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GENDER DIVERSITY IN SENIOR MANAGEMENT AND FIRM PRODUCTIVITY: EVIDENCE FROM NINE OECD COUNTRIES

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ABSTRACT/RÉSUMÉ

Gender Diversity in Senior Management and Firm Productivity:
Evidence from nine OECD Countries

This paper investigates the link between gender diversity in senior management and firm-level productivity. For this purpose, it constructs a novel cross-country dataset with information on firms' senior management group and other firm characteristics, covering both publicly listed and unlisted firms in manufacturing and non-financial market services across nine OECD countries. The main result from the analysis is that productivity gains from increasing gender diversity in senior management are highest among firms with low initial diversity. Increasing the female share to the sample average of 20% in firms with initially lower shares would increase aggregate productivity by around 0.6%. This suggests that improving women's access to senior management positions matters not only for equity but could yield significant productivity gains.

Keywords: total factor productivity (TFP), senior management, gender diversity.

JEL classification codes: O47, M14, J16.

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ABSTRACT/RÉSUMÉ

Diversité des genres des cadres supérieurs et productivité des entreprises :
Preuves de neuf pays de l'OCDE

Cet article étudie le lien entre la diversité des genres des cadres supérieurs et la productivité de l'entreprise. Cet article construit un nouvel ensemble de données contenant des informations sur la haute direction des entreprises ainsi que d'autres caractéristiques de l'entreprise, couvrant à la fois les entreprises cotées et non cotées du secteur manufacturier et des services marchands non financiers dans neuf pays de l'OCDE. Le principal résultat de l'analyse est que les gains de productivité résultant de l'augmentation de la diversité des genres des cadres supérieurs sont les plus élevés parmi les entreprises dont la diversité initiale est faible. L'augmentation de la part des femmes à la moyenne de 20 % dans les entreprises dont la part était initialement inférieure augmenterait la productivité globale d'environ 0,6 %. Cela suggère que l'amélioration de l'accès des femmes aux postes de direction est importante non seulement pour l'équité, mais pourrait aussi générer des gains de productivité importants.

Mots clés : productivité globale des facteurs (PGF), cadres supérieurs, diversité des genres.

Classification JEL : O47, M14, J16.

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Gender Diversity in Senior Management and Firm Productivity: Evidence from nine OECD countries

By Clara Kögel, Chiara Criscuolo, Peter Gal and Cyrille Schwellnus[1]

1. Introduction

1. Despite the increasing participation of women in the labour market and a narrowing gender wage gap, women remain underrepresented in leadership positions (OECD, 2017[1]; OECD, 2023[2]). This "glass ceiling" reflects a range of interrelated factors, including childbirth-related caring responsibilities that hinder career development and unconscious or conscious biases in promotion decisions (OECD, 2023[2]; OECD, 2023[3]). The glass ceiling raises essential issues about equity in the labour market, considering women do not receive the same opportunities as men.

2. At the same time, gender diversity may matter not only for equity in the labour market but also for productivity. Corporate governance theory suggests that diversity in top management matters for firm performance (Carter, Simkins and Simpson, 2003[4]; Ferreira, 2010[5]). Moreover, increasing the participation of women in top management positions increases the pool of potential candidates and could ultimately generate a better firm-candidate match (Profeta, 2017[6]).

3. This paper provides a firm-level analysis of the causal impact of gender diversity in senior management on firm-level productivity. It constructs a novel cross-country firm-level dataset with detailed information on firms' senior management group and other standard firm characteristics. The data covers both publicly listed and unlisted firms in manufacturing and services across nine European countries. It is the result of a merge between the financial information of the Orbis dataset and a more recent dataset containing information about managers and directors, both provided by Moody's / Bureau van Dijk (BvD). The focus is on the senior management group. First, gender diversity in senior management may have broader implications for women's careers at lower levels of responsibility, e.g., by narrowing gender gaps in promotions and skill development. Second, senior management decisions have direct implications for firm performance.

4. Estimating the causal effect of gender diversity on firm productivity is challenging because of potential endogeneity. Previous studies suggest that women tend to self-select into lower-productivity firms, in part due to non-wage job characteristics such as greater working-time flexibility (OECD, 2021[7]).

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To address this issue, this paper proposes a novel instrumental variable (IV) strategy. It instruments the firm-specific female share with the average female share in similar firms abroad.

5. The contribution of this paper is twofold. First, the paper provides new evidence on the effect of gender diversity on firm performance. So far, existing empirical evidence has found mixed results on the effect of gender diversity in senior management. While some papers find a positive link (Erhard, Werbel and Shrader, 2003[8]; Smith, Smith and Verner, 2006[9]; Campbell and Mínguez-Vera, 2008[10]; Martín-Ugedo and Minguez-Vera, 2014[11]; Flabbi et al., 2019[12]; Luanglath, Ali and Mohannak, 2019[13]), others do not find a robust positive relationship (Adams and Ferreira, 2009[14]; Carter et al., 2010[15]; Wolfers, 2006[16]; Gagliarducci and Paserman, 2015[17]). These studies have primarily focused on narrowly targeted settings considering single countries and often publicly listed firms only, raising concerns about external validity. Our data allows to shed new light on the relationship of gender diversity and firm performance, exploiting data from a broader group of firms and different countries.

6. Second, the paper addresses the potential endogeneity challenge in estimating the effect of gender diversity on firm-level productivity, proposing a novel instrumental variable strategy. The richness of the data allows building several instruments based on the average female share in senior management in similar firms.

7. The main result is that increasing the female share in senior management raises productivity, particularly for firms with a low initial share of women in senior management. Productivity gains from an increase in female managers are highest for firms with less than 5% of female share in senior management. On average across these firms, increasing the female share to 20% (sample average) would increase their productivity by around 1.4%. Given that these firms account for about 40% of value added in the sample, this would increase average productivity in the sample by 0.6%. To put this productivity increase into perspective, it is equal to half of the average annual productivity growth of firms in the sample over 2015-2019.

8. A wide range of policies can help increase female representation in management positions. Beyond widely used mandatory gender quotas and voluntary targets, this includes various policy areas (OECD, 2023[18]). Family support policies, such as the provision of universal childcare and the harmonisation of parental leave for men and women, tend to reduce the extent to which care, and other household responsibilities fall on women. This can create a more favourable environment for their career progression.2 Further, combating gender stereotyping in the media and in the materials that parents and educators use to raise children may also promote female representation of women in senior management positions by affecting women's occupational choices (Bertrand et al., 2019[19]). Insofar as policies aimed at removing barriers to women's career progression and combating gender stereotyping address the root causes of female underrepresentation in senior positions, they are an essential policy tool to complement gender quotas that address the symptoms of underrepresentation but, on their own, may do little to remove barriers to women's career progression more broadly.

9. The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on gender diversity in senior management and firm performance. Section 3 describes the data and the definitions used in the empirical analysis. Section 4 presents the empirical model. Section 5 presents the results, and Section 6 provides related robustness checks. Section 6 concludes.

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[2] For instance, the evidence suggests that early childhood spending raises both female labour supply and their wages relative to men (Olivetti and Petrongolo, 2017[43]).

2. Literature

2.1. Theory

10. Corporate governance theory suggests that diversity in top management influences firm decision-making and, therefore, matters for firm performance (Carter, Simkins and Simpson, 2003[4]; Ferreira, 2010[5]). Carter et al. (2003[4]) conclude that diverse boards in terms of gender, ethnicity or cultural background may be better able to assess market conditions, bring more creativity and quality to board decision-making and produce more effective problem-solving. Further, Smith et al. (2006[9]) stress that increasing the diversity of boards may also generate a better public image and ultimately improve firm performance.

11. Considering gender diversity, women's leadership style might improve firm performance (Profeta, 2017[6]). A range of studies finds that women exhibit less over-confidence in decision-making than men and have a stronger preference for cooperation (Niederle and Vesterlund, 2007[20]; Woolley et al., 2010[21]). Female and male directors also differ systematically in risk attitudes, even after controlling for observable characteristics such as age and tenure (Adams and Funk, 2012[22]). An additional factor might be more active "mutual monitoring", as more gender-diverse boards are associated with more intense monitoring practices of managers (Adams and Ferreira, 2009[14]).

12. Apart from improving the decision-making of the management board, female participation among senior management may also boost firm performance by increasing the pool of qualified candidates. As the number of skilled and talented women is abundant, firms can select talents from a larger number of potential candidates.

13. Under some circumstances, gender diversity may be detrimental to firm performance. A heterogeneous team of top managers is more likely to have a broad range of opinions and experience conflict, which may be time-consuming and ineffective if the firm has to react quickly to changes in market conditions. Thus, the direction of the effect of gender diversity on firm performance is ultimately an empirical question.

2.2. Empirical studies

14. While early studies on the effect of gender diversity in senior management on firm performance focused on correlations between gender diversity and firm financial performance[3], several more recent studies have attempted to address potential reverse causality related to women systematically sorting into high or low-performing firms. Among these studies, several have used the introduction of gender quotas as an exogenous factor raising the representation of women in the boardroom.

15. Some of these studies document a positive effect of gender diversity in top management positions on firm performance.

- Campbell and Mínguez-Vera (2008[10]) use a legislative change in Spain and find a positive effect on stock valuation of the appointment of female board managers.
- Smith et al. (2006[9]), using a sample of 2,500 Danish firms, also document a positive gender-firm performance effect for various accounting-based performance measures. They build an instrument using the education of the spouses of other CEOs in the firm. This is based on the idea that CEOs married to well-educated spouses are supposed to have a less traditional view on the competences

[3] Some of these studies find a positive relation between gender diversity on firm performance, looking at the board of directors (Erhard, Werbel and Shrader, 2003[8]; Martín-Ugedo and Minguez-Vera, 2014[11]) or at senior management (Luanglath, Ali and Mohannak, 2019[13]). Other studies document no significant or a negative effect of gender diversity on firm performance, focusing on CEO gender (Wolfers, 2006[16]; Parrotta and Smith, 2021[44]), the board of directors (Campbell and Mínguez-Vera, 2008[10]; Carter et al., 2010[15]) and senior management (Gagliarducci and Paserman, 2015[17]).

of female CEOs, making them more willing to hire a woman in their own firm as compared to other CEOs married to lower educated spouses.

- Flabbi et al. (2019[12]) use a matched employer-employee panel dataset of Italian firms and construct a Bartik-type instrument based on beginning-of-the-period female leadership shares at the firm level interacted with female leadership growth at the regional level. They also find a positive impact the impact of a female CEO on firm performance increases with the share of female workers.

16. Other studies document no significant or a negative effect of an increased gender diversity on firm performance. The negative effect found in these studies might not represent the actual effect of increasing the female share per se but may capture the effect quotas may lead to the appointment of underqualified women on boards.

- Matsa and Miller (2013[23]) explore the effect of quota introductions in Norway, where the female shares in management boards increased from 18 to 40% in only three years. The study finds a negative effect on short-term profitability.
- Ahern and Dittmar (2012[24]), show that the introduction of the quota in Norway led to younger and less experienced boards, with a negative effect on firms operating performance.
- Adams and Ferreira (2009[14]) analyse a sample of US firms and find a negative effect of gender diversity among directors on firm performance. The analysis is based on an IV approach, using the share of male directors with board connections to female directors as an instrument for the share of female directors. However, one must be caution that any effect might be linked to attributes of individual female managers.

17. Overall, no consensus has emerged on the effect of gender diversity in senior management on firm performance. But existing empirical studies have primarily focused on narrowly targeted settings considering single countries and often publicly listed firms, raising concerns about external validity. Our allows to shed new light on the relationship between gender diversity and firm performance, exploiting data from a broader group of firms and different countries, and at the same time, addressing potential endogeneity issues.

3. Data and stylised facts

3.1. Data

18. The paper builds a new cross-sectional firm-level dataset across manufacturing and non-financial services sectors in nine OECD countries. The first data source is the OECD Orbis product provided by Bureau Van Dijk (BvD). It includes firm-level financial information, such as sales, employment and other firm characteristics. Using the BvD identifier, the financial data is matched to the Orbis Management Boards & Directors module. This module provides information on directors and managers, such as gender and appointment date. This data refers to the financial year 2019.

19. Productivity is calculated from financial information following several previous studies at the OECD and the academic literature (Andrews, Criscuolo and Gal, 2019[25]; Gopinath et al., 2017[26]).4 To maximise representativeness across the sample, on the analysis is restricted to firms with more than 20 employees. For the main analysis, the paper focuses on total factor productivity (TFP), as defined in (Wooldridge, 2009[27]). This measure reflects the overall efficiency with which labour and capital inputs are used together in production. The Appendix presents the estimation based on labour productivity, calculated as value added per worker.

[4] Many thanks to OECD colleagues Valentine Millot and Natia Mosiashvili for carrying out, refining and updating the calculations and the data preparation of more recent vintages.

20. The empirical analysis focuses on female representation in the Senior Management Group (SMG). Among other positions, the SMG covers business operators, directors, business managers, partners, managing directors, and legal representatives.5 The paper restricts the analysis to firms for which at least two members of the SMG can be identified (“SMG sample”).6

21. The paper further restricts the sample to firms where the ratio of managers to total employment is at most 5%. The rationale is that a small ratio signals a high level of management responsibility. For instance, in a firm with a management/total employment ratio of 1%, the average senior manager manages approximately 100 employees. By capping this ratio at 5%, this paper excludes firms where managers are on average responsible for fewer than 20 employees, thereby effectively excluding middle managers.7

22. The final merged dataset includes nine countries with adequate coverage of both management and financial information: Belgium, Germany, Denmark, France, Ireland, Italy, Portugal, Sweden, and the United Kingdom.

23. Table 1 compares the merged Orbis SMG sample and the Orbis financial dataset. The table shows that the merged sample is considerably smaller than the overall financial sample. In addition, it focuses on larger, older, and more productive firms. Lastly, the merged sample includes a higher share of listed firms than the Orbis sample. However, listed firms still only amount to 2.6% in the merged Orbis SMG sample.

Table 1. Main firm-level variables (mean)

Orbis financial sample vs merged Orbis SMG sample, 2019

	L	Age	TFP	Listed (%)	N. Obs.
Orbis	335	25.7	9.79	1.45	47,872
Merged Orbis (SMG)	911	29.3	11.25	2.63	47,872

Note: TFP refers to (log) total factor productivity as in (Wooldridge, 2009[27]). Listed is a dummy variable equal to 1 if the firm is listed and 0 otherwise. Firms with unknown listed status amount to less than 1% of the respective samples and are dropped from the analysis. The table refers to the year 2019.
Source: Author’s calculations based on the merged Orbis SMG sample.

3.2. Stylised facts

24. Female representation remains low among senior management. In our sample, the mean female share is below 19% across companies. Figure 1 presents the distribution of firms by female share in senior management. Across firms in the sample, around 60% of firms have a female senior management share below 5%.

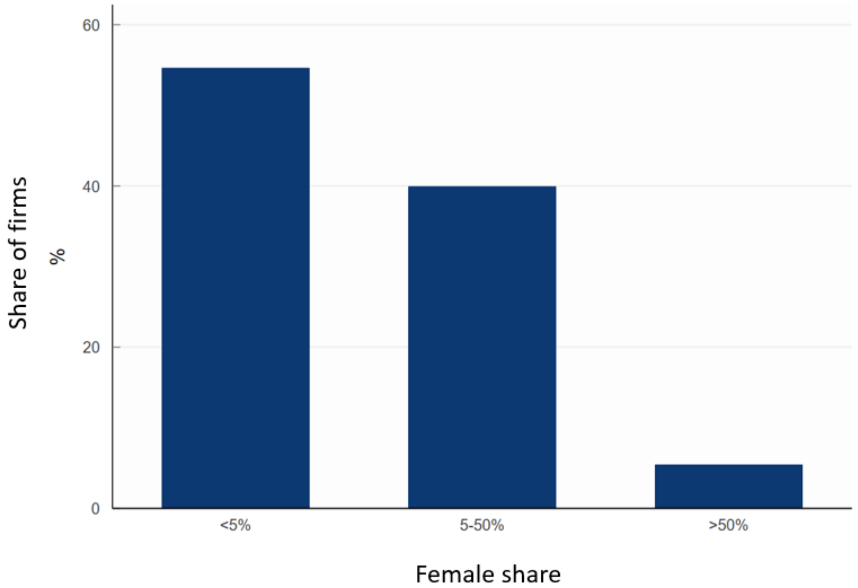
[5] The data also provides the name of the position in the country's respective language. For example, in France this code refers to directeur, gérant, exploitant, directeur géneral, directeur géneral adjoint; in Germany to Inhaber, Geschäftsführer, Komplementär; in Spain to director general, consejero delegado, administrador concursal, vicepresidente.

[6] Across the sample the mean number of senior managers within a firm is four.

[7] By restricting our focus to no more than 5% of the workforce, this paper also reduces the importance of a potential mechanical negative relationship between female shares and productivity. The reason is that a high share of part-time employees can introduce a systematic negative impact on productivity, as measured by output over the number of employees (headcounts – our only available measure in the data). Since women work part-time more often than men, this could introduce a mechanical negative relationship between productivity and the share of women. This is much less the case when focusing only on 5% of the workforce. This is even more so the case since these are the highest managerial positions, where the prevalence of part-time is also much less frequent.

25. The figure suggests that senior management positions remain largely out of reach for women. To some extent, this glass ceiling could reflect male-dominated social networks and male-oriented corporate culture that can hamper women's career progression. However, it could also reflect conscious or unconscious biases in promotion decisions and social norms by which childcare and household tasks are disproportionately shouldered by women, precluding access to positions with the highest levels of responsibility.

Figure 1. Distribution of firms by female share in senior management, 2019



Note: The chart shows the distribution of the female share in senior management across the firms in the sample for 2019. The data includes manufacturing and non-financial services sectors across nine OECD countries.
Source: Author's calculations based on the merged Orbis SMG sample.

4. Empirical model

26. Consider a basic equation characterising the relationship between firm-level productivity and the female share in senior management for firm *i*, sector *s*, and country *c*:

$$Prod_{i,s,c} = \beta_0 + \beta_1 Female\ Share_{i,s,c} + \beta_2 Female\ Share_{i,s,c}^2 + \delta\, X_{i,s,c} + \gamma_{s,c} + \varepsilon_{i,s,c} \tag{1}$$

where $Prod_{i,s,c}$ captures (log) productivity of firm *i*, $Female\ Share_{i,s,c}$ denotes the female share in senior management; $X_{i,s,c}$ are size, age, and listed fixed effects; and $\gamma_{s,c}$ are sector-country fixed effects. The quadratic form of this model allows capturing potential non-linear effects of higher female shares.

27. An OLS estimation of Equation (1) is likely to face a downward bias due to the selection of women into low productive firms.8 The explanation for this sorting might be related to non-wage advantages and structures in firms with lower productivity. In particular temporal flexibility might represent a significant support for women to the extent household responsibilities are unequally shared between women and men (Goldin, 2014[28]; Gallen, Lesner and Vejlin, 2019[29]). Recent OECD evidence (OECD, 2021[7]) has shown

[8] The bias could also go in the opposite direction if high-performing firms have better hiring practices and discriminate less against women, or if high-performing firms face a higher level of public scrutiny, making gender-based discrimination less viable.

that women tend to change firms less often and when they do, to sort in firms with a lower firm wage premium, a proxy for a firm's productivity.[9] Behavioural studies have found that women shy away from competition more than men (Niederle and Vesterlund, 2007[20]). At the same time, evidence related to the so-called ``glass cliff hypothesis'' (Ryan and Haslam, 2005[30]) has shown that women are more likely to be appointed to leadership positions that are more precarious than men (see Ryan et al. (2016[31]) for a review of the existing literature). Further, discriminatory hiring practices by employers might increase the difficulty for women to obtain a top management position within a highly productive firm.

28. To address reverse causality, the paper implements an instrumental variable (IV) approach. The IV strategy is based on two instruments, for the two endogenous variables in the model (Woolley et al., 2010[21]). The model is then estimated in a two stage least squares (2SLS) analysis.

29. The first instrument is the mean female share in a cell defined by size, age, listed status and sector, excluding the country where the firm is located:

$$Foreign\ ShareIV1_{i,c} = \frac{\sum_{c'\neq c}\sum_{i'\in cell1_i}^{N_{ic'}} Female\ Share_{i'c'}}{N_{cell1'_i}} \tag{2}$$

where:

- $cell1_i$ is firm *i*'s size, age, listed status and sector cell;
- $N_{ic'}$ is the number of firms in $cell_i$ in country *c'*;
- $N_{cell1'_i}$ is the number of firms in firm i's cell in all other countries (abroad).

30. The second instrument includes an additional characteristic based on the specific country's regulation. It is distinguished between countries with gender quotas and voluntary targets (all countries in the sample are covered by either one or the other, see Box 1 for a more detailed discussion of the two policies). The instrument is defined as the mean female share within a detailed size, age, and listed group, sector, and among countries with similar regulation (quota vs voluntary target):

$$Foreign\ ShareIV2_{i,c} = \frac{\sum_{c'\neq c}\sum_{i'\in cell2_i}^{N_{ic'}} Female\ Share_{i'c'}}{N_{cell2'_i}} \tag{3}$$

where:

- $cell2_i$ is firm *i*'s size, age, listed status, sector and policy (voluntary target or quota) cell;
- $N_{ic'}$ is the number of firms in $cell_i$ in country *c'*;
- $N_{cell2'_i}$ is the number of firms in firm i's cell in all other countries (abroad).

31. Instrument validity requires the instruments to be exogenous to the firm's productivity. This is plausibly the case because productivity of the firm is unlikely to influence the female share of a different firm in a different country. At the same time, the instruments need to be relevant, in the sense of correlating with the female share of senior managers, which is ultimately an empirical question and shown to be the case in Annex Table E.1.[10]

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[9] Firm wage premia refer to the component of workers' wages that is determined by the characteristics of the firm and not the characteristics of workers and can be seen as proxy for the firm's productivity (OECD, 2021[7]).

[10] To make sure that the correlation between the instruments and firm productivity is driven by the instrument rather than an omitted variable, such as firm size or age, the estimation controls for fixed effects in the regression.

Box 1. Gender Quotas and Voluntary Targets

Gender quotas are mandatory requirements setting a minimum percentage share of women in supervisory boards for large or public firms. They have become an increasingly popular legal instrument to narrow the gender gap in management boards. Since 2008, numerous European countries have introduced gender quotas with different enforcement mechanisms. However, their merits are debated. Opponents argue that quotas would go against meritocratic principles, displace qualified men, and ultimately reduce the quality of managers. Some countries have introduced voluntary targets to accommodate some of these concerns and leave more freedom of choice to firms. They are voluntary objectives with defined timeframes in which these should be achieved. The countries covered in this paper all have imposed either binding quotas or voluntary targets to improve the representation of women on the supervisory boards of listed companies.

A broad literature has looked at the effectiveness of gender quotas on gender diversity. Examples are Smith (2018[32]) for Norway, De Cabo et al. (2019[33]) for Spain, and Zenou et al. (2017[34]) for France. The evidence generally suggests that both mandatory quotas and voluntary targets can foster female participation in management boards (OECD, 2023[3]) (OECD, 2021[35]). In particular, the evidence suggests that countries with mandatory quotas experience an immediate rise in female representation in management boards. Countries with voluntary targets have experienced a more gradual increase over time (OECD, 2020[36]). In both cases, complementary measures such as training, mentoring, and networking programmes are essential to improve a female-friendly work environment and foster women's careers in leadership positions (OECD, 2020[36]).

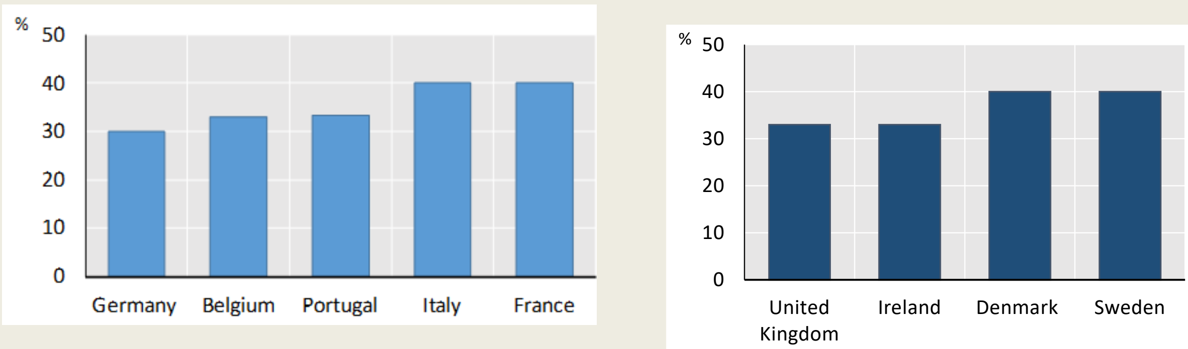
Further, and of interest for this paper, some studies have shown a discernible, positive relation between the growth of the female share on supervisory boards and on executive boards (Matsa and Miller, 2013[23]; Cook and Glass, 2015[37]; Gould, Kulik and Sardeshmukh, 2018[38]; Kirsch and Wrohlich, 2020[39]), also known as "trickle-down effect".

Figure 2. Mandatory gender quotas and voluntary targets by country

Mandatory gender quotas and voluntary targets by country

(A) Mandatory Quota

(B) Voluntary Target



Source: (OECD, 2023[3]).

The regression results in Table 2 show that a female CEO is associated with a 42% higher female share in senior management, which is consistent with the “trickle-down effect”. However, this does not imply a causal effect as an omitted variable driving both the female CEO and the female share in senior management (e.g., corporate culture) can bias the estimation.

Table 2. The relation of a female CEO and the female share in senior management

	Female share senior management
Female CEO	0.42***
	(0.02)
Country-Sector FE	yes
Firm-level controls	yes
N	8,792
R-squared	0.34

Note: Standard errors are clustered at the country-sector level (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firm-level controls include dummy variables for 16 size groups, 14 age groups, and listed status. The estimations refer to the year 2019. For this regression only firms with one CEO and more than 2 members of the senior management are identified to avoid that the CEO is included in the senior management group.
Source: Author’s calculations based on the merged Orbis SMG sample.

5. Empirical results

32. The results from Column (1) (Table 3) present the estimation of a non-parametric specification based on dummies for the female share, confirming the non-linear relationship between the female share and firm productivity. The main dependent variable is TFP, derived from the value-added-based procedure proposed by Wooldridge (2009[27]). Gains are the highest for firms with a low initial female share and vanish in bins with a larger initial share of female senior managers.

33. Estimating Equation (1) confirms that more gender diversity in the SMG raises productivity in a non-linear way. OLS results using a quadratic specification reveal an inverted U-shaped relationship between productivity and the SMG female share (Column (2)).[11] This implies a productivity premium associated with higher female representation compared to currently observed levels in most firms. In this sense, breaking the glass ceiling for women may produce not only more equality but also substantial efficiency gains for firms.

34. To provide an insight into potential heterogeneity of the effect by type of firm, the analysis tests for differences across sectors (Annex Table E.4), firm age and size (Annex Table E.4). Only differences across firm size are statistically significant. Firms with more than 150 employees observe a strong positive effect on productivity, while smaller firms do not observe any significant effect (Annex Figure E.1). The overall significant effect observed hence comes from large firms.

35. As discussed in the Empirical Model section, the OLS estimates likely face a downward bias and should not be interpreted as causal results due to potential reverse causality. To address this, the paper implements an IV strategy estimated as 2SLS, presented in Column (3). The IV estimation confirms the significant positive effect of the female share in senior management on firm-level productivity. The results hold using an alternative measure of firm productivity as dependent variable (see Annex Table E.2 for the results based on labour productivity). The coefficients of the IV estimation are larger than the OLS estimates, confirming the downward bias due to the selection of women into low productive firms such as

[11] These results are consistent with a recent OECD study based on linked employer-employee datasets from ten countries (Criscuolo et al., 2021).

fewer working hours or lower competition. The results hold controlling for more demanding fixed effect structures in Annex Table E.3.[12]

36. The table also reports the Kleibergen-Paap Wald F statistic on the significance of the instruments. Instrumentation is not weak according to the F statistic (Angrist and Pischke, 2008[40]), which confirms the relevance of the selected set of instruments. Further, the First-Stage Estimation presented in Annex Table E.1 confirms that both instruments positively correlate with the firm's female share and are statistically significant, suggesting that both chosen instruments are relevant.

37. One concern of the estimation is that the correlation between the instrument and the female share could capture other firm characteristics. To address this detailed size, age, listed status, and country-sector fixed effects are included in the main estimation.

38. The estimation results also shed a light on the underlying mechanism explaining the results. As discussed in the literature, there are two potential channels explaining why an increased female share in senior management could have a positive effect on firm performance. One would be that (1) women have better managerial skills than male, and the other is that (2) diversity itself has a positive impact on firm productivity. If women were better managers than men, the effect of the female share in senior management should increase linearly. However, the binned OLS regression (Column 1, Table 3) shows that the effect of increasing the female share on firm productivity is positive up until 50%, the highest gender diversity possible, but becomes insignificant for a higher share of female. This means that the effect is significantly positive as far as gender diversity within senior management increases, and that it is gender diversity that matters for the effect on productivity.

Table 3. Effect of the female share in SMG on productivity, 2019

Dependent variable:	Total factor productivity		
	OLS	**IV-2SLS**	
	(1)	(2)	(3)
Female share: 0 %	(.)		
Female share: >0 - 25%	0.08*** (0.02)		
Female share: >25-50%	0.05*** (0.01)		
Female share: >50 %	-0.02 (0.01)		
Female Share		0.07*** (0.03)	0.17*** (0.07)
Female Share^2		-0.11*** (0.05)	-0.32** (0.14)
Country-Sector FE	yes	yes	yes
Age + Size + Listed Fixed Effects	yes	yes	yes
N	47,872	47,872	47,872
R squared	0.54	0.54	0.42
F-stat			16.9

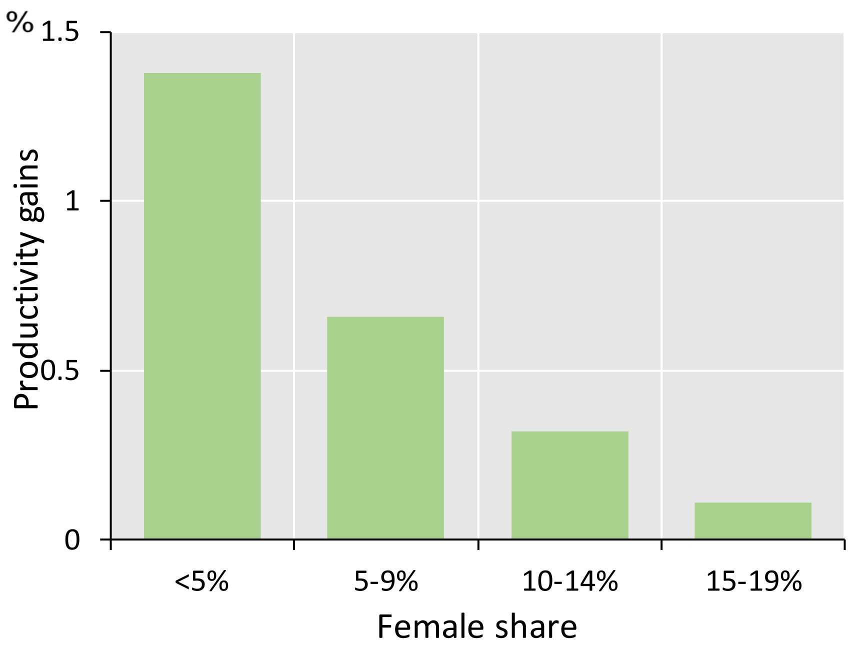
Note: Standard errors are clustered at the country-sector level ($*$ p < 0.05, $**$ p < 0.01, $***$ p < 0.001). The table reports the estimation based on three different regressions. Columns (1) and (2) show OLS regressions and columns (3) show 2SLS IV regressions. The reported F-stat for the 2SLS IV regressions is the Kleibergen-Paap Wald F statistic. Firm-level controls include dummy variables for 16 size groups, 14 age groups, and 2 listed groups. The interacted firm-level controls specification adds an interaction term of the size and age dummies. $\gamma_{s,c}$ denote country-sector fixed effects. The estimations refer to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

[12] These include the fixed effects structures based on size-age and listed-age, size-listed and age-listed, and size-age + size-listed + age-listed groups.

39. A graphical representation of the productivity gains (Figure 4) helps to simplify the interpretation of the results from Column (3), Table 3. The aim of this exercise is to focus on productivity gains for firms increasing their female share to the sample average (20%). For each firm, predicted productivity is weighted based on the share of value added within bins of initial female share.

40. The productivity premium from increased gender diversity is highest for firms with initially less than 5% of female managers. For these firms, increasing the female share to 20% (sample average) would increase productivity by around 1.4% on average. Firms with a higher initial female share also observe positive productivity gains, but to a smaller extent. All in all, the lower the initial female share of the firm, the higher the productivity gain from increasing the female share to sample average.

Figure 3. Productivity gains increasing female share to sample average (20%)



Note: This graph reports the predicted values from the regression: $Prod_{i,s,c} = \beta_0 + \beta_1 Fem\,\widehat{share}_{i,s,c} + \beta_2 Fem\,\widehat{Share}^2_{i,s,c} + \delta X_{i,s,c} + \gamma_{s,c} + \varepsilon_{i,s,c}$, with $Prod_{i,s,c}$ as firm-level log TFP and $Fem\,\widehat{share}_{i,s,c}$ denoting the predicted female share of SMG. Firm-level controls include dummy variables for 16 size groups, 14 age groups, and two listed groups. $\gamma_{s,c}$ denotes country-sector fixed effects. The estimation refers to the year 2019. Robust standard errors are clustered at the country-sector level.
Source: Author's calculations based on the merged Orbis SMG sample.

41. The aggregate effect across the sample weights the productivity gains by value added weights of the initial female share bins. Firms with a female share below 5% represent an important share of value added in the sample (36%). Firms with an initial female share of 5 to 20% make up 16 % of total value added in the sample. When increasing the female share in senior management to 20%, these firms experience average productivity gains of 1%. This implies that the value added-weighted average productivity increase from raising the female share to 20% for firms with lower initial shares equals 0.6%.

42. To put this into perspective, the average annual productivity growth rate of firms in the sample for 2015 to 2019 amounts to 1.1%. Productivity gains from increasing the female share to the sample average (20%) for firms with initially lower shares is therefore equal to half a year of average within-firm productivity growth.

6. Robustness

43. One concern is that the cross-sectional dimension of the data does not allow to control for confounding factors through firm fixed effects. For example, firms that are more innovative, that export more, or that have a higher turnover, might also employ more women in their senior management. In that case, innovativeness and export intensity might be two omitted variables that could explain the differences in productivity across firms with different female share in senior management. It is widely accepted that firm size is positively related to the propensity to export at the firm level (Bonaccorsi, 1992[41]; Wagner, 2001[42]). The demanding control structures of firm size, as detailed size groups, should therefore already account for the confounding factor of export intensity. To account for further confounding factors in the analysis, two additional regressions control for innovativeness at the firm level (through intangible intensity as intangible assets over total assets), and for capital intensity (as capital per worker).

44. Table 4 shows the results including intangible intensity, defined as intangible assets over total assets, in the estimation. The additional control confirms the main results and shows that the estimation is not driven by the innovativeness of the firms.

Table 4. Robustness with control for innovativeness of the firm

	First stage		Second stage
	$Female\ Share$	$Female\ Share^2$	*Labour productivity*
Foreign Share IV1	1.39*** (0.08)	0.75*** (0.07)	
Foreign Share IV2	0.32*** (0.01)	0.17*** (0.10)	
Intangible Intensity	-0.00 (0.03)	-0.00	0.04*** (0.00)
Female Share			0.24*** (0.01)
Female Share^2			-0.52*** (0.02)
Country-Sector FE	yes	yes	yes
Firm-level controls	yes	yes	yes
F Test			22.41
N	47,872	47,872	47,872
R-squared	0.52	0.33	0.32

Note: Standard errors are clustered at the country-sector level ($*$ p < 0.05, $**$ p < 0.01, $***$ p < 0.001). The table reports the estimation based a 2SLS IV regression. The reported F-stat for the 2SLS IV regressions is the Kleibergen-Paap Wald F statistic. Firm-level controls include dummy variables for 16 size groups, 14 age groups, and 2 listed groups. The interacted firm-level controls specification adds an interaction term of the size and age dummies. $\gamma_{s,c}$ denote country-sector fixed effects. Intangible intensity is defined as intangible assets over total assets. The estimation refers to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

45. Table 5 includes capital intensity, as capital per worker, in the estimation. Including capital intensity in the regression estimation also confirms our results. These results suggest that the positive effect of the share of women in senior management is not driven by omitted variables such as innovativeness or capital intensity.

Table 5. Robustness with control for capital intensity

	First stage		Second stage
	Female Share	*Female Share*^{2}	*Labour productivity*
Foreign Share IV1	1.37*** (0.08)	0.73*** (0.03)	
Foreign Share IV2	0.31*** (0.10)	0.16*** (0.10)	
Capital Intensity	-0.00 (0.00)	-0.34*** (0.06)	0.00 (0.00)
Female Share			0.23*** (0.07)
Female Share^2			-0.50*** (0.13)
Country-Sector FE	yes	yes	yes
Firm-level controls	yes	yes	yes
F Test			22.41
N	47,872	47,872	47,872
R-squared	0.52	0.33	0.32

Note: Standard errors are clustered at the country-sector level ($*$ $p < 0.05$, $**$ $p < 0.01$, $***$ $p < 0.001$). The table reports the estimation based a 2SLS IV regression. The reported F-stat for the 2SLS IV regressions is the Kleibergen-Paap Wald F statistic. Firm-level controls include dummy variables for 16 size groups, 14 age groups, and 2 listed groups. The interacted firm-level controls specification adds an interaction term of the size and age dummies. $\gamma_{s,c}$ denote country-sector fixed effects. Capital intensity is defined as capital over total employees. The estimation refers to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

7. Conclusion

46. This paper provides a firm-level analysis of the causal impact of gender diversity in senior management on firm-level productivity. It constructs a novel cross-country firm-level dataset with detailed information on firms' senior management group and other standard firm characteristics. The data covers both publicly listed and unlisted firms in manufacturing and services across nine European countries.

47. The underlying estimation strategy addresses potential reverse causality issues through a novel IV strategy. It instruments the firm-specific female share with the average female share within similar groups of firms. The paper estimates the causal effects of female share in senior management on firm productivity, allowing for non-linear effects and including a large set of fixed effects and control variables.

48. The main finding of this paper is that increasing the female share in senior management has a positive effect on productivity, particularly for firms with low initial shares of women in senior management. Productivity gains from an increase in female managers are highest for firms with less than 5% of female share in senior management. Increasing the female share to 20% (sample average) would increase for these firms would increase their productivity by around 1.4%. Across the sample, increasing the female share to 20% in firms with initially lower shares would lead to an average productivity increase of 0.6%. This equals half the average annual within-firm productivity growth rate in the sample over 2015-2019.

49. The findings suggest substantial costs of the underrepresentation of women at the top of the corporate hierarchy and the importance for governments and firms to take action. A wide range of policies can help increase female representation in management positions. Beyond widely used mandatory gender quotas and voluntary targets, this also includes a range of other policy areas, such as family support policies and policies aiming at combating gender stereotyping within society. Future research could try to gain a more in-depth understanding of the mechanism underlying the positive effect of gender diversity on firm productivity.

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Annex A. Sample and definitions

1. **The SMG sample:** This sample keeps firms with more than one member of top-level management.

- The SMG refers to the broad group of Senior Managers. It is defined as all members belonging to the occupation codes ranging from 13000 to 13090.[13] The SMG captures amongst others the position labels *business operator, director, business manager, partner, managing director, legal representative*.[14]
- Observations with a resignation date before 2019 are dropped.
- As the idea of the Senior Management Group is to identify a ``group'' of individuals, this paper restricts the definition to firms where at least two individuals are identified.

Table A.1. Occupation codes

Occupation code	Labels
130	Senior management
13000	Highest executive
13010	Member (Limited Liability Partnership)
13020	Unspecified executive
13025	Deputy executive
13030	Company secretary
13035	Representative
13040	Strategic planning & business development
13060	Internal auditor
13065	Investor relations
13070	Public relations
13075	Trustee
13080	Liquidator
13090	Senior management employee

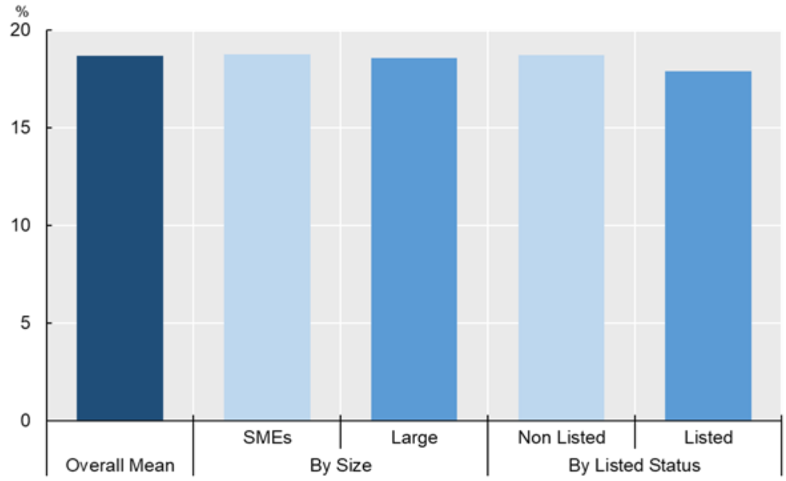
Source: Merged Orbis SMG sample.

[13] Duplicates in terms of name, occupation code and firm are considered as error and are dropped.

[14] The data also provides the name of the position in the country's respective language. For example, in France this code refers to *directeur, gérant, exploitant, directeur géneral, directeur géneral adjoint*; in Germany to *Inhaber, Geschäftsführer, Komplementär*; in Spain to *director general, consejero delegado, administrador concursal, vicepresidente.*

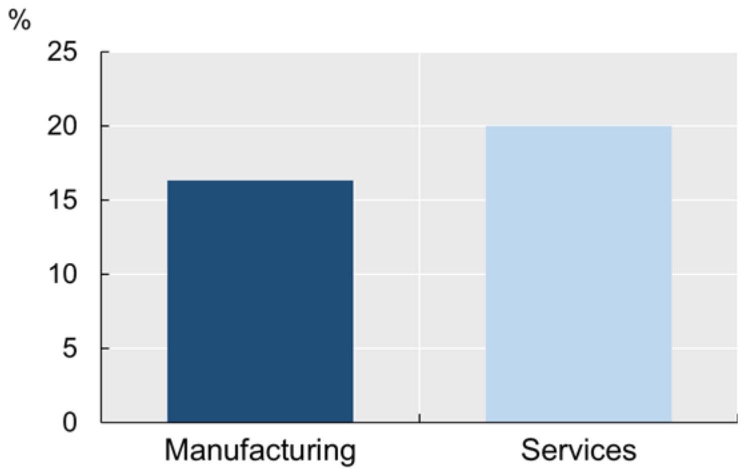
Annex B. Additional descriptive statistics

Figure B.1. Female share in the Senior Management Group, by firm size and listed status, 2019



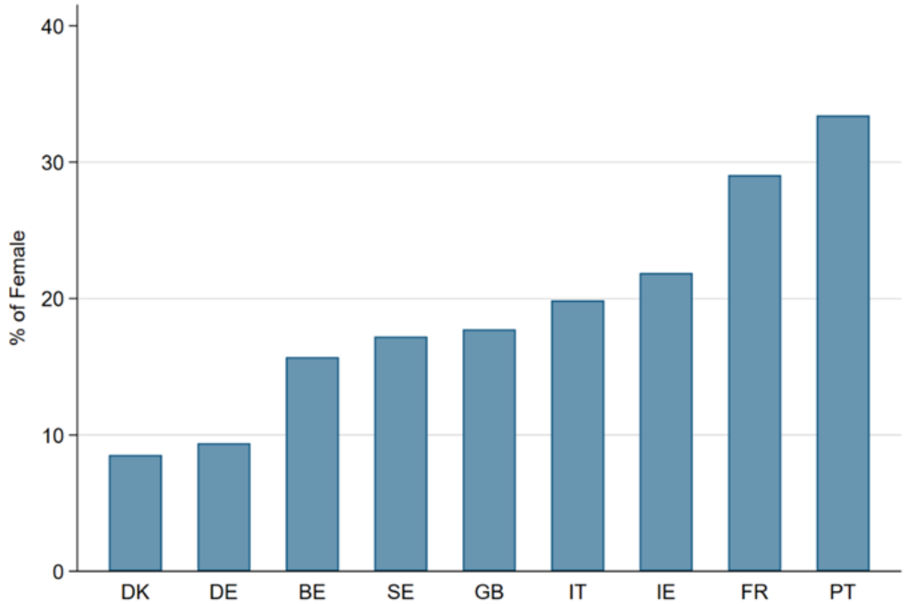
Source: Author’s calculations based on the merged Orbis SMG sample.

Figure B.2. Female share in the Senior Management Group, by macro sector, 2019



Note: The chart is based on the fitted values from the model: $Female\ Share_{i,s,c} = Macrosector_s + Size_{i,s,c} + Age_{i,s,c} + Listed_{i,s,c} + \gamma_c + \varepsilon_{i,s,c}$, where $Female\ Share_{i,s,c}$ refers to the female share of the SMG, $Size_{i,s,c}$ is a dummy variable that takes the value of 1 for firm with more than 250 employees, and 0 otherwise, $Age_{i,s,c}$ is a dummy variable that is equal to 1 if the firm is older than 5 years old, and 0 otherwise, $Listed_{i,s,c}$ is a dummy indicating if a firm is listed on the stock exchange, γ_c denotes country fixed effects.
Source: Author’s calculations based on the merged Orbis SMG sample.

Figure B.3. The share of women in senior management (2018)



Source: OECD calculations based on the merged Orbis SMG sample. Average values across firms by country.

Annex C. Overview quotas and voluntary targets

Table C.1. Quotas and voluntary targets by country

Country	Policy	%	Criteria	Size threshold	Impl. Period	Source
Belgium	Binding Quota	33%	Listed	< 250 Empl. until 2019	2011-2017	Belgian Company Act, 2011
Denmark	Voluntary Target	40%/ 60% of either gender	Listed, Private (> 250 Empl.), and SOEs		2013	Erhvervsstyrelsen, Kønsfordeling i ledelsen: Efterlevelse af måltal og politik for den kønsmæssige sammensætning
France	Binding Quota	40%	Listed, Private (Rev. or Total Assets > 50 mio € & Empl. > 500)	(-)	2011-2017	French Copé Zimmerman Company Act, 2011
Germany	Binding Quota	30%	Listed	< 2000 Empl. until 2020	2016	Law on Equal Participation of Women and Men in Leadership Positions in the Private and Public Sector
Italy	Binding Quota	30% (40% in 2020)	Listed	(-)	2011	Law 120/2011, Gender Balance on the Board of Listed Companies
Ireland	Voluntary Target	40%	SOEs	Smaller listed companies 25% until 2023	2019	'Balance for Better Business' Initiative
Portugal	Binding Quota	20% (33.3% in 2020)	Listed	(-)	2018	The Official Journal Electronic, Law No. 62/2017
Sweden	Voluntary Target	40%	Listed	(-)	2020	Swedish Corporate Governance Code
United Kingdom	Voluntary Target	40%	Listed (FTSE 100)		2015-2020	Hampton-Alexander Review: FTSE Women Leaders, Improving Gender Balance in FTSE Leadership

Source: The information is based on Table 4.19 from the OECD Corporate Governance Factbook (2023[3]) and complemented using the respective national laws.

Annex D. Empirical model

2. Relying on the instruments defined above, this paper estimates the following model (second stage) in the form of a Two-Stage-Least-Squares (2SLS) estimation:

$$Prod_{i,s,c} = \beta_0 + \beta_1 Fem\,\widehat{share}_{i,s,c} + \beta_2 Fem\,\widehat{Share}^2_{i,s,c} + \delta X_{i,s,c} + \gamma_{s,c} + \varepsilon_{i,s,c} \tag{4}$$

with $Prod_{i,s,c}$ as total factor productivity (log) of firm *i*, $Fem\,\widehat{share}_{i,s,c}$ as the predicted female share in senior management based on the first stage estimation, $X_{i,s,c}$ captures firm-level controls including the number of employees, the age, and the listed status of the firm, and $\gamma_{s,c}$ are sector-country fixed effects.

3. The estimates corresponding to the first-stage model for the two endogenous variables are as follows:

$$\begin{aligned} Fem\,share_{i,s,c} = {} & \alpha_0 + \alpha_1\, Foreign\,ShareIV1_{i,s,c} + \alpha_2 Foreign\,ShareIV2_{i,s,c} \\ & + \delta X_{i,s,c} + \gamma_{s,c} + \varepsilon_{i,s,c} \end{aligned} \tag{5}$$

and

$$\begin{aligned} Fem\,share^2_{i,s,c} = {} & \alpha_0 + \alpha_1\, Foreign\,ShareIV1_{i,s,c} + \alpha_2 Foreign\,ShareIV2_{i,s,c} \\ & + \delta X_{i,s,c} + \gamma_{s,c} + \varepsilon_{i,s,c} \end{aligned} \tag{6}$$

with $Fem\,share_{i,s,c}$ as the female share in senior management. $Foreign\,ShareIV1_{i,s,c}$ captures the first instrument based on the mean female share within a detailed size, age, listed group, sector, excluding country where the firm is located. The second instrument $Foreign\,ShareIV2_{i,s,c}$ refers to the mean female share within a detailed size, age, listed group, sector, abroad among countries with similar regulation (quota vs voluntary target). $X_{i,s,c}$ captures firm-level controls, including the number of employees, the age, and the listed status of the firm, and $\gamma_{s,c}$ are sector-country fixed effects.

Annex E. Additional Results

4. This table reports the results of the first stage estimation of the two-stage approach to estimating the effect of gender diversity on firm TFP (Table 2, Column (3) in the main text). In this stage, this paper estimates the impact of the instrumental variables on the firm's female share after conditioning on country-sector fixed effects and including a large number of firm size, age, and listed dummies. The identification is therefore based on within country-sector and detailed firm group variability. The first instrument ($Foreign\ ShareIV1_{i,s,c}$) captures the mean female share within the detailed cell as size, age, listed group, sector, excluding country where the firm is located. The second instrument ($Foreign\ ShareIV2_{i,s,c}$) refers to the mean female share within a detailed cell as size, age, listed group, sector, abroad among countries with similar regulation (quota vs voluntary target).

Table E.1. First-Stage estimation from 2SLS (using TFP)

	$Female\ Share$	$Female\ Share^2$
	(1)	(2)
Foreign Share IV1	2.32***	1.12***
	(0.08)	(0.06)
Foreign Share IV2	0.21***	0.11***
	(0.02)	(0.01)
Country-Sector FE	yes	yes
Firm-level controls	yes	yes
N	47,872	47,872
R-squared	0.55	0.35

Note: Standard errors are clustered at the country-sector level ($*$ p < 0.05, $**$ p < 0.01, $***$ p < 0.001). Firm-level controls include dummy variables for 16 size groups, 14 age groups, and two listed groups. $\gamma_{s,c}$ denotes country-sector fixed effects. The estimation refers to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

5. This paper also shows that results also hold using a different measure of firm productivity. For this step, the estimation is replicated using firm labour productivity, measured as value added per employee.

Table E.2. The effect of gender diversity on labour productivity

	First stage		Second stage
	Female Share	*Female Share*^{2}	*Labour productivity*
Foreign Share IV1	2.30***	1.18***	
	(0.07)	(0.05)	
Foreign Share IV2	0.37***	0.13***	
	(0.01)	(0.10)	
Female Share			0.27***
			(0.10)
Female Share^2			-0.51**
			(0.19)
Country-Sector FE	yes	yes	yes
Firm-level controls	yes	yes	yes
F Test			14.02
N	47,872	47,872	47,872
R-squared	0.56	0.36	0.32

Note: Standard errors are clustered at the country-sector level (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The table reports the estimation based on 2SLS IV regressions using labour productivity as main dependent variable. The reported F-stat for the 2SLS IV regressions is the Kleibergen-Paap Wald F statistic. Firm-level controls include dummy variables for 16 size groups, 14 age groups, and 2 listed groups. The estimation also controls for country-sector fixed effects. The estimations refer to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

6. To make sure that the correlation between the instruments and firm productivity is driven by the instrument rather than an omitted variable, such as firm size or age, the estimation controls for additional fixed effects in the regression. Table 6 shows that the results are robust to more demanding fixed effects structures.

Table E.3. Robustness check with alternative fixed effects structures

Dependent variable:	Total factor productivity			
	IV-2SLS			
	(1)	(2)	(3)	(4)
Female Share	0.17***	0.16*	0.16*	0.16*
	(0.07)	(0.06)	(0.06)	(0.06)
Female Share^2	-0.32**	-0.30*	-0.31**	-0.30*
	(0.14)	(0.11)	(0.12)	(0.12)
Country-Sector FE	yes	yes	yes	yes
Age + size + listed FE	yes	no	no	no
Age*size + age*listed FE	no	yes	no	no
Size*age + size*listed FE	no	no	yes	no
Size*age + size*listed + age*listed FE	no	no	no	yes
N	47,872	47,872	47,872	47,872
R squared	0.42	0.43	0.43	0.42

Note: Standard errors are clustered at the country-sector level (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The table reports the estimation based on 2SLS IV regressions using TFP as main dependent variable. The reported F-stat for the 2SLS IV regressions is the Kleibergen-Paap Wald F statistic. The estimation also controls for country-sector fixed effects. The estimations refer to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

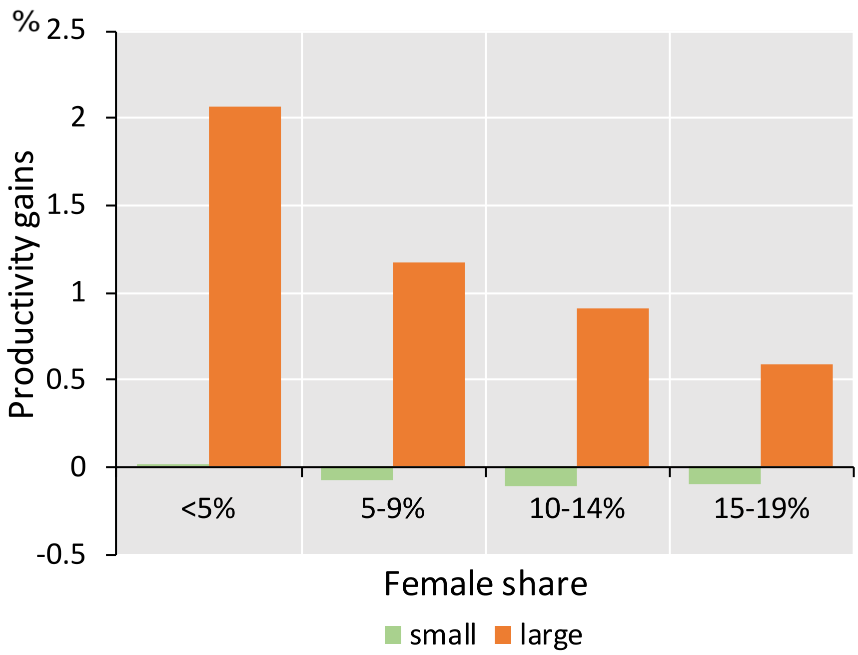
7. The following section explores heterogeneity of the effect by economic sector, firm age, and firm size.

Table E.4. The relation of the female share in senior management on firm productivity by economic sector (manufacturing vs. services)

	(1)
Female share	-0.16
	(0.12)
Female share^2	-0.06
	(0.16)
Manufacturing	-0.34***
	(0.03)
Manufacturing*Female share	0.35
	(0.12)
Manufacturing*Female share^2	-0.27
	(0.19)
Country-Sector FE	yes
Firm-level controls	yes
N	47,872
R-squared	0.15

Note: Standard errors are clustered at the country-sector level ($*$ $p < 0.05$, $**$ $p < 0.01$, $***$ $p < 0.001$). The table reports the estimation based on an OLS regression using TFP as main dependent variable. The estimation also controls for sector fixed effects. The estimations refer to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

Figure E.1. Productivity gains of increasing the female share in senior management to 20% by firm size



Note: Firm-level controls include dummy variables for 16 size groups, 14 age groups, and two listed groups. $\gamma_{s,c}$ denotes country-sector fixed effects. The estimation refers to the year 2019. Robust standard errors are clustered at the country-sector level.
Source: Author's calculations based on the merged Orbis SMG sample.

Table E.5. The relation of the female share in senior management on productivity by firm age and size

Dependent variable:	Total factor productivity	
	(1)	(2)
Female share	0.25**	0.01
	(0.10)	(0.04)
Female share^2	-0.38**	-0.13*
	(0.13)	(0.05)
Old	0.13***	
	(0.02)	
Old*Female share	-0.20*	
	(0.12)	
Old*Female share^2	0.31*	
	(0.13)	
Large		0.30***
		(0.02)
Large*Female share		0.28***
		(0.07)
Large*Female share^2		-0.20
		(0.10)
Country-Sector FE	yes	yes
Firm-level controls	yes	yes
N	47,872	47,872
R-squared	0.54	0.52

Note: Standard errors are clustered at the country-sector level ($*$ $p < 0.05$, $**$ $p < 0.01$, $***$ $p < 0.001$). The table reports the estimation based on an OLS regression using TFP as main dependent variable. The estimation also controls for sector fixed effects. Old is a dummy variable taking the value of 1 if the firm is older than 10 years, and 0 otherwise. Large is a dummy variable equal to 1 if the firm has more than 150 employees, and 0 otherwise. The estimations refer to the year 2019.
Source: Author's calculations based on the merged Orbis SMG sample.

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