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Assessing the Risk of Profit Shifting among the Suppliers to Danish Municipalities

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Abstract

Purpose

An increasing number of Danish municipalities aim to minimize tax avoidance due to profit shifting in their public procurement. To facilitate this effort, we develop a firm-level indicator to assess the potential risk of profit shifting (PS-risk) from Danish subsidiaries of multinational corporations to subsidiaries in low-tax jurisdictions.

Approach

Drawing from previous research, we contend that PS-risk is contingent on the maximum difference in the effective corporate tax rate between the Danish subsidiary and other subsidiaries under the global ultimate owner, in conjunction with the tax regulations relevant to profit shifting. We identify the top 400 contractors in Danish municipalities from 2017 to 2019 and estimate their relative PS-risk by combining information about corporate ownership structure with country-specific information on corporate tax rates, tax regulations, and profit shifting from three independent datasets.

Findings

Our PS-risk estimates are highly significantly positively correlated across the datasets and show that 17% to 23% of the total procurement sum of the Danish municipalities has been spent on contracts with corporations having a medium to high PS-risk. On average, PS-risk is highest for large non-Scandinavian multinational contractors in sectors such as construction, health, and information processing.

Originality

Our PS-risk indicator is novel, and our analysis provides the first estimate of PS-risk in Danish public procurement.

Social implications

Danish public procurers may use our indicator to screen potential suppliers and, if procurement regulations permit, to ensure high-PS-risk bidders document their tax practices.

Keywords: procurement, tender, indicator, multinational corporations, tax avoidance, subsidiaries, country-by-country reporting

Article classification: Research Paper

1. Introduction

Multinational corporations may be able to save corporate tax by transferring their pre-tax profits from high- to low-tax jurisdictions. A recent global analysis of macroeconomic data reveals that 36% of the profits of multinational corporations are shifted to low-tax jurisdictions (Tørsløv et al., 2023). In high-tax jurisdictions, such a practice leads to significant tax losses, market distortions, and unfair competition between locally owned companies and local subsidiaries of multinational corporations (Gauß et al., 2022).

Public procurement depends on the taxpayers' willingness to pay, and may therefore be particularly relevant to examine in a tax avoidance context. In order to maintain public support, public procurement should be transparent and free from collusion, discrimination, and unfair competition due e.g. to tax-motivated profit shifting. In the European Union (EU), public procurement constitutes approximately 14% of the gross domestic product (GDP) (Prier et al., 2021) and is generally subject to national rules. However, contracts exceeding 140,000 EUR (5.382 million EUR for construction contracts) must adhere to the EU public procurement rules. These rules require that tender evaluation is based on pre-published criteria emphasizing the best economic value or price-quality ratio, as well as public disclosure of the successful bidder and the value of the contract. Currently, neither the EU nor the Danish procurement rules permit setting criteria to reduce tax-motivated profit shifting (Ylönen, 2016).

In 2018 Oxfam Ibis (now Oxfam Denmark), a Danish NGO, launched a campaign against corporate profit shifting in Denmark. As part of the campaign, a publication describing ways to combat tax-motivated profit shifting in public procurement and investment was released (Hvid et al., 2018). The publication outlines the few steps that municipalities may take to reduce tax-motivated profit shifting within the Danish Procurement Law (Folketinget, 2022) and EU procurement regulations (EU, 2014) and ask them to endorse a tax charter, signaling their commitment to exclude tax haven companies from public procurement and cease investments in such entities. The goal was that municipalities became "tax haven free". Twenty-six municipalities, inhabited by 45% of the Danish population, have now signed the Tax Charter. However, whereas some of the municipalities have adopted a fair tax policy and now use ESG-rating companies to screen their investments for problematic tax behavior, they have not yet been

84 able to curb tax-motivated profit shifting in their procurement process due to the legal challenges
85 posed by the Danish and EU procurement rules.

86 Although profit shifting estimates can be derived at the jurisdiction level, evaluating tax-
87 motivated profit shifting at the level of individual subsidiaries is difficult due to a lack of
88 country-by-country information about their tax payments and pre-tax profits. For example, in the
89 Orbis database of Bureau van Dijk, an international corporate database, the total profits reported
90 by subsidiaries of multinational corporations only account for 17% of the reported consolidated
91 profits of the corporations (Tørsløv et al., 2023). Hence, with insufficient global data on the taxes
92 and pre-tax profits of subsidiaries available, new approaches to assess tax-motivated profit
93 shifting at the subsidiary level are needed.

94 To identify potential tax-motivated profit shifting among the suppliers to Danish municipalities,
95 we therefore develop an indicator of the risk of tax-motivated profit shifting at the individual-
96 supplier level. The indicator is based on a combination of information from Orbis regarding the
97 presence of the suppliers' affiliates in different jurisdictions, as well as information from three
98 different sources about tax regulations, tax rates and profit shifting into these jurisdictions.
99 Deriving indicator estimates from three distinct sources, we are able to cover affiliates in 117
100 jurisdictions and test the consistency of our indicator across data derived by disparate methods.

101 We find the indicator values derived from the three sources to be significantly correlated across
102 jurisdictions. Applying our indicator to the 400 most important suppliers to Danish
103 municipalities in the 2017 to 2019 period, we also find the indicator values from the three
104 sources to be highly significantly correlated across suppliers. Our results reveal that between
105 17% and 23% of the total value of the contracts signed by Danish municipalities may be at high
106 or intermediate risk of profit shifting.

107 The indicator we propose is simple and may help municipalities identify suppliers with a high or
108 intermediate risk of tax-motivated profit shifting, provided they know their corporate structure.
109 However, a high indicator value does not necessarily mean that a supplier is involved in profit
110 shifting. Hence, if the municipalities wish to curb tax avoidance in their procurement process,
111 and if legally possible, they should also require high-risk suppliers to explain their tax practices
112 and provide sufficiently detailed corporate tax and other economic data on a subsidiary as well as
113 country-by-country basis.

114   The remainder of this paper is organized as follows: Section 2 presents the theoretical framework

115   of the indicator. Section 3 describes Danish municipalities' public procurement data along with

116   the information about profit shifting, corporate tax rates, and tax regulations from the three

117   different sources. Section 4 outlines the empirical framework used to estimate the indicator

118   values. Section 5 presents the results, details about the affiliates of the Danish suppliers, subject

119   of the contracts, and a robustness check. Section 6 discusses our findings, potential biases, the

120   relationship between tax avoidance and public trust, as well as the implications of the 2022

121   revision of the Danish Procurement Law and 2021 EU public country-by-country reporting

122   directive to reduce profit shifting. Finally, Section 7 concludes the paper and suggests directions

123   for future research.

124

125   2. The indicator

126   Reducing tax to boost post-tax profits is considered the prime motivation of corporate tax

127   avoidance. The classical microeconomic models of tax avoidance at firm-level and analysis of

128   country-by-country reporting demonstrate that profit shifting is significantly related to the

129   difference in effective corporate tax rate between high- and low-tax subsidiaries controlled by

130   the same global ultimate owner (GUO) (Huizinga and Laeven, 2008; Johannesen *et al.*, 2016;

131   Garcia-Bernardo *et al.*, 2021). Moreover, Janský *et al.* (2022) analyzed procurement data at the

132   European level and found that the effective corporate tax rate in the jurisdictions to which

133   suppliers had links explained part of the variation in the total value of tenders in different EU

134   countries relative to these countries' GDP.

135   In addition, Dharmapala and Hines (2009) found it important that the laws, regulations, and

136   political systems of the countries and jurisdictions involved provided opportunities for a discrete

137   and secure profit transfer between a subsidiary and its affiliates. Hence, opportunities for tax-

138   motivated profit shifting increase if rules and regulations make profit shifting easy and hard to

139   detect.

140   Although tax-motivated profit shifting is legal, it may not be ethically defensible (Payne and

141   Raiborn, 2018; Lenz, 2020). In classical economic literature (e.g. Allingham and Sandmo, 1972),

142   individuals are predicted to engage in tax evasion if their expected economic benefits exceed

143 their expected costs. However, research on "tax morale" demonstrates that the propensity to

144 engage in tax evasion and avoidance can be influenced by social and ethical values (Frey and

145 Torgler, 2007; Morgan, 2023). Unfortunately, these values are not easily quantified. For

146 instance, although CSR-ratings are believed to reflect a company's social and ethical values, the

147 relationship between CSR and tax avoidance is ambiguous (Ylönen and Laine, 2015; Kovermann

148 and Velte, 2021). Contrary to expectations, Col and Patel (2019) thus found CSR ratings of US

149 multinational companies to increase substantially in the two years after they opened subsidiaries

150 in tax havens, suggesting that the companies attempted to boost their public image to hedge

151 against potential negative connotations associated with aggressive tax avoidance practices. We

152 therefore decided not to include an ethical component in the indicator.

153 Our profit-shifting indicator, thus, combines the tax rate gap, the difference in the corporate tax

154 rate between Denmark and jurisdiction i, with what we call the relative profit-shifting

155 friendliness (PS-friendliness) of the laws and regulations affecting the transfer of profit from

156 Denmark to jurisdiction i. We standardize both to the interval [0,1] and multiply them to produce

157 an indicator reflecting the risk of profit shifting, $PS_{risk_i} \in [0,1]$:

158 $$PS_{risk_i} = \tau_{DK,i} * \alpha_i \qquad (1)$$

159 where PS_{risk_i} reflects the likelihood that a subsidiary in jurisdiction i is used for profit shifting

160 by a Danish subsidiary; $\tau_{DK,i}$ is an index reflecting the corporate tax rate gap between Denmark

161 and i; and α_i is an index reflecting the PS-friendliness of the tax regulations of i. Note that

162 multiplying the tax-rate-gap index $\tau_{DK,i}$ by PS-friendliness α_i implies that the indicator PS_{risk_i} is

163 zero if one of the two multipliers is zero, and that PS_{risk_i} only reaches its maximum value of 1.0

164 if both multipliers are 1.0. Thus, according to the indicator, a lack of a tax rate minimizing

165 incentive or lawful and discrete means to shift the profit may both hinder tax-motivated profit

166 shifting.

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3. Data

Public procurement in Denmark

In Denmark the standard way of awarding public contracts above 140,000 EUR is through competitive tendering, as described by the EU tendering rules (EU, 2023). Briefly, within competitive tendering, there are three different types of public procurement procedures. In an open procedure, anyone can submit a full tender; in a restricted procedure, only companies that are pre-selected may submit a tender; and in a competitive negotiated procedure, only those who are pre-selected are invited to submit initial tenders and negotiate. Furthermore, bidders may enter a competitive dialogue with a contracting authority to propose a method to address specific needs defined by the authority.

All procurement procedures and notices for public contracts are now made publicly available on www.udbud.dk. Tenders are evaluated by awarding points based on pre-published criteria, with each category worth a certain amount; for example, the price may be worth 40%, technical characteristics 50%, and environmental impact 10%.

Public procurement data

We downloaded the public procurement data of Danish municipalities from Udbudsportalen, the precursor of www.udbud.dk, selecting contracts signed between 2017 and 2019. To verify their accuracy, we asked 13 of the 98 Danish municipalities to review their data. While some inconsistencies and errors were identified, the overall assessment was that the data downloaded from Udbudsportalen represented a largely accurate and comprehensive set of contracts. However, variations in company naming across municipalities necessitated further screening and editing. To streamline this process, we focused on the top 400 suppliers accounting for 75% of the total contract sum.

We used the EU Common Procurement Vocabulary (CPV) codes in the procurement data to identify the subject of each contract and estimated the average consolidated annual revenue of each company over the period from 2017 to 2019 from their annual financial reports or other publicly available data. The downloaded procurement data from Udbudsportalen contained no information about the price offers of alternative bidders or information that allowed us to identify the weighing of the criteria in the evaluation of tenders.

Corporate ownership structure

Using Orbis, an international corporate database, we identified the GUOs of the 400 suppliers in the procurement data, defining the path from a company to its GUO as at least 50% direct or indirect ownership. Having identified the GUO, we defined the corporate ownership structure as all the subsidiaries in which the GUO had at least 50% direct or indirect ownership (as these companies could potentially be used for profit shifting). UK subsidiaries located in Jersey, Guernsey, or the Isle of Man, where corporate tax rates are much lower than in Great Britain, were identified based on a list of towns in these jurisdictions and the addresses of the subsidiaries in Orbis.

Data on tax rate gap, PS-friendliness, and PS_{risk}

In order to cover a large number of jurisdictions and different methods to quantify tax-motivated profit shifting, we use three independent data sources to quantify the tax rate gap, PS-friendliness, and PS-risk of the countries and jurisdictions of the subsidiaries in the corporate structure of each company. All three contain jurisdiction-level information that allowed us to quantify at least two of the three variables in Equation (1).

CTHI data

The Corporate Tax Haven Index (CTHI) (Ates *et al.*, 2021; Tax Justice Network, 2021) provides data on minimum corporate tax rates and PS-friendliness of existing corporate tax and profit shifting regulations. The CTHI uses 20 different indices relevant to profit shifting in 70 jurisdictions, with scores ranging from 0 to 100 for each index. A score of 0 indicates no scope for corporate tax-motivated profit shifting, while a score of 100 indicates an optimal scope. The 20 indices are grouped into 5 categories. To derive the CHTI, the average of the index values in each category is first calculated, after which the arithmetic mean of the five averages is estimated and used as an overall index of the likelihood of profit shifting in each jurisdiction.

The EU Joint Research Center assessed the CTHI as a robust indicator of aggressive tax planning, aligning with other tax haven lists. However, the Center suggested considering using a geometric mean of the five category averages rather than the arithmetic mean to estimate the overall index value, i.e. to use a multiplicative model, similar to ours, rather than an additive one,

228   "in order to avoid that a high score in one category could compensate for a low score in another"

229   (Erhart, 2020).

MPN data

231   The Missing Profits of Nations (MPN) project (Tørsløv *et al.*, 2023) covers 78 jurisdictions and

232   provides an estimate of effective corporate tax rate and a macroeconomic index of PS-risk for

233   each jurisdiction based on the relative profit-to-wage ratio of foreign- and local-owned

234   companies. The risk of profit shifting increases when subsidiaries of foreign-owned companies

235   in jurisdiction, i, on average, have a higher profit-to-wage ratio than similar locally owned

236   companies in i, seemingly reflecting the relative ability of the foreign-owned companies to shift

237   profit into i from their subsidiaries in high-tax jurisdictions.

238   We downloaded the effective corporate tax rates and the average profit-to-wage ratios of foreign

239   and domestic companies in each jurisdiction from 2015 to 2018 from the MPN website

240   (https://missingprofits.world). The data were averaged across years and used to express the gap

241   in effective corporate tax rate between Denmark and jurisdiction i, as well as the PS-risk

242   associated with controlling a subsidiary in the jurisdiction.

PSMC data

244   The Profit Shifting of Multinational Corporations (PSMC) (Garcia-Bernardo and Janský, 2022)

245   also provides estimates on effective corporate tax rates, but uses a different profit-shifting index

246   based on the OECD country-by-country reports of large multinational corporations from 2016,

247   supplemented by country-by-country data for 2017 from large US multinationals. Using the

248   country-by-country reports, the authors calculate the fraction of the total profits booked in each

249   jurisdiction that is shifted into or out of the jurisdiction. From this data, Garcia-Bernardo and

250   Janský (2022) apply various models to calculate effective tax rates and profit per employee.

251   They find that their "misalignment model" produces the most accurate estimates of the shifted

252   profits. We therefore use the output from this model to estimate effective tax rates and the

253   fraction of the total profits booked that is shifted into each of the 54 jurisdictions receiving a net

254   influx of profit (see Table A7 of Garcia-Bernardo and Janský (2022)).

255

4. Empirical Framework

CTHI

The first category of the indices in the CTHI index reflects the Lowest Available Corporate Income Tax (LACIT) rate that a company can obtain in a given jurisdiction. In the CTHI dataset, India has the highest corporate tax rate (35% p.a.) and receives a LACIT-index value of zero, signifying that no corporate tax saving motivated profit transfer to India is likely. All other jurisdictions are scaled linearly from zero (India) to 100, with the value 100 assigned to jurisdictions with a zero corporate tax rate. We transform the LACIT-index to apply it to Danish companies by using the Danish corporate tax rate (22% p.a.) instead of India's corporate tax rate and express the index values on a scale from zero to one, instead of from zero to 100. Furthermore, we assign a tax rate gap of zero to jurisdictions with the same or higher LACIT than Denmark, and a value of one to all jurisdictions with a zero LACIT.

Hence, we define the tax-rate-gap index as:

$$\tau_{DK,i} = \begin{cases} \frac{LACIT_{DK} - LACIT_i}{LACIT_{DK}} & if \ LACIT_i \leq LACIT_{DK} \\ 0 & if \ LACIT_i > LACIT_{DK} \end{cases} \quad (2)$$

The remaining 19 country specific CTHI indices belong to four categories: loopholes and gaps, double tax treaty aggressiveness, transparency, and anti-avoidance regulations. Each category focuses on a different aspect of a jurisdiction's PS-friendliness, with a value of 100 indicating a high scope for profit shifting and a value close to zero indicating a low scope. We use the average index values of the four categories, $\overline{alfa_i}$, as an indicator of PS-friendliness and rescale the index to the interval from 0.0 to 1.0:

$$\alpha_i = \frac{\overline{alfa_i}}{100} \quad (3)$$

Having determined both the corporate tax-rate-gap index and PS-friendliness, the PS_{risk_i} value of each jurisdiction is estimated using Equation (1).

MPN data

In the MPN dataset we use the average effective corporate tax rate in jurisdiction i, ETR_i, to estimate the relative tax rate gab:

$$282 \qquad \tau_{DK,i} = \begin{cases} \frac{ETR_{DK} - ETR_i}{ETR_{DK}} & if\ ETR_i \leq ETR_{DK} \\ 0 & if\ ETR_i > ETR_{DK} \end{cases} \qquad (4)$$

283 To transform the difference in the profit-to-wage ratios into an indicator of PS-risk in the interval

284 from zero to one, we assume that PS_{risk_i} must be 0.0 if the profit-to-wage ratio in jurisdiction i

285 is lower for foreign subsidiaries than for domestic companies and/or the tax-gap $\tau_{DK,i}$ is zero. We

286 also assume that PS_{risk_i} gradually will approach 1.0 the more the profit-to-wage ratio of foreign

287 subsidiaries exceeds that of locally owned companies:

$$288 \qquad PS_{risk_i} = \begin{cases} 0 & if\ F_i < L_i\ or\ \tau_{DK,i} = 0 \\ 2 * \left(\frac{F_i}{F_i + L_i} - 0{,}5 \right) & if\ F_i \geq L_i\ and\ \tau_{DK,i} > 0 \end{cases} \qquad (5)$$

289 where F_i and L_i are the profit-to-wage ratios of foreign and locally owned companies in i,

290 respectively. Note that $\lim_{F_i \to \infty} \frac{F_i}{F_i + L_i} = 1.0$ and that $\lim_{F_i \to \infty} PS_{risk_i}$, therefore, also is 1.0.

291 Finally, we estimate α_i by dividing PS_{risk_i} with $\tau_{DK,i}$. As α_i by definition is limited to the

292 interval between zero and one, α_i is by default set to 1.0 if PS_{risk_i} exceeds $\tau_{DK,i}$.

293 *PSMC data*

294 Using estimates of effective tax rates from the misalignment model of Garcia-Bernardo and

295 Janský (2022), we standardize the tax-rate-gap between Denmark and other jurisdictions to the

296 interval from zero to one using Equation (4). With a positive tax rate gap, we further assume that

297 the fraction of the total profits booked that is shifted into a given jurisdiction will reflect the

298 likelihood that a subsidiary of a multinational corporation in the jurisdiction is involved in profit

299 shifting. If either the fraction or the tax rate gap is zero, there is no risk that profit shifting is

300 taking place. If the fraction is 1.0, all profit in the jurisdiction is shifted into the jurisdiction by

301 foreign subsidiaries and the PS-risk is 1.0. We can therefore express the risk of profit shifting to

302 subsidiaries in jurisdiction i as:

$$303 \qquad PS_{risk_i} = \begin{cases} 0 & if\ SP_i = 0\ or\ \tau_{DK,i} = 0 \\ \frac{SP_i}{TP_i} & if\ SP_i > 0\ and\ \tau_{DK,i} > 0 \end{cases} \qquad (6)$$

304 where SP_i and TP_i are the shifted and total booked profits in i, respectively. We finally estimate

305 α_i as $\tau_{DK,i}$ divided by PS_{risk_i}, as we did for the MPN data.

Risk of profit shifting of Danish subsidiaries

The data from the three sources allow us to determine the risk of profit shifting from a Danish subsidiary with corporate links to one or several affiliates in 117 different jurisdictions (See Supplementary Table). We calculate the overall risk of profit shifting from a Danish subsidiary to an affiliate in jurisdiction i, as the average of the available PS_{risk_i} values across the three datasets. Assuming that the most profit shifting prone affiliate in the corporate structure is the most likely to be used for profit shifting, we use the maximum of the average PS_{risk_i} values of the affiliates controlled by the GUO as our subsidiary-level indicator of the PS-risk of a Danish subsidiary.

Research has further demonstrated a convex, increasing relationship between corporate tax rate gap and the logarithm of the reported profits by US multinationals in different jurisdictions (e.g., Dowd *et al.*, 2017; Garcia-Bernardo and Janský, 2022). This may be because tax havens tend to combine a low or zero corporate tax rate with a PS-friendly legal environment, generating a positive correlation between PS-friendliness and corporate tax rate gap. To examine this, we estimate the correlation between our observations of PS-friendliness from the CTHI dataset and the estimated tax rate gaps from the MPN and PSMC data. We also test the robustness of the PS-risk indicator by raising the tax-rate-gap index to a power greater than 1.0 to examine whether this could improve the fit of our model to the data.

Finally, we use a Wilcoxon rank-sum test to compare the average PS-risk of Danish subsidiaries of multinational corporations controlled by Danish or Scandinavian GUOs to the average PS-risk of subsidiaries of multinational corporations controlled by a GUO residing elsewhere. To ensure that a difference in PS-risk is unrelated to company size and contract value, we use a binomial generalized linear regression with a logit link and either Danish vs. foreign or Scandinavian vs. foreign GUO as the dependent binary variable, and PS-risk, total consolidated revenue and contract sum as independent variables. All tests are carried out using R vers. 4.0.4.

5. Results

Comparing the PS-risk, corporate tax rate gaps, and PS-friendliness estimates derived from the three data sets, we find positive and either significant or highly significant correlations between the estimates, both across jurisdictions and at the subsidiary-level (Table I).

TABLE I here

The correlations are higher for the subsidiary-level estimates than for the jurisdictions, and PS_{risk_i} estimates are better correlated across the datasets than either tax-rate-gap, $\tau_{DK,i}$, or PS-friendliness, α_i. Plotting the PS_{risk_i} estimates of the data sets against each other shows that differences in the jurisdiction values mostly occur in the intermediate range of indicator values, while high and low values generally are more in accordance (Figure 1).

FIGURE 1 here

Furthermore, we find that 62% of the suppliers do not have any links to affiliates in jurisdictions with a PS_{risk_i} above zero. Most of these are relatively small Danish-owned companies without subsidiaries outside Denmark. Owing to the uncertainty of our PS-risk estimates, we characterize the PS-risks of the remaining 38% of the suppliers as either low (0<PS-risk ≤0.33), medium (0.33<PS-risk≤0.67) or high (0.67<PS-risk≤1.0) and find that 18%, 6%, and 14% of the remaining suppliers have links to subsidiaries in countries with a low, medium, or high PS_{risk_i}, respectively. Considering the total economic value of the contracts, these percentages change slightly, with the zero PS_{risk_i} group accounting for 48% of the total contract sum and the other three groups for 29%, 7%, and 16%, respectively (Figure 2).

FIGURE 2 here

13

361   All the jurisdictions on Oxfam's list of the top 15 tax havens (Oxfam, 2016) have a PS-risk score

362   above 0.5. Additionally, only two of the companies with PS-risk scores above 0.5 have an

363   indicator value generated by a jurisdiction (Gibraltar) not included on the Oxfam list. Overall,

364   22% of the money spent on public procurement by Danish municipalities went to companies

365   with affiliates in one or more of the top 15 tax havens.

366   Among the contracting companies, only one resided in a jurisdiction (the Netherlands) with a

367   medium or large PS-risk. Most resided in Denmark (88%), Norway, Sweden, Finland (6%), or

368   other EU member states (5%). Only four subsidiaries resided in a jurisdiction outside Europe.

369   The same was found for the GUOs. Most resided in Denmark (70%), the rest of Scandinavia

370   (10%), or the remaining part of Europe (16%). Only 4% resided in a jurisdiction outside Europe.

371   Among the 23 GUOs residing in a jurisdiction with a medium or high PS-risk, twelve resided in

372   Luxembourg, five in the Netherlands, four in Jersey, one in Ireland, and one in Singapore.

373   An analysis of the location of the affiliates of the contracting companies shows that among

374   European countries with a medium or high PS-risk, the Netherlands, Luxembourg, Belgium, and

375   Switzerland are the most popular. However, some of the companies also have affiliates in

376   medium-risk countries and jurisdictions such as Mexico, Singapore, and Hong Kong, as well as

377   in a few high-risk countries and jurisdictions such as the United Arab Emirates, Jersey, the

378   British Virgin Islands, the Cayman Islands, Bermuda, the Bahamas, the Isle of Man, Curaçao,

379   and Mauritius (Figure 3).

380   We were unable to identify any contracts with a company or GUO residing in one of the twelve

381   jurisdictions on the current EU blacklist, although eleven of the corporations had subsidiaries in

382   one or a few of the blacklisted jurisdictions. These subsidiaries were in Panama (13 subsidiaries),

383   Trinidad and Tobago (7), the Bahamas (4), and Fiji (1).

384   There was a highly significant difference ($W=990.5$, p-value=$7.0*10^{-10}$) in the average PS-risk of

385   multinational corporations with a GUO residing in Denmark (mean=0.21) and a GUO residing

386   abroad (mean=0.59), and an even more significant difference ($W=708$, p-value=$1.1*10^{-14}$), when

387   multinational corporations with GUOs residing in Scandinavia (Denmark, Norway, Sweden and

388   Finland) (mean=0.25) were compared to GUOs residing in non-Scandinavian jurisdictions

389   (mean=0.78). For Scandinavian corporations this difference was unlikely to be caused by

390   differences in their consolidated revenue, as this factor was insignificant in the binomial

391   regressions, while PS-risk was highly significant (p-value=$8.1*10^{-12}$, df=148). For Danish

392   corporations, the difference was caused by significant differences in both the PS-risk distribution

393   and company revenue. However, no significant interaction between the two was observed here

394   (see Supplementary material appendix 1 for further information).

395

396   FIGURE 3 here

397

398   Using the CPV procurement codes in our dataset to define the subject of the contracts reveals

399   that most of the contract sums in the medium- and high- PS-risk groups are in construction work,

400   machinery, and materials; medical, security, and office equipment and pharmaceutical products;

401   and IT, administration, and business services (Figure 4). Among the suppliers of construction

402   work, machinery, and materials (2-digit CPV groups 44 and 45), the most frequent high- and

403   medium-risk locations of the affiliates were the Netherlands (196 affiliates), Luxembourg (141),

404   Hong Kong (30), and Switzerland (30). Companies in pharmaceuticals and medical, security, and

405   office equipment (CPV groups 33 and 38) mainly had affiliates in the Netherlands (45 affiliates),

406   Switzerland (26), and Luxembourg (21), and those in IT, administration, and business services

407   (CPV groups 72 and 79) had affiliates in the Netherlands (100 affiliates), Hong Kong (34),

408   Singapore (24), and Luxembourg (20).

409

410   FIGURE 4 here

411

412   Grouping the contracts according to the total consolidated revenue of the suppliers, we find

413   corporations with an annual consolidated revenue in the 10 million to 10 billion Euro range to

414   account for most of the total contract sum. Furthermore, the percentage of the contract sum that

415   is found in the medium- or high- PS-risk groups increase with company revenue from 0% in the

416   1–10 million Euro range to 100% for the three largest corporations, which have an annual

417   consolidated revenue of more than 100 billion Euros (Figure 5).

418

419   FIGURE 5 here

420

421   Regarding the procurement tenders, 48% of tenders were announced as open procedures, 20% as

422   restricted procedures, and 27% as competitively negotiated procedures. Concerning selection

423   criteria, 89% of contracts were awarded using selection criteria involving either the most

424   economically advantageous offer or the best quality-price ratio as described in the EU

425   Procurement Directive (EU, 2014). No information about the weighting of additional criteria or

426   competing price offers was available in the procurement data.

427   To check the robustness of our results, we raised the tax-rate-gap index in Equation (1) to a

428   power greater than one to generate an increasing convex relationship between the PS-risk

429   indicator and the tax-rate-gap, as observed by Dowd *et al.* (2017) and Garcia-Bernardo and

430   Janský (2022). However, varying the exponent between 1.0 and 5.0 reveals that an exponent

431   around 1.0 produces the highest across dataset correlations for PS-friendliness and PS-risk, and

432   that the fit of the model declines as the power increases, as both the PS-friendliness and tax-rate-

433   gap correlations in the CTHI data and the MPN and PSMC datasets decline. Nevertheless, by

434   comparing a model with a power of 5 to our original model, we find the overall average country-

435   specific PS-risk estimates from the two models to be highly correlated, both for jurisdictions

436   (r=0.992, t=86.7, df=115, p-value<$3*10^{-16}$) and companies (r=0.997, t=262.7, df=398, p-

437   value<$3*10^{-16}$). Furthermore, only one of the 400 companies and three of the 117 jurisdictions

438   (Switzerland, Malta, and Macao) move to a lower PS-risk group.

439   The lack of an overall significant change in PS-risk may be explained by noting that PS-risk is

440   estimated directly from the observations in the MPN and PSMC cases. Therefore, only the PS-

441   risk values generated by the CTHI dataset change as the tax-rate-gap power varies, and this

442   change is not sufficient to change the overall average PS-risk estimates substantially. Overall,

443   this suggests that the PS-risk estimates are robust even with a large change in power.

444   Comparing indices across datasets, the input tax-rate-gap index in the MPN data is significantly

445   positively correlated to the input PS-friendliness in the CTHI data (r=0.585, t=5.15, df=51, p-

446   value=$5*10^{-16}$). The PSMC tax-rate-gap index is also positively correlated to the PS-friendliness

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447   index from the CTHI data, but in this case, the regression is insignificant (r=0.295, t=1.48,

448   df=23, p-value=0.15), perhaps because fewer observations are available.

449   According to Garcia-Bernardo *et al.* (2017), the Netherlands, United Kingdom, Ireland,

450   Singapore, and Switzerland are "conduit" countries with tax laws and regulations that favor

451   profit shifting to tax havens. However, against expectations, the proportion of high-

452   PS_{risk_i} subsidiaries among the corporations with affiliates located in these five countries was

453   lower than the comparable proportion for corporations without subsidiaries in these countries.

454   Therefore, there is no evidence in our data suggesting that presence in a conduit jurisdiction

455   increases the likelihood of having an affiliate in a high-risk jurisdiction.

456

457   6. Discussion

458   Our results show that 20% of the suppliers in our data have affiliates in medium- or high-risk

459   jurisdictions, an estimate in line with Gumpert *et al.* (2016), who found that 20.4% of German

460   multinational companies had affiliates in tax havens. Our analysis further reveals that contracts

461   with a medium- or high-risk of profit shifting account for 23% of the total contract sum of the

462   companies. However, the top 400 suppliers included in our analysis are only responsible for 75%

463   of the total contract sum. Furthermore, the percentage of suppliers in the medium- and high-risk

464   groups increase from zero for small locally-owned suppliers to 100% for the largest

465   multinational suppliers. Thus, profit shifting may be less prevalent among the small suppliers

466   responsible for the remaining 25% of the contract sum. Our best estimate is, therefore, that

467   between 17% and 23% of the total contract sum is used on companies with affiliates in high- and

468   medium-risk categories. According to a report from the Danish Competition and Consumer

469   Authority, Danish municipalities spent 35 billion DKK on public procurement in 2021 (DCCA,

470   2022). This implies a yearly risk of 6 to 8 billion DKK in municipal tenders, where winning

471   bidders may reduce their tax by shifting profits to affiliates in low-tax jurisdictions.

472   Among the high-PS-risk jurisdictions we identify, many are also on the Oxfam list of top tax

473   havens (Oxfam, 2016) (Figure 3 or Supplementary Table) and other tax haven lists (see, e.g.,

474   Table A.1 in Laffitte (2023)). This adds credibility to our indicator. Oxfam created its Tax Haven

475   List by assessing countries against a set of criteria that included three harmful tax policies: low

476   or zero corporate tax rates, available tax incentives, and a lack of cooperation with international

477   efforts against tax avoidance. Although the Oxfam list is from 2016, it contains most of the high-

478   PS-risk jurisdictions used by subsidiaries of corporations involved in Danish public procurement

479   in 2017–2019. The only exception is one high-scoring jurisdiction (Gibraltar) that is absent from

480   the Oxfam list. Furthermore, our estimates of the relative tax gap, PS-friendliness, and PS-risk in

481   different jurisdictions correlate significantly across the datasets. Additionally, perhaps owing to

482   the dominance of a relatively small number of high-risk jurisdictions in the corporate structures

483   or the higher number of observations, there is even better agreement between the individual

484   company scores (Table I).

485   However, we once more caution that these results do not prove that profit shifting takes place. A

486   direct or indirect link between a Danish subsidiary of a multinational corporation and a

487   subsidiary in a high-risk jurisdiction does not necessarily document that the Danish subsidiary is

488   involved in profit shifting. Furthermore, equation (1) is a simple indicator of tax-motivated profit

489   shifting and not a full statistical model. Hence, although a doubling of the indicator value

490   signifies an increase in PS-risk, it does not entail a doubling of the probability of tax-motivated

491   profit shifting.

492   Our estimates of PS-risk may furthermore be biased or uncertain for various reasons:

493   First, the Orbis data may not resolve the entire corporate structure of the 400 companies we

494   examine, potentially leaving some of their subsidiaries unknown (Bajgar *et al*., 2020).

495   Second, our results derive from a model that may not properly account for the highly curvilinear

496   relationship between profit per employee and the effective tax rate observed by Garcia-Bernardo

497   and Janský (2022). However, generating an indicator of PS-risk with a curvilinear relationship

498   by raising our tax-rate-gap index in Equation (1) to a power greater than 1.0, resulted in a decline

499   in the across-dataset correlations among the estimated PS-risk and PS-friendliness indices in

500   Table I. This suggests that a model with an exponent of 1.0 is more plausible than a model with a

501   higher exponent. We furthermore find positive correlations between the observation-derived PS-

502   friendliness index in the CTHI dataset and the observation-derived tax-rate-gap indices in the

503   MPN and PMSC datasets. This suggests that countries with a low corporate tax rate also tend to

504   have laws and regulations that make profit shifting feasible and may explain at least some of the

505 curvilinear relationship between profit per employee and effective tax rates observed by Garcia-
506 Bernardo and Janský (2022).

507 Third, we implicitly assume that the size of the corporate tax gap is the sole motivation behind
508 corporate profit shifting, but this may not always be the case. Although there is strong evidence
509 that corporate tax rate differences affect the geographical distribution of profits of multinational
510 corporations, Johannesen (2016) observed that internal loans of German firms often flowed from
511 high-tax countries to low-tax countries, which would not be expected if profit shifting to save tax
512 was the only driving factor behind the loans. Profit shifting is also not the only method to reduce
513 corporate tax. Besides profit shifting, Beer *et al.* (2020) and Lejour (2021) mention treaty
514 shopping (where differences in withholding taxes in different countries are exploited to reduce
515 tax on profit transfers), among several other methods. Others have pointed out that large net
516 operating loss carryforwards are common in many companies but not fully understood from a tax
517 avoidance perspective (e.g., Christensen *et al*., 2022; Wolff, 2021).

518 Fourth, the methods to shift profits and the intensity of profit shifting will change over time as
519 corporate tax rates and tax regulations change (Beer et al., 2020). In the literature three common
520 methods of profit shifting have been identified. The first is overcharging for intellectual property
521 rights held in low-tax jurisdictions or patent boxes with minimal income tax (Heckemeyer and
522 Overesch, 2017). The second involves providing high-interest loans from subsidiaries in low-tax
523 jurisdictions to subsidiaries in high-tax jurisdiction with deductible interest (Huizinga et al.,
524 2008), whereas the third is based on transfer pricing, where subsidiaries in low-tax jurisdictions
525 sell goods, services, and raw materials to affiliates in high-tax jurisdictions at inflated prices
526 (Cristea and Nguyen, 2016; Hebous and Johannesen, 2021). To reduce tax-motivated profit
527 shifting, while simultaneously trying to retain and attract multinational corporations, Denmark
528 and many other countries have adopted bilateral tax agreements and introduced anti-avoidance
529 measures (i.e., CFC rules, thin capitalization rules, and transfer pricing regulations) (Johansson
530 et al., 2017). Knoll *et al.* (2023) examined domestic Danish multinational companies controlled
531 by a Danish GUO and found that the strictness and efficiency of transfer pricing rules increased
532 over time in the jurisdictions of the affiliates from which the companies sourced their products,
533 which reduced tax-motivated mispricing. Similarly, the analysis of Delis *et al.* (2022) showed
534 that profit shifting among subsidiaries depended on the ratio of intangible assets to total assets

535 and generally declined with time in Western Europe and other developed countries, but increased

536 in the rest of the world.

537 Finally, Garcia-Bernardo *et al.* (2017) used network analysis to divide tax havens into "conduit"

538 and "sink" countries. They defined "sink" countries as low-tax jurisdictions that attracted and

539 retained foreign capital, while "conduit" countries were intermediate tax jurisdictions attracting

540 the money flowing toward the sinks. Even though the domestic corporate tax rates of the conduit

541 countries were not always low, they typically had low or zero taxes on money in transfer to other

542 countries and had highly developed legal systems and expertise to assist multinational

543 corporations with profit shifting. Based on Orbis firm-level data, Garcia-Bernardo *et al.* (2017)

544 found the Netherlands, United Kingdom, Ireland, Singapore, and Switzerland to be conduit

545 countries and most other profit destinations to be sinks. Therefore, defining PS-friendliness by

546 combining the scope of profit shifting across a range of laws and regulations and using the

547 overall effective corporate tax rate to measure the tax rate gap may not be sufficient to

548 characterize the PS-risk of having a subsidiary in a conduit country.

549 Tax avoidance correlates negatively with societal trust (Kanagaretnam *et al.*, 2018). Social trust

550 is high both in Denmark and Scandinavia in general (OECD, 2023) and is positively linked to tax

551 morale (Koumpias *et al.*, 2020). Perhaps this explains the significantly lower average PS-risk we

552 observe for multinational corporations with GUO's residing in Denmark and Scandinavia,

553 compared to corporations with GUO's residing elsewhere. However, although Danish citizens

554 generally have a high level of trust in their government institutions, the downscaling of the

555 Danish tax administration and several high-profile tax evasion and avoidance cases seem to have

556 shattered public trust in the Danish tax collection system. The "cum-ex" and "cum-cum" scandal

557 revealed in 2017 that the Danish tax authorities had refunded more than 2 billion euros in

558 dividend tax that was fraudulently claimed (Casi *et al.*, 2022; Smith Nielsen, 2020). The VAT

559 "carousel fraud" demonstrated how goods and services were traded across borders without

560 declaring and/or settling VAT (e.g., Kowal and Przekota, 2021), and the revelations in the

561 Luxembourg Leaks and the Paradise and Panama Papers illustrated how tax havens were used by

562 corporations and high-ranking members of society. The audit reports submitted to the Public

563 Accounts Committee of the Danish Parliament have repeatedly criticized the Danish Tax

564 Agency's performance, including its compliance checks of the corporate taxes paid by large

565 companies (Rigsrevisionen, 2022) and its control of transfer pricing (Rigsrevisionen, 2014). A

566   report from the Danish Tax Agency (2014) has furthermore suggested that public trust in the

567   Danish tax administration has declined over time. The manner in which this impinges on the

568   future prevalence of tax-motivated profit shifting among Danish controlled multinationals

569   remains to be seen.

570   Regarding the impact of tax-motivated profit shifting on public procurement it is likely that the

571   winning bids from tax-avoiding companies will be below those from tax-abiding ones (Gauß *et*

572   *al.*, 2022). If so, the attitude of a Danish municipality towards becoming "tax haven free" may

573   depend upon how much of an expected increase in corporative tax it will be allowed to receive to

574   compensate for the anticipated increase in procurement costs. Currently, a Danish municipality

575   may receive a refund corresponding to 14.24% of the corporate tax generated by the work of the

576   company's employees living within the municipalities' area. However, this refund is just a small

577   part of a system where the Danish central government collects income and corporate taxes and

578   redistributes them in a complex "equalization scheme" of transfers from richer to poorer

579   municipalities based on a number of demographic and economic indicators (Houlberg and

580   Ejersbo, 2020). Given Denmark's high public trust in government institutions, criticism of the

581   Danish tax administration, and uncertain municipal tax benefits, it is challenging to assess the

582   welfare implications of our findings. The revenue sources and municipalities' tasks differ from

583   country to country, adding to the difficulties involved in extrapolating the Danish case to other

584   countries.

585   Increasing tax transparency is widely seen as a way to restore societal trust. As the Secretary

586   General of the OECD in 2013 explained, "Transparency of the tax system is critical to building

587   trust in policies and policy outcomes" (Gurria, 2013). One way to increase transparency might be

588   to require all multinational corporations to report their annual economic data and tax payments

589   on a country-by-country basis. In the UK, Dyreng *et al.* (2016) found that increased public

590   pressure following the disclosure of the location of subsidiaries changed the tax behavior of

591   companies and reduced their profit shifting and other tax-minimizing procedures. Under the UK

592   Companies Act of 2006, all corporations are required to disclose the names and locations of their

593   subsidiaries publicly. However, in 2010, an ActionAid investigation found that the act was

594   insufficiently enforced and that almost half of the 100 largest corporations listed on the London

595   Stock Exchange did not disclose this information. Following an ActionAid International

596   campaign that pressured more corporations to disclose their subsidiaries, tax avoidance and the

597 use of tax havens declined among corporations that had not previously disclosed their full
598 corporate structure. In summary, Dyreng *et al.* (2016) concluded that public pressure related to
599 the disclosure of company structures involving tax havens creates fear of significant political and
600 reputational costs, leading to reduced tax avoidance. Others (e.g., Baudot *et al.*, 2020; Joshi,
601 2020) have found mixed evidence in support of country-by-country reporting as a tool to reduce
602 tax-motivated profit shifting.

603 Janský *et al.* (2022) found that in the EU countries, 5.5% of the total value of public procurement
604 was associated with firms with links to EU grey- and blacklisted countries. In contrast to our
605 definition, Janský *et al.*'s (2022) definition of corporate structure only included presence in grey-
606 and blacklisted countries in the direct chain from the supplier to its ultimate parent company (or
607 GUO), and did not focus solely on the jurisdiction where the supplier was residing, as required
608 by the current Danish Procurement Law. Despite this, they concluded that the EU black- and
609 grey-lists do not reflect the most important tax havens for companies involved in EU tenders.

610 In June 2022 the Danish Social Democratic government adopted a revised national procurement
611 law. Following this revision, companies from EU blacklisted countries have been excluded from
612 public tenders (Folketinget, 2022). Although we identified 15 affiliates in four EU blacklisted
613 countries in the corporate structures of the Danish suppliers and service providers, we did not
614 find any supplier or service provider to be residing in a blacklisted country. Additionally, only
615 two of the medium- or high-risk countries with a PS-risk above 0.33 were on the EU blacklist in
616 the autumn of 2022. Thus, introducing the EU blacklist in the 2022 revision of the Danish
617 Procurement Law had little or no immediate impact on the amount of profit shifting in Danish
618 public procurement.

619 On December 21, 2021, the EU officially adopted a directive requiring public country-by-
620 country reporting (EU, 2021). By June 2023, member states must have implemented the directive
621 in their national laws, and by June 2024, the national laws must be applied. The directive
622 requires multinational corporations with consolidated annual revenues of more than 750 million
623 EUR to disclose information to the public about their annual financial activities and tax
624 payments on a country-by-country level. However, they are only obliged to do so for subsidiaries
625 residing in EU member states, in EU blacklisted jurisdictions, and in EU grey-listed jurisdictions
626 that have continuously been present on the EU grey list during the two most recent years.

627   Applying the rules of the new EU public country-by-country reporting directive to our data, we

628   find that 102 of the 400 suppliers to the Danish municipalities have a consolidated annual

629   revenue above 750 million EUR and will thus be required to publish their financial and tax

630   information on a country-by-country basis within the EU. In total, the 102 suppliers accounted

631   for 38% of the contract sum. However, only 15 of these suppliers, representing approximately

632   3% of the contract sum, have subsidiaries in the black or grey-listed jurisdictions covered by the

633   directive. Among the remaining suppliers, 45 are present in one or more countries with a PS_{risk_i}

634   value above 0.33, and 43 of these have subsidiaries in tax havens on the Oxfam Tax Haven List.

635   These suppliers account for 14% of the contract sum and will be required to publish their

636   financial activities and tax payments on a country-by-country basis for their EU-based

637   subsidiaries, but not for their subsidiaries in the non-listed tax havens outside the EU.

638   At present, it thus seems unlikely that the EU public country-by-country reporting directive will

639   lead to public disclosure of country-by-country information of a type that could generate

640   sufficient public pressure to achieve a "tax haven free" procurement practice in Denmark. If

641   standardized public country-by-country information eventually becomes mandatory for all

642   jurisdictions where a given multinational corporation has subsidiaries, municipalities and NGOs

643   should be able to verify whether profit shifting occurs. Until then, our PS-risk indicator may help

644   the municipalities, and the ESG-rating companies they engage, to identify high-risk corporations

645   among the bidders and perhaps contribute toward generating the political pressure needed to

646   reduce profit shifting among public suppliers.

647   Should the current situation persist, Danish municipalities will continue to use taxpayer money

648   on contracts with suppliers and service providers that may use profit shifting and other forms of

649   aggressive tax planning to avoid paying a fair share of their corporate income to the societies in

650   which they profit. The EU's adoption of the OECD recommended 15% minimum corporate tax

651   rate in December 2022 (EU, 2022) may change this situation, but much will depend on its actual

652   implementation.

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7. Summary and Concluding Remarks

To derive an indicator of the tax-motivated profit shifting risk at the firm-level, we combine information about corporate structure with jurisdiction-level estimates of profit shifting, tax rate gaps, and tax regulations from three separate sources that differ in geographic coverage and methodology. This enable us to cover 117 jurisdictions and to test the consistency of our indicator across data derived by disparate methods. Our results are consistent, and significant positive correlations are found between estimates of profit-shifting risk derived from the three sources. Additionally, our indicator values align with Oxfams Tax Haven List of and other tax haven lists.

We further identify a positive correlation between the observed tax-rate gaps and the profit-shifting friendliness of tax regulations. This suggests that a low tax rate is associated with a profit-shifting-friendly regulatory environment, possibly explaining the convex increasing relationship between estimates of profit-shifting and tax-rate gaps found in the literature.

Applying our indicator to the public tenders of Danish municipalities we find that between 17% and 23% of the total value of the contracts signed between 2017 and 2019 may be at high or intermediate risk of profit shifting. Among the suppliers the average risk of profit shifting is higher for suppliers belonging to large corporations, in sectors dealing with construction, health, and information processing, and for multinational suppliers controlled by a global ultimate owner residing outside Scandinavia. None of the suppliers of Danish municipalities resided in a country on the EU blacklist. The latest revision of the Danish procurement law, which permitted the exclusion of suppliers residing in blacklisted jurisdictions, is, therefore, unlikely to reduce tax-motivated profit shifting in Danish procurement.

The main limitation of our study is its focus on corporate structure as an indicator of tax-motivated profit shifting. Inclusion of additional corporate characteristics and subsidiary-level data on effective tax rates and book tax differences might have improved our estimates of the tax avoidance risk of individual subsidiaries (Wolff, 2021, Dyreng *et al.*, 2022, Delis *et al.*, 2022).

Further research is needed to examine the manner in which tax avoidance affects the bidders' price offers, impact of public trust in tax authorities on corporate tax avoidance, extent to which the country of residence of the global ultimate owner affects the risk of profit shifting within

685 multinational corporations, relationship between the indicator and the ratio of intangible assets to
686 total assets, and potential well-fare effects of municipalities becoming "tax haven free".

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Variable	Comparison	Jurisdiction estimates			Subsidiary-level estimates		
		r	df	p-value	r	df	p-value
Profit-shifting risk, PS_{risk_i}	CTHI vs. MPN	0.77	51	p=2*10^{-11}	0.91	390	p<3*10^{-16}
	CTHI vs. PMSC	0.75	23	p=2*10^{-5}	0.91	382	p<3*10^{-16}
	MPN vs. PMSC	0.82	26	p=2*10^{-7}	0.93	385	p<3*10^{-16}
Corporate tax-rate gap, $\tau_{DK,i}$	CTHI vs. MPN	0.67	51	p=6*10^{-8}	0.81	390	p<3*10^{-16}
	CTHI vs. PMSC	0.73	23	p=3*10^{-5}	0.87	382	p<3*10^{-16}
	MPN vs. PMSC	0.70	26	p=4*10^{-5}	0.79	385	p<3*10^{-16}
Profit-shifting friendliness, α_i	CTHI vs. MPN	0.55	51	p=3*10^{-5}	0.81	390	p<3*10^{-16}
	CTHI vs. PMSC	0.52	23	p=9*10^{-3}	0.82	382	p<3*10^{-16}
	MPN vs. PMSC	0.65	26	p=2*10^{-4}	0.86	385	p<3*10^{-16}

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937 Table I. Correlation, r, between estimates of profit-shifting risks, corporate tax-rate gaps, and
938 profit-shifting friendliness derived from three different datasets: MPN (Tørsløv *et al.*, 2023),
939 PSMC (Garcia-Bernardo *et al.*, 2022), and CTHI (Tax Justice Network, 2021). Estimates were
940 derived for the different jurisdictions (Jurisdiction estimates) represented in each dataset using
941 Equations 1 to 6 (see table of profit shifting estimates in Supplementary Table), and for different
942 Danish subsidiaries (Subsidiary-level estimates) based on the jurisdiction where the affiliate in
943 the corporate structure that generated the maximum profit-shifting risk resided (see text for
944 further explanation). df: degrees of freedom, p-value: probability that no correlation exist
945 (equivalent to r=0.0). Source: Created by authors.

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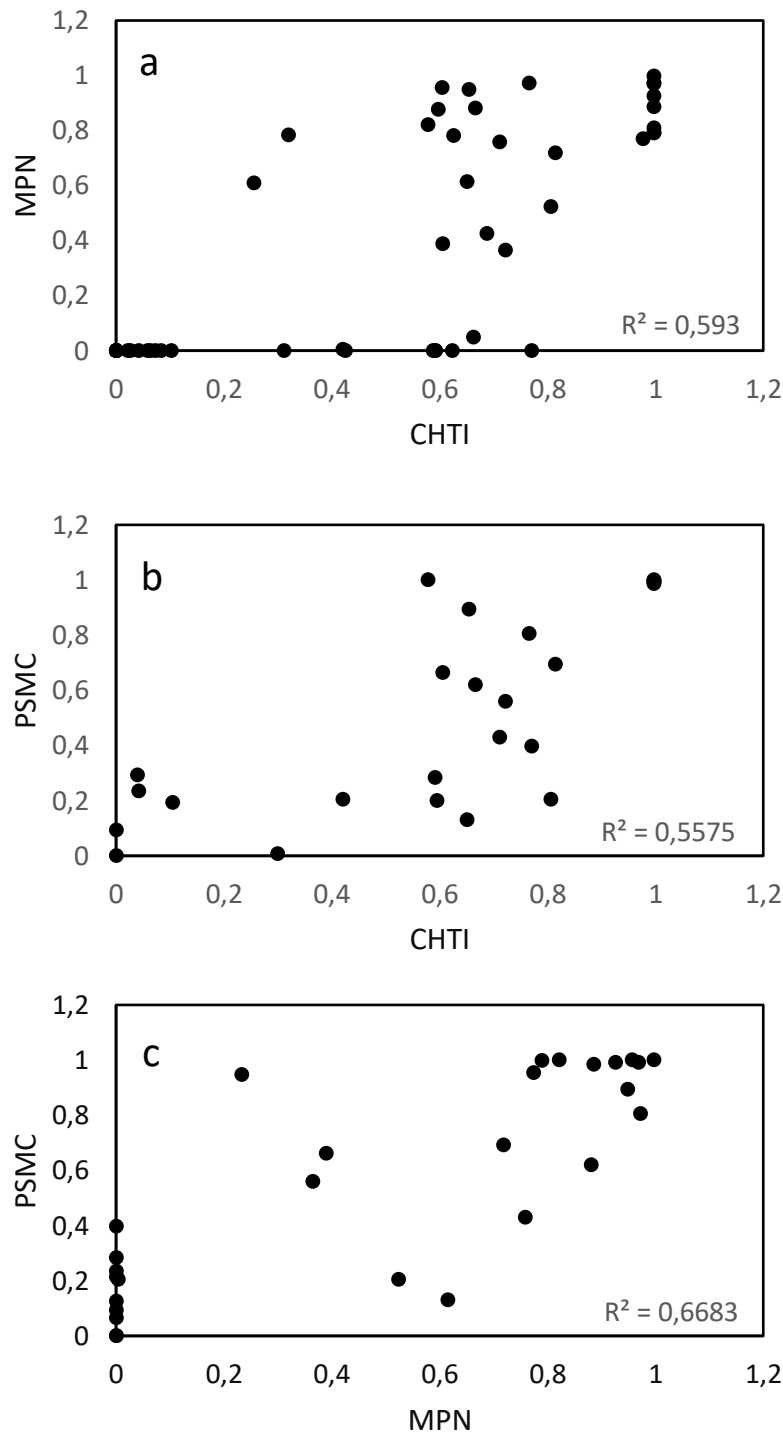
972 Figure 1. Pairwise plots of the PS-risks estimated from the three independent datasets: MPN:
973 Missing Profits of Nations (Tørsløv *et al.*, 2023), CTHI: Corporate Tax Haven Index (Tax
974 Justice Network, 2021), and PSMC: Profit Shifting of Multinational Corporations (Garcia-
975 Bernardo and Janský, 2022). PS-Risk: Risk of profit shifting. Source: Created by authors.

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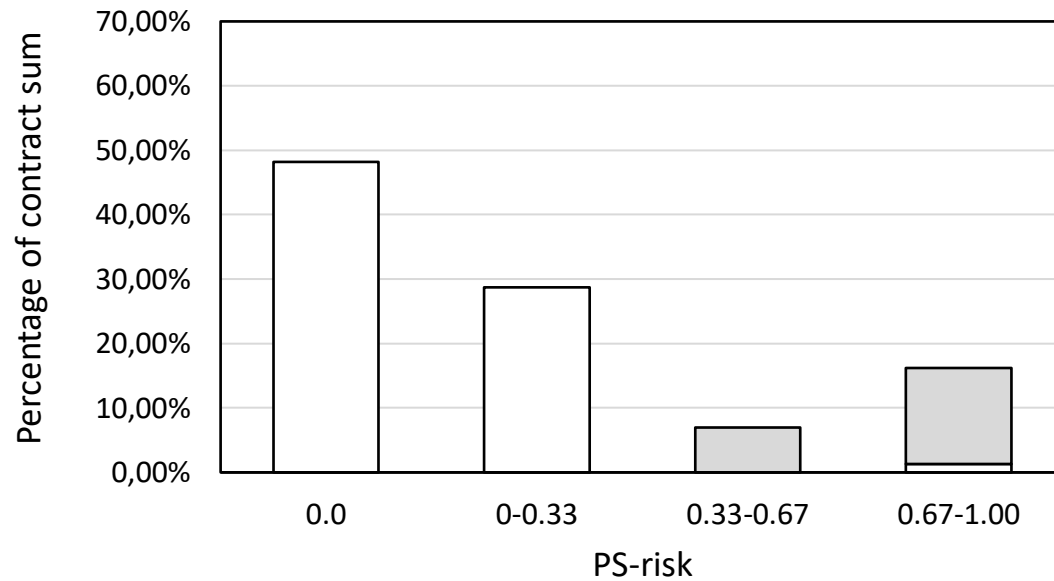
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983 Figure 2. Percentage of total contract sum in different PS-risk categories divided into companies
984 without (white) and with (grey) subsidiaries present in jurisdictions on the Oxfam list of Tax
985 Havens. PS-risk: Risk of profit shifting. Source: Created by authors.
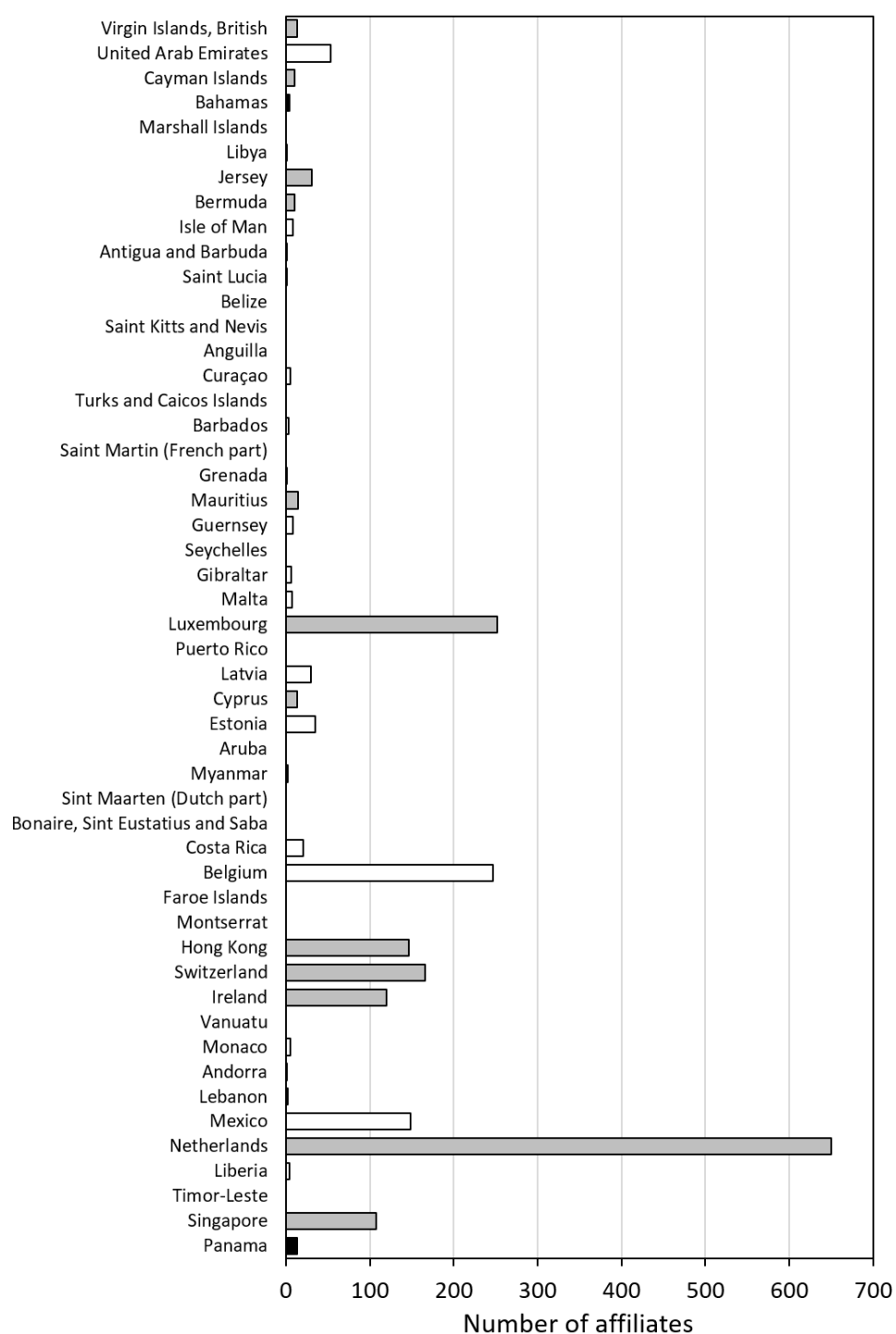
Figure 3. Number of affiliates residing in jurisdictions with a PS-risk score above 0.33.
Jurisdictions divided into those found on the Oxfam list of Top Tax Havens (grey), on the
European Union blacklist of non-cooperating countries (black), and on none of the two lists
(white). PS-risk: Risk of profit shifting. Source: Created by authors.
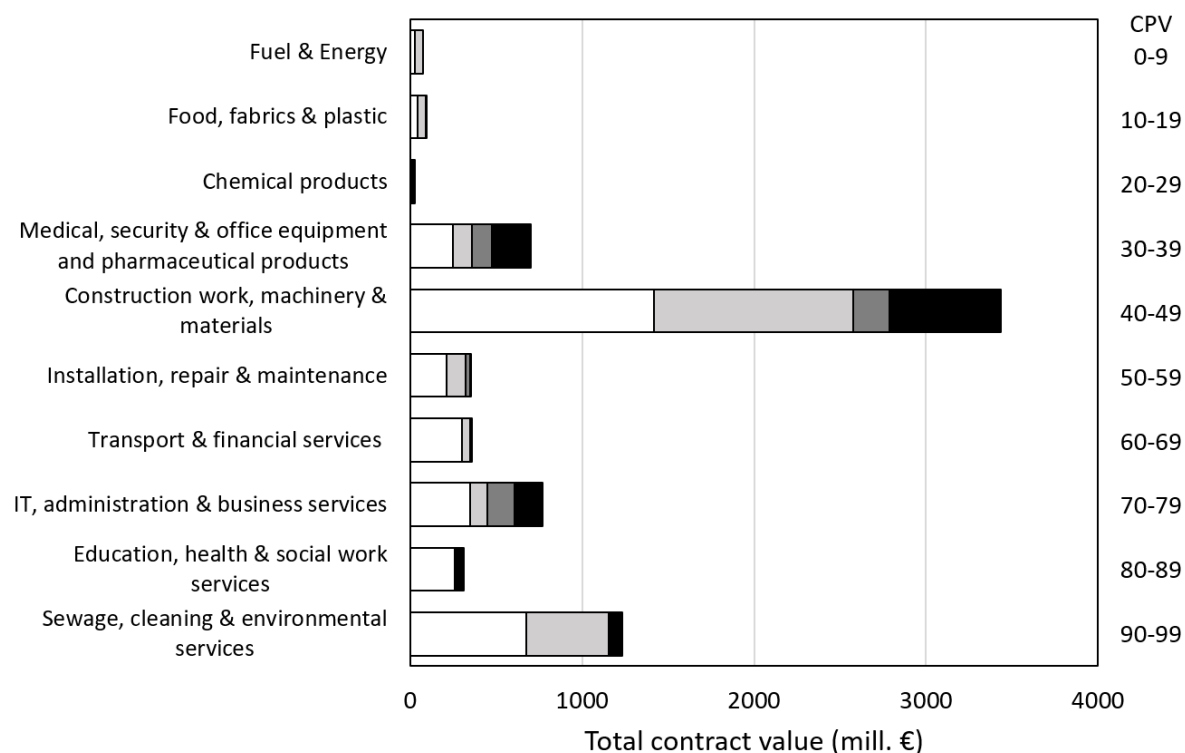
Figure 4. Distribution of the total contract value on different goods, works, and services categories, subdivided into companies without (white) and with subsidiaries present in jurisdictions with a PS-risk from 0 to 0.33 (light grey), 0.33 to 0.67 (dark grey), and 0.67 to 1.0 (black). Right axis displays 2-digit CPV code. CPV: Common Procurement Vocabulary. PS-risk: Risk of profit shifting. Source: Created by authors.

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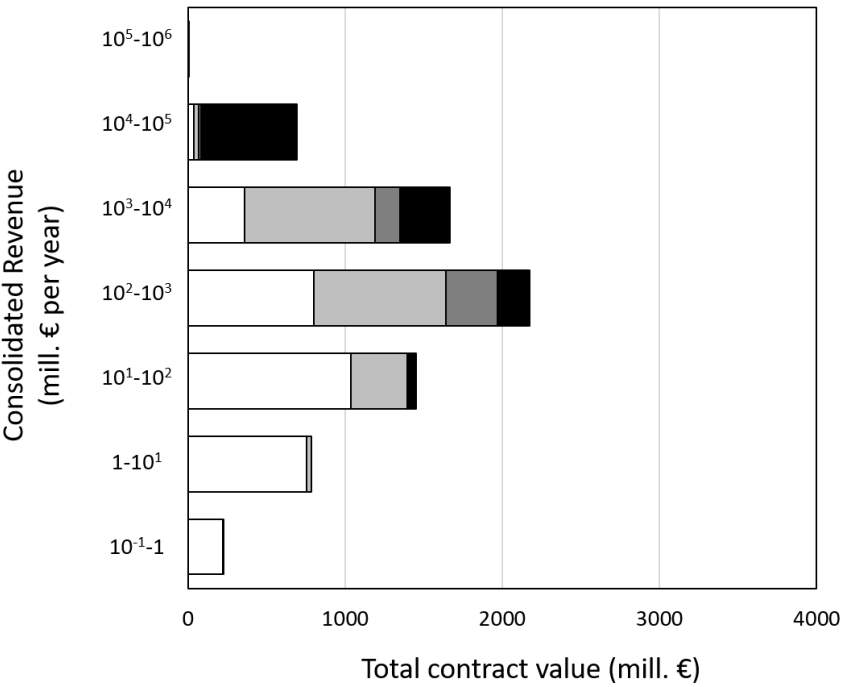
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1003 Figure 5. Consolidated annual revenue of the 400 companies versus total contract value
1004 separated into companies without (white) and with subsidiaries present in jurisdictions with a
1005 PS-risk from 0 to 0.33 (light grey), 0.33 to 0.67 (dark grey), and 0.67 to 1.0 (black). PS-risk:
1006 Risk of profit shifting. Source: Created by authors.

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1009   Supplementary Table.

1010   List of jurisdictions and profit shifting risk (PS_{risk}) derived from data from the Tax Justice
1011   Network (2021) (CTHI: Corporate Tax Haven Index), Tørsløv *et al.* (2023) (MPN: Missing
1012   Profits of Nations), and Garcia-Bernardo and Janský (2022) (PSMC: Profit Shifting of
1013   Multinational Corporations). The "Average" column presents the unweighted mean of the
1014   available PS_{risk} values for each jurisdiction. A blank cell signifies that no information is
1015   available. The "Listed" column shows whether the jurisdiction is on one or several tax haven
1016   lists (OX: The jurisdiction is on the Oxfam Tax Haven list, BL: The jurisdiction is on the EU
1017   blacklist autumn 2022, GRL: The jurisdiction is on the EU grey list autumn 2022). Source:
1018   Created by authors.

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Code	Jurisdiction/Country	Listed	CTHI	MPN	PSMC	Average
AF	Afghanistan				0.51	0.51
DZ	Algeria				0.00	0.00
AS	American Samoa	BL				
AD	Andorra		0.32	0.78		0.55
AI	Anguilla	BL	1.00	0.81		0.90
AG	Antigua and Barbuda			0.93		0.93
AR	Argentina		0.00			0.00
AW	Aruba		0.63	0.78		0.70
AU	Australia			0.00		0.00
AT	Austria		0.00	0.00		0.00
AZ	Azerbaijan				0.38	0.38
BS	Bahamas	OX. BL	1.00	0.97		0.98
BH	Bahrain			0.53		0.53
BB	Barbados	OX. GRL		0.96	1.00	0.98
BE	Belgium		0.59	0.00		0.29
BZ	Belize			0.92		0.92
BM	Bermuda	OX	1.00	0.93	0.99	0.97
BT	Bhutan				0.54	0.54
BO	Bolivia				0.00	0.00
BQ	Bonaire. Sint Eustatius. and Saba			0.77		0.77
BW	Botswana	GRL	0.00			0.00
BR	Brazil		0.00	0.00		0.00
BG	Bulgaria		0.30		0.01	0.15
BF	Burkina Faso				0.37	0.37
KH	Cambodia				0.34	0.34
CA	Canada			0.00	0.07	0.03
KY	Cayman Islands	OX	1.00	0.97	0.99	0.99
CL	Chile			0.00	0.21	0.11
CN	China		0.00	0.00	0.09	0.03
CO	Colombia			0.00		0.00
CR	Costa Rica		0.59	0.00		0.30
HR	Croatia		0.10		0.19	0.15
CW	Curaçao	OX	0.65	0.95	0.89	0.83
CY	Cyprus		0.81	0.72	0.69	0.74
CZ	Czech Republic		0.08	0.00		0.04

DK	Denmark		0.00	0.00	0.00	0.00
DM	Dominica	GRL				
EC	Ecuador		0.00			0.00
EE	Estonia		0.62	0.00		0.31
FO	Faroe Islands				0.59	0.59
FJ	Fiji	BL				
FI	Finland		0.06	0.00		0.03
FR	France		0.00	0.00		0.00
GM	Gambia		0.00			0.00
DE	Germany		0.00	0.00		0.00
GH	Ghana		0.00			0.00
GI	Gibraltar		0.58	0.82	1.00	0.80
GR	Greece		0.00	0.00		0.00
GD	Grenada			0.90		0.90
GU	Guam	BL				
GT	Guatemala				0.10	0.10
GG	Guernsey		0.98	0.77		0.87
GN	Guinea				0.00	0.00
HK	Hong Kong	OX	0.72	0.36	0.56	0.55
HU	Hungary		0.42	0.00	0.21	0.21
IS	Iceland			0.00		0.00
IN	India			0.00		0.00
IQ	Iraq				0.00	0.00
IE	Ireland	OX	0.71	0.76	0.43	0.63
IM	Isle of Man		1.00	0.79	1.00	0.93
IL	Israel			0.00		0.00
IT	Italy		0.00	0.00		0.00
JM	Jamaica	GRL				
JP	Japan			0.00		0.00
JE	Jersey	OX	1.00	0.89	0.99	0.96
JO	Jordan	GRL			0.31	0.31
KZ	Kazakhstan				0.17	0.17
KE	Kenya		0.00			0.00
KR	Korea. Republic of			0.00		0.00
LV	Latvia		0.66	0.05		0.36
LB	Lebanon		0.69	0.43		0.56
LR	Liberia		0.59		0.20	0.40
LY	Libya				0.92	0.92
LI	Liechtenstein		0.31	0.00		0.16
LT	Lithuania		0.18			0.18
LU	Luxembourg	OX	0.67	0.88	0.62	0.72
MO	Macao		0.25	0.61		0.43
MY	Malaysia				0.09	0.09
MV	Maldives				0.00	0.00
MT	Malta		0.60	0.88		0.74
MH	Marshall Islands			0.23	0.95	0.59
MU	Mauritius	OX	0.77	0.97	0.81	0.85
MX	Mexico		0.43	0.00		0.21
MC	Monaco		0.59	0.00	0.28	0.29

MS	Montserrat			0.57			0.57
MM	Myanmar					0.66	0.66
NL	Netherlands	OX	0.61	0.39	0.66	0.55
NZ	New Zealand				0.00	0.13	0.06
NO	Norway				0.00	0.00	0.00
PW	Palau	BL				
PA	Panama	BL	0.65	0.61	0.13	0.47
PG	Papua New Guinea					0.16	0.16
PE	Peru			0.00			0.00
PL	Poland			0.06	0.00		0.03
PT	Portugal			0.00	0.00		0.00
PR	Puerto Rico				0.77	0.95	0.86
RO	Romania			0.17			0.17
RU	Russian Federation				0.07		0.07
KN	Saint Kitts and Nevis				0.92		0.92
LC	Saint Lucia				0.93		0.93
MF	Saint Martin (French part)				0.90		0.90
WS	Samoa					
SM	San Marino			0.14			0.14
SG	Singapore	OX	0.81	0.52	0.20	0.51
SX	Sint Maarten (Dutch part)				0.77		0.77
SK	Slovakia			0.03	0.00		0.02
SI	Slovenia			0.07	0.00		0.04
ZA	South Africa			0.00	0.00		0.00
ES	Spain			0.00	0.00		0.00
SE	Sweden			0.04	0.00	0.24	0.09
CH	Switzerland	OX	0.77	0.00	0.40	0.57
TW	Taiwan			0.04		0.29	0.17
TZ	Tanzania			0.00			0.00
TH	Thailand	GRL			0.06	0.06
TL	Timor-Leste					0.65	0.65
TT	Trinidad and Tobago	BL				
TR	Turkey	GRL		0.00		0.00
TC	Turks and Caicos Islands	BL	1.00	0.79		0.90
AE	United Arab Emirates			0.98			0.98
GB	United Kingdom			0.10	0.00		0.05
US	United States			0.02	0.00		0.01
VU	Vanuatu	BL			0.50	0.50
VN	Viet Nam					0.35	0.35
VG	Virgin Islands. British	OX	1.00	1.00	1.00	1.00
VI	Virgin Islands. U.S.	BL				

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Supplementary Material Appendix 1

To examine the difference in PS-risk between multinational companies with a Danish or a Scandinavian global ultimate owner (GUO), versus those with a GUO from another country, we performed two binomial linear regressions where the nationality of the GUO was described by the logit of a binary probability, p, of obtaining $Y_j = 1.0$ where:

$$Y_j = \begin{cases} 1.0 & \text{if nationality is Danish} \\ 0 & \text{if nationality is} \neq \text{Danish} \end{cases} \quad or \quad Y_j = \begin{cases} 1.0 & \text{if nationality is Scandinavian} \\ 0 & \text{if nationality is} \neq \text{Scandinavian} \end{cases}$$

$$Y_j \sim Bin(1, p)$$

and

$$logit(p) = intercept + \beta_1 \cdot PS_{risk_j} + \beta_2 \cdot Revenue_j + \beta_3 \cdot PS_{risk_j} \times Revenue_j \qquad \text{(a.1)}$$

where PS_{risk_j} is the PS-risk of the Danish subsidiary, and $Revenue_j$ is the consolidated revenue (in billion DKK) of the multinational corporation, j. We also tested if contract size or industry would affect nationality, but found both variables to be insignificant.

When Danish subsidiaries of multinational companies with a Danish GOU were compared to Danish subsidiaries of multinational companies with a GUOs residing outside Denmark, PS_{risk} contributed significantly to $logit(p)$ and so did $Revenue$ (Table A.2.1), while the interaction term between PS_{risk} and $Revenue$ was insignificant. In other words, a company with high PS_{risk} had a lower probability of being controlled by a Danish GUO than a company with a low PS_{risk}, and this difference between Danish and foreign GUOs increased with annual revenue (see Figure A.1.1).

When Danish subsidiaries of multinational companies with a Scandinavian GOU were compared to Danish subsidiaries of multinational companies with a GUOs residing outside Scandinavia, $Revenue$ was insignificant and only PS_{risk} contributed significantly to explain $logit(p)$ (Table A.1.1). In other words, a company with high PS_{risk} had an much lower probability of being Scandinavian than a company with a low PS_{risk}, and revenue was not a significant interfering factor (see Figure A.1.1). Figure A.1,1 shows the two resulting probability distributions.

1049 Table A.1.1 Parameter estimates from binomial regressions of GUO nationality versus PS-risk
1050 and consolidated revenue after insignificant terms have been removed. NS: non-signifikant.
1051 Source: Created by authors.

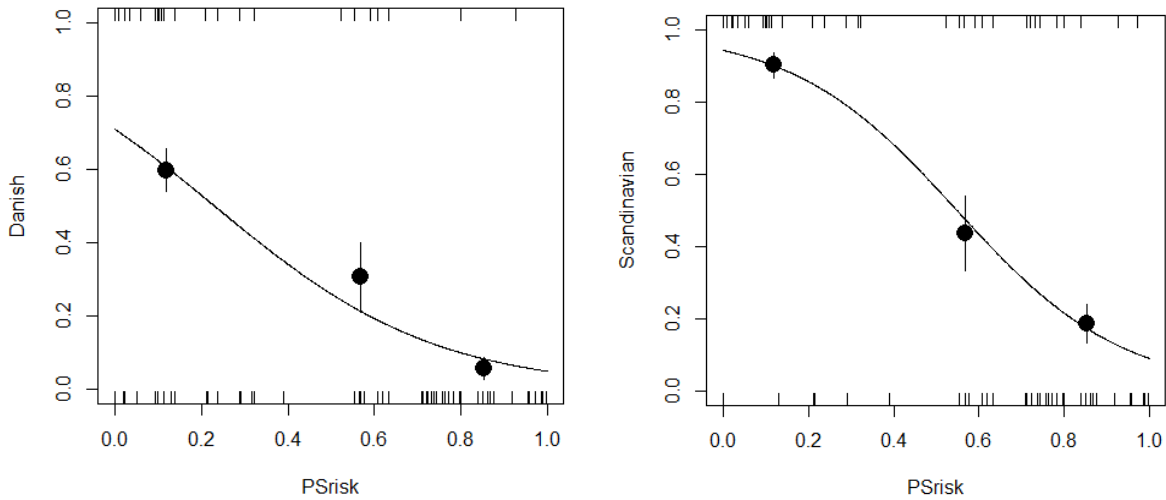| Nationality of GUO	Parameter	Estimate	p-value
Danish	$intercept$	1.05	$8.78*10^{-4}$
	β_1	-3.19	$1.51*10^{-5}$
	β_2	$-2.25*10^{-5}$	0.04
	β_3	NS	NS
Scandinavian	$intercept$	2.81	$7.14*10^{-10}$
	β_1	-5.14	$8.13*10^{-12}$
	β_2	NS	NS
	β_3	NS	NS

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1055 Figure A.1.1. Fits of the binomial model $logit(p) = intercept + \beta_1 \cdot PS_{risk_j}$ to data from
1056 multinational companies residing in Denmark (left) and Scandinavia (right). The rugs along the
1057 upper horizontal axis parts of the panels show the distribution of the PS_{risk} input data for Danish
1058 and Scandinavian GUOs, respectively, and those along the lower axis the corresponding PS_{risk}
1059 data for non-Danish and non-Scandinavian GUOs, respectively. The filled circles show the
1060 average proportions of the PS_{risk}-estimates of Danish (left panel) and Scandinavian GUOs (right
1061 panel) in the low (]0,0.33]), intermediate (]0.33,0.67]) and high (]0.67,1.00]) categories. The
1062 vertical lines associated with the circles are standard errors. Source: Created by authors.

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