive statistics – workerXfirm panel

Ln hourly wage	Log weekly working hours	Log seniority	Vacancies per unemployed	Union density	Free-trade agreement	Accumulated rounds of free-trade agreements	Export share to free-trade agreement countries
Panel A) All firms							
5.568	3.573	1.547	5.275	0.629	0.311	0.630	0.012
(0.401)	(0.201)	(1.297)	(6.650)	(0.234)	(0.463)	(1.212)	(0.055)
[1123398]	[1123398]	[1123398]	[1123398]	[1123398]	[1123398]	[1123398]	[1123398]
Panel B) Matched sample							
5.616	3.574	1.572	5.651	0.670	0.471	0.887	0.016
(0.391)	(0.185)	(1.284)	(7.018)	(0.207)	(0.495)	(1.357)	(0.065)
[684823]	[684823]	[684823]	[684823]	[684823]	[684823]	[684823]	[684823]
Panel C) Firms exporting to no more than two countries							
5.461	3.568	1.467	4.384	0.468	0.041	0.002	0.001
(0.412)	(0.244)	(1.259)	(5.996)	(0.289)	(0.196)	(0.049)	(0.012)
[1123398]	[86649]	[86649]	[86649]	[86649]	[86649]	[86649]	[86649]

Note: Population: Population of workers employed by private sectors firms 2007-2017 with at least 3 employees. Descriptives: Table elements report mean, standard deviation (in parentheses) and number of observations (in brackets).

Table A4 IW-regressions of total factor productivity and log mark-up – for firmsXcountry panel

	TFP-Revenue		TFP-unit		Log mark-up	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
F9event	-0.095	-0.186	-0.098	-0.345	-0.013	-0.208
	(0.099)	(0.236)	(0.097)	(0.191)	(0.072)	(0.338)
F8event	-0.074	-0.156	-0.073	-0.288	-0.101	-0.272
	(0.090)	(0.214)	(0.090)	(0.176)	(0.099)	(0.292)
F7event	-0.039	-0.161	-0.060	-0.185	-0.027	-0.173
	(0.068)	(0.141)	(0.066)	(0.123)	(0.080)	(0.191)
F6event	-0.025	-0.092	-0.054	-0.160	0.117	-0.004
	(0.058)	(0.121)	(0.052)	(0.105)	(0.077)	(0.208)
F5event	-0.021	-0.077	-0.055	-0.144	-0.006	-0.106
	(0.046)	(0.092)	(0.046)	(0.080)	(0.078)	(0.186)
F4event	-0.076	-0.111	-0.096**	-0.150**	-0.039	-0.117
	(0.040)	(0.065)	(0.036)	(0.057)	(0.049)	(0.084)
F3event	-0.082**	-0.097*	-0124**	-0.147**	-0.001	-0.046
	(0.031)	(0.046)	(0.031)	(0.041)	(0.043)	(0.074)
F2event	-0.056	-0.065	-0.096**	-0.109**	-0.021	-0.039
	(0.032)	(0.035)	(0.031)	(0.035)	(0.036)	(0.044)
L0event	0.042	0.045	0.020	0.027	0.084**	0.101**
	(0.027)	(0.026)	(0.026)	(0.026)	(0.032)	(0.034)
L1event	0.025	-0.016	0.013	-0.059*	0.065	0.068*
	(0.027)	(0.025)	(0.023)	(0.026)	(0.037)	(0.033)
L2event	0.038	0.003	0.007	-0.047**	0.028	0.051
	(0.033)	(0.024)	(0.028)	(0.023)	(0.046)	(0.038)
L3event	0.047*	-0.175**	0.027	-0.227**	0.069	0.204**
	(0.019)	(0.029)	(0.017)	(0.023)	(0.041)	(0.046)
L4event	0.052**	-0.159**	0.065**	-0.178**	0.064	0.177**
	(0.016)	(0.026)	(0.019)	(0.024)	(0.040)	(0.027)
L5event	0.077**	-0.172**	0.070**	-0.207**	0.080**	0.199**
	(0.018)	(0.029)	(0.019)	(0.025)	(0.028)	(0.038)
L6event	0.132**	-0.101**	0.138**	-0.109**	0.015	0.158**
	(0.013)	(0.025)	(0.020)	(0.026)	(0.019)	(0.033)
L7event	0.087**	-0.115**	0.082**	-0.132**	-0.040	0.097**
	(0.014)	(0.024)	(0.017)	(0.022)	(0.032)	(0.034)
L8event	0.104**	-0.133**	0.077**	-0.173**	-0.047	0.050
	(0.022)	(0.020)	(0.024)	(0.022)	(0.048)	(0.034)
L9event	0.089**	-0.159**	0.084**	-0.147**	-0.029	0.044
	(0.027)	(0.027)	(0.024)	(0.022)	(0.032)	(0.026)
L10event	0.175**	-0.052**	0.151**	-0.059**	-0.041	0.054
	(0.019)	(0.012)	(0.018)	(0.014)	(0.033)	(0.022)
R^2-adj.	0.675	0.613	0.671	0.671		
FXC	12795	12795	12795	12795	10874	10874
N (FxT)	72013	72013	72013	72013	60248	60248

Note: Unit of observation: export country(C)Xfirm(F). Population: All exporting manufacturing firms 2005-2018 with at least 3 employees.

Table A5 Matching

Firm matching		Worker matching	
Log number of export countries	2.092**	Log number of export countries	1.555**
	(0.293)		(0.007)
Number of export countries	0.004	Log Seniority	-0.002*
	(0.016)		(0.007)
Log transport cost per kilo	0.226**	Log weekly working hours	-0.292**
	(0.086)		(0.028)
Transport costs per kilo	0.006	Log worker age	-0.400**
	(0.006)		(0.023)
Number of observations by firm	-0.084	Log number of observations by worker	0.287**
	(0.110)		(0.009)
Log number of observations by firm	2.791**	+ 7 dummies for 1-digit occupation sic code.	
	(0.911)		
Log workforce size	0.108**		
	(0.336)		
Workforce size	0.001		
	(0.001)		
Log total assets	0.152		
	(0.155)		
Total assets	-3.2e-8		
	(1.6e-8)		
Log capital intensity	0.286		
	(0.326)		
Firms	2541	Workers	157833

Note: Firm population: first observation of manufacturing exporting firms 2005-2017 with at least 3 employees. Worker population: the first observation of workers employed by manufacturing exporting firms 2005-2017 with at least 3 employees. Dependent variables: Indicator taking the value of 1 if the firm in the pre-period experiences the establishment of a free-trade agreement. The table elements report the parameter estimates from Logistic regressions. Matching is based on the nearest 5 neighbours. Standard errors are adjusted for firm clustering and presented in parentheses. ^{x}, * and ** denote 10, 5 and 1 percent level of significance, respectively.

Table A6 Matching - balancing

	Firm				Worker			
	Unmatched		Matched		Unmatched		Matched	
	Treat	Not-treat	Treat	Not-treat	Treat	No-treat	Treat	No-treat
Log number of export countries	3.092	1.271	3.221	3.053	2.709	0.979	2.728	2.255
	(0.785)	(0.984)	(0.785)	(0.802)	(0.888)	(0.824)	(0.863)	(0.902)
Log transport cost per kilo	1.586	1.747	1.797	1.645				
	(1.509)	(1.807)	(1.513)	(1.463)				
Log number of observations	11.433	6.472	12.350	12.034				
per firm	(3.210)	(4.258)	(3.209)	(3.135)				
Log workforce size	4.113	3.317	4.115	3.952	6.180	5.243	6.198	5.451
	(1.309)	(1.048)	(1.312)	(1.204)	(1.345)	(1.441)	(1.333)	(1.115)
Log total assets	11.568	10.306	11.569	11.454	21.124	19.514	21.150	20.051
	(1.708)	(1.456)	(1.708)	(1.567)	(2.003)	(1.891)	(1.986)	(1.459)
Log capital intensity	3.015	3.315	3.206	3.290				
	(0.788)	(0.804)	(0.788)	(0.613)				
Log seniority					1.611	1.504	1.614	1.515
					(1.282)	(1.306)	(1.282)	(1.283)
Log weekly work hours					3.576	3.571	3.576	3.571
					(0.216)	(0.176)	(0.175)	(0.197)
Log age					3.725	3.721	3.726	3.669
					(0.307)	(0.299)	(0.299)	(0.309)
Log number of observations					7.660	5.964	7.709	6.373
per job					(3.533)	(3.482)	(0.619)	(0.717)
Firms	277	2269	275	399				
Workers					457734	665664	453985	230838

Note: Firm population: first observation of manufacturing exporting firms 2005-2017 with at least 3 employees. Worker population: the first observation of workers employed by manufacturing exporting firms 2005-2017 with at least 3 employees. The table elements report the averages for the treated and not-treated population, before and after matching. Matching is based on the nearest 5 neighbours. See Table A5.