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THE GENDER GAP IN INTERNATIONAL TRADE: FEMALE-RUN FIRMS AND THE EXPORTER PRODUCTIVITY PREMIUM

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The Gender Gap in International Trade: Female-run Firms and the Exporter Productivity Premium*

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Abstract. Female-run firms are less likely to be exporters although they exert positive influence in various aspects in an economy and society. With a new and comprehensive data set on manufacturing plants, I investigate the exporter productivity premium of female-run firms in Germany. The results show that female-run firms gain a higher exporter-productivity premium than male-run firms. I find evidence for selection into exporting but no impact for learning from exporting for female-run exporting firms. These results give hint to discrimination barriers that female-run firms face when they are exporting as compared to male-run firm exporters.

Keywords: Gender Inequality, Exporter-Productivity Premium, Germany, Firm Heterogeneity.

JEL: F14, L25, L60, O12.

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1. Introduction

Female-run firms are found to be much less involved into exporting than male-run firms (Chiu 2018, Froman 2018).[1] This is surprising in so far as female-run firms are found to have very positive effects on the economy and society. Female-run businesses pay back loans more quickly and reliably than males (D'Espallier (2011); a 98 percent pay-back rate for female enterpreneurs is mentioned according to the WTO "Aid for Trade Global Review", 2017), female-owned firms hire more women in their companies (ITC, 2015; Ederington et al. 2009), and female firm owners are more educated than male firm owners (Canadian Trade Commissioner, 2016). As females invest more into their children's education and health than men (about 90 percent as compared to about 40 percent by men, ITC, 2015), a promotion of females into international trade and the additional income gained upon is regarded as one of the major tools to bring families out of poverty circles in the developing world (ITC, 2015).

The issue that females are underrepresented in international trade is currently experiencing a high level of policy attention. The Buenos Aires Declaration on Trade and Women's Economic Empowerment (which was endorsed at the December 2017 WTO Ministerial Conference in Buenos Aires and signed by about 120 WTO members and observers) acknowledged that empowering female businesses and providing more inclusive trade policies will promote economic growth, sustainable development and reduce gender inequality and poverty. Several international institutions have fostered programmes to remove barriers to trade for women, to increase their economic empowerment and to help them participate in international trade.[2]

Lack of adequate data to investigate the situation and needs of female-run businesses remains a problem. The WTO engages in rising awareness of gender issues in trade and aims to gather data together with the World Bank in order to better understand this phenomenon. The outcome of this endeavour shall be published with the 2019 Aid for Trade Global Review. Empowering female engagement in international trade is considered as a part of the 2030 Agenda

[1] Froman (2018) mentions that among US American companies 30 percent are female-owned but only 12 percent of exporting businesses are female-owned.

[2] The WTO's Aid for Trade initiative endeavours, for example, to support e-commerce, new digital technologies and services trade for women (WTO, 2017). The National Trade Promotion Agency of Malaysia, for example, has launched the so called Women Exporters Development Programme (WEDP). The programme provides three years of support for female-owned and -led companies. The support consists of financial support for visiting international trade fairs, participation in seminars and workshops, business coaching, skill enhancement training, networking, mentoring and leadership and entrepreneurial development, see http://www.matrade.gov.my/en/malaysia-exporters-section/224-etrade-programme–supporting-document .

on Sustainable Development among Goal No. 5 which aims to achieve gender equality and to empower all women and girls.

Based on Official German Statistics, I construct a new, unique tailor-made and rich data set on manufacturing plants for Germany and analyse the exporter productivity premium for female-run businesses in the German economy. The advantage of the data is that they are based on the whole population of firms in the German economy, which differentiates these data from other firm data sets that are based on surveys (e.g. ZEW, IAB) or on sub-samples (e.g. Bundesbank microdata for foreign direct investments).[3] The data is of high quality and comprehensive as German Law mandates that all firms have to report to the Official Statistics. I use the terminology of a female-run firm for my analyses to cover either female firm ownership or a majority share of female employees in a company (either more than 50 or 60 percent). The exporter productivity premium is defined as the difference in productivity between an exporter versus a non-exporter.[4]

Germany is a highly industrialized and democratic country and is one of the major exporting nations in the world. Yet, a glass ceiling, which is defined as a gender gap in getting access to management and top job positions and to the same wage is highly persistent in the economy. According to recent figures, the gender wage gap amounts to about 21 percent in Germany.[5] In 2014, Germany endorsed a law to increase the share of females in executive positions or boardrooms in big enterprises to at least 30 percent by 2016 (*Frauenquote* or women's quota). Whereas research about how that share of female leaders or the share of female employees in a company is attributing to firms' success is increasing over the past years, there is up-to-date no

[3]The register of firms comprises all firms, especially all manufacturing firms, which are considered for the present analysis. Excepted are only those firms from sectors A, O, T and U according to ISIC rev. 4, which are the sectors of agriculture, forestry and fishing, public administration and defense and other services.

[4]Henceforth, female/ male exporter is used as an abbreviation for an exporting female-run / male-run firm.

[5]See $https://ec.europa.eu/eurostat/statistics-explained/index.php/Gender-pay-gap-statistics$. This figure represents the 2017 unadjusted gender pay gap, that is the difference between average gross hourly earnings between male and female employees as percentage of gross hourly earnings of males. It is computed from enterprises that employ 10 or more employees.

study that investigates the role of German female-run firms in productivity and international trade performance.[6] [7] The present paper is intended to fill this gap.

The intuition and underlying mechanism for my analysis is the following. Female-run firms might face a higher degree of discrimination when it comes to establishing trade. Females might not be taken seriously by potential other traders. They might be viewed as being less committing to work, following the argumentation by Boler, Javorcik, Ulltveit-Moe (2018). They might face barriers to trade that range from institutional to financial and social factors, which I will describe in more detail in the following. As such traders (importers) might discriminate against women and thus female run firms will exhibit a higher gender exporter-productivity premium than male run firms. In particular, discrimination of female-run firm exporters may depend on the importer's cultural background. Female-run firms might face difficulties when in the importer's country female leadership or business activity is rare or frowned upon.[8]

My results show that female-run firms in Germany, measured either by female firm ownership, or by the percentage of female employment in a firm being either higher than 50 or 60 percent, bear a higher exporter-productivity premium than male-run firms. This points to difficulties that female-run firms face when they try to export. I find strong evidence for female-owned firms as well as for those firms that have a majority share of female employees in their company to be less likely to export. While controlling for firm characteristics including firm productivity and

[6]Bertrand et al. (2019) find that the introduction of the 40 percent quota for women in corporate boards of public limited liability companies in Norway reduced the gender wage gap within boards, however they do not find an impact on other females. They further find that qualifications of women appointed to the boards were higher after the reform. Pletzer et al. (2015) find small and non-significant effects of female representation in corporate boards on financial firm performance in their meta-analysis which is based on 20 different studies' coefficients and results, however they point out that there might be several limitations of their meta-study.

[7]A range of studies examined how promotions of females or perception of females in leading positions relate to discrimination and how discriminating beliefs can be reduced. It is found that female promotion increases when more women are in senior positions in a company but not when there are more females at the same rank (Kunze and Miller, 2017). The authors explain that female bosses might enable lower-ranked females to get better mentors, role models and networks. Among peers, however, greater competition might prevail regarding promotions or mentoring and support. Conducting experiments in military camps, the literature shows that when men lived and worked together with females in the camps, their attitude towards female squad leadership positively changed over time (Finseraas et al., 2016).

[8]In many countries legal and regulatory barriers exist which prevent women from work and asset ownership (ITC, 2015). Permission of a male is required to register a business in some countries. Inheritance rights favor men over women, a report from the World Bank reveals that 33 out of 173 countries do not support equal inheritance rights between sons and daughters, 18 of these countries are from the MENA region (World Bank, 2015). Having fewer assets and property rights, females will have more difficulties to access financial credits, aside from the dependence on male permission. The report further found that in 90 percent of the 173 analyzed countries at least one law existed that reduced female opportunities. In another report the World Bank reveals that in different regions of the world gender disparities in ownership and in control of assets, rigid social norms about gender roles, gender wage gaps, underrepresentation of females in top job positions as well as occupational segregation exist (World Bank, 2013). In several places in the world women have fewer opportunities in education and suffer in particular from lack of infrastructure and water access.

further regional and industry-wide influences, this shows that the decision to export significantly depends on gender.

There are manifold barriers that female exporters will face. These barriers are an unequal access to finance and capital, unequal access to market information and networks, institutions and regulations that hinder women from using their assets, and cultural and social norms like the division of housework or caring responsibilities (ITC, 2015).[9] These barriers do already hinder non-exporting female firm owners, however, they are even higher for exporters, as these businesses require even more capital, networks, skills and travel activities and time for work. Discrimination barriers can be differentiated across supply-side and demand-side driven ones (Pande and Ford, 2011). Demand-side discrimination can comprise the preference for male leaders and businessmen, lack of information about the skills and capabilities of females[10], and restrictive business networks that exclude women or make it difficult for women to participate in business. On the supply-side, discrimination barriers comprise duties of child care and other household tasks for which women might interrupt career or work fewer hours, and fewer aspirations or preference for non-competitive environments due to fewer female role models or lack of information. Evidence from the literature (Pande and Ford, 2011), especially from the literature on women's quota (Bertrand et al., 2019), suggests that females want to act in high positions in companies, and they are very well-qualified: all the reserved places in boards were filled with women, and their qualifications were higher than before the female quota reform.

The rest of the paper is organized as follows. The next part reviews the previous literature. Part 3 describes the data, the choice of variables and descriptive statistics. The fourth part deals with the empirical analysis, describes the methodology and reports the results. The last section concludes.

2. Review of the Literature

This section summarizes related research from the literature, on i. discrimination theory, ii. evidence on firms, productivity and trade in Germany, iii. international trade and the exporter productivity premium, iv. gender studies and findings for wages and trade.

[9]Previous literature found that difficulties and higher costs to attain external finance do negatively affect firms' productivity and innovation (Gorodnichenko and Schnitzer, 2013). A survey of studies revealing evidence on credit constraints and exporting can be found in Wagner (2014).

[10]Lack of information about abilities of females in leading positions/ at work might lead to judge females on assumed average performance. This judgement might be biased and underestimate females' performance, this is known as statistical discrimination.

2.1. **Discrimination theory.** According to the seminal discrimination model of Becker (1957), competition should in the long-run drive out those firms from the market that discriminate (which could involve fewer employment of minorities, females, other races, etc.). Discrimination is costly, when taking into account that males are paid more than women. Firms will loose profits for either paying or forfeiting income for their act of discrimination. In the end only the most profitable firms, which are those that are less discriminating, will survive.

Ederington et al. (2009) extend Becker's model to the case of international trade and put his hypotheses to an empirical test using Colombian plant-level data. In terms of international trade theory, exporting firms that open themselves to the world market and experience increasing competition should discriminate less than firms that produce for the domestic market, only. The authors test whether firms employ more or less women. They assume as well that there exists a wage differential in the beginning and wages for women are lower than those for men. Firms that discriminate more - who hire less women - will thus bear a higher marginal cost of production and will be less profitable. Using the Colombian data, the authors find that firms that employ a higher share of women are those that engage more into exporting. More competition induces firms to hire more women. However, they do not find evidence for trade liberalization to drive firms out of the market.

Juhn et al. (2013, 2014) find that exporting firms upgrade their technology due to trade liberalization which improves the productivity of women in blue-collar occupations. These firms pay those women higher wages which reduces the gender wage gap, moreover it increases their employment. They find empirical support for these results using plant-level data for Mexico.

Contrasting evidence is found by Saure and Zoabi (2014). They construct a model where trade integration induces a widening of the gender wage gap and a reduction of female labor participation. Female and male labor are considered to be imperfect substitutes and two distinct factors of production. Female labor and capital are assumed to be in a stronger complementary relation than male labor and capital. The country is assumed to be capital-abundant. If trade integration occurs, the sector that uses more female labor expands and the sector that uses more male labor contracts. Male workers migrate to the female sector, which reduces the capital labor ratio and drops the marginal productivity of women by more than the marginal productivity of men. They find supporting empirical evidence for their model using US population survey data and bilateral trade data for the US and Mexico.

2.2. **Firms and productivity in Germany.** Almost 30 years after German reunification differences in firm performance still exist between the West and East of Germany (Wagner, 2012, 2016, 2018). Although the East experienced a considerable catch-up in living standards over time, labor productivity is still significantly lagging behind in the East as compared to the West (Burda, 2006, 2008; Burda and Severgnini 2018; Burda and Hunt 2001).

Burda and Severgnini (2018) conduct regional TFP regressions across the German federal states and show that the labor productivity gap can be explained by a persistent TFP gap in East Germany and by low concentration of managers, low start-up intensity and a fewer number of large firms.

Burda and Hunt (2001) find that the East-West productivity gap remains constant across skill-levels. They argue that factors other than skills explain the persistent gap and point for example to the relevance of further infrastructure investment in East Germany. Moreover, the authors find that better educated migrate from the East to the West of Germany which might explain a TFP reduction in the East. This is further investigated by Burda (2006, 2008) in a model that captures opposite directions of factor movement for capital and labor and which is backed by the fact that after reunification East Germany became subject to a massive inflow of capital, however it also became subject to an outflow of employment after reunification.

In numerous studies Wagner used firm-level data from the Official German Statistics and merged the Official German Trade Statistics to these data. His studies show that firms in East Germany are smaller in size, export less and have a lower human capital rate defined as wages per employee (e.g. Wagner, 2016).

With data for more than 160 million export and import transactions over the years from 2009 to 2012, Wagner (2018) shows that in the Germany economy larger, older and foreign owned firms, and firms that have a higher labor productivity as well as research and development and human capital intensity are the firms that are active in a larger number of foreign markets. Most of the firms are active on a few markets, only, but firms that are active on many markets are responsible for a higher share of foreign trade.

In numerous further studies Wagner shows that the extensive margins of trade are positively associated with labor productivity in the German economy (e.g. Wagner, 2012).

2.3. **Exporting and productivity.** There exists a wide range of studies on the relationship between firm productivity and trade. An overview of studies can be found for example in

Wagner (2016 b). Empirical evidence on the relationship between trade and productivity has been established by the seminal papers by Bernard and Jensen (1995, 1999), and was followed up by the theory on heterogenous firms in international trade by Melitz (2003). According to these studies only the most productive firms will decide to export as those are the firms that are able to cover the fixed costs of production. This relation is investigated as selection into exporting in the trade literature. Another link is that firms once they export might show a better performance in terms of productivity or firm survival. This effect is known as learning from exporting. Whereas the previous literature has found ample evidence for selection into exporting (Clerides et al. 1998, van Biesebroeck 2005, International Study Group on Trade and Productivity 2008; see Singh 2010 for an overview), there is less evidence found for learning from exporting (no evidence for learning from exporting is for example found by Bernard and Jensen 1999, Bernard and Wagner 1997, Clerides et al. 1998, Smeets and Warzynski 2010). Positive evidence for learning from exporting is found by Van Biesebroeck (2005) for a sample of Sub-Saharan African countries, Blalock and Gertler (2004) for Indonesian firms, and de Loecker (2007) for Slovenian firms.

2.4. **Gender, wages and exports.** A large body of literature investigates the gender wage gap (see e.g. Goldin, 2014, and for an overview and discussion Blau and Kahn, 2017). Here I focuss on explanations for the relation between international trade, gender, wages and productivity.

Boler et al. (2018) investigate the gender wage gap in Norwegian manufacturing exporting firms using a matched employer-employee data set. They exploit the mechanism that an exposure in competition faced by exporting firms induces them to require more commitment to work from their employees. However, when females are observed as being less committing to work, the gender wage gap increases. The authors find a widening of the gender wage gap when college educated females are employed in an exporting firm. Exploiting a policy variable that captures fathers' parental leave they show that the gender wage gap between exporters and non-exporters is narrowing. The authors explain that when additional child care is available, women are perceived to commit more to work.

Black and Brainerd (2002), however, find evidence that the wages gap decreases more rapidly due to a trade shock in those industries that were more concentrated rather than competitive in the beginning. They use population survey and census data for the United States to analyze the

impact of a change in the import share on the gender wage gap across industries and metropolitan areas.

The closest work to this paper is Davies and Mazikheyev (2015). They conduct a cross-sectional analysis using data from the World Enterprise Survey to investigate the gender exporter productivity premium for a sample of developing countries. They find a negative female exporter productivity premium, while I find a positive one. The authors interpret their results as pointing to women having problems in learning from exporting rather than less trade barriers to be present for female exporters. However, in one regression they find a positive effect for the case of large firms when interacting the variables of exporting and female firm ownership with export costs (which they measure at the country- and not at the firm-level) and interpret this as pointing to barriers to trade and discrimination that female exporters face. One limitation of their study is that they do not directly test for selection into exporting and learning from exporting.

Summarizing, literature on the relationship between females' engagement in international trade and productivity, the impact of barriers to trade or learning from exporting effects, can be found almost none. Few studies explain the effects of trade and globalization on the gender wage gap. How trade affects productivity of female-run businesses remains to date an open question. In the following I analyze the exporter productivity premium of female-run firms in the German economy.

3. Data

For the analysis I constructed a new data set based on data from the German Federal Statistical Office and the Offices of the Laender. I merged data from three different sources: the register of firms (*Unternehmensregister, abbr. URS*) which covers information on plants and enterprises, the data set on manufacturing plants (*AFiD Industriebetriebe*) and the data set on manufacturing enterprises (*AFiD Industrieunternehmen*).[11] The data is of high quality, accurate and comprehensive as by German Law all firms in the German economy have to report to the official statistics. The register of firms is capturing all plants and enterprises in the German economy. Data provision and management by the Statistical Offices, however, takes time.[12] Remote data access applied. In what follows, I analyze the exporter-productivity premium in

[11]AFiD stands for *Amtliche Firmendaten* or Official Firm Data.

[12]It took more than $2\frac{1}{2}$ years after application for the data that I got some first access to the data. Additional time is passing by for having the Statistical Office run the author's programmes on the original data on the Office's computer and for checks of confidentiality of results.

the German economy at the plant level. Each plant has a unique plant-level identifier and its affiliation to an enterprise can be traced back by a given enterprise-level identifier. A plant is defined as the local production unit. An enterprise is defined as the judicial entity and one or more plants are assigned to a judicial entity. The terminology 'firm' is used as a broad concept - which is commonly used in the literature as well - that encompasses plants and/ or enterprises.

For the analyses, I took data for the manufacturing sectors, only.[13] Due to data availability at the plant-level, I run estimations for the cross-section of the year 2014. The final data set consists of all manufacturing plants in Germany that have at least 20 employees. This cut-off is given by the AFiD data. Subsequently, effects were also estimated separately for the subsets of small and medium-sized plants and large plants. Large plants are characterized as having more than 250 employees and more than 50 billions euros of sales value. Firms other than that are defined as small and medium-sized plants.

For the analysis I use information on the status of a female firm owner of the enterprise that the plant belongs to, which is modelled by a dummy variable that equals 1 if there is at least one female firm owner and zero otherwise. In the following this will be referred to as female firm ownership. The information is extracted from the AFiD data on manufacturing enterprises. Given that female firm ownership does not necessarily represent the operation of business by females, I approximate the female management and operation of a firm by the share of female employees being bigger than 50 and 60 percent, using the number of female employees in the total number of employees. This information does also come from the AFiD data on manufacturing enterprises. The idea for this proxy comes from the previous literature that found that female-managed and -owned firms employ a higher share of females than male-managed and -owned ones (ITC, 2015; Ederington et al. 2009).[14]

I use further explanatory factors at the plant-level that played a role in the previous literature on trade and productivity. I control for the export status by a dummy variable that is 1 when the plant exports and zero otherwise (this is also a measure for the extensive margin of trade

[13]The sectors comprise the manufacturing industries according to the German industry classification WZ 2008, sectors 1000 to 3300. This classification corresponds to the international ISIC rev 4 classification. 11.6 percent of the plants are from the sector of food production, 11.5 percent from the sector of fabricated metals production and 13.7 from the sector of machinery construction.

[14]Ederington et al. (2009) find in their regression analyses that the hiring of female employees depends significantly and positively on the female share of managers and owners. The authors argue that this might reveal that female owners and managers have less taste for discriminating women. Data from the ITC for 20 developing countries show that in 40 percent of female-owned firms more than 50 percent of employees is female, whereas this is the case only in 22 percent of male-owned and -managed firms. About 53 percent, more than half of the male-owned and -managed firms employ only up to 20 percent female employees (ITC, 2015).

that I use in one of the later subsections). I used a measure of the log of the share of exports in total sales to control for the intensive margin of trade. Further variables include firm size as measured by the log of the number of employees in a plant, the status to be a multi-product firm (dummy variable that equals 1 when more than one good is produced by the plant), the foreign ownership status (that is 1 when the plant is a subsidiary to a multinational enterprise which has its headquarter in a foreign country[15], this data comes from the register of firms), the log of investment in intangible assets (licenses, patents, trade marks, concessions), the log of intermediate goods intensity (the value of intermediate goods is taken in relation to the number of employees), the capital depreciation to gain a measure of capital intensity which is logged (capital intensity is measured as the absolute amount of capital depreciation in relation to the number of employees; there are no measures for capital stock in the data available, and this approach has also been applied by Wagner (2016)), as well as 2-digit industry affiliation and regional federal state effects, and an East dummy variable (that is 1 when the plant is in East Germany and zero if it is in West Germany). There are no variables for firm demography and age in the data sets available. Therefore, I used a measure to capture whether a plant is older than five years, that is based on whether the plant reported within 5 years or not in the register of firms. Productivity is measured as the log of plant-level labor productivity by dividing sales output by the number of employees. As no information on the capital stock is available in the mentioned firm data sets, a more detailed measure of total factor productivity could not be used for this analysis.

Insert Table 1 here.

Table 1 displays the descriptive statistics for my full data set covering all manufacturing plants in the German economy that have at least 20 employees. As can be seen from the data sample 4.8 percent of the plants belong to an enterprise that has a female-owner, 9 percent of manufacturing plants belong to an enterprise that employs more than 60 percent of women and 14 percent of plants belong to an enterprise that employs more than 50 percent of females. 19 percent of plants are operating in the East of Germany. Around 73 percent of plants export and

[15]A firm is considered to be foreign-owned if it has more than 50 percent of the voting rights of the owner or more than 50 percent of the shares directly or indirectly controlled by a firm or person or institution in another country.

59 percent are multi-product plants. Around 20 percent of plants belong to an enterprise that is foreign-owned and about 97 percent of plants were older than 5 years.

Table 2 reports descriptive statistics where firm ownership and the employee share are differentiated by gender. Comparing mean values, the results show that female-owned firms are less productive than male-owned firms. 68 percent of female-owned firms export whereas about 73 percent of male-owned firms export. A higher share of female-owned firms produce more than one product (65 versus 59 percent), female-owned firms are less foreign-owned, smaller in size, older and fewer are operating in East Germany than male-owned firms. These statistics for female-owned firms are broadly in line with those for the groups of firms that employ more than 50 percent of females or more than 60 percent of females, except for one important difference: the share of firms that employ more than 50 or more than 60 percent females is higher in East Germany, about 23 versus 18 percent in West Germany.

Insert Table 2 here.

Table 3 displays results from a non-parametric test for first order stochastic dominance of one distribution over another. With this test not only the differences in mean productivity but across groups for all moments of the distribution can be examined. The According to the Kolmogorov-Smirnov test the hypothesis that the two distributions between female and male exporters do not differ is rejected at the one percent significance level. Moreover, the results show that the productivity distribution of male-owned firm exporters is dominated by the productivity distribution of female-owned firm exporters, i.e. female exporters have a higher productivity. As these results do not cover a fully fledged regression analysis, one can only cautiously interpret these results pointing to female firm exporters either producing with higher productivity possibly due to higher trade costs or by learning more from exporting. A different picture emerges for the size of firms: the productivity distribution of male exporters is to the right of female exporters. Exporting female firms thus seem to be smaller firms.

Insert Table 3 here.

4. Empirical Results

4.1. **Methodological Design.** To investigate the exporter-productivity premium across female- and male-run firms in Germany, I estimated the following basic regression:

$$Y_i = \beta_0 + \beta_1 Female_i + \beta_2 Exporter_i * Female_i + \beta_3 Exporter_i + \beta_4 X_i + \delta_s + \gamma_j + \epsilon_i \qquad (1)$$

where i is the manufacturing plant, s the industry sector, j the regional state, Y is the log of labor productivity measured by sales output in relation to the number of employees, Female is a dummy that is equal to one when the firm is owned by a female or when the employment share of females in a firm is either bigger than 50 or bigger than 60 percent, exporter is a dummy that is equal to one when the plant is exporting, X is a vector of control variables (including the log of the number of employees capturing firm size, a dummy for foreign ownership status, a dummy for multi-product status, a dummy to capture whether the plant is older than 5 years, the log of investments in intangible assets, the log of intermediate goods intensity, the log of capital intensity, and interaction terms between East Germany, exporting and productivity), δ_s are 2-digit industry fixed effects, γ_j are regional fixed effects at the federal state level and ϵ is an idiosyncratic error term.

The exporter productivity premium for a male-run firm is β_3 and for a female-run firm it is $\beta_2 + \beta_3$. If $\beta_2 > 0$, the exporter productivity gap is larger for female-run firms and according to the mechanism explained above this can be interpreted as female firms facing higher barriers to trade than male-run firms. An analysis of the impact of causation is provided in subsection 4.5. It has to be disentangled whether female-run firms have to be more productive to start exporting or whether they learn from exporting and thus have higher productivity. The results of my analyses show that a positive exporter productivity premium is present among German firms, and the gap becomes larger when the exporter is a female-owned firm or a firm in which the female employment share is larger than 50 or 60 percent. Moreover, the results point to selection into exporting being relevant whereas no significant effects are found in favor of learning from exporting.

4.2. **Baseline Results.** Table 4, Table 5 and Table 6 report the main results. In Table 4, column 1 shows a basic estimation including only the export status, female-ownership status and the interaction term between female firm ownership and exporting. The results reveal

a strongly significant and positive exporter productivity premium of male exporters being 33 percent more productive than male non-exporters. The exporter productivity premium of a female-owned firm is almost twice as large, namely 57 percent.[16] The inclusion of industry and regional fixed effects sorts out influences of different gender patterns across industries and regions.

Insert Table 4 here.

Further controls are added to the regression and results are shown in columns 2 and 3. When including firm size, multi-product status, foreign ownership status and information for whether the plant is older than 5 years, the female exporter productivity premium roughly stays the same, at 0.2784. When adding further controls on intermediate inputs and capital intensity - which are important to properly estimate a production function - and intangible assets investments, the coefficient becomes lower, it is 0.1277. The results show that firms that are larger, foreign-owned, multi-product firms and have more intangible assets are more productive.

I further investigated whether running a business in East Germany bears more costs that female exporting firms will have to bear. For that purpose I added interaction terms between the East dummy and exporting, the East dummy and female ownership status as well as a triple interaction term between exporting, female firm ownership and the East dummy. If additional barriers and costs were present for female exporters when they are operating in East Germany, then one would expect the triple interaction term to be positive. The coefficient on the interaction term of female owner, exporter and East Germany is positive, as expected, however it is not significant.

Insert Table 5 here.

In Table 5 results are shown for the female employee share as a regressor, to proxy for female management of the firm. The exporter productivity premium in firms that employ less than 50 percent men is lower than in the case of male firm ownership, it is about 21 percent as shown in column 1. Firms with a female employee share bigger than 50 percent have an exporter productivity premium of about 65 percent. This effect is more than twice as high as in the

[16]This results from computing $0.33 + 0.24 = 0.57$ and multiplying this term by 100.

case of female firm ownership. These results are still valid when introducing further explanatory factors to the regression equation, though the premium becomes lower in absolute terms.

Insert Table 6 here.

Table 6 displays results when the female employee share is exceeding 60 percent. The exporter productivity premium is lower than for the case when the female employee share was larger than 50 percent. The estimate is positive and significant and female-run firms have an exporter productivity premium of at least 34 percent, which is somewhat less than twice the premium for male-run firms.

4.3. **Firm Size.** Table 7 presents results from an estimation differentiated by firm size. The sample is split between large plants that have more than 250 employees and a sales value of more than 50 billion euros, and the remainder of small and medium-sized plants.

In column 1 and 2 it is shown that the female exporter productivity premium is positive but insignificant for big plants. Female-owned firms are not significantly less productive than male-owned firms, which is different from previous baseline results. The exporter premium is positive and significant.

In column 3 and 4 it is shown that the female exporter productivity premium is positive and significant for small and medium-sized plants. The premium is about 34 percent. Moreover, female-owned firms are significantly less productive and the exporter premium is positively significant.

Summarizing, the results show that the exporter productivity premium for female firm owners is significant and positive in small and medium-sized plants. Female firm owners require a higher productivity premium to find it profitable to export in order to cover additional costs and discrimination.

Insert Table 7 here.

4.4. **Extensive and Intensive Margins of Trade.** In a next step the extensive and intensive margins of trade were investigated. For the extensive margin an export dummy (1 if it is an exporting plant) was used as the dependent variable. A logit regression is applied to investigate whether a plant exports or not depending on productivity, gender and further factors. The results from the regressions are shown in Table 8. The premium for female-owned firms that are more productive is significant and positive. This is the case for female firm ownership, as well as for the female employee share of a firm being higher than 50 and 60 percent. Moreover, the results show that larger, older, more productive, multi-product-, foreign-owned firms and firms that have more intangible assets are more likely to export. Apparently, producing in East Germany is fostering trade for firms with employment shares of females bigger than 50 or 60 percent, but it is negatively impacting the export decision according to the female ownership status in East Germany.

Most importantly, the results reveal that female-owned firms and firms that have female employee shares larger than 50 or 60 percent are less likely to export. Given that influential firm characteristics as well as industry and regional effects are controlled for in the regressions for the export decision, the results show that it is female ownership or the majority share of female employees that significantly and strongly reduce the decision to export. This remains true even after controlling for the productivity of manufacturing plants.

Insert Table 8 here.

For regressions at the intensive margin the log of the export share was used as dependent variable. A Tobit estimator was taken and the same set of explanatory variables was included as for the extensive margin regressions. The results are shown in Table 9. The coefficient of the interaction term of female and productivity is positive, however not significant in the case of a female employee share higher than 50 and 60 percent. This could be interpreted as traders decide whether to trade with female-run firms or not (that means the extensive margin is important only), and when they decided to do, how much they trade does not depend on the gender status of the firm. Furthermore, the results show that more productive, larger, foreign-owned firms and firms that have more intangible assets export a larger share of their sales. The coefficients for age of the plant and multi-product status are negative but not significant. Moreover, the effects for East Germany are non-significant.

Insert Table 9 here.

4.5. **Selection into Exporting and Learning from Exporting.** To investigate the causal relationship between female exporting and firm productivity it is important to sort out whether firms that are more productive from the beginning sort into exporting (selection into exporting) or whether exporting is leading to an improvement of firm productivity (learning from exporting). For this task, I accessed additional firm-level and external data for the cross-section of the year 2012.[17] These data comprise information from the AFiD data sets of manufacturing plants and manufacturing enterprises, but not from the register of firms. For that reason, measures of foreign firm ownership and of the age of the plant are not available for the regression. Deflated measures were taken for values of variables.

For testing for selection into exporting, the pre-entry differences in labor productivity for those plants that export and those that do not are investigated.[18] The idea behind this procedure is that if the more productive firms become exporters, differences in firm productivity and performance should be found already some years before those firms start to export. This comparison has been applied for example in Bernard and Jensen (1995, 1999) or the International Study Group on Exports and Productivity (2008) who find that several years before firms start to export firms are larger, more productive and pay higher wages. For my analyses, plants that did not export between the years t-2 and t-1 but did so in year t were selected (this is the export status variable Exp) and the difference in labor productivity in year t-2 between plants who exported in year t and those who did not is estimated. t is in this context the year 2014. The following regression is estimated:

$$Y_{it-2} = \beta_0 + \beta_1 Female_{it-2} + \beta_2 Exp_{it} * Female_{it-2} + \beta_3 Exp_{it} + \beta_4 X_{it-2} + \delta_s + \gamma_j + \epsilon_{it-2} \quad (2)$$

where i is the plant, t the year, Y is the log of labor productivity, Exp is a dummy variable for export status (1 if a plant exports in year t, but not in years t-2 and t-1), Female is a dummy for firm ownership or the female employee share being bigger than 50 or 60 percent, X is a vector of control variables (including the log of employees to capture firm size, a dummy for

[17]This involved further time for coordination and data management by the Statistical Office, as well as financial costs.

[18]Pre-entry and post-entry differences can be computed for one, two, three or more year-differences, the final choice depends not least on data access.

multi-product status, the log of investments in intangible assets, the log of intermediate goods intensity and the log of capital intensity), γ are regional dummies at the federal state level, δ are 2-digit industry dummies and ϵ is an idiosyncratic error term.

Insert Table 10 here.

Results in Table 10 show that female firm ownership exerts a significantly negative effect on labor productivity for different models, and exporting exerts a significantly positive effect on labor productivity. The coefficient for the interaction term of female firm ownership and exporting is positive, however not significant at the conventional levels.

Insert Table 11 here.

In Table 11 results are shown for the female employee share being bigger than 50 percent. As can be seen a positive and significant effect can be found for the interaction term between the female employee share and exporting, which weakens in significance the more variables are entering the model.

Insert Table 12 here.

Table 12 displays results for the female employee share being bigger than 60 percent. The exporter-productivity premia of female-run firms are positive. To summarize, the effects that support selection into exporting appear relevant for the female employee share, but not for female firm ownership. This indicates that only the most productive female-run firms sort into exporting, which points to barriers that those firms face and additional costs they have to cover, which only the most productive firms can afford to pay and thus can finally become exporters.

For tests of the learning from exporting hypothesis, plants that did not export in years t-2 and t-1 but in year t and in at least one other year in the year t+1 and t+2 are compared with plants that did not export in any year between t-2 and t+2. t in this context is the year 2012. The idea behind this comparison is that exporting fosters the post-entry productivity

differences. The dependent variable is the difference in the growth of labor productivity over two years after starting to export. I estimate the following regression:

$$Y_{it+2} - Y_{it+1} = \beta_0 + \beta_1 Female_{it} + \beta_2 Exp_{it} * Female_{it} + \beta_3 Exp_{it} + \beta_4 X_{it} + \delta_s + \gamma_j + \epsilon_{it} \quad (3)$$

with i the plant, t the year, Y is the log of labor productivity, Exp is a dummy variable for export status (which is 1 if a plant did not export in years t-2 and t-1 but in t and in at least one other year in t+1 or t+2), Female is a dummy variable for female firm ownership or the female employee share being bigger than 50 or 60 percent, X is a vector of control variables (including the log of the number of employees capturing firm size, a dummy variable for multi-product status, the log of investments in intangible assets, the log of intermediate goods intensity, the log of capital intensity), γ are regional dummies at the federal state level, δ are 2-digit industry dummies and ϵ is an idiosyncratic error term.

Insert Table 13 here.

The results from Table 13 show that there is no relationship between the interaction term on female firm ownership and export status at the conventional significance levels. There is also no significant relationship resulting when the female employee shares bigger than 50 or 60 percent are considered. The results can be seen from Table 14 and Table 15. Consequently, one may conclude that learning from exporting does not play a significant role. This finds support in the literature for example by studies from Bernard and Jensen (1995, 1999), Bernard and Wagner (1997), and Clerides et al. (1996). Interestingly, the results further reveal that female-run firms have a higher productivity two years after the export starting date: the coefficient for this effect in the case of a female employee share bigger than 50 or 60 percent is positive and statistically different from zero. This is a remarkable result for its own sake. Independently from exporting, female-run businesses achieve higher productivity growth in the German economy, as compared to male-run firms.

Insert Table 14 here.

Insert Table 15 here.

5. Conclusion

Female-run firms differ from male-run firms in many aspects. One of them is that female-run businesses are less involved in exporting. This comes as a disadvantage because what is known from international trade theory is that exporters are more productive, they pay higher wages and hire more people. Inclusion of more women to international trade is put high on the current policy agenda with many efforts by the WTO, ITC, Worldbank and other institutions to empower women, to decrease barriers of trade for women and help them participate in international trade. Female participation in trade is considered to have an important impact on sustainable development and economic growth worldwide.

The present paper focusses on the relationship between exporting and productivity for female-run businesses in Germany. For that purpose I constructed a new, tailor-made and comprehensive data set on manufacturing plants based on official firm statistics from the German Federal Statistical Office and the Offices of the Laender. The results show that female-run firms have a positive exporter-productivity premium. Female-run firms that export are about twice as productive as male-run firms. Having a higher premium indicates that female-run firms face higher costs through discrimination barriers that they have to overcome when they decide to engage in exporting. The effect is large from an economic point of view. Disentangling effects through correlation from causation, results further exhibit that this effect results from a process of selection into exporting rather than learning from exporting. It corroborates the finding that female-run firms face discrimination barriers, they have to be more productive to become an exporter, and this translates into a higher female exporter-productivity premium. The difficulties that female firms face when they want to export and the resulting higher gender exporter-productivity premium will have an impact on the gender wage gap and gender income inequality in Germany.

The literature on the relationship between trade and productivity of female-run firms is still very scarce. Only through gathering adequate data that capture information on female exporters additional insight into the needs and disadvantages that female-run businesses face can be gained. The results for the German economy point to important policy implications. Politics could enforce programmes to support females to engage in international trade through financial means, networks and institutional set-ups and regulations. Moreover, it could encourage females by improving cultural perception of female business activities and females' role division between

work, family and children and within the society. This will also involve to improve child and family care facilities as well as flexible work conditions. These measures are likely to feed back positively on the whole economy and on society.

References

Becker, G. S. (1957). The Economics of Discrimination, Chicago, University of Chicago Press.

Bernard, A. B., Jensen, J. B. (1999). Exceptional exporter performance: cause, effect, or both?, *Journal of International Economics* 47, 1, 1-25.

Bernard, A. B., Wagner, J. (1997). Exports and Success in German Manufacturing, *Review of World Economics*, 133, 1, p. 134-157.

Bernard, A. B., Jensen, J.B. (1995). Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-1987, *Brookings Papers: Microeconomics*, p. 67-119.

Bertrand, M., Black, S. E., Jensen, S., Lleras-Muney, A. (2019). Breaking the Glass Ceiling? The Effect of Board Quotas on Female Labour Market Outcomes in Norway, *Review of Economic Studies*, 86, 191-239.

Black, S. E., Brainerd, E. (2004). Importing equality? The impact of globalization on gender discrimination, *Industrial and Labor Relations Review* 57, 4, 540-559.

Blalock, G., Gertler, P. J. (2004). Learning from exporting revisited in a less developed setting, *Journal of Development Economics* 75, 2, p. 397-416.

Blau, F. D., Khan, L. M. (2017). The Gender Wage Gap: Extent, Trends, and Explanations, *Journal of Economic Literature* 55, 3, 789-865.

Boler, E. A., Javorcik, B., Ulltveit-Moe, K. H. (2018). Working across time zones: Exporters and the gender wage gap, *Journal of International Economics* , 111, 122-133.

Burda, M. C. (2008). What kind of shock was it? Regional integration and structural change in Germany after unification, *Journal of Comparative Economics*, 36, 557-567.

Burda, M. C. (2006). Factor reallocation in Eastern Germany after reunification, *American Economic Review Papers and Proceedings*, 96, 2, 368-374.

Burda, M. C., Hunt, J. (2001). From reunification to economic integration: productivity and the labor market in Eastern Germany, *Brookings Papers on Economic Activity*, 32, 2, 1-92.

Burda, M. C., Severgnini, B. (2018). Total factor productivity convergence in German states since reunification: Evidence and explanations, *Journal of Comparative Economics*, 46, 1, 192-211.

Canadian Trade Commissioner (2016). Majority-Female Owned Exporting SMEs in Canada, , p. 1-16, https://www.tradecommissioner.gc.ca/businesswomen-femmesdaffaires/2016-MFO-SMES-PME-EDMF.aspx?lang=eng.

Chiu, B. (2018). Women-run Businesses Aren't Exporting Enough - But Things Are Changing, Forbes, https://www.forbes.com/sites/bonniechiu/2018/10/05/female-entrepreneurs-are-going-global-new-policy-attention-may-close-the-gap.

Clerides, S. K., Lach, S., Tybout, J. R. (1998). Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco, *Quarterly Journal of Economics* 113, 3, 903-947.

D'Espallier, B., Guerin, I., Mersland, R. (2011). Women and repayment in Microfinance: A Global Analysis, *World Development*, 39, 5, 758-772.

Davies, R. B., Mazhikeyev, A. (2015). The Glass Border: Gender and Exporting in Developing Countries, UCD working paper, WP15/25.

de Loecker, J. (2007). Do exports generate higher productivity? Evidence from Slovenia, *Journal of International Economics* , 73, 69-98.

Ederington, J., Minier, J., Troske, K. R. (2009). Where the Girls Are: Trade and Labor Market Segregation in Colombia, IZA discussion paper No. 4131.

Finseraas, H., Johnsen, A. A., Kotsadam, A., Torsvik, G. (2016). Exposure to female colleagues breaks the glass ceiling: Evidence from a combined vignette and field experiment, *European Economic Review*, 90, 363-374.

Froman, M. (2019). Unlocking Export Opportunities for Women-Owned Businesses, The United State of Women, https://www.theunitedstateofwomen.org/blog/unlocking-export-opportunities-for-women-owned-businesses.

Goldin, C. (2014). A Grand Gender Convergence: Its Last Chapter, *American Economic Review*, 104, 4, 1091-1119.

Gorodnichenko, Y., Schnitzer, M. (2013). Financial Constraints and Innovation: Why Poor Countries Don't Catch Up, *Journal of the European Economic Association*, 11, 5, 1115-1152.

ITC, International Trade Centre (2015). Unlocking Markets for Women to Trade, Geneva.

International Study Group on Exports and Productivity (2008). Understanding Cross-Country Differences in Exporter Premia - Comparable Evidence for 14 Countries, *Review of World Economics* , 144, 4, 596-635.

Juhn, C., Ujhelyi, G., Villegas-Sanchez, C. (2014). Men, Women, and Machines: How Trade Impacts Gender Inequality, *Journal of Development Economics* , 106, 179-193.

Juhn, C., Ujhelyi, G., Villegas-Sanchez, C. (2013). Trade Liberalization and Gender Inequality, *American Economic Review*, 103, 3, 269-273.

Kunze, A., Miller, A. R. (2017). Women helping Women? Evidence from private sector data on workplace hierarchies, *Review of Economics and Statistics*, 99, 5, 769-775.

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

Pande, R., Ford, D. (2011). Gender quotas and female leadership: A review, Background paper for the World Development Report on Gender 2012.

Pletzer, J. L., Nikolova, R., Kedzior, K. K., Voelpel, S. C. (2015). Does Gender Matter? Female Respresentation on Corporate Boards and Firm Financial Performance - A Meta-Analysis, *Plos One*, doi:10.1371/journal.pone.0130005.

Saure, P., Zoabi, H. (2014). International trade, the gender wage gap and female labor force participation, *Journal of Development Economics*, 111, 1723.

Singh, T. (2010). Does International Trade cause Economic Growth? A Survey, *World Economy*, 33, 11, 1517-1564.

Smeets, V., Warzynski, F. (2010). Learning by Eporting, Importing or Both? Estimating productivity with multi-product firms, pricing heterogeneity and the role of international trade, Aarhus Economics Department Working paper 10-13.

van Biesebroeck, J. (2005). Exporting raises productivity in Sub-Saharan African manufacturing plants, *Journal of International Economics* 67, 2, 373-391.

Wagner, J. (2018). Active on Many Foreign Markets: A Portrait of German Multi-market Exporters and Importers from Manufacturing Industries *Journal of Economics and Statistics*, 238, 2, 157-182.

Wagner, J. (2016). Still different after all these years - Extensive and Intensive Margins of Exports in East and West German Manufacturing Enterprises, *Journal of Economics and Statistics*, 236, 2, p. 297-322.

Wagner, J. (2016 b). Microeconometrics of International Trade, World Scientific Publishing.

Wagner, J. (2014). Credit constraints and exports: a survey of empirical studies using firm-level data, *Industrial and Corporate Change*, 23, 6, 1477-1492.

Wagner, J. (2012). Productivity and the extensive margins of trade in German manufacturing firms: Evidence from a non-parametric test, *Economics Bulletin*, 32, 4, p. 3061-3070.

World Bank (2017). Doing Business Report 2017, Washington, 14th edition.

World Bank (2015). Women, business, and the law 2016 - Getting to equal, Washington.

World Bank (2013). Opening Doors - Gender Equality and Development in the Middle East and North Africa, Washington.

WTO, World Trade Organization (2017). Aid for Trade Global Review 2017.

Appendix

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	p(1)	p(99)	Obs.
Log productivity	9.6088	0.8437	7.7433	11.9435	19418
Female employees share $>$ 50 percent	0.1375	0.3444	0	1	20236
Female employees share $>$ 60 percent	0.0886	0.2842	0	1	20236
Female firm ownership	0.0485	0.2148	0	1	20236
Exporter	0.7253	0.4464	0	1	20236
Multi-product	0.5883	0.4922	0	1	20236
Foreign ownership	0.2031	0.4023	0	1	20236
Log plant size	6.8959	1.3088	3.1781	10.0686	20236
Plant older than 5 years	0.9738	0.1599	0	1	20236
Log quality certificate	0.7619	2.7167	0	12.3579	20000
Log intermediate goods intensity	9.3197	1.9669	5.4071	15.3858	20000
Log capital intensity	6.3139	2.1786	0	12.1876	20000
East Germany	0.1885	0.3911	0	1	20236

Note: The Table displays descriptive statistics for firm level characteristics in Germany. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 2: Descriptive Statistics differentiated by Gender

Variable	Mean					
	Male Owner	Female Owner	Male $< 50\%$	Female $> 50\%$	Male $< 40\%$	Female $> 60\%$
Log productivity	9.6234	9.3237	9.6923	9.0939	9.6699	8.9931
Exporter	0.7276	0.6809	0.7461	0.5947	0.7442	0.5304
Multi-product	0.5853	0.6463	0.5861	0.6015	0.5831	0.6414
Foreign ownership	0.2131	0.0061	0.2211	0.0902	0.2176	0.0541
Log plant size	6.9032	6.7524	6.9275	6.6974	6.9234	6.6127
Plant older than 5 years	0.9729	0.9908	0.9729	0.9792	0.9725	0.9866
East Germany	0.193	0.0999	0.1822	0.2278	0.1849	0.2248

Note: The Table displays descriptive statistics for firm level characteristics in Germany differentiated by gender: male versus female firm ownership, firms with a female employment share $> 50\%$ and $> 60\%$, respectively. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 3: Kolmogorov-Smirnov tests

	H1	H2	H3
Productivity female exporter vs. male exporter	0.000	0.335	0.000
Size female exporter vs. male exporter	0.001	0.000	0.262

Note: This Table displays results from a non-parametric Kolmogorov-Smirnov test for the equality of distribution across gender. The tested hypotheses are: H1: the productivity distributions of the two groups do not differ. H2: The productivity distribution of the first group is first-order stochastically dominated by the productivity distribution of the second group. H3: The productivity distribution of the second group is first-order stochastically dominated by the productivity distribution of the first group. The data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 4: The exporter-productivity premium - female firm ownership

	Baseline results			
Female firm owner	-0.4697	-0.424	-0.1533	-0.1506
	(0.000)	(0.000)	(0.000)	(0.000)
Female firm owner * exporter	0.2419	0.2784	0.1277	0.1219
	(0.000)	(0.000)	(0.003)	(0.006)
Exporter	0.3327	0.2914	0.2358	0.2494
	(0.000)	(0.000)	(0.000)	(0.000)
Multi-product		0.0485	0.0361	0.0362
		(0.000)	(0.000)	(0.000)
Foreign firm ownership		0.3963	0.1469	0.1471
		(0.000)	(0.000)	(0.000)
Log plant size		0.0111	0.0749	0.0746
		(0.084)	(0.000)	(0.000)
Plant older than 5 years		-0.0335	0.0117	0.0108
		(0.471)	(0.725)	(0.746)
Log intangible assets			0.014	0.014
			(0.000)	(0.000)
Log intermediate goods intensity			0.2909	0.2906
			(0.000)	(0.000)
Log capital intensity			-0.0446	-0.0444
			(0.000)	(0.000)
Female firm owner * East Germany				0.0015
				(0.990)
Exporter * East Germany				-0.0527
				(0.056)
Female firm owner * exporter * East Germany				0.0199
				(0.889)
Regional FE	√	√	√	√
Industry FE	√	√	√	√
Number of plants	19326	19326	19118	19118
R^2	0.1611	0.1957	0.4736	0.4737

Note: This Table displays estimates for the exporter-productivity premium. The dependent variable is the log of productivity. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 5: The Exporter-productivity premium - female employee share > 50%

	Baseline results			
Female employee share > 50%	-0.9996	-0.9647	-0.4922	-0.4963
	(0.000)	(0.000)	(0.000)	(0.000)
Female employee share > 50% * exporter	0.4416	0.4553	0.2257	0.2382
	(0.000)	(0.000)	(0.000)	(0.000)
Exporter	0.2101	0.1776	0.1807	0.1910
	(0.000)	(0.000)	(0.000)	(0.000)
Multi-product		0.0421	0.0338	0.0340
		(0.000)	(0.000)	(0.000)
Foreign firm ownership		0.3689	0.1448	0.1451
		(0.000)	(0.000)	(0.000)
Log plant size		0.0059	0.0683	0.0682
		(0.346)	(0.000)	(0.000)
Plant older than 5 years		-0.0104	0.0209	0.0201
		(0.819)	(0.526)	(0.541)
Log intangible assets			0.0133	0.0132
			(0.000)	(0.000)
Log intermediate goods intensity			0.2763	0.2760
			(0.000)	(0.000)
Log capital intensity			-0.044	-0.0437
			(0.000)	(0.000)
Female employee share > 50% * East Germany				0.0159
				(0.764)
Exporter * East Germany				-0.0398
				(0.181)
Female employee share > 50% * exporter * East Germany				-0.0530
				(0.411)
Regional FE	√	√	√	√
Industry FE	√	√	√	√
Number of plants	19326	19326	19118	19118
R^2	0.2218	0.2512	0.4882	0.4883

Note: This Table displays estimates for the exporter-productivity premium. The dependent variable is the log of productivity. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 6: The Exporter-productivity premium - female employee share > 60%

	Baseline results			
Female employee share > 60%	-0.9724	-0.9431	-0.4494	-0.4626
	(0.000)	(0.000)	(0.000)	(0.000)
Female employee share > 60% * exporter	0.3234	0.3608	0.1395	0.1635
	(0.000)	(0.000)	(0.000)	(0.000)
Exporter	0.2452	0.2105	0.2020	0.2114
	(0.000)	(0.000)	(0.000)	(0.000)
Multi-product		0.0496	0.0370	0.0372
		(0.000)	(0.000)	(0.000)
Foreign firm ownership		0.3739	0.1449	0.1451
		(0.000)	(0.000)	(0.000)
Log plant size		0.0056	0.0689	0.0686
		(0.376)	(0.000)	(0.000)
Plant older than 5 years		0.0007	0.0264	0.0257
		(0.988)	(0.426)	(0.439)
Log intangible assets			0.0133	0.0133
			(0.000)	(0.000)
Log intermediate goods intensity			0.2794	0.2790
			(0.000)	(0.000)
Log capital intensity			-0.0443	-0.044
			(0.000)	(0.000)
Female employee share > 60% * East Germany				0.052
				(0.396)
Exporter * East Germany				-0.0369
				(0.201)
Female employee share > 60% * exporter * East Germany				-0.0997
				(0.182)
Regional FE	√	√	√	√
Industry FE	√	√	√	√
Number of plants	19326	19326	19118	19118
R^2	0.2101	0.2405	0.4847	0.4848

Note: This Table displays estimates for the exporter-productivity premium. The dependent variable is the log of productivity. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 7: The exporter-productivity premium - differentiated by firm size

	Big firms		Small and medium-sized firms	
Female firm owner	-0.1377	-0.1595	-0.1237	-0.0948
	(0.192)	(0.171)	(0.002)	(0.017)
Female firm owner * exporter	0.1499	0.1666	0.1125	0.0792
	(0.184)	(0.176)	(0.009)	(0.074)
Exporter	0.0800	0.1001	0.2442	0.2653
	(0.016)	(0.010)	(0.000)	(0.000)
Multi-product	0.0407	0.0411	0.0194	0.0195
	(0.020)	(0.019)	(0.049)	(0.048)
Foreign firm ownership	0.0791	0.0793	0.0900	0.0903
	(0.000)	(0.000)	(0.000)	(0.000)
Log plant size	-0.2248	-0.2251	-0.0274	-0.0276
	(0.000)	(0.000)	(0.007)	(0.007)
Plant older than 5 years	-0.1673	-0.1677	0.096	0.0944
	(0.015)	(0.015)	(0.004)	(0.005)
Log intangible assets	0.0056	0.0055	0.0150	0.015
	(0.003)	(0.003)	(0.000)	(0.000)
Log intermediate goods intensity	0.2726	0.2725	0.238	0.2376
	(0.000)	(0.000)	(0.000)	(0.000)
Log capital intensity	-0.0504	-0.0504	-0.0346	-0.0343
	(0.000)	(0.000)	(0.000)	(0.000)
Female firm owner * East Germany		0.2071		-0.1339
		(0.153)		(0.286)
Exporter * East Germany		-0.0853		-0.0805
		(0.225)		(0.004)
Female Firm Owner * exporter * East Germany		-0.1073		0.1556
		(0.669)		(0.288)
Regional FE	√	√	√	√
Industry FE	√	√	√	√
Number of plants	4300	4300	14383	14383
R^2	0.5286	0.5288	0.3780	0.3784

Note: This Table displays estimates for the exporter-productivity premium. The dependent variable is the log of productivity. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 8: The extensive margin of trade

Female firm owner	-3.9832		
	(0.000)		
Female firm owner * log productivity	0.4438		
	(0.000)		
Female employee share > 50%		-4.2056	
		(0.000)	
Female employee share > 50% * log productivity		0.4218	
		(0.000)	
Female employee share > 60%			-2.5761
			(0.002)
Female employee share > 60% * log productivity			0.2223
			(0.018)
Log productivity	0.5992	0.5158	0.5500
	(0.000)	(0.000)	(0.000)
Female firm owner * East Germany	-0.4899		
	(0.060)		
Female employee share > 50% * East Germany		0.2673	
		(0.027)	
Female employee share > 60% * East Germany			0.2921
			(0.037)
Multi-product	0.0781	0.0706	0.0776
	(0.064)	(0.096)	(0.067)
Foreign firm ownership	0.1863	0.1904	0.1823
	(0.001)	(0.001)	(0.002)
Log plant size	0.6439	0.6303	0.6304
	(0.000)	(0.000)	(0.000)
Plant older than 5 years	0.2097	0.2177	0.2417
	(0.087)	(0.076)	(0.049)
Log intangible assets	0.0635	0.0631	0.0631
	(0.000)	(0.000)	(0.000)
Log intermediate goods intensity	-0.0047	-0.0094	-0.0123
	(0.819)	(0.647)	(0.549)
Log capital intensity	-0.0443	-0.0449	-0.0459
	(0.005)	(0.005)	(0.004)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	19118	19118	19118
$PseudoR^2$	0.2394	0.2416	0.2415

Note: This Table displays estimates for the extensive margin of trade. The dependent variable is a dummy variable for export status. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 9: The intensive margin of trade

Female firm owner	-1.8867		
	(0.039)		
Female firm owner * log productivity	0.1899		
	(0.045)		
Female employee share > 50%		-0.1652	
		(0.778)	
Female employee share > 50% * log productivity		0.0077	
		(0.900)	
Female employee share > 60%			-1.3076
			(0.081)
Female employee share > 60% * log productivity			0.1255
			(0.116)
Log productivity	0.2621	0.2615	0.2538
	(0.000)	(0.000)	(0.000)
Female firm owner * East Germany	-0.1450		
	(0.625)		
Female employee share > 50% * East Germany		0.0109	
		(0.928)	
Female employee share > 60% * East Germany			0.0303
			(0.847)
Multi-product	-0.0073	-0.0102	-0.011
	(0.773)	(0.687)	(0.666)
Foreign firm ownership	0.3829	0.3839	0.3840
	(0.000)	(0.000)	(0.000)
Log plant size	0.3815	0.3810	0.3809
	(0.000)	(0.000)	(0.000)
Plant older than 5 years	-0.0346	-0.036	-0.033
	(0.712)	(0.702)	(0.726)
Log intangible assets	0.0141	0.0143	0.0141
	(0.000)	(0.000)	(0.000)
Log intermediate goods intensity	-0.0389	-0.0383	-0.0385
	(0.006)	(0.006)	(0.006)
Log capital intensity	-0.0199	-0.0213	-0.0215
	(0.018)	(0.011)	(0.011)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	14456	14456	14456
R^2	0.0683	0.0682	0.0683

Note: This Table displays estimates for the intensive margin of trade. The dependent variable is the log of the share of exports. Robust standard errors were computed. P-values are shown in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 10: Selection into exporting - female firm ownership

Female firm owner	-0.2864	-0.3044	-0.1187
	(0.000)	(0.000)	(0.002)
Female firm owner * export status	0.1271	0.0788	0.1969
	(0.683)	(0.768)	(0.360)
Export status	0.1434	0.1785	0.1369
	(0.014)	(0.002)	(0.001)
Multi-product		-0.0434	-0.0053
		(0.140)	(0.827)
Log plant size		-0.1441	0.0157
		(0.000)	(0.343)
Log intangible assets			0.0282
			(0.000)
Log intermediate goods intensity			0.2355
			(0.000)
Log capital intensity			-0.019
			(0.010)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4606	4606	4579
R^2	0.2532	0.2792	0.4808

Note: This Table displays estimates for the selection into exporting. The dependent variable is the log of productivity in year t-2. Export status is the export in t but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 11: Selection into exporting - female employee share > 50%

Female employee share > 50%	-0.7633	-0.7800	-0.4615
	(0.000)	(0.000)	(0.000)
Female employee share > 50% * export status	0.2841	0.2444	0.1599
	(0.055)	(0.104)	(0.139)
Export status	0.0843	0.1243	0.1107
	(0.144)	(0.027)	(0.009)
Multi-product		-0.0414	-0.0049
		(0.151)	(0.839)
Log plant size		-0.1497	-0.0016
		(0.000)	(0.924)
Log intangible assets			0.0272
			(0.000)
Log intermediate goods intensity			0.219
			(0.000)
Log capital intensity			-0.0162
			(0.025)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4606	4606	4579
R^2	0.3022	0.3301	0.4984

Note: This Table displays estimates for the selection into exporting. The dependent variable is the log of productivity in year t-2. Export status is the export in t but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 12: Selection into exporting - female employee share > 60%

Female employee share > 60%	-0.755	-0.7651	-0.4469
	(0.000)	(0.000)	(0.000)
Female employee share > 60% * export status	0.3817	0.3241	0.1927
	(0.042)	(0.094)	(0.149)
Export status	0.0921	0.1331	0.1178
	(0.103)	(0.016)	(0.004)
Multi-product		-0.0195	0.0080
		(0.497)	(0.738)
Log plant size		-0.1483	0.0037
		(0.000)	(0.824)
Log intangible assets			0.0272
			(0.000)
Log intermediate goods intensity			0.2209
			(0.000)
Log capital intensity			-0.0162
			(0.026)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4606	4606	4579
R^2	0.2967	0.3234	0.4958

Note: This Table displays estimates for the selection into exporting. The dependent variable is the log of productivity in year t-2. Export status is the export in t but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 13: Learning by exporting - female firm ownership

Female firm owner	0.0302	0.0302	0.0242
	(0.203)	(0.201)	(0.308)
Female firm owner * export status	0.2098	0.2081	0.2220
	(0.133)	(0.137)	(0.110)
Export status	-0.0172	-0.0175	-0.0137
	(0.659)	(0.653)	(0.718)
Multi-product		0.0034	-0.0003
		(0.734)	(0.973)
Log plant size		0.0012	-0.003
		(0.788)	(0.531)
Log intangible assets			0.0038
			(0.150)
Log intermediate goods intensity			-0.0066
			(0.007)
Log capital intensity			-0.0001
			(0.954)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4414	4414	4389
R^2	0.0076	0.0076	0.0104

Note: This Table displays estimates for learning from exporting. The dependent variable is the difference in the log of productivity in year t+2 and t+1. Export status is the export in t and in at least one of the years t+1 or t+2, but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 14: Learning by exporting - female employee share > 50%

Female employee share > 50%	0.0337	0.0338	0.0263
	(0.004)	(0.003)	(0.031)
Female employee share > 50% * export status	0.0082	0.0084	0.0035
	(0.934)	(0.933)	(0.972)
Export	-0.0043	-0.0047	-0.0007
	(0.918)	(0.909)	(0.985)
Multi-product		0.0040	0.0003
		(0.686)	(0.978)
Log plant size		0.0013	-0.0024
		(0.775)	(0.610)
Log intangible assets			0.0038
			(0.148)
Log intermediate goods intensity			-0.0059
			(0.020)
Log capital intensity			-0.0002
			(0.939)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4414	4414	4389
R^2	0.0079	0.0079	0.0104

Note: This Table displays estimates for learning from exporting. The dependent variable is the difference in the log of productivity in year t+2 and t+1. Export status is the export in t and in at least one of the years t+1 or t+2, but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.

Table 15: Learning by exporting - female employee share > 60%

Female employee share > 60%	0.0432	0.0431	0.0360
	(0.001)	(0.001)	(0.007)
Female employee share > 60% * export status	-0.0328	-0.0316	-0.0323
	(0.742)	(0.752)	(0.739)
Export status	-0.0003	-0.0008	0.0025
	(0.995)	(0.985)	(0.950)
Multi-product		0.0026	-0.0009
		(0.790)	(0.927)
Log plant size		0.0013	-0.0022
		(0.769)	(0.638)
Log intangible assets			0.0038
			(0.144)
Log intermediate goods intensity			-0.0056
			(0.026)
Log capital intensity			-0.0003
			(0.918)
Regional FE	√	√	√
Industry FE	√	√	√
Number of plants	4414	4414	4389
R^2	0.0085	0.0085	0.0108

Note: This Table displays estimates for learning from exporting. The dependent variable is the difference in the log of productivity in year t+2 and t+1. Export status is the export in t and in at least one of the years t+1 or t+2, but not in t-1 and t-2. Robust standard errors were computed. P-values are given in parentheses. Data are taken from the German Federal Statistical Office and the Offices of the Laender.