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Résumé / Abstract

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Keywords: profitability, merchanting, outsourcing, productivity, firm size
JEL codes: L25, D22, G39

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Luxembourg consistently ranks low in EU-wide profitability rankings by Gross Operating Rate (GOR), as reported by STATEC analysis and confirmed by Eurostat data. To explain these outcomes, this study examines the factors correlated with profitability in Luxembourg using Structural Business Statistics (SBS) data at the industry level. The analysis is conducted first in a cross-country framework, followed by a focused investigation on Luxembourg. Cross-country evidence indicates that merchanting, subcontracting and distributive activities are negatively correlated with GOR, with the effect being especially pronounced for Luxembourg relative to other European countries. Luxembourg-specific analysis confirms this negative correlation, which seems stronger in the wholesale and retail trade sector. We also find evidence that big firms are less profitable than small ones. Across specifications, nominal labour productivity is systematically and positively associated with profitability. This study also evaluates the margin rate as an alternative measure of profitability. According to this metric, Luxembourg's profitability ranking for some industries shows improvement. Overall, the results advise against the use of a single profitability measure and its application to broad industry aggregates.

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Executive summary

Luxembourg has persistently ranked among the least profitable EU economies when profitability is measured using the gross operating rate (GOR). GOR is an aggregate indicator of firm profitability that captures the share of gross operating surplus (GOS) in total sales, where GOS is defined as the surplus generated after labour costs are covered. Luxembourg's low ranking in terms of GOR, documented by STATEC and confirmed by Eurostat data, has raised concerns regarding the competitiveness and performance of Luxembourg's non-financial sectors.

Against this background, the present study provides an empirical assessment of relevant factors correlated with profitability in Luxembourg. Particular attention is devoted to the role of merchanting, subcontracting and distributive activities, jointly referred to as *négoce.* Labour productivity, firm size and industry structure also occupy an important role in the profitability analysis. In addition, this study explores the margin rate as an alternative profitability indicator.

The analysis is conducted in two stages, based on two data sources. First, a cross-country investigation is carried out using Eurostat's Structural Business Statistics (SBS). Second, we performed a more detailed analysis using Luxembourg-specific SBS data aggregated by industry and firm size classes.

Cross-country evidence shows that Luxembourg combines two key features: it ranks among the leading European countries in the prevalence of *négoce*, while ranking low in operating profitability, as measured by GOR. To clarify this relationship, our study decomposes GOR into two multiplicative components, defined as the margin on output and the production ratio, following a DuPont-type framework. Regression results show that *négoce* share, proxied by the share of purchases for resale, is negatively associated with the production ratio but positively associated with the margin on output. Although these effects operate in opposite directions, the overall association between *négoce* and GOR is negative. Moreover, Luxembourg's GOR appears to be particularly sensitive to the adverse effects of *négoce* share relative to other countries in the sample. However, it is important to remember that this analysis does not establish a causal link between *négoce* and GOR.

The second part of the study focuses exclusively on SBS data for Luxembourg and extends the analysis to firm size dimension. The results broadly confirm the cross-country findings, demonstrating that *négoce* share is negatively associated with GOR. This relationship varies across the economy. From an industry perspective, the negative association is strongest in NACE Rev. 2 sections D (Electricity, gas, steam and air conditioning supply) and G (Wholesale and retail trade), which are sectors characterised by high turnover relative to value added. These industry-specific findings, however, require further investigation and remain dependent on the underlying model assumptions.

Firm size is also closely correlated with profitability. Large firms, defined as those with 250 or more persons employed, contribute substantially to GOS, especially after 2014. At the same time, they tend to record lower profitability ratios than small firms with fewer than 10 employees. This is largely explained by turnover growing more rapidly than profits in large firms relative to small firms.

Both across countries and for Luxembourg alone, nominal labour productivity is systematically and positively correlated with GOR. Although this does not imply causality, this finding is consistent with theoretical predictions that more productive firms are better able to generate operating surplus. This finding supports the view that productivity differences are associated with profitability and aligns with previous evidence for Luxembourg reported by the National Productivity Board (see the 2023-2024 annual report).

The study critically assesses the suitability of GOR as a standalone profitability metric, which might have important limitations. A low GOR does not necessarily imply weak operating surplus in absolute terms. Indeed, Luxembourg's non-financial economy has recorded strong growth in GOS since 2014. Wholesale trade and professional services account for a substantial share of total surplus even though they rank among the least profitable sectors when evaluated using GOR.

In light of the limitations of GOR, the study considers the margin rate (GOS over gross value added) as an alternative profitability indicator. This measure reflects the distribution of value added between labour compensation and operating surplus to capital and is commonly interpreted as an indicator of internal financing capacity for investment. Empirical results indicate that the margin rate might be less affected by merchanting and subcontracting than GOR. In addition, using this alternative profitability measure leads to an improvement in Luxembourg's relative position across several major industries, notably wholesale and retail trade and information and communication.

To sum up, findings lead to four main conclusions. First, Luxembourg's low profitability ranking under GOR is closely linked to the structural importance of *négoce*, which negatively correlates with operating profitability. Second, when looking at GOS, we notice stable and sizable increase of 55% between 2008 and 2020, which suggests a steady growth dynamic. Third, profitability shows a positive correlation with nominal productivity. Fourth, evaluating profitability based on the margin rate leads to a significantly different ranking.

Overall, these results advise against using a single profitability indicator, especially when applied to broad industry aggregates. On the contrary, the findings suggest that a comprehensive assessment of profitability in Luxembourg requires the joint consideration of multiple indicators. Such an assessment should also be accompanied by the evaluation of additional elements, such as firm size, industry structure, and the underlying dynamics of turnover, gross value added, and GOS.

Synthèse

Le Luxembourg figure de manière persistante parmi les économies les moins rentables de l'Union européenne lorsque la rentabilité est mesurée par le taux d'excédent brut d'exploitation (EBE). Le taux d'EBE est un indicateur agrégé de rentabilité des entreprises qui mesure la part de l'EBE dans le chiffre d'affaires total, l'EBE étant défini comme le surplus généré après couverture des coûts du travail. Le faible classement du Luxembourg selon cet indicateur, documenté par le STATEC et confirmé par les données d'Eurostat, soulève des préoccupations quant à la compétitivité et à la performance des secteurs non financiers luxembourgeois.

Dans ce contexte, la présente étude propose une évaluation empirique des facteurs corrélés à la rentabilité au Luxembourg. Une attention particulière est accordée au rôle des activités de négoce, de sous-traitance et de distribution, regroupées sous le terme de négoce. La productivité du travail, la taille des entreprises et la structure sectorielle occupent également une place importante dans l'analyse de la rentabilité. En outre, l'étude examine le taux de marge comme indicateur alternatif de la rentabilité.

L'analyse est menée en deux étapes, sur la base de deux sources de données. Premièrement, une analyse comparative internationale est réalisée à partir des statistiques structurelles des entreprises (SSE) d'Eurostat. Deuxièmement, une analyse plus détaillée est effectuée à l'aide des données SSE spécifiques au Luxembourg, agrégées par branche d'activité et par classe de taille d'entreprises.

Les résultats de la comparaison internationale montrent que le Luxembourg combine deux caractéristiques clés : il figure parmi les pays européens où le négoce est le plus répandu, tout en se classant à un niveau faible en termes de rentabilité opérationnelle, telle que mesurée par le taux d'EBE. Afin de clarifier cette relation, notre étude décompose le taux d'EBE en deux composantes multiplicatives, définies comme la marge sur la production et le ratio de production, selon une approche de type DuPont. Les résultats des régressions indiquent que la part du négoce, approchée par la part des achats pour revente, est négativement associée au ratio de production mais positivement associée à la marge sur la production. Bien que ces effets agissent dans des directions opposées, l'association globale entre le négoce et le taux d'EBE est négative. En outre, le taux d'EBE du Luxembourg semble particulièrement sensible aux effets défavorables du négoce par rapport aux autres pays de l'échantillon. Toutefois, il convient de rappeler que cette analyse n'établit pas de lien de causalité entre le négoce et le taux d'EBE.

La seconde partie de l'étude se concentre exclusivement sur les données SSE du Luxembourg et étend l'analyse à la dimension de la taille des entreprises. Les résultats confirment globalement les conclusions issues de la comparaison internationale, montrant que la part du négoce est négativement associée au taux d'EBE. Cette relation varie toutefois selon les secteurs de l'économie. D'un point de vue sectoriel, l'association négative est la plus marquée dans les sections NACE Rév. 2 D (Production et distribution d'électricité, de gaz, de vapeur et d'air conditionné) et G (Commerce de gros et de détail), des secteurs caractérisés par un chiffre d'affaires élevé relativement à la valeur ajoutée. Ces résultats sectoriels nécessitent toutefois des analyses complémentaires et restent dépendants des hypothèses sous-jacentes au modèle.

La taille des entreprises est également fortement corrélée à leur rentabilité. Les grandes entreprises, définies comme celles employant 250 personnes ou plus, contribuent de manière substantielle à l'excédent brut d'exploitation, en particulier après 2014. Dans le même temps, elles tendent à présenter des ratios de rentabilité plus faibles que les petites entreprises comptant moins de 10

salariés. Cela s'explique en grande partie par une croissance du chiffre d'affaires plus rapide que celle des profits dans les grandes entreprises par rapport aux petites.

Tant dans la comparaison internationale que pour le Luxembourg seul, la productivité nominale du travail est systématiquement et positivement corrélée au taux d'EBE. Bien que cela n'implique pas de relation de causalité, ce résultat est cohérent avec les prédictions théoriques selon lesquelles les entreprises plus productives sont mieux à même de générer un excédent d'exploitation. Ce constat conforte l'idée que les écarts de productivité sont associés à la rentabilité et s'inscrit dans la continuité des résultats précédemment rapportés pour le Luxembourg par le Conseil national de la productivité (voir le rapport annuel 2023-2024).

L'étude évalue de manière critique la pertinence du taux d'EBE en tant qu'indicateur unique de rentabilité, qui peut présenter des limites importantes. Un taux d'EBE faible n'implique pas nécessairement un faible excédent brut d'exploitation en valeur absolue. En effet, l'économie non financière luxembourgeoise a enregistré depuis 2014 une forte croissance de l'excédent brut d'exploitation. Le commerce de gros et les services professionnels représentent une part substantielle de l'excédent total, bien qu'ils figurent parmi les secteurs les moins rentables lorsqu'ils sont évalués sur la base du taux d'EBE.

Compte tenu des limites du taux d'EBE, l'étude considère le taux de marge (excédent brut d'exploitation rapporté à la valeur ajoutée brute) comme un indicateur alternatif de la rentabilité. Cette mesure reflète la répartition de la valeur ajoutée entre la rémunération du travail et l'excédent d'exploitation du capital et est généralement interprétée comme un indicateur de la capacité de financement interne de l'investissement. Les résultats empiriques indiquent que le taux de marge pourrait être moins affecté par le négoce et la sous-traitance que le taux d'EBE. En outre, l'utilisation de cet indicateur alternatif conduit à une amélioration du classement relatif du Luxembourg dans plusieurs secteurs majeurs, notamment le commerce de gros et de détail ainsi que l'information et la communication.

En résumé, les résultats conduisent à quatre conclusions principales. Premièrement, le faible classement du Luxembourg en matière de rentabilité selon le taux d'EBE est étroitement lié à l'importance structurelle du négoce, qui est négativement corrélée à la rentabilité opérationnelle. Deuxièmement, l'excédent brut d'exploitation a connu une augmentation stable et substantielle de 55 % entre 2008 et 2020, ce qui suggère une dynamique de croissance soutenue. Troisièmement, la rentabilité présente une corrélation positive avec la productivité nominale. Quatrièmement, l'évaluation de la rentabilité sur la base du taux de marge conduit à un classement sensiblement différent.

Globalement, ces résultats déconseillent l'utilisation d'un indicateur unique de rentabilité, en particulier lorsqu'il est appliqué à de larges agrégats sectoriels. À l'inverse, ils suggèrent qu'une évaluation exhaustive de la rentabilité au Luxembourg nécessite la prise en compte conjointe de plusieurs indicateurs. Une telle évaluation doit également s'accompagner de l'analyse d'éléments complémentaires, tels que la taille des entreprises, la structure sectorielle et la dynamique sous-jacente du chiffre d'affaires, de la valeur ajoutée brute et de l'excédent brut d'exploitation.

1. Introduction

This research presents an empirical analysis of the relevant economic factors correlated with profitability, placing Luxembourg at the centre of the investigation. The study first positions the country within a cross-country context and then turns to a more detailed examination of Luxembourg. The analysis relies on Structural Business Statistics (SBS) data by industry. Profitability is measured primarily using the gross operating rate (GOR). According to Observatoire de la compétitivité (2017) and STATEC (2018), Luxembourg persistently occupies a low position in EU-wide profitability rankings in terms of GOR. A key objective of our analysis is to identify the factors underlying this positioning.

The GOR profitability indicator is defined as the ratio of gross operating surplus to sales revenue (GOS/S). According to the Eurostat SBS methodological manual (Eurostat, 2024), gross operating surplus (GOS) is calculated as value added minus personnel costs. It represents the surplus generated from core operations after compensating labor inputs and before accounting for depreciation, interest, and taxes. As such, GOR profitability measure captures operating cost efficiency and provides insight into the resilience of the business model.

STATEC (2018) is a closely related study that uses SBS data to examine profitability in Luxembourg. First and foremost, the study notes that Luxembourg consistently ranks low in terms of GOR relative to other EU countries (see p. 6). It then provides a descriptive analysis of GOR and GOS in the specific context of the Luxembourgish economy over the period 2005–2015. The study indicates that the increase in sales revenues may be attributable to rapid growth of merchanting and subcontracting, which tend to exert downward pressure on GOR ratios.[1] Cross-sectoral differences in the GOR ratio can be largely attributed to variations in cost structures depending on the nature of the activity (capital- vs labour- or trade-intensive).

This study examines profitability in Luxembourg along the lines suggested by STATEC (2018), taking a wider cross-country perspective and with particular emphasis on the role of merchanting, subcontracting and distributive activities. For the rest of this paper, we group these activities under the French term *négoce*.

Using Eurostat's SBS data at industry level for 2008-2020[2], our cross-country descriptive analysis shows that Luxembourg has an exceptionally high proportion of *négoce* in its total turnover, ranking among the top countries along this dimension.[3] At the same time, we illustrate that over the period under consideration Luxembourg ranks relatively low in terms of the GOR, thus supporting previous evidence. We further confirm this pattern for certain aggregated sectors, notably industry, trade, and non-financial services.

[1] Merchanting is defined as the purchase of goods by a resident (of the compiling economy) from a nonresident combined with the subsequent resale of the same goods to another nonresident without the goods being present in the compiling economy (International Monetary Fund, 2009). Subcontracting refers to a situation in which a firm contracts out the production of a specific component or task to another firm, while retaining responsibility for the final product (see, e.g. Grossman and Helpman, 2005). Distributive activities refer to distribution of goods from producers to final users, without significant transformation of those goods, as typical in retail and wholesale.

[2] Annual enterprise statistics for special aggregates of NACE Rev. 2 activities (2005–2020), available at https://doi.org/10.2908/SBS_NA_SCA_R2 (accessed April 2026).

[3] SBS data on "Purchases of goods and services purchased for resale in the same condition as received" are used as a proxy for *négoce.* Section 3.1 provides more details on this measure.

To better understand the underlying forces, we follow the DuPont decomposition approach outlined in Zangerlé (2011).[4] Specifically, we decompose GOR into two multiplicative components, which we define as margin on output and production ratio. We then perform separate regression analyses for each component to examine how *négoce* affects each of them. A series of cross-country regressions show that the production ratio is negatively correlated with the share of *négoce*, whereas the margin on output is positively correlated. Overall, the total correlation between *négoce* and GOR is negative. This means that GOR measure of profitability decreases with the increase of *négoce*. Moreover, GOR in Luxembourg is particularly sensitive to the adverse effects of *négoce* relative to the countries considered. This means that an increase in *négoce* is associated with a larger decline in GOR in Luxembourg than in other countries in our sample.

In the continuation of the research, we take a specific focus on Luxembourg and employ STATEC SBS data aggregated by industry and employment size classes. This makes it possible to overcome the coverage limitations of the Eurostat SBS data by size and broaden the analysis to explore the role played by firm size. Regression results based on Luxembourg's SBS data align with the cross-country findings, showing that the share of *négoce* in total purchases is negatively associated with GOR. When considering firm size, the econometric analysis offers some evidence that largest firms (250+ persons employed) are less profitable, in terms of GOR, as compared to the smallest firms (2-9 persons employed).

We also consider the sensitivity of GOR to variations in the *négoce* share by size classes and industrial activities. Although the results depend on the underlying model assumptions, the findings suggest that this association varies along both dimensions. As for industrial activity, under the least restrictive model assumptions, a negative and significant correlation emerges for various industries and appears strongest for the NACE Rev. 2 sections D (Electricity, gas, steam and air conditioning supply) and G (Wholesale and retail trade). As for size classes, our estimates show that small firms with 10-19 persons employed are the most sensitive to the negative effect of *négoce* on profitability. Overall, these interesting findings on the sensitivity by size and industry require further investigation.

We further account for the role of labour productivity as a possible determinant of profitability, as suggested by related literature. We employ the Eurostat's (apparent) labour productivity that equals value added at factor cost divided by the number of persons employed. We find that nominal productivity is positively and statistically significantly associated with GOR. This applies to both the cross-country investigation and the separate analysis for Luxembourg. Furthermore, the result is robust to changes in the applied methodology. While our findings do not imply causality, they are consistent with theoretical predictions.[5] This study is in line with reports of Luxembourg's National Productivity Board (NPB). As part of its 2023–2024 annual report, Chen and Mangiarotti (2025) present a firm-level analysis of the relationships between firms' characteristics and total factor productivity (TFP) in Luxembourg.[6] Higher TFP was found to be associated with larger employment, greater capital stock, increased value added, and higher profitability measured in terms of GOR.

The study of STATEC (2018) highlights the limitations of using GOR as the key indicator of profitability. First of all, a low GOR does not necessarily correspond to low levels of GOS. STATEC (2018) shows that despite a 24% drop in GOR ratio between 2005 and 2015, Luxembourg's non-financial market

[4] Zangerlé (2011) analyses the profitability of non-financial enterprises in Luxembourg over 2006–2008. The key financial ratios such as return on assets (ROA) and return on equity (ROE) are examined, with detailed analysis of their variations across sectors, firms' sizes and time.

[5] The literature review provides additional details on the profitability – productivity nexus.

[6] Total factor productivity reflects firm-level productivity given labour and capital inputs.

economy nearly doubled its GOS over the decade under consideration. Outside finance, wholesale trade and professional, scientific, and technical services generated the largest GOS, yet they ranked among the sectors with the lowest GOR. Furthermore, branch-level GOR often masks firm-level realities, frequently reflecting the behaviour of a small number of large companies.

Given the aforementioned limitations of the GOR indicator, an important objective of this study is to investigate an alternative measure of profitability. To this end, we consider gross operating surplus over gross value added (GOS/GVA) rate as a potential alternative to the GOR measure. This ratio is commonly interpreted as a margin rate that captures the distribution of value added between labour compensation and operating surplus to capital. A higher GOS/GVA ratio indicates greater internal financing capacity for investment. Regression results suggest that this measure might be less affected by the influence of *négoce*. Furthermore, for several major NACE Rev. 2 industries, Luxembourg ranks higher when profitability is measured by the margin rate rather than by GOR. In particular, Luxembourg's profitability in wholesale and retail trade ranks relatively low in cross-country comparisons when assessed using GOR, but substantially higher when the margin rate is considered.

The remainder of this paper is structured as follows. Section 2 contains a review of the literature on the determinants of firm profitability. Section 3 provides cross-country analysis for European countries. Section 4 contains empirical analysis for Luxembourg. Section 5 highlights margin rate as a possible alternative indicator of firm profitability. Finally, Section 6 concludes.

2. The determinants of profitability: a literature review

This section provides a brief overview of empirical studies on the determinants of profitability. Given its prominence, particular attention will be given to productivity. As discussed in the introduction with reference to STATEC (2018), this study explores the possibility that merchanting, and to a lesser extent subcontracting, play a significant role in shaping profitability and its evolution. Therefore, some space will be devoted to available research on outsourcing and firm performance.

Profitability is a key indicator of an enterprise's performance. Broadly speaking, it can be defined as the ratio of revenue to cost. In other words, profitability reflects an enterprise's ability to generate returns on invested capital and compensate entrepreneurial effort. However, profitability may be better understood as a measure of a company's financial health, rather than as a business objective in itself (Grifell-Tatjé and Lovell, 2015).

2.1 Profitability indicators and data sources

This research focuses on the GOR as a key profitability indicator and considers margin rate as an alternative. It is worth reporting that the margin rate and its decomposition have recently been used in macro-level analyses of the profitability of French firms (INSEE, 2022). This approach was also adopted by STATEC (2023), who examine changes in the margin rate of Luxembourg's non-financial firms over the period 2018–2023. A related methodology is employed by Warzynski (2009), who estimates average profit margins in the European manufacturing industry using data from the Amadeus microeconomic database.

Meanwhile, the economic and management literature employs a wide range of measures and definitions of profitability. McGahan and Porter (2002) analyse variance in accounting profitability among U.S. firms from 1981 to 1994. Slade (2004) explicitly compares alternative models of firm profitability rooted in industrial organization, finance, and the economics of exhaustible resources. Using panel estimations from 14 nonferrous-metal mining and refining markets, the study provides

strong empirical support for the hypothesis that market structure is a key determinant of firm profitability.

Afrifa and Padachi (2016) examine the relationship between working capital and the profitability of UK small and medium-sized enterprises (SMEs), using three metrics: return on assets (ROA), return on capital employed (ROCE), and return on equity (ROE). Gaganis et al. (2019) examine the impact of country-specific characteristics on the ROA profitability measure of European manufacturing SMEs. Cherchye and Verriest (2016) employ six alternative ratios of profitability, including ROA and ROE, and document the role of firm characteristics, industry structure and home-country institutions for profitability.[7]

The availability of data significantly limits the choice of profitability indicators. In this study, GOR and margin rate profitability ratios are based on Structural Business Statistics (SBS) data. Meanwhile, the ROA and ROE measures frequently used in the literature are not readily available from the aggregated SBS data, limiting the scope for additional comparative analysis. Two alternative databases for these and possibly other metrics are ORBIS and BACH.

The ORBIS dataset contains firm-level micro data that has previously been used to study the firm profitability.[8] Johansson et al. (2017) employ the data from the ORBIS database and estimate the impact of tax planning by multinational firms on their profitability. In their specification, profitability is defined as the ratio of pre-tax profit over total assets, based on unconsolidated firm accounts. In a related study, Millot et al. (2020) employ ORBIS data to address the impact of corporate taxes on the investments of multinationals. In this study, firm-level profitability is calculated as the profit-before-tax to turnover ratio.

Another alternative source of profitability indicators is BACH dataset developed by Banque de France. It offers harmonized firm-level accounting information that facilitates cross-country comparisons of firms' financial characteristics and performance within Europe.[9] This dataset was used by the study of STATEC (2020) to analyse the profitability of European firms. The study notes that this dataset provides relatively limited coverage for Luxembourg. The results indicate that Luxembourgish firms exhibit one of the lowest median ROA values. However, based on the median ROE, these firms are ranked more favourably, despite a persistently high level of dispersion. Moreover, the divergence between ROA and ROE is particularly pronounced in the case of Luxembourg.

2.2 Profitability and productivity

The importance of the link between productivity and profitability has been previously studied in the related literature. To start with, under the superior firm hypothesis introduced by Demsetz (1973), heterogeneity in firm productivity generates competitive advantages, such that more productive firms achieve higher profitability than their less productive counterparts. Grifell-Tatjé and Lovell (2018)

[7] ROA is defined as profit before interest and tax divided by total assets at the end of the financial year. It indicates how efficiently a firm uses its assets to generate profit and reflects management's effectiveness in deploying resources. ROCE is profit before interest and tax divided by capital employed. It shows how much operating profit the firm generates for each unit of long-term capital committed to the business. ROCE evaluates how effectively long-term capital is turned into operating profit, indicating the quality and durability of a firm's investment decisions. ROE is profit for the year divided by shareholders' equity. It measures the return earned by equity holders after all expenses and interest and reflects both operating performance and the effects of financial leverage.

[8] ORBIS is a commercial, subscription-based database. For the description of this data source, see, e.g. Ribeiro et al. (2010) and Bajgar et al. (2020).

[9] Note that the coverage is limited to 12 European countries at the time of writing (April 2026).

investigate the link between productivity and financial performance. In their analytical framework, profit change is attributed to quantity changes, driver of which is productivity change.[10]

Bottazzi et al. (2008) investigated the relationship between productivity, profitability, and financial performance. They conducted a detailed analysis of the profitability and productivity dynamics of a substantial sample of Italian firms over the period 1998–2003, documenting a particularly strong correlation between productivity and profitability, proxied by return on sales (ROS)[11] and return on investment (ROI). Similarly, Lim and Lovell (2009), using an unbalanced panel of U.S. railroads from 1996 to 2003, found that productivity improvements and increased production scale both contribute to higher profitability.

Stierwald (2010) estimated a dynamic profit model that explicitly incorporates measures of productivity and productivity persistence. Using a panel of large Australian firms from 1995 to 2005, the study demonstrated that profitability is primarily determined by firm-specific characteristics, including productivity.

Yazdanfar (2013) analyses the determinants of profitability for a large sample of Swedish non-financial micro firms in 2006–2007. Firm size, growth, lagged profitability, and productivity are found to have a positive effect on profitability, while firm age has a negative effect. Productivity is found to be the most important determinant, and larger, younger, high-growth firms are more likely to be profitable.

2.3 Profitability and firm sizes

Previous studies focusing on other countries report mixed evidence on the relationship between firm size and profitability. A substantial body of literature finds a negative correlation. In one of the pioneering studies in this area, Whittington (1980) finds a negative relationship between average profitability and firm size (measured either as net or gross assets, or as sales). The study of Goddard et al. (2005) finds that the firms that increased in size, as measured by balance sheet assets, tend to experience a reduction in profitability.

Yadav et al. (2022) use a panel of non-financial firms from 1995 to 2016 for 12 industrial and emerging Asia–Pacific economies. They find a negative relationship between firm size and profitability. While firms initially benefit from growth, profitability eventually declines as size (total assets, net sales or market capitalization ratio) increases, suggesting inefficiencies at larger scales.

Youssef et al. (2023) study profitability of non-financial listed SMEs in UK in 2012-2020. They take both ROA and ROE as the outcome variables. The profitability determinants are size, age, efficiency, working capital, leverage and volatility of the firm. All of these determinants, except liquidity, demonstrate significant influence on profitability. In this study, firm size (total assets) has a significant negative impact on ROA and an insignificant impact on ROE.

The report of Bank of Korea (2023) provides overview and descriptive analysis of firm profitability in the South Korea across industries and company sizes.[12] In that report, two alternative measures of profitability are employed: operating income to sales and net income before tax to sales. The study of

[10] In that study, the productivity change is measured with the ratio of an output quantity index to an input quantity index.

[11] In Bottazzi et al. (2008), return on sales is measured as the ratio of gross operative margins to total sales, a measure that is substantially similar to the GOR.

[12] In this report, firm size is classified categorically based on Korean legal criteria, primarily total assets and average sales, following the Framework Act on SMEs and related legislation. The firms are grouped into large, mid sized, small and medium sized enterprises.

ECCBSO (2024), reports that in 2022 the median large firm had lower profit margins than smaller firms in France, Italy, Poland, and Portugal.

Nonetheless, part of the literature reports a positive association between profitability and size. Lee (2009) studies the determinants of firm performance, focusing on the role of firm size in profitability. Using a fixed-effects dynamic panel model for over 7,000 US publicly listed firms from 1987–2006, that study finds a positive but non-linear relationship between firm size (total assets) and profit rates.

Alarussi and Alhaderi (2017) examined the factors influencing profitability of listed companies in Malaysia. They used two measures of profitability: earnings per share (EPS) and return on equity (ROE). The findings show a strong positive relationship between firm size (total sales), working capital, company efficiency (assets turnover ratio) and profitability.

2.4 Outsourcing

As already mentioned with reference to STATEC (2018), merchanting and subcontracting may contribute meaningfully to understand profitability. Subcontracting is closely linked to outsourcing, which can be defined as "different kinds of corporate actions related to all subcontracting relationships between firms and the hiring of workers in nontraditional jobs" (see p.98 of Heshmati, 2003).

Görg and Hanley (2004) study how outsourcing affects profitability in Ireland's electronics sector, using detailed plant-level data across 12 sub-sectors. Outsourcing of materials and outsourcing of services are distinguished. Their findings show that larger plants gain profitability from outsourcing materials, while smaller plants do not experience this benefit. The impact of outsourcing services is less conclusive.

Görg et al. (2008) analyse the effect of international outsourcing on productivity in Irish manufacturing, focusing separately on materials and services inputs. The results show that outsourcing services boosts productivity for exporters, regardless of ownership. Meanwhile, no significant productivity gains are observed for firms that do not export.

The study of Bertrand (2011) investigates how offshore outsourcing affects firms' export performance. Based on the data on about 2,000 French manufacturing multinationals in 1999, the results show that offshore outsourcing boosts export performance, especially in markets where firms import intermediate goods. The positive effects are further enhanced by larger firm size, organized intra-firm imports, and greater export experience. These results could be interpreted in the context of international business, resource-based, and transaction cost theories. Outsourcing can lower costs, increase flexibility, and provide new resources and knowledge, though its benefits depend on firms' capabilities to manage foreign suppliers and absorb knowledge.

Gunasekaran et al. (2015) reviews the literature on outsourcing with a focus on performance measures used in decision making across various outsourcing stages. Outsourcing has become a key element of global operations management, helping companies manage supply chains, cut costs, and improve strategic flexibility. While it offers benefits such as reduced production and overhead expenses, it also raises concerns, including integration challenges, increased coordination costs, reduced innovation, and potential risks to competitive advantage.

It is important to note that the literature offers no clear consensus on the effects of outsourcing on firm performance. In a comprehensive review of 57 empirical studies published between 1996 and 2015, Lahiri (2016) documents substantial heterogeneity in research scope, contextual settings, methodological approaches, industry coverage, and performance metrics. Reflecting this diversity, the

empirical evidence indicates that outsourcing may have positive, negative, mixed, moderated, or no significant effects on firms. However, in a later study, Lahiri et al. (2022) provide a meta-analysis of the nexus between firm performance and outsourcing whose results point to a positive relationship. Such link is more pronounced for non-core outsourcing than core outsourcing and for international outsourcing than domestic outsourcing.

3. Cross-country analysis

In this section, we present a cross-country analysis of profitability in terms of gross operating rate (GOR). According to STATEC (2018), merchanting and subcontracting might be an influential element affecting the GOR ratio. Therefore, we develop an investigation framework that allows to assess this hypothesis.

We first conduct a descriptive analysis, focusing on Luxembourg's profitability ranking compared with other countries. We illustrate graphically the correlation between the share of *négoce* and each of the two components of GOR. We then examine these relationships econometrically.

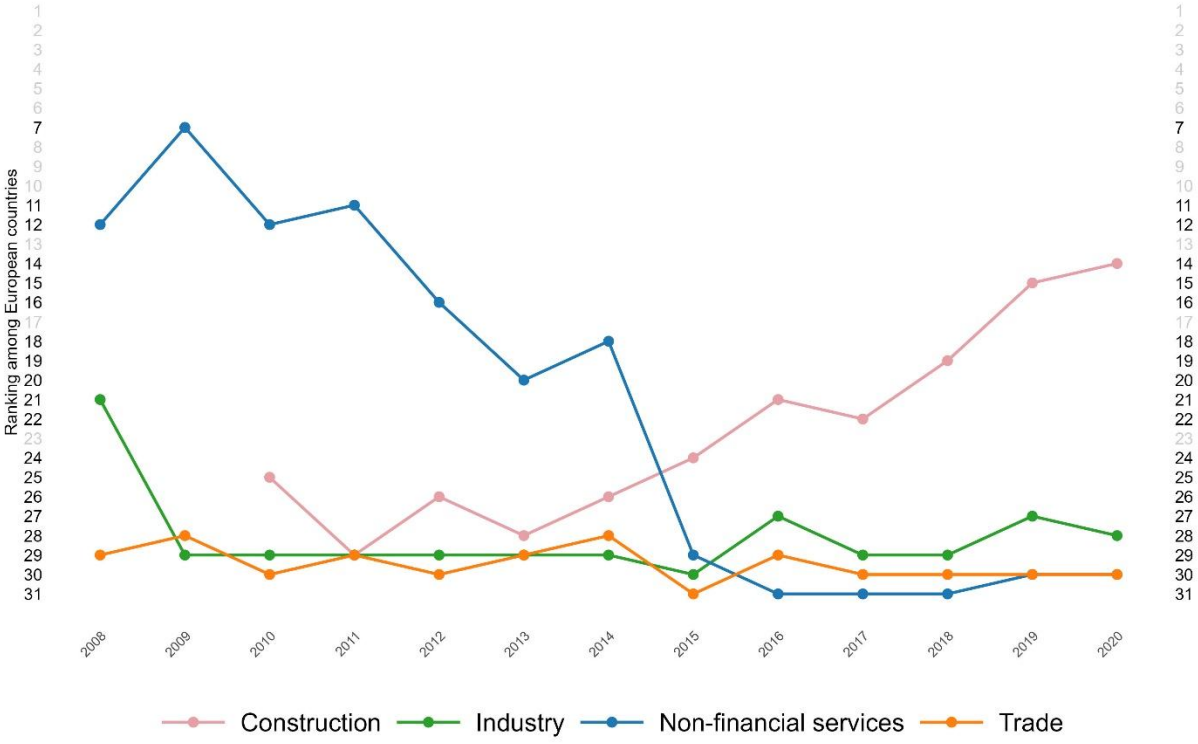
Our cross-country analysis is based on freely available Eurostat SBS data covering the period from 2008 to 2020. A strength of this dataset is its suitability for cross-country comparisons among European countries.[13] The main weakness is the limited availability of profitability indicators, excluding for instance important financial ratios such as return on assets (ROA) and return on equity (ROE). Each observation in the dataset corresponds to a NACE two-digit industry in a specific country and year.[14] Our main measure of firm profitability is the GOR. Eurostat (2024) defines GOR as gross operating surplus (GOS) over turnover, with GOS calculated as value added minus personnel costs.

3.1 Descriptive analysis

Figure 1 illustrates Luxembourg's ranking in terms of GOR over time. The figure indicates that Luxembourg has consistently ranked low in the sectors of trade, industry, and non-financial services. The only exception is the construction sector, which has shown an improvement in ranking since 2013.

[13] Comparisons include EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Observations may not be available for all countries and industries for all years.
[14] In total, there are around 20.000 observations.

Figure 1 – Luxembourg's ranking in GOR among European countries.



Note: The chart plots the ranking of Luxembourg across the trade, construction, industry, and non-financial services sectors for the gross operating rate (GOR) profitability measure. The comparison includes EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Industry includes B (Mining and quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Water supply; sewerage, waste management and remediation activities). Construction corresponds to the NACE Rev. 2 section F (Construction). Trade corresponds to NACE G (Wholesale and retail trade; repair of motor vehicles and motorcycles). The non-financial services include H (Transportation and storage), I (Accommodation and food service activities), J (Information and communication), L (Real estate activities), M (Professional, scientific and technical activities) and N (Administrative and support service activities).
Source: EUROSTAT SBS data. Authors' calculations.

Following a similar approach as Zangerlé (2011), we apply the DuPont approach[15] to decompose GOR into two multiplicative components that highlight the role played by *négoce*.

The decomposition of GOR yields the following expression:

$$\text{GOR} = \frac{GOS}{Turnover} = \frac{Value\ Added - Personnel\ Costs}{Turnover} = \left(\frac{GOS}{Prod.value}\right) \times \left(\frac{Prod.value}{Turnover}\right) \qquad (1)$$

In the reminder of this work, the $\frac{GOS}{Prod.value}$ component is referred to as margin on output, while $\frac{Prod.value}{Turnover}$ as production ratio. This decomposition makes it possible to analyse the effect of *négoce* on each of the two components separately.

The difference between turnover and production value gives an approximation of *négoce*. This can be expressed as follows:

[15] The DuPont analysis is used to break down a company's Return on Equity (ROE) into components related to profitability, efficiency, and leverage. Within this framework, the profit margin explains how (expected) sales translate into (expected) operating profit (see, e.g., Li et al., 2014).

$$Négoce \sim Turnover - Production\ value \quad (2)$$

Relying on the approximation in equation (2), the production ratio component and *négoce* are related as follows:

$$\frac{Prod.value}{Turnover} \sim \frac{Turnover - Négoce}{Turnover} = 1 - \frac{Négoce}{Turnover} \quad (3)$$

Likewise, the following relationships can be written for the margin on output component:

$$\frac{GOS}{Prod.Value} \sim \frac{GOS}{Turnover - Négoce} \quad (4)$$

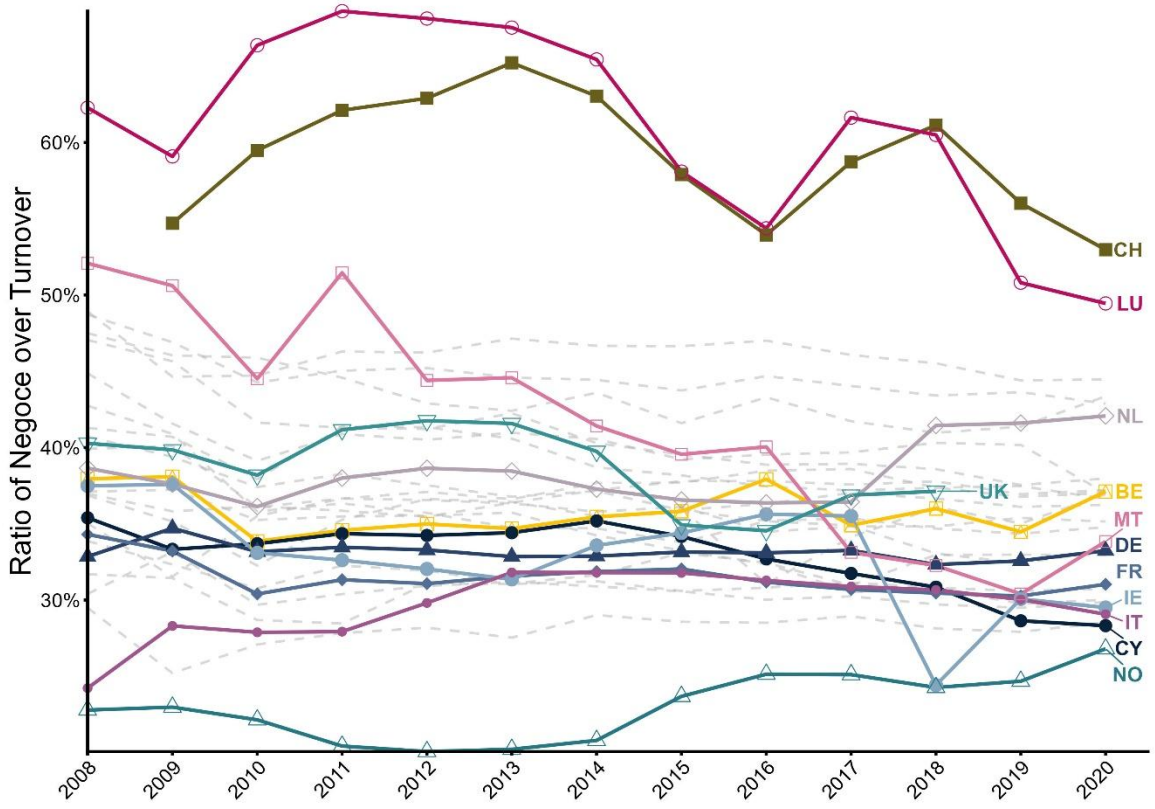
From a conceptual perspective, an increase in *négoce* for a given turnover level leads to a decrease in the production ratio. In turn, this lowers GOR. On the contrary, an increase in *négoce* for a given level of GOS and turnover causes an increase in the margin on output and therefore an increase in GOR. Therefore, the net effect of *négoce* on GOR depends on which of these opposing forces—changes in the production ratio or shifts in output margins—ultimately prevails. To clarify this, we empirically assess the above relationship, which is essentially accounting in nature. We make no specific economic assumptions about relationships between variables in the ratios. In other words, we adopt a purely empirical, non-structural approach to estimate the link between *négoce* and GOR.

The accounting identity underlying the components of GOR implies a unity relationship with the theoretical measure of *négoce*. Therefore, to avoid estimating a unity relationship between variables in the accounting relationships, we replace *négoce* with *négoce* share in the estimated equations. *Négoce* share, in turn, is proxied by the ratio between purchases of goods and services for resale and total purchases. These purchases capture merchanting, subcontracting, and distributive activities, although they may not fully reflect all forms of subcontracting and outsourcing.[16] As the total purchases include those for resale, this share is between zero and one and remains independent from price variations.

Relying on this proxy, Figure 2 shows the share of *négoce* in sales turnover across European countries. The evidence indicates that Luxembourg has consistently been the leader in this domain, although this share declined from over 60 percent in 2008 to approximately 50 percent in 2020.

[16] Note that there could be discrepancies between countries in the identification of this concept, which may affect the analysis.

Figure 2 – Share of *négoce* in turnover across European countries.



Note: The chart plots the share of purchases of goods and services purchased for resale in the same condition in turnover for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Selected countries are plotted in color, while non-highlighted countries are shown with dashed grey lines.

Source: EUROSTAT SBS data. Authors' calculations.

We then provide a descriptive analysis of the association between the *négoce* share, on the one hand, and GOR and its two components on the other.[17] In this analysis, we pool all available observations for all countries and years.

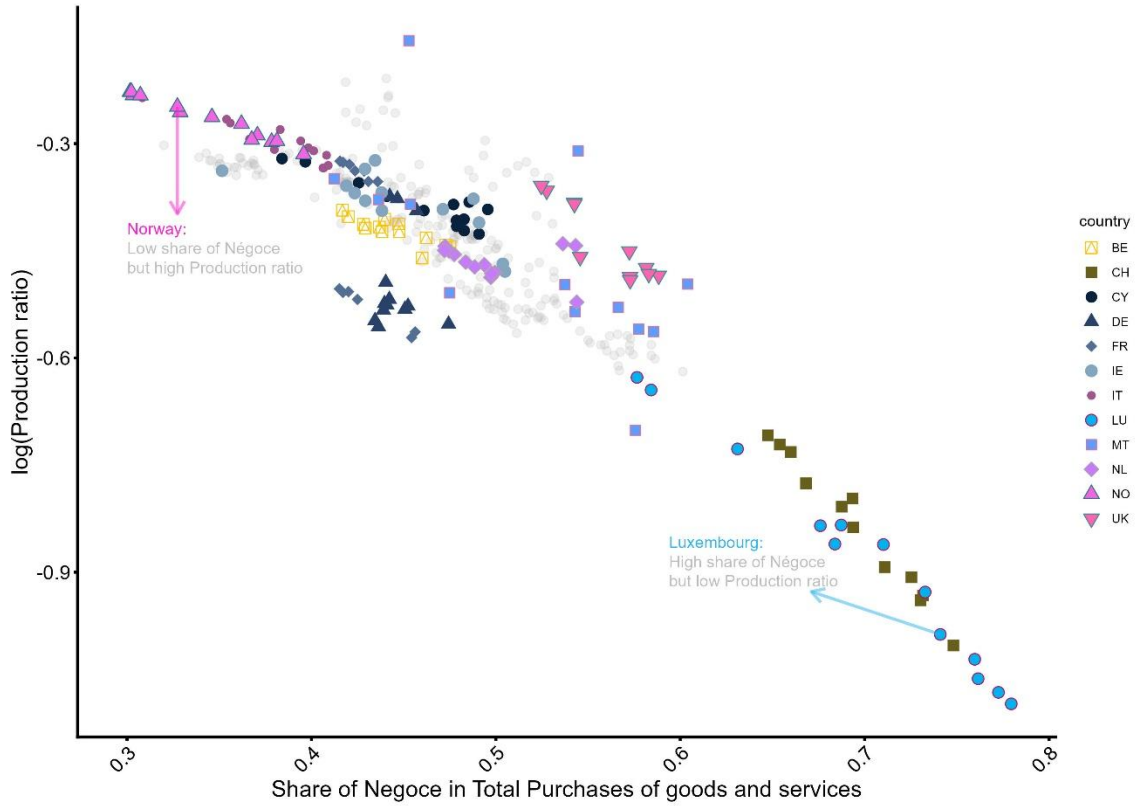
First, we present a graphical analysis of the relationship between the production ratio component of GOR and the share of *négoce*. This relationship is illustrated in Figure 3. The correlation appears strongly negative both across countries and within countries over time. Countries with a higher importance of *négoce* tend to feature a lower production ratio, and a similar negative association is also apparent within countries across years. Overall, the patterns observed in Figure 3 are consistent with the predictions derived from the accounting relationship underlying the production ratio component of GOR.

[17] It is important to note that the descriptive analyses presented in the figures below are purely bivariate. They illustrate how the distribution of the production ratio varies across different levels of the share of *négoce*, but it does not control for other potentially relevant factors. A more comprehensive assessment based on a regression analysis that includes additional controls, such as fixed effects for NACE Rev. 2 sections and countries, is then presented in Section 3.2.

Luxembourg stands out at the bottom right of the chart, combining a relatively high share of purchases for resale with a particularly low production ratio. Observations for Switzerland lie close to those of Luxembourg and display a similar pattern. In addition, several observations for France and Germany fall outside the main cluster.

To further explore the observations lying outside the main cluster, we examine the same relationship at a more disaggregated level by NACE Rev. 2 section. The corresponding charts for selected sectors are reported in Figure A.1 in Appendix 1.

Figure 3 – Relationship between production ratio component of GOR and share of *négoce* in total purchases of goods and services.

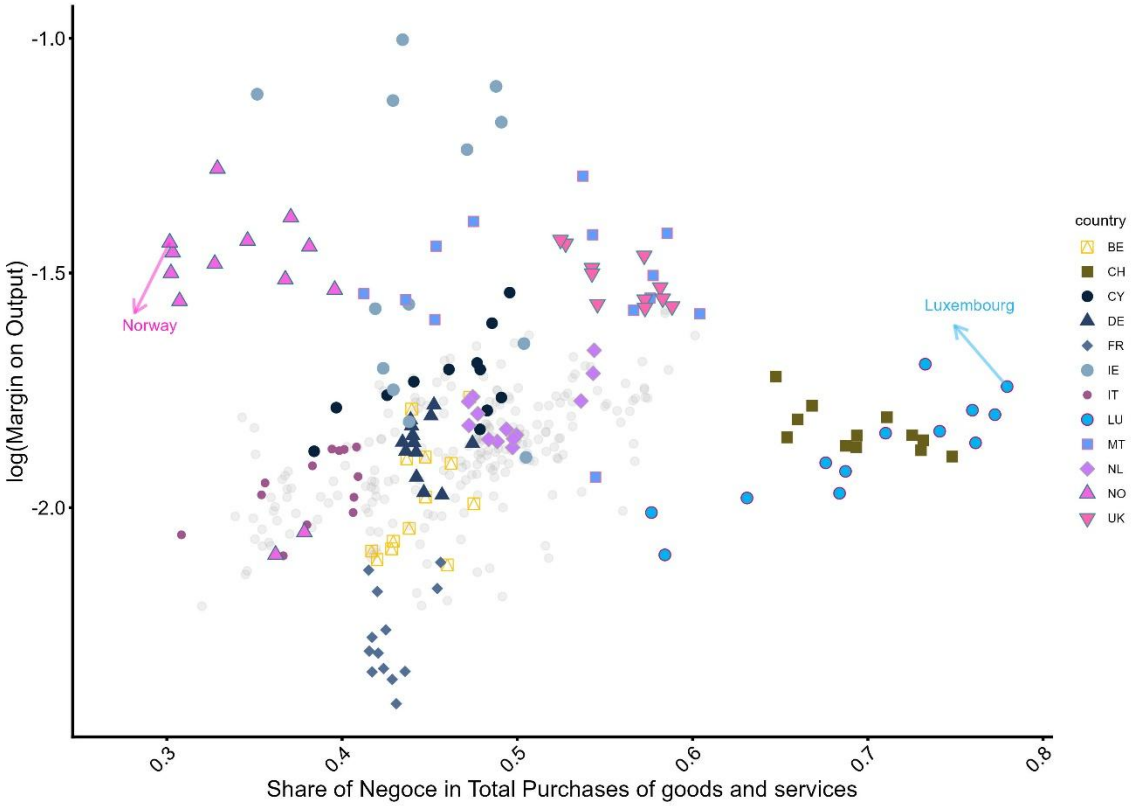


Note: The chart plots production ratio component of gross operating rate (GOR) against the share of *négoce* in total purchases of goods and services for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Distinct points for the same country correspond to different years.

Source: EUROSTAT SBS data. Authors' calculations.

Figure 4 presents the relationship between the margin on the output component of GOR and the *négoce* share in total purchases of goods and services. Again, Luxembourg stands out due to its relatively high share of *négoce*. While the overall correlation appears to be positive, this does not seem to appear clearly across countries or for all countries over the years. For Luxembourg, however, a positive correlation seems to hold over time. Therefore, a possible positive association between the margin on output component and *négoce* as predicted by the conceptual relationship does not emerge as a strong general pattern from this descriptive analysis. To further explore this relationship, we plot it at the level of NACE Rev. 2 sections, with charts for selected sections presented in Figure A.2 in Appendix 1.

Figure 4 – Relationship between margin on output component of GOR and share of *négoce* in total purchases of goods and services.

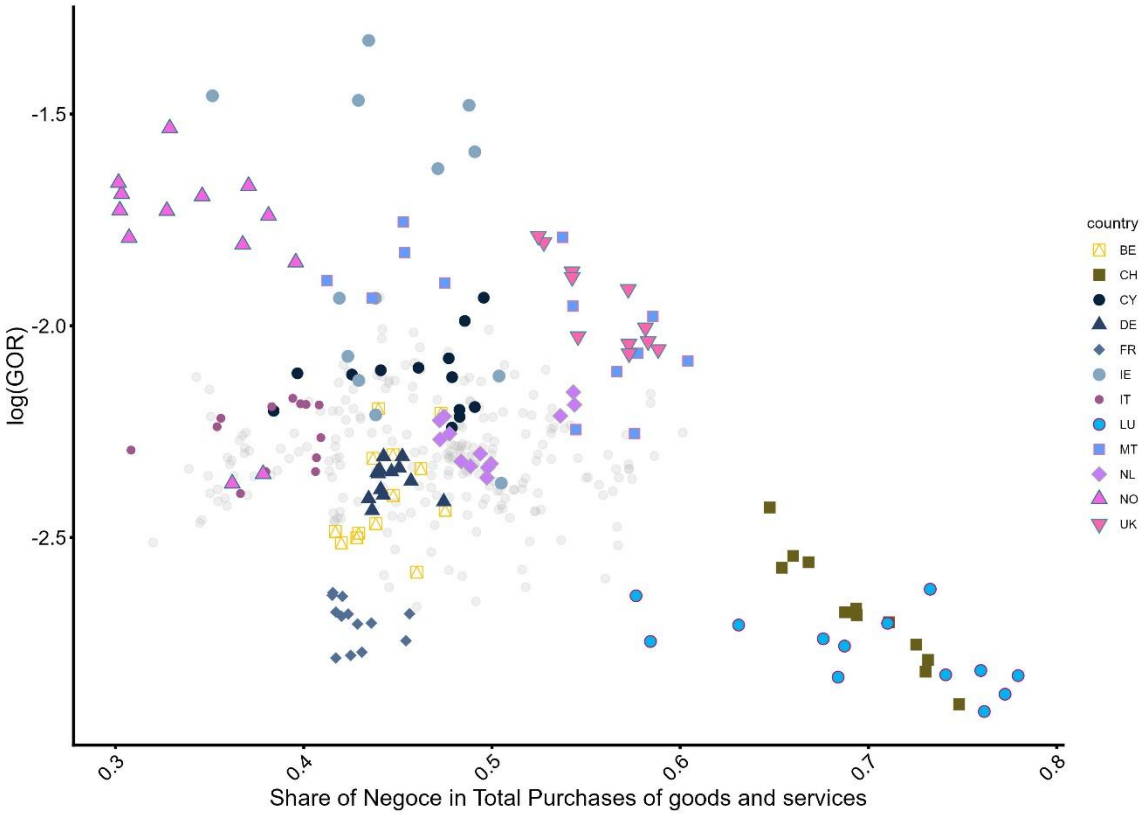


Note: The chart plots the margin-on-output component of gross operating rate (GOR) against the share of *négoce* in total purchases of goods and services for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Separate data points for each country represent different years.

Source: EUROSTAT SBS data. Authors' calculations.

Finally, Figure 5 illustrates the relationship between GOR and the share of *négoce* in total purchases of goods and services. The figure reveals a negative correlation between these two variables. Luxembourg shows a relatively high share of *négoce* combined with a comparatively low GOR. Recalling the decomposition, this may be interpreted as the combined effect of the two individual components on GOR. Intuitively, results from the descriptive analysis would suggest that the negative effect of *négoce* through the production ratio component of GOR prevails on a possibly positive effect through the margin on output.

Figure 5 – Relationship between GOR and share of *négoce* in total purchases of goods and services.



Note: The chart plots gross operating rate (GOR) against the share of *négoce* in total purchases of goods and services for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Distinct points for the same country correspond to different years.

Source: EUROSTAT SBS data. Authors' calculations.

3.2 Econometric analysis

While the descriptive analysis is informative, we now turn to an econometric analysis to examine the relationship between GOR and the share of *négoce* more formally. This analysis also accounts for other factors that may influence the relationship. In addition to controls for NACE Rev. 2 section, country, and year fixed effects, we include labour productivity, measured as value added per person employed. Value added, and thus productivity, is expressed in nominal terms.

To implement the analysis, we apply a logarithmic transformation to the previously discussed decomposition (see equation 1), which yields the following relationship:

$$\log(\mathrm{GOR}) = \log\left(\frac{GOS}{Prod.value}\right) + \log\left(\frac{Prod.value}{Turnover}\right) \quad (5)$$

This transformation allows us to express GOR and each individual component in terms of the same set of explanatory variables. In this way, we can evaluate the effect of the explanatory variables separately for each component and decompose their overall impact on GOR as the sum of the impacts on each component.

3.2.1 Role of négoce

We first estimate the percentage change in GOR associated with a one percentage point change in the *négoce* share, controlling for aforementioned factors. We then implement the same estimates for each of the two components separately. In our context, it is crucial to determine whether this association varies across European countries, with particular attention to Luxembourg relative to the others. Accordingly, we allow the effect of the *négoce* share to differ by country.[18]

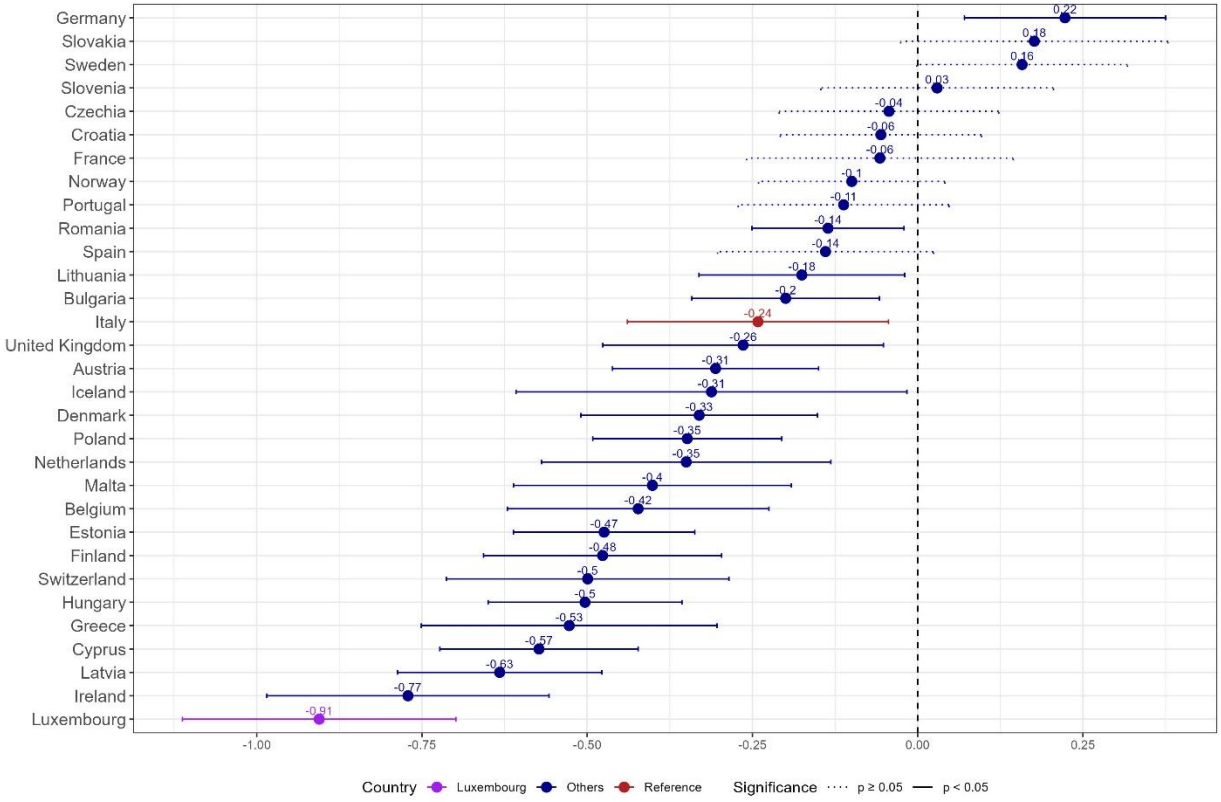
The resulting marginal effects by country for GOR are shown in Figure 6a. A "marginal effect" indicates how much GOR is expected to change when *négoce* share increases slightly while everything else is held constant. The results in Figure 6a show that for most countries, the impact of *négoce* share is negative. Luxembourg is the country with the largest negative impact: an increase of one percentage point in the *négoce* share is associated with a 0.91% decrease in GOR. Germany stands out as the single exception, with a positive and statistically significant effect.

Figure 6b shows the marginal effects of the *négoce* share on the margin on output component of GOR. The results for this component indicate that the effect is positive and statistically significant at the 5% level for all countries except Iceland. Luxembourg is ranked among the countries with the smallest positive effect of *négoce* share: a one percentage point increase in the share is associated with a 0.36% increase in the margin on output. In contrast, Figure 6c indicates that Luxembourg shows one of the largest negative marginal effects of the *négoce* share on the production ratio component. Specifically, a one-percentage-point increase in the *négoce* share is associated with a 1.27% decline in this component. The net effect of the *négoce* share on GOR is the algebraic sum of these marginal effects. As shown above, this corresponds to a 0.91% decrease in GOR for a one-percentage-point increase in the *négoce* share.[19]

[18] Technically, we regress the logarithm of GOR, and of each of its components, on the *négoce* share interacted with country dummies. The estimated equations are reported in the Appendix 2.

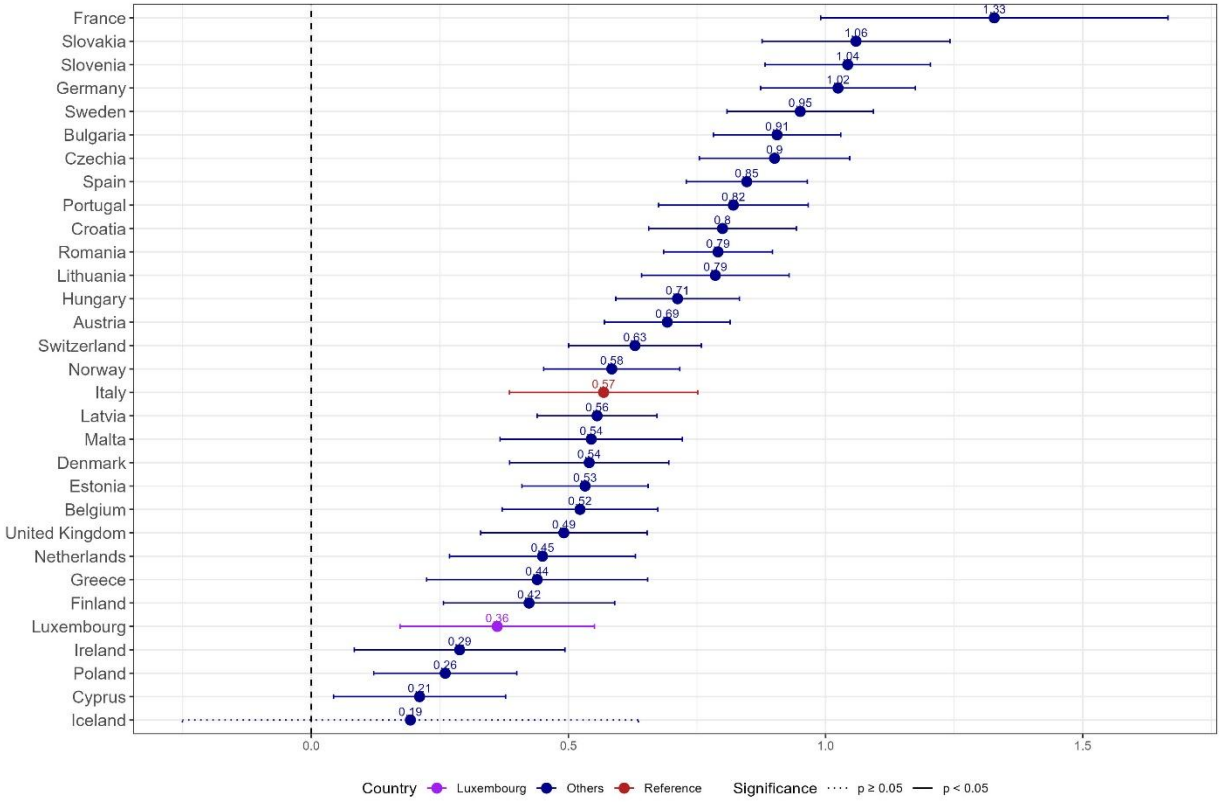
[19] Using a similar approach, we have also verified that the margin on output component has a positive impact on GOR, while the production share component has a negative impact. Consistently with the results reported here, we find that GOR is highly sensitive to changes in the production share component. Results are reported in the Appendix 1 (see Figures A.1 and A.2).

Figure 6a – Marginal effects of the *négoce* share on GOR, by country.



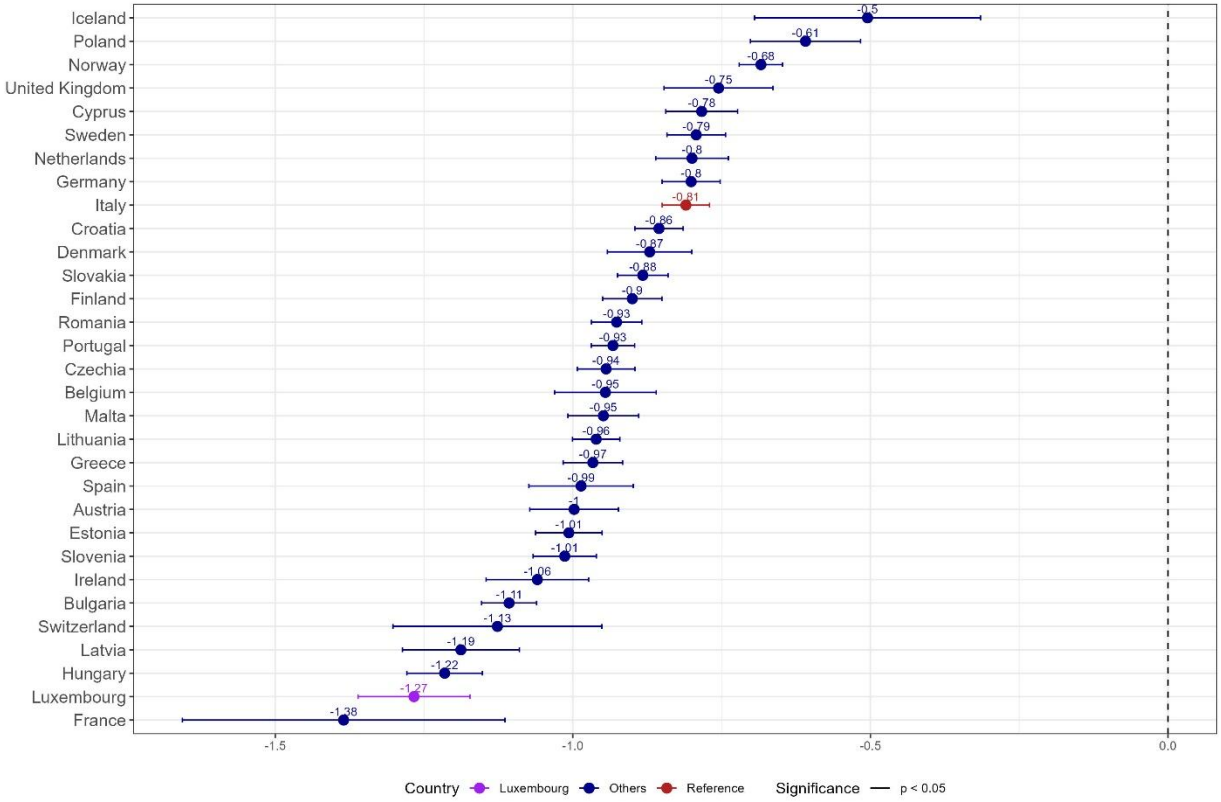
Note: The chart plots the estimated marginal effects of the *négoce* share, by country. The estimated specification includes interaction terms between *négoce* share and country dummies, with controls for NACE Rev. 2 section and nominal labour productivity.
Source: EUROSTAT SBS data. Authors' calculations.

Figure 6b – Marginal effects of the *négoce* share on the margin on output component of GOR, by country.



Note: The chart plots the estimated marginal effects of the *négoce* share, by country. The estimated specification includes interaction terms between *négoce* share and country dummies, with controls for NACE Rev. 2 section and nominal labour productivity.
Source: EUROSTAT SBS data. Authors' calculations.

Figure 6c – Marginal effects of the *négoce* share on the production share component of GOR, by country.

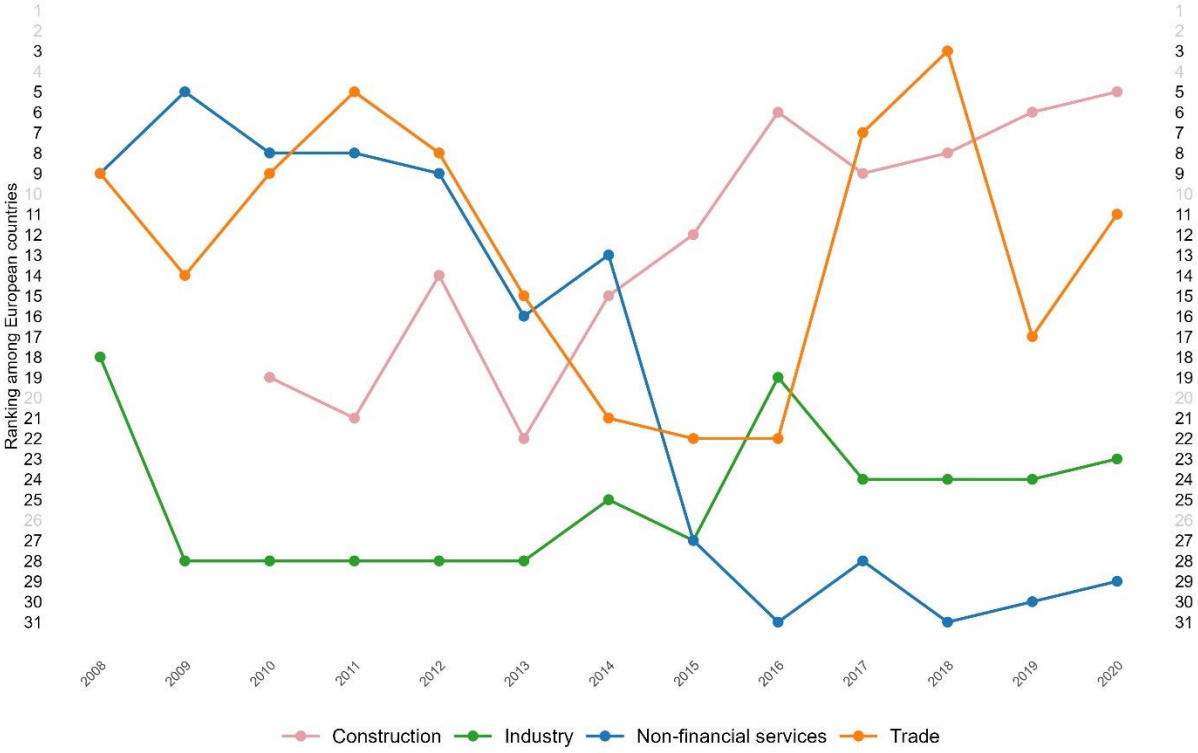


Note: The chart plots the estimated marginal effects of the *négoce* share, by country. The estimated specification includes interaction terms between *négoce* share and country dummies, with controls for NACE Rev. 2 section and nominal labour productivity.
Source: EUROSTAT SBS data. Authors' calculations.

Overall, these results suggest that *négoce* dampens GOR in Luxembourg more than in the other countries considered, and this happens through their adverse effect on the production ratio. These findings are aligned with the expectations initially derived from the accounting relationship, as already suggested by the descriptive analysis. At the same time, it is worth remembering that this correlational analysis does not establish a causal link between *négoce* and GOR.

Given that the share of *négoce* tends to reduce GOR through the production ratio component, it is instructive to examine how the cross-country ranking changes when this component is excluded. This corresponds to evaluating the country ranking based solely on the margin-on-output component. Results are presented in Figure 7, where this exercise is performed by aggregated sectors.

Figure 7 – Ranking of Luxembourg for margin on output, by aggregated sectors.



Note: The chart plots the ranking of Luxembourg across the trade, construction, industry, and non-financial services sectors for the margin on output measure. The comparison includes EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Industry includes NACE Rev. 2 sections B (Mining and quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply) and E (Water supply; sewerage, waste management and remediation activities). Construction corresponds to section F (Construction). Trade corresponds to G (Wholesale and retail trade; repair of motor vehicles and motorcycles). The non-financial services include H (Transportation and storage), I (Accommodation and food service activities), J (Information and communication), L (Real estate activities), M (Professional, scientific and technical activities), N (Administrative and support service activities) and S (Other service activities).

Source: EUROSTAT SBS data. Authors' calculations.

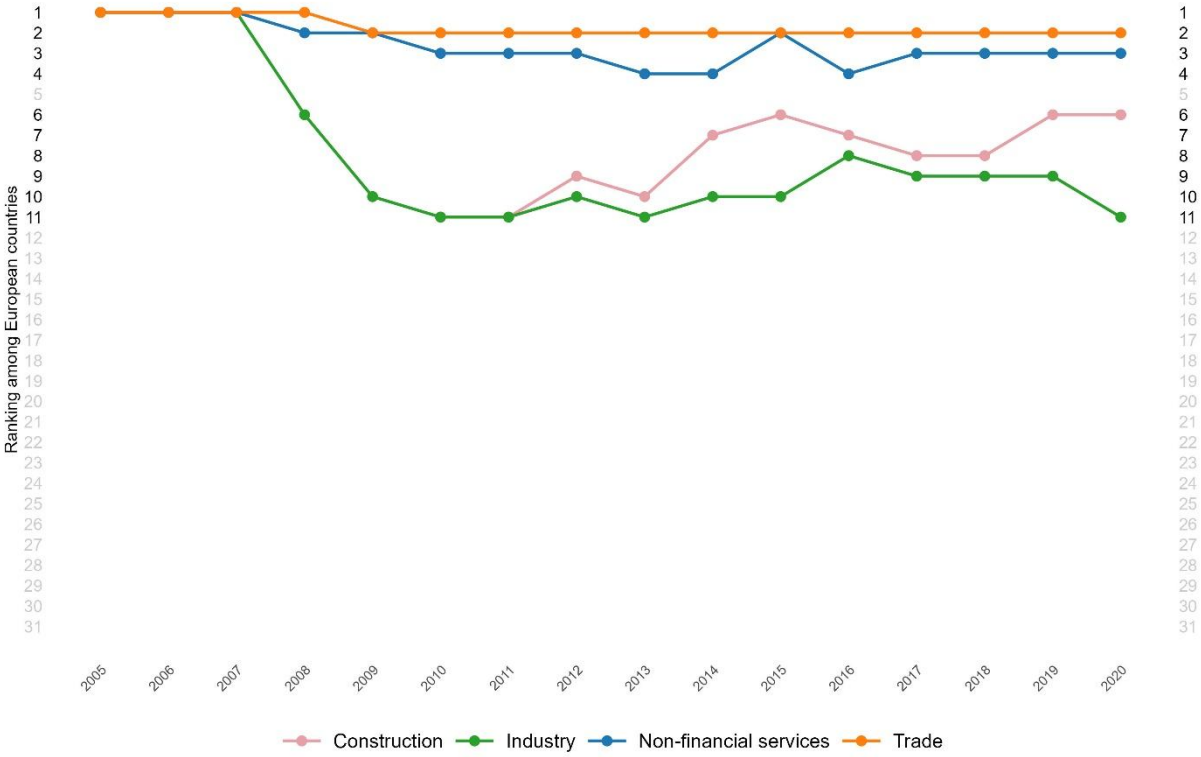
By comparison with Figure 1, we detect remarkable improvements for trade and, to a lesser extent, for construction. The positive effect for industry is less pronounced and occurs mostly after 2015. On the contrary, no substantial changes arise for non-financial services. This highlights the different impact of *négoce* across industries. To complement the analysis, we further evaluate the average association between GOR and the *négoce* share, with controls for labour productivity, countries, industries and time. More precisely, we perform a series of simple Ordinary Least Square (OLS) regressions based on the logarithmic transformation of the GOR decomposition previously discussed. Cross-country results are reported in the Appendix 3 (Tables A.1–A.3).

Results in Table A.1 show that GOR is statistically significantly and negatively associated with the share of *négoce*. Looking at the regressions for the two individual components of GOR on the *négoce* share, results show that the margin on output is positively and significantly associated with this share (Table A.2), whereas the production ratio displays a negative and significant association (Table A.3). The two coefficients are therefore opposite in sign and sum to the negative coefficient on *négoce* in the GOR regression shown in Table A.1. Essentially, results for the average association confirm the conclusion previously drawn about the connection channels between GOR and the share of *négoce*.

3.2.2 Role of productivity

We now turn our attention to the relationship between nominal labour productivity and GOR. Labour productivity is defined as nominal value added per person employed and is calculated using Eurostat SBS data. Figure 8 shows Luxembourg's strong European standing for this important measure of enterprise performance. Indeed, the trade and non-financial services sectors rank in the top three among European countries in 2020.

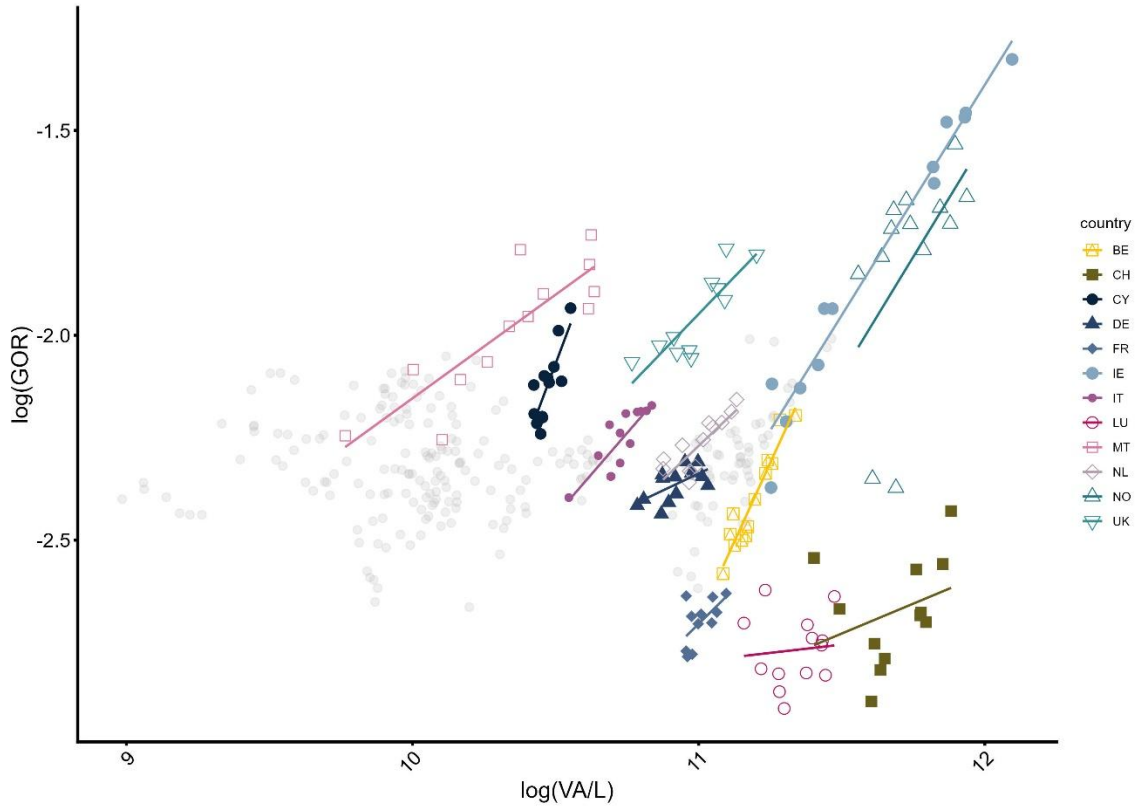
Figure 8 – Luxembourg's ranking in nominal labour productivity among European countries.



Note: The chart plots the ranking of Luxembourg across the trade, construction, industry, and non-financial services sectors for nominal labour productivity. The comparison includes EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Industry includes Rev. 2 sections B (Mining and quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply) and E (Water supply; sewerage, waste management and remediation activities). Construction corresponds to the section F (Construction). Trade corresponds to G (Wholesale and retail trade; repair of motor vehicles and motorcycles). The non-financial services include H (Transportation and storage), I (Accommodation and food service activities), J (Information and communication), L (Real estate activities), M (Professional, scientific and technical activities), N (Administrative and support service activities) and S (Other service activities).
Source: EUROSTAT SBS data. Authors' calculations.

Figure 9 shows the association between GOR and nominal labour productivity across European countries. Visual inspection reveals a positive relationship between labour productivity and GOR within countries, as shown by the linear fits drawn for a selected group of countries. This signals that higher levels of nominal productivity may be associated with better profitability in terms of GOR.

Figure 9 – Association between GOR and nominal labour productivity among European countries.



Note: The chart plots the gross operating rate (GOR) against nominal labour productivity. The straight lines are linear fits that suggest correlation within countries. This plot includes EU27, UK and most EFTA countries (Iceland, Norway and Switzerland).
Source: EUROSTAT SBS data. Authors' calculations.

As part of the econometric analysis of the relationship between profitability and *négoce* (see Section 3.2.1), nominal labour productivity is included in the estimated specifications. The results (see Tables A.1–A.3 in Appendix 3) show consistently positive, statistically significant link between productivity and profitability. Table A.1 shows indeed that the coefficients of nominal labour productivity are positive and highly significant across all tested specifications. This positive association stems mostly from the margin on output component of GOR (Table A.2), and to much lesser extent from the production ratio component (Table A.3). While this correlational analysis does not establish a causal link between productivity and GOR, the results are compatible with the theoretical view (e.g. Demsetz, 1973) that the productivity is a major determinant of profitability.

4. Empirical analysis for Luxembourg

This section is dedicated to the analysis of the profitability of resident firms in Luxembourg for the period 2008–2020. It begins with a descriptive analysis, followed by an econometric investigation based on the same conceptual framework as the cross-country analysis (see Section 3.2.1).

4.1 Descriptive analysis

The descriptive analysis for Luxembourg is built on Eurostat SBS data, which is also employed in the cross-country comparison.

Figure 10 –Evolution of GOS and GOR the non-financial market economy in Luxembourg.

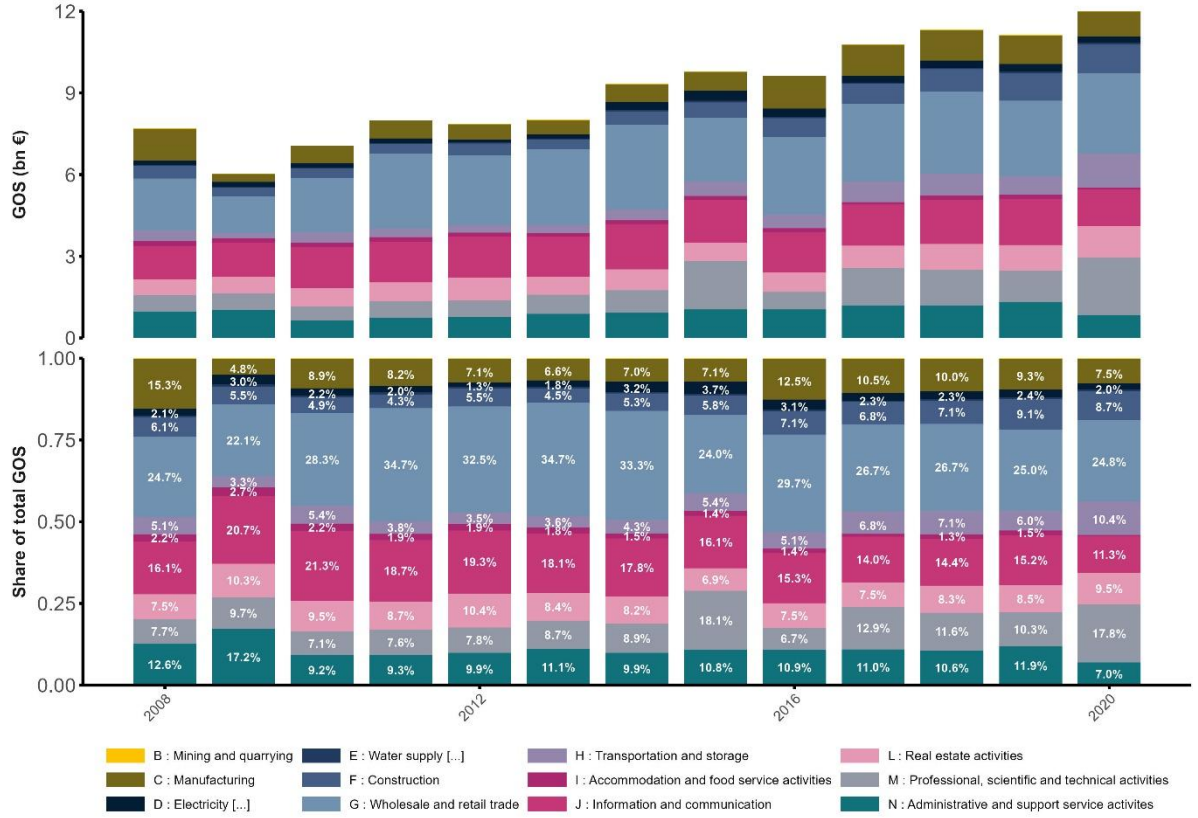
Note: The chart plots evolution of gross operating surplus (GOS) and gross operating rate (GOR) for the non-financial market economy in Luxembourg.

Source: EUROSTAT SBS data. Authors' calculations.

Figure 10 plots the evolution of GOS and GOR for the non-financial market economy in Luxembourg over the period under examination. GOR shows a declining phase between 2008 and 2013, with a decrease from 7.3% to 5.4% which are also the maximum and minimum for the period. This is followed by a recovery phase that brings it back to almost the same 2008 level. Overall, during the entire period, GOR changes within a relatively narrow interval.

On the contrary, total GOS increased by around 55% between 2008 and 2020, reaching approximately 12 billion euros in 2020. With the exception of the financial crisis period, a steadily increasing trend emerges as the main feature of GOS. Therefore, despite Luxembourg's consistently low ranking in terms of GOR, the sustained growth in gross operating surplus signals positive developments in profit generation capabilities of Luxembourgish firms.

Figure 11 – Evolution of GOS in Luxembourg by NACE Rev. 2 sections.



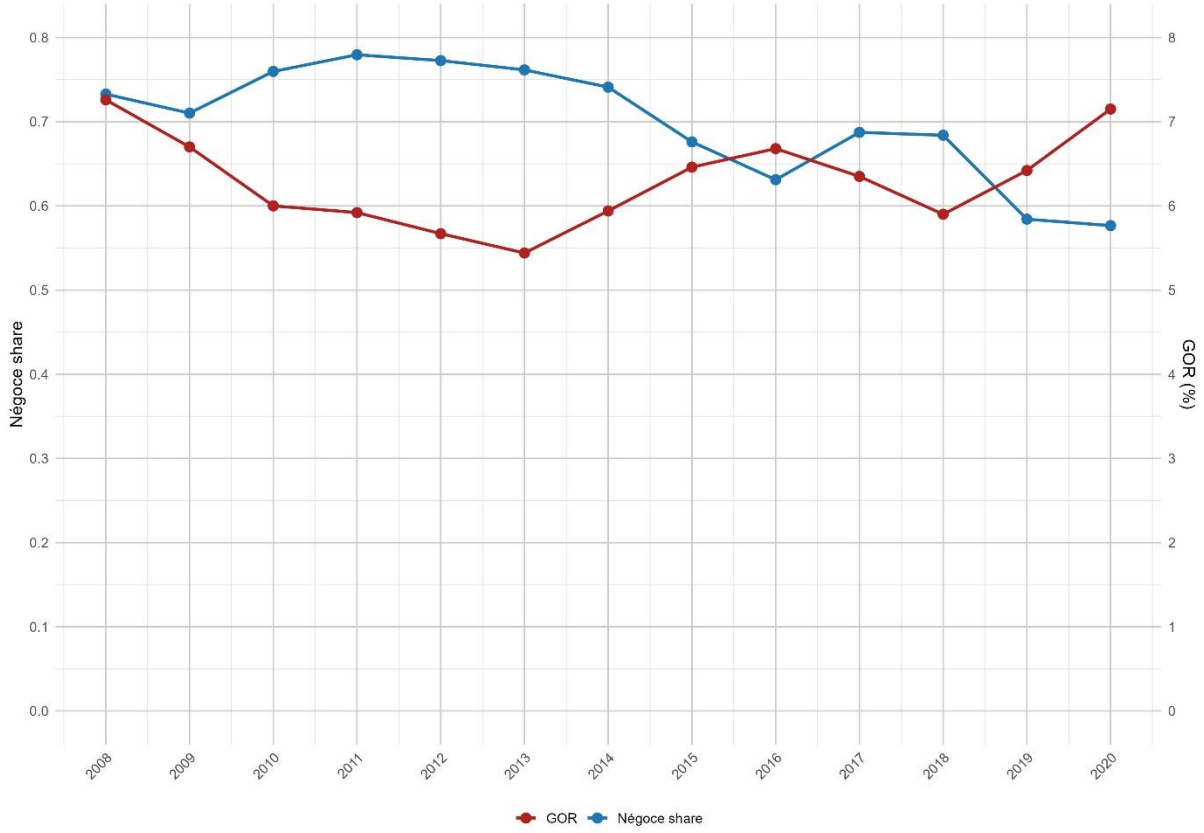
Note: The chart plots evolution of gross operating surplus (GOS) in Luxembourg by NACE Rev. 2 sections. Shares under one percent are not labeled for readability.

Source: EUROSTAT SBS data. Authors' calculations.

Figure 11 presents the evolution of the Gross Operating Surplus (GOS) in Luxembourg by NACE Rev. 2 sections. This chart presents both absolute levels (upper panel) and relative shares in total GOS (lower panel). The sections F (Construction), H (Transportation and storage) and M (Professional, scientific, and technical activities) accounted for the largest increases in absolute terms. In relative terms, the share of section H (transportation and storage) increased from 5.1% in 2008 to 10.4% in 2020 (see lower panel of Figure 11). The share of section M (professional, scientific, and technical activities) rose from 7.7% in 2008 to 17.8% in 2020, although the latter value could be affected by an anomalous fluctuation. The share of section F (construction) has moderately increased over the entire period. In section G (wholesale and retail trade), the period of expansion from 2009 to 2016 was followed by a contraction over 2017–2020. It is noteworthy that section G accounts for a quarter of total GOS at the end of studied period. A decreasing trend in relative terms is observed for section J (information and communication), with share of total GOS decreasing from 16.1% in 2008 to 11.3% in 2020, with some intermediate fluctuations.

This evidence points to the fact that GOR does not inform directly about the underlying GOS levels. For instance, as shown in Figure A.3 for 2019 (see Appendix 1), sections G and M record the lowest GOR among all industries considered. At the same time, they jointly account for around 35% of total GOS. This can be easily understood considering the comparatively high turnover level of these industries. Therefore, while GOR may be informative, the underlying levels of GOS and turnover should also be considered for an overall assessment.

Figure 12 –Evolution of GOR and *négoce* share for the non-financial market economy in Luxembourg.



Note: The chart plots evolution of gross operating rate (GOR) and *négoce* share for the non-financial market economy in Luxembourg.

Source: EUROSTAT SBS data. Authors' calculations.

Figure 12 illustrates the dynamics of GOR and the *négoce* share for thenon-financial market economy in Luxembourg over the period 2008-2020. The figure is suggestive of a negative correlation between GOR and the *négoce* share, as periods of relatively high or rising *négoce* share tend to coincide with low or declining GOR. For example, the sustained decline in the *négoce* share after 2011 is accompanied by an increase in the GOR measure of profitability starting in 2013. At the same time, the relationship is not strictly monotonic over the whole sample, with some shorter subperiods displaying parallel or weakly related movements, notably in 2011-2013 and 2017-2018. The relationship between GOR and *négoce* share is further explored with the econometric analysis in the next section.

4.2 Econometric analysis

The econometric research relies on the same conceptual framework already described for the cross-country investigation (see section 3.1). The analysis uses the STATEC Structural Business Statistics (SBS) dataset, which overcomes the limitations of the Eurostat SBS data by offering a breakdown by employment size.[20] To extend the analysis to the size dimension, we aggregate the source microdata by grouping firms according to the number of persons employed into five size classes: 2–9, 10–19, 20–49, 50–249, and 250 or more persons employed. We exclude firms with one or less persons employed, following Bottazzi et al. (2008), who argue that, in such cases, the proprietor and the employee coincide. As a result, self-employment is not considered. Moreover, this eliminates very small units that enter and/or exit the sample at some point during the year. In the final dataset, the unit of observation is a NACE Rev. 2 two-digit sector for each size class and for each year over 2008–2020.

We further examine how *négoce*, labour productivity, and firm size relate to profitability, measured by the GOR ratio, while controlling for industry effects at either the NACE Rev. 2 section or 2-digit level. To strengthen the reliability of our inference, we estimate most models twice: once with heteroskedasticity-robust standard errors and once with standard errors clustered at the NACE 2-digit level.

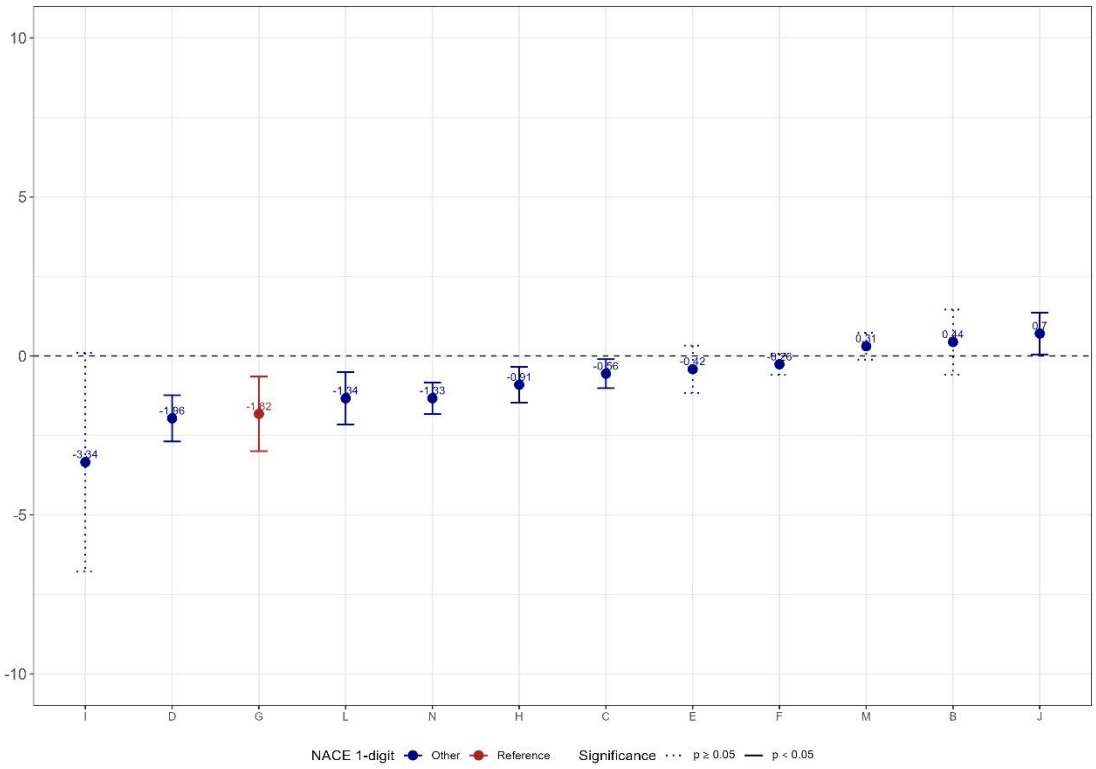
Estimation results are reported in Tables A.4 (robust standard errors) and A.5 (clustered standard errors).[21] Two findings are consistent across both specifications: the *négoce* share is negatively associated with profitability, while labour productivity is positively associated with profitability. Both findings are in line with the cross-country analysis. However, the statistical significance of the *négoce* share reduces when industry fixed effects are included and standard errors are clustered.

The decomposition of GOR ratio into two components and their separate estimation yield meaningful explanatory insights. In Tables A.7 and A.8 we report OLS estimations for margin on output and production ratio components of GOR, respectively. The association between *négoce* share and margin on output is positive, while the one between *négoce* share and production ratio is negative. The sum of these estimated coefficients approximately equals the estimate of the association between *négoce* share and GOR (see Tables A.4 and A.5). We find that labour productivity is positively and highly significantly associated with the margin-on-output component (see Table A.7), and not statistically significantly with the production ratio (see Table A.8). Taken together, the evidence suggests that labour productivity influences GOR mainly through the margin-on-output channel, whereas *négoce* operates primarily through the production-share channel. The results based on Luxembourg data for the subcomponents of the GOR ratio are mainly consistent with the cross-country evidence, with the possible exception of the relationship between the production ratio component and productivity.

[20] The industry coverage of the STATEC SBS dataset for Luxembourg corresponds to that of the Eurostat SBS dataset employed in the cross-country analysis. The Eurostat SBS data by size class have very limited coverage, which is insufficient for a meaningful cross-country comparison. Furthermore, data for Luxembourg by size classes in that dataset are almost entirely missing due to confidentiality constraints.

[21] Robust standard errors handle heteroskedasticity but still assume independence across observations. Clustering, in turn, allows the error terms to be arbitrarily correlated within a cluster (NACE 2-digit industries) while remaining independent across clusters. Clustering provides a way to account for shocks shared within industries—such as sector-level demand or policy shocks. If such shocks are present, treating observations as independent underestimates the sampling variability (standard errors), which can overstate statistical significance. The sensitivity to the assumed error structure warrants a cautious interpretation of the findings.

Figure 13 – Marginal effects of the share of *négoce* on GOR by NACE Rev. 2 sections, for Luxembourg, estimated with robust standard errors.

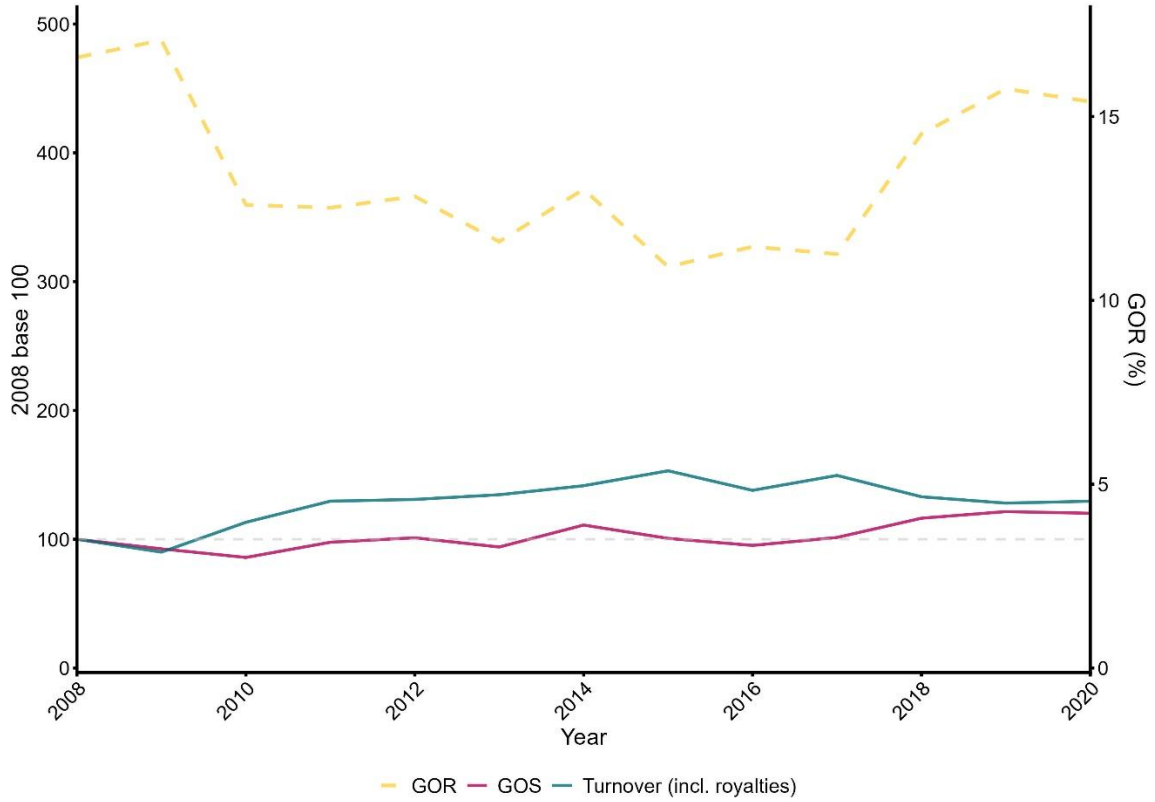


Note: The chart plots the estimated marginal effects of the share of *négoce* on gross operating rate (GOR). The estimated specification includes interaction terms between share of *négoce* and NACE Rev. 2 section dummies, with controls for firm sizes classes and labour productivity. This regression uses ordinary least squares and robust standard errors. The following list presents the NACE rev. 2 classification of economic activities used to categorise industries: B: Mining and quarrying, C: Manufacturing, D: Electricity, gas, steam and air conditioning supply, E: Water supply; sewerage, waste management and remediation activities, F:Construction, G: Wholesale and retail trade, H: Transportation and storage, I: Accommodation and food service activities, J: Information and communication, L: Real estate activities, M: Professional, scientific and technical activities, N: Administrative and support service activities.
Source: STATEC SBS data for Luxembourg. Authors' calculations.

We next examine whether the relationship between firms' use of *négoce* and their profitability differs across industries. To this end, we allow the effect of *négoce* to vary by NACE Rev. 2 sections. Figure 13 presents the marginal effects for each NACE Rev. 2 section, illustrating how the outcome changes across industries as the share of *négoce* increases. The results show that for sectors D (Electricity, gas, steam and air conditioning supply), G (Wholesale and retail trade), L (Real estate activities), N (Administrative and support service activities), H (Transportation and storage) and C (Manufacturing) the marginal effects are negative and statistically significant at 5% level. This implies that within these sectors, *négoce* is associated with a reduction in profitability, as measured by GOR. For the sector J (information and communication), we find positive impact. For the other sectors we do not find statistical significance at 5% level.[22]

[22] We estimate specifications with robust standard errors. Under the specification with standard errors that are clustered at the NACE two-digits level, the results are different (see Figure A.4 in Appendix 1).

Figure 14a – Evolution of GOR, GOS, and turnover for firms with less than 10 persons employed, for Luxembourg.



Note: The chart plots gross operating rate (GOR), gross operating surplus (GOS) and turnover for firms with less than 10 persons employed. Both GOR and GOS are indexed to a base value of 100 in 2008.
Source: STATEC (LUSTAT). Authors' calculations.

We continue our analysis by examining further the role of firm size for the profitability in Luxembourg. The two charts in Figures 14a and 14b[23] illustrate the evolution of GOR, GOS, and turnover for firms in Luxembourg, comparing small firms (with fewer than 10 persons employed) and largest firms (with at least 250 persons employed). GOS and turnover are both indexed to a 2008 base of 100.

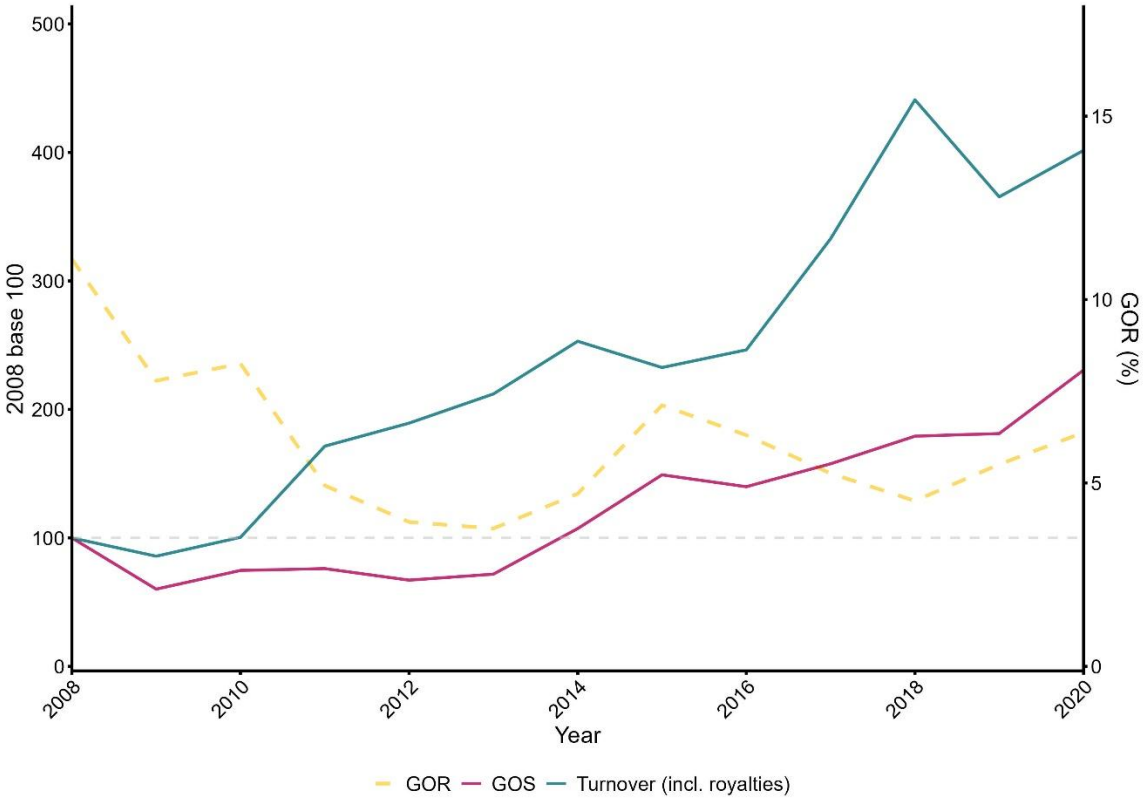
For smallest firms (Figure 14a), turnover remains relatively stable over time, with modest growth after 2012. GOR and GOS fluctuate slightly and show no strong upward trend. In contrast, largest firms (Figure 14b) display a remarkably different pattern. Turnover grows substantially after 2010, rising to nearly four times its 2008 level by 2020. GOS also increases over time by approximately two times. GOR remains volatile, suggesting that profitability did not keep pace with the expansion in turnover. Overall, the GOR of the largest firms (about 6% in 2020) is consistently lower than that of smallest firms (about 15% in 2020).

The existing literature (see Section 2.3) provides mixed evidence on the relationship between firm size and profitability. However, our results are consistent with studies that find a negative correlation. For example, Goddard et al. (2005) show that firms that expand in size, as measured by balance sheet

[23] For the analysis presented in these charts, we use publicly available data from LUSTAT, the statistics portal of the Grand Duchy of Luxembourg.

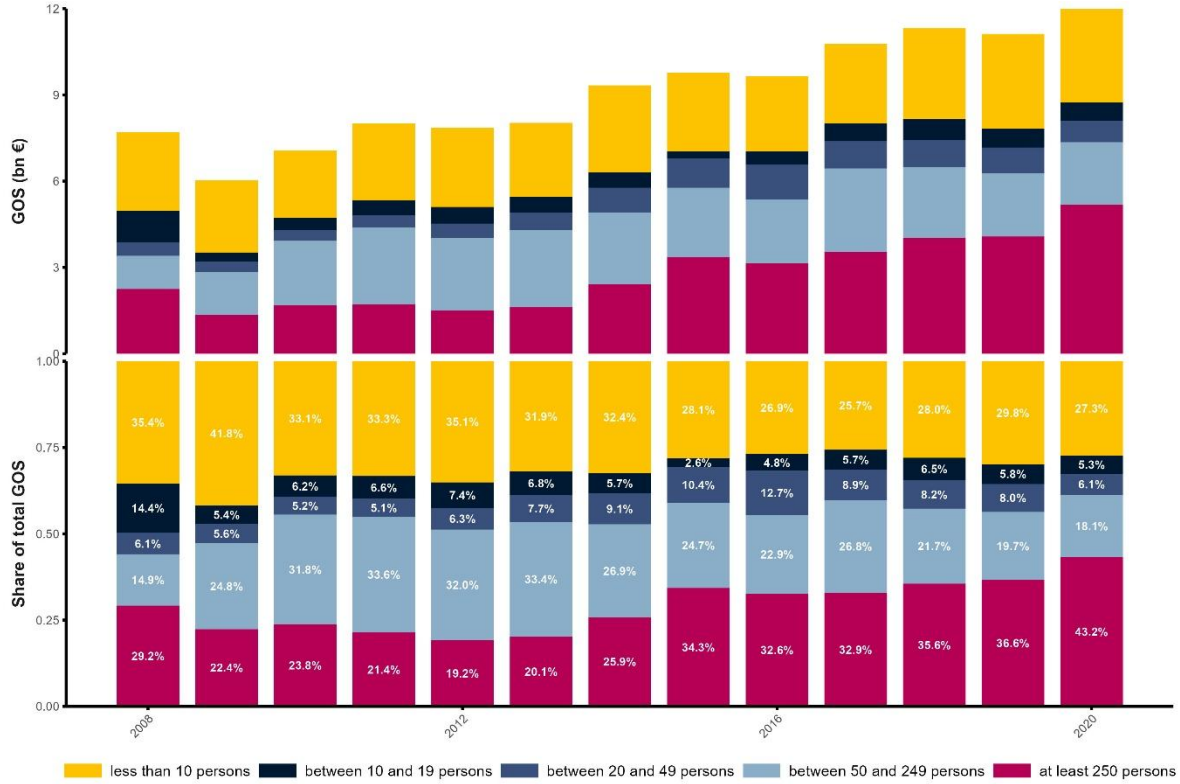
assets, tend to experience a decline in profitability. More recently, ECCBSO (2024) reports that in 2022 the median large firm had lower profit margins than smaller firms in France, Italy, Poland, and Portugal.

Figure 14b – Evolution of GOR, GOS, and turnover for firms with at least 250 persons employed, for Luxembourg.



Note: The chart plots gross operating rate (GOR), gross operating surplus (GOS) and turnover for the firms with at least 250 persons employed. Both GOR and GOS are indexed to a base value of 100 in 2008.
Source: STATEC (LUSTAT). Authors' calculations.

Figure 15 – Evolution of GOS and its composition by firm size, for Luxembourg.



Note: The chart plots evolution of gross operating surplus (GOS) and its composition. Different colors correspond to different size classes.
Source: STATEC (LUSTAT). Authors' calculations.

Figure 15 illustrates the evolution of gross operating surplus (GOS) by enterprise size class in Luxembourg, presenting both absolute levels (upper panel) and relative shares in total GOS (lower panel).[24] In absolute terms, GOS has increased noticeably. This growth is largely driven by enterprises with at least 250 employees, whose GOS rises strongly, particularly from 2014 onwards. By contrast, the GOS generated by the smallest enterprises (less than 10 persons employed) remains broadly stable over time. The composition of GOS by firm size, shown on the stacked bar chart in the lower panel, indicates a gradual reallocation of profits towards largest firms. The share of total GOS attributable to enterprises with at least 250 persons employed increased from 19.2% in 2012 to 43.2% in 2020. Over the same period, the share of the smallest firms (less than 10 persons employed) decreased from 35.1% to 27.3%.

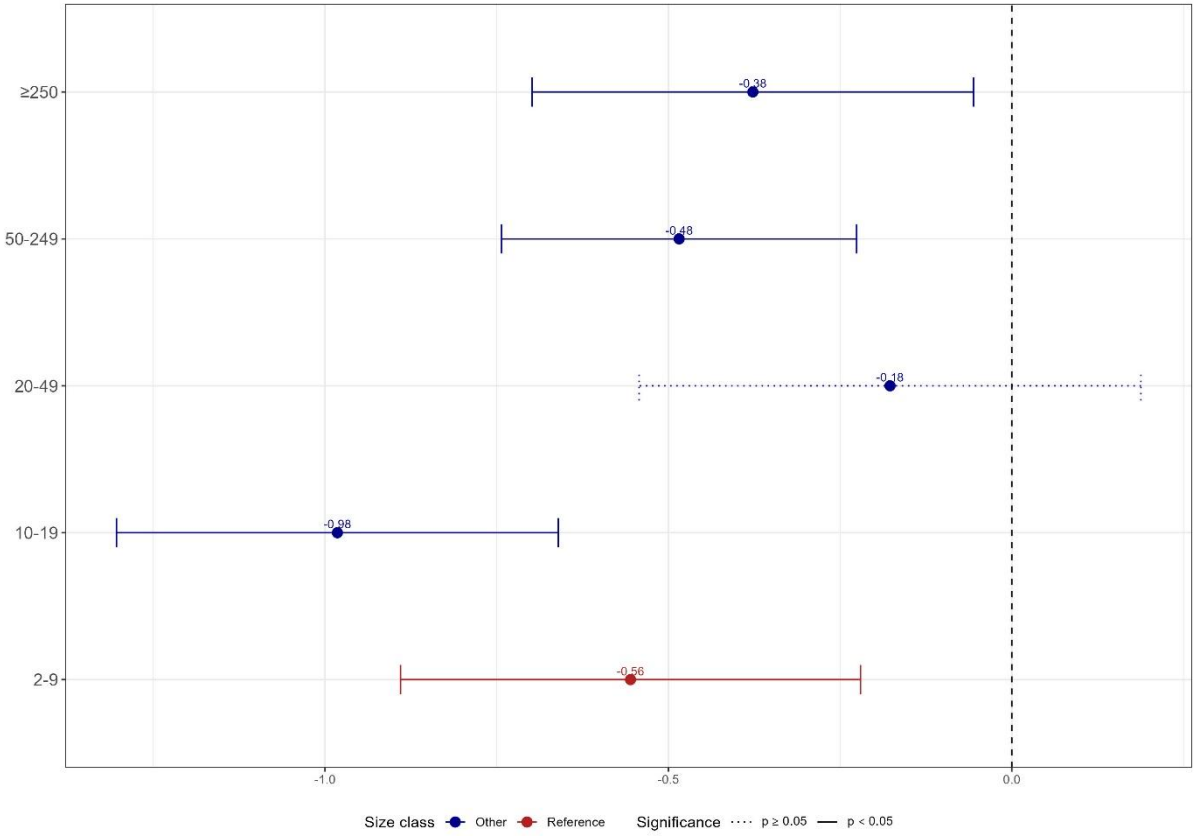
The regression results confirm the pattern revealed by the descriptive evidence. In particular, the estimations reported in Table A.4 (see Appendix 3) demonstrate that the largest firms (those with 250 or more persons employed) show significantly lower profitability compared with the smallest firms.[25]

To evaluate how the effect of *négoce* depends on firm size, we interact *négoce* share with firm size classes. Figure 16 presents the corresponding marginal effects, all of which are negative, with most being statistically significant at the 5% level. Profitability (GOR) declines with a higher *négoce* share across all firm sizes, though the magnitude of the effect varies. The largest reduction in GOR is

[24] For the analysis presented in this chart, we use publicly available data from LUSTAT, the statistics portal of the Grand Duchy of Luxembourg.
[25] In Table A.5 we reproduce this estimation with clustered standard errors. Under this assumption, we observe the reduced statistical significance in the model with the most stringent set of fixed effects.

observed among firms with 10 - 19 employees. This effect is weaker among firms with more than 50 persons employed.[26]

Figure 16 – Marginal effects of the share of *négoce* on GOR by size class, for Luxembourg, estimated with robust standard errors.



Note: The chart plots the estimated marginal effects of the share of *négoce* on gross operating rate (GOR). The estimated specification includes interaction terms between share of *négoce* and firm sizes dummies, with controls for NACE Rev. 2 section dummies and labour productivity. This regression uses ordinary least squares and robust standard errors.
Source: STATEC SBS data for Luxembourg. Authors' calculations.

A plausible interpretation is that small firms are more exposed to *négoce* because they have weaker bargaining power over purchases, less capacity to absorb coordination costs, and tighter margins (see Görg and Hanley, 2004). Large firms may incur lower search costs because they are more established in the market and possess greater knowledge of competitors and suppliers than smaller firms.[27]

Table A.9 (see Appendix 3) reports the estimated association between GOS and firm size for Luxembourg, while Table A.10 presents the corresponding estimates for total turnover. These regression results indicate that larger firms tend to have higher GOS as well as higher turnover. Moreover, the estimated coefficients for turnover are higher than those for GOS across the same firm

[26] We report results using robust standard errors. In the specification with standard errors clustered at the NACE two-digit industry level (see Figure A.5), only the marginal effects for the firms with 10-19 persons employed are statistically significant at 5% level.
[27] Grossman and Helpman (2002) provide theoretical foundation for analysing outsourcing decisions. In their model, the feasibility of outsourcing is shaped by the allocation of bargaining power between the contracting parties, the intensity of market competition, and the availability of potential partners.

size categories.[28] This indirect comparison suggests that turnover increases with firm size at a faster rate than GOS, which may help explain our empirical finding that larger firms are less profitable.

5. Alternative indicator of firm profitability

One objective of this study is to investigate alternative measures of firm profitability. Following INSEE (2022) and STATEC (2023), we compute the margin rate, defined as gross operating surplus (GOS) divided by value added. Therefore, the margin rate captures the distribution of value added between labour compensation and operating surplus to capital. This contrasts with the GOR ratio, which uses turnover as the denominator.

Figure 17 compares GOR and the margin rate across years and NACE Rev. 2 sections. Luxembourg's relative profitability ranking improves for several sections when profitability is measured by the margin rate rather than GOR. The most notable differences are observed for sections G (Wholesale and retail trade) and J (Information and communication). Section G in particular ranks among the weakest in terms of GOR, while it tops the ranking for margin rates for most years. In other words, while GOR identifies Section G among the least profitable, the margin rate places it among the industries with the highest share of GOS in value added for all countries considered. For the sections M (Professional, scientific and technical activities) and D (Electricity, gas, steam and air conditioning supply) the difference between rankings in margin rate and GOR are smaller, but nonetheless present.

It is also important to observe that a more granular analysis reveals considerable differences within NACE Rev. 2 sections. This is shown, for instance, in Figure A.6 (see Appendix 1) for Manufacturing (section C) and Accommodation and food service activities (section I). Grouping together medium-low technology (MLT) with high-technology (HIT) industries and comparing this aggregate with the rest of Manufacturing reveals a remarkably better GOR ranking for the latter. Likewise, substantial difference in relative rankings and in their evolution over time can be detected for the two NACE divisions of section I, namely Accommodation (I55) and Food and beverage service activities (I56). In particular, division I55 displays substantially higher and increasing ranking for both margin rate and GOR from 2017 onwards.

Figure A.7 (see Appendix 1) presents an additional comparison between the GOR and the margin rate for Luxembourg and its neighbouring countries, as well as the EU average, for 2019. Besides relative ranking, this comparison shows also the magnitude of GOR and margin rate. The results indicate that Luxembourg ranks higher in terms of the margin rate for Wholesale and Retail Trade (G), Manufacturing (C), and Information and Communication (J). In particular, the margin rates for sections G and J are among the highest, displaying a share of GOS in value added slightly above 50%.

An important message that comes from this comparison is that profitability rankings based on different indicators may indeed reveal different scenarios. Moreover, the assessment based on a given profitability measure may also depend on the level of granularity considered. This may speak against the use of a single indicator and its application to wide industry aggregates.

We further examine the relationship between the margin rate and the *négoce* share, labour productivity, and firm size categories. This amounts to replicating the same analysis performed for GOR, although it must be noted that for the margin rate we have no priors regarding in particular the

[28] This result holds across the following firm size categories: 20 to 49, 50 to 249, and 250 or more persons employed. For these groups, the estimated associations between firm size and both GOS and turnover are highly statistically significant. The estimated coefficients for turnover are systematically larger than those for GOS.

relationship with *négoce*. Therefore, we consider this as a rather descriptive comparative exercise. The estimation results are presented in Table A.6. The evidence regarding the *négoce* share is not consistent across model specifications with different fixed effects. In the models including either year or NACE Rev. 2 section fixed effects, the estimated coefficient is positive and significant at the 5% level. When NACE 2-digit fixed effects are introduced, the coefficient becomes insignificant. As industry effects are most likely relevant, this suggests that margin rate might be less sensitive than GOR to the *négoce* share.[29] At the same time, it is worth noting that in all estimated specifications, labour productivity is positively and statistically significantly associated with the margin rate measure of profitability.

[29] The NACE Rev. 2 section fixed effects (column 2 in Table A.6) are highly statistically significant. Most of the 2-digit fixed effects (column 3) are also highly statistically significant. Furthermore, these industry fixed effects are jointly statistically significant.

Figure 17 – Ranking of Luxembourg for GOR and margin rate, by NACE Rev. 2 section.

Note: The chart illustrates Luxembourg's ranking across NACE Rev. 2 sections based on two profitability measures: gross operating rate (GOR, in blue) and margin rate (in orange).

Source: EUROSTAT SBS data. Authors' calculations.

6. Conclusions

This study provides empirical estimates of relevant factors correlated with profitability, with a particular focus on Luxembourg. The first part of this study is devoted to a cross-country analysis based on sector-level Structural Business Statistics (SBS) data from Eurostat. The dataset is publicly available and covers the period 2008–2020. The analysis focuses on the gross operating ratio (GOR) as the principal measure of profitability. In line with previous studies, our findings indicate that Luxembourg consistently ranks low among European countries in terms of GOR.

A cross-country descriptive analysis shows that Luxembourg has an exceptionally high share of merchanting, subcontracting and distributive activities in its total turnover. We collectively refer to these activities using the French term *négoce*, and we use as a proxy for their measurement the "Purchases of goods and services purchased for resale in the same condition as received". To shed light on the underlying mechanisms, we decompose GOR into two multiplicative components defined as the margin on output and the production ratio. We exploit this decomposition to estimate separate regressions for each component. Cross-country regression results indicate that the *négoce* share over total purchases of goods and services is negatively correlated with the production ratio but positively correlated with the margin on output. Despite the opposite effects, the net association between *négoce* and GOR is negative. Moreover, Luxembourg's GOR appears particularly sensitive to the adverse effects of *négoce* share compared with other countries in the sample.

These empirical results are consistent with our conceptual framework, which postulates that *négoce* depresses operating profitability. It is important to note, however, that while the framework implies a causal relationship between *négoce* and GOR, our empirical analysis does not allow us to formally establish such causality. Finally, nominal labour productivity is positively and statistically significantly associated with GOR. Although this does not imply causality, the finding is consistent with the theoretical view (e.g., Demsetz, 1973) that productivity is a key determinant of profitability.

The second part of this research is based on STATEC SBS data for Luxembourg for 2008-2020, aggregated by industry and size classes. The corresponding regression results are consistent with the cross-country findings, confirming both a strong negative correlation between GOR and the *négoce* share and a positive association of GOR with nominal labour productivity.

The STATEC SBS data for Luxembourg allows extending the investigation to the size dimension, overcoming Eurostat data limitations for this relevant variable. In this respect, the econometric analysis suggests that the largest firms tend to be less profitable compared to the smallest ones. Descriptive statistics reveal that lower GOR for the largest firms is partly explained by a relatively slower growth in GOS compared to turnover, unlike the smallest firms where the relative dynamics between GOS and turnover have been more stable over time. Nonetheless, the largest firms appear as the driving force behind the growth in total GOS after 2014, while the smallest firms tend to maintain their relative weight over the same period. Therefore, while GOR provide relevant information on profitability, the underlying levels of GOS and turnover should also be considered for a more comprehensive assessment. The same consideration applies when looking at profitability from the industry viewpoint. For instance, while section G (Wholesale and retail trade) and M (Professional, scientific and technical activities) record the lowest GOR among all industries considered, they jointly account for around 35% of total GOS and 70% of total turnover for Luxembourg.

Again, in terms of size, GOR appears more sensitive to the negative effect of the *négoce* share among small firms with 10-19 persons employed. As for industries, GOR is also more sensitive in the NACE Rev. 2 sections D (Electricity, gas, steam and air conditioning supply), G (Wholesale and retail trade),

L (Real estate activities), N (Administrative and support service activities), H (Transportation and storage) and C (Manufacturing). These findings, however, require further investigation and remain dependent on the underlying model assumptions.

An important objective of this study is to investigate alternative indicators of profitability for Luxembourg. For this purpose, we examine the margin rate, defined as gross operating surplus divided by value added. Regression results indicate that this indicator might be less influenced by *négoce*. For several major NACE Rev. 2 sections, descriptive statistics also show that Luxembourg ranks higher based on the margin rate than based on GOR. In particular, section G (wholesale and retail trade) ranks among the least profitable in terms of GOR but among the most profitable for margin rate in all countries considered. Moreover, different profitability assessment may also emerge when applying the same indicator to smaller aggregates. Overall, the results advise against the use of a single profitability measure and its application to broad industry aggregates.

It is important to highlight several limitations of this study. Merchanting, subcontracting and distributive activities are jointly proxied rather than directly and separately measured. Therefore, the analysis cannot distinguish between each individual component. Expressing labour productivity in volumes, rather than nominal terms, would be advisable to assess the robustness of the analysis. Methodologically, while the data aggregation by industry and size prevents large economies or sectors from dominating the analysis, countries and industries are not represented in proportion to their economic scale. Therefore, this approach does not allow to capture aggregate economic effects. In our research context, this limitation might be satisfactorily addressed with the use of microdata.[30] Finally, only two profitability indicators are considered, and comparisons based on these measures may not fully capture the specific features of Luxembourg's economy.

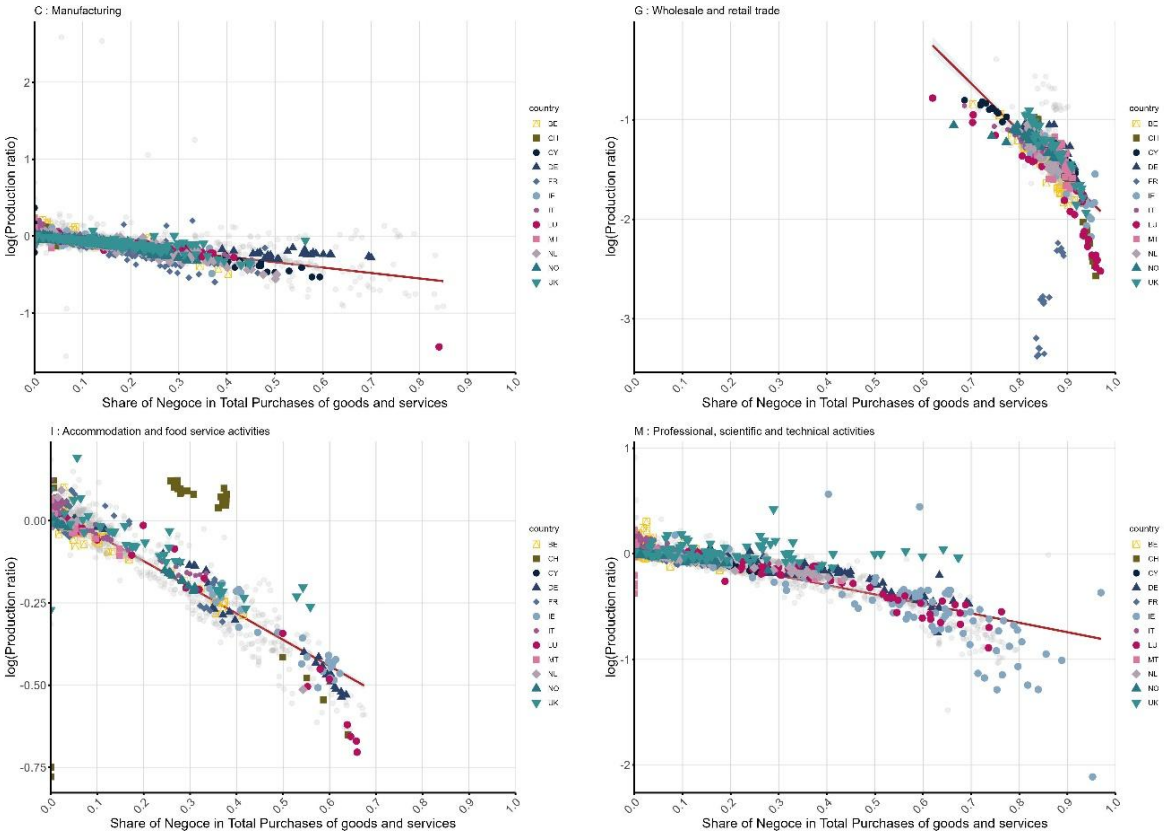
Firm-level regression analysis is therefore a highly desirable development for research on profitability. The use of microdata should allow for a deeper analysis of the patterns identified in this country- and sector-level study. The analysis may also be extended to return on assets (ROA), a widely used profitability indicator in the relevant literature. Another advantage of the microeconometric approach is that it can include relevant firm-level controls, such as ownership structure, firm age and ICT adoption. Since ORBIS and BACH datasets often used in profitability analysis have limited coverage for Luxembourg, it would be desirable to combine SBS data with information from "Centrale des bilans". Although with some limitations, this approach would yield the widest possible coverage for Luxembourg.

[30] Weighted least squares represents one possible estimation strategy when working with aggregated data organized in industry-size cells. Using analytical weights based on the number of enterprises would assign greater importance to industries and size classes with a larger firm population, thereby emphasizing the role of larger and potentially more dispersed sectors while limiting the influence of smaller and more concentrated activities. However, the nature of the data and the structure of our analysis are not entirely suitable for applying a weighting strategy in our baseline investigations. The Appendix 4 provides further details on this aspect.

Appendix

Appendix 1. Figures

Figure A.1 – Relationship between production ratio component of GOR and share of *négoce* in total purchases of goods and services, for selected NACE Rev. 2 sections.



Note: The chart plots production ratio component of gross operating rate (GOR) against the share of *négoce* in total purchases of goods and services for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Distinct points for the same country correspond to different NACE Rev. 2 sections and years.

Source: EUROSTAT SBS data. Authors' calculations.

Figure A.1 presents four sector-specific scatter plots relating the share of *négoce* in total purchases of goods and services (horizontal axis) to the log production ratio (vertical axis). Each observation corresponds to a country-sector pair. The fitted line indicates a generally negative relationship across selected NACE sectors, suggesting that higher *négoce* share tends to be associated with lower production ratio, although the strength of this relationship varies by sector.

In manufacturing (C), the relationship is relatively weak, and most observations are concentrated at low shares of *négoce*. Luxembourg stands out with an observation at a very high *négoce* share that lies well below the main group of observations, making this observation a clear outlier relative to the general pattern.

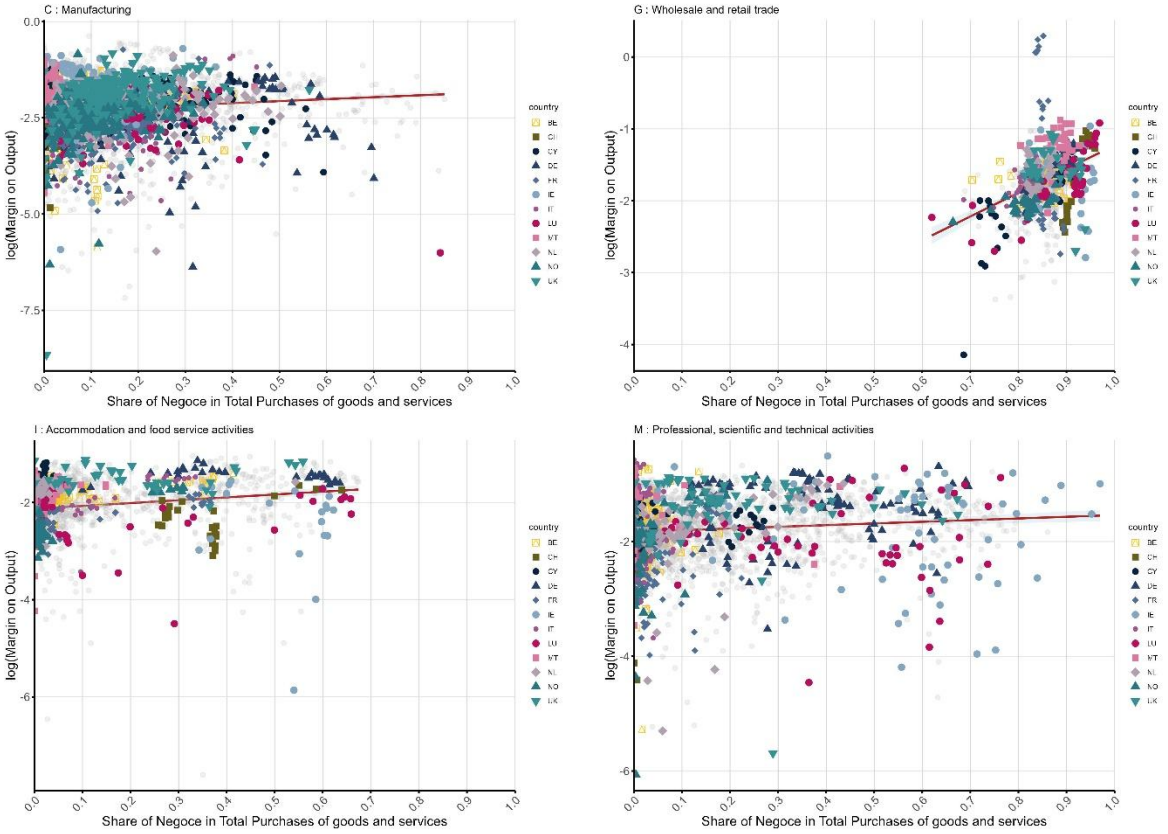
In wholesale and retail trade (G), the negative relationship is much stronger. Observations are concentrated at high shares of *négoce* and follow a steep downward pattern. Luxembourg lies within the main trend at the upper end of the *négoce* share distribution. By contrast, France appears as a

clear outlier, with several observations falling well below the main set of observations and the fitted relationship.

In accommodation and food service activities (I), the negative relationship is again clearly visible. Luxembourg appears toward the higher end of the *négoce* share distribution and broadly follows the general pattern. Switzerland, however, forms a distinct group of outliers, with observations located above the main concentration of points despite moderate shares of *négoce*.

Finally, in professional, scientific and technical activities (M), the relationship is weaker, and the dispersion of observations is larger. Luxembourg lies close to the overall trend. Ireland and the United Kingdom show several outlying observations that deviate from the overall cross-country pattern.

Figure A.2 – Relationship between margin on output component of GOR and share of *négoce* in total purchases of goods and services, for selected NACE Rev. 2 sections.



Note: The chart plots the margin-on-output component of gross operating rate (GOR) against the share of *négoce* in total purchases of goods and services for EU27, UK and most EFTA countries (Iceland, Norway and Switzerland). Separate data points for each country correspond to different NACE Rev. 2 sections and years.

Source: EUROSTAT SBS data. Authors' calculations.

Figure A.2 presents four sector-specific scatter plots showing the relationship between the margin on output component of GOR (vertical axis) and the share of négoce in total purchases of goods and services (horizontal axis). Each observation corresponds to a country-year pair, with colors identifying countries. The fitted line indicates the association within each sector. Overall, the relationship between the two variables appears weak, although some sectoral differences are present.

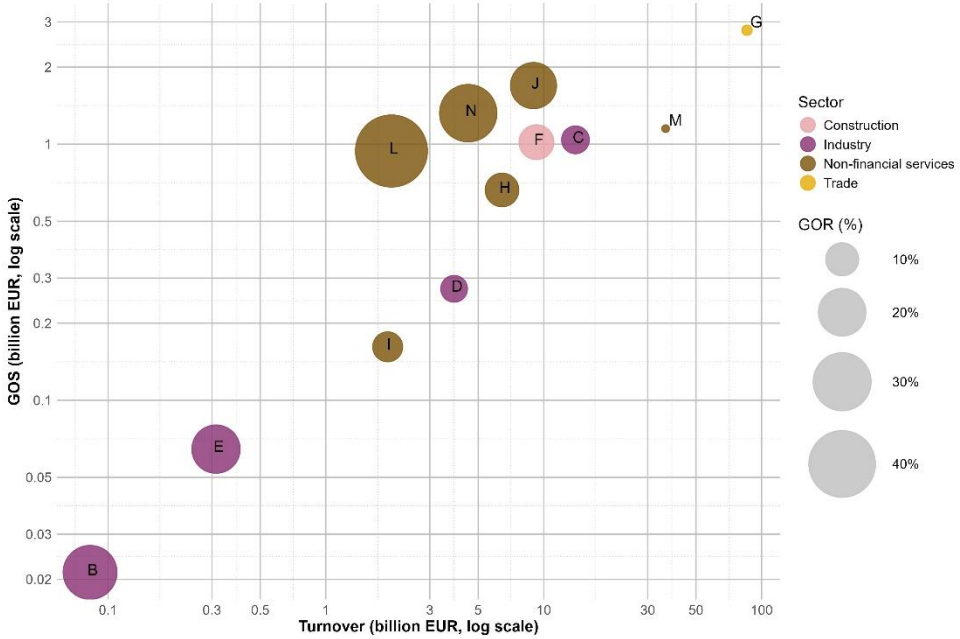
In manufacturing (C), the association is slightly positive but weak, with most observations concentrated at low shares of *négoce*. Luxembourg stands out with an observation at a very high *négoce* share that lies well below the main distribution of points, making it a clear outlier.

In wholesale and retail trade (G), the relationship is more clearly positive. Observations are concentrated at high shares of *négoce*, and Luxembourg follows the general pattern. France appears as an outlier, with observations deviating from the main distribution.

In accommodation and food service activities (I) and professional, scientific and technical activities (M), the positive relationship is very weak. The observations for Luxembourg are widely dispersed.

It is important to note that the graphical analysis of the relationship between the production ratio or the margin on output and the share of *négoce* is purely bivariate. The boxplots in Figures A.1 and A.2 illustrate how the distribution of the production ratio, or respectively the margin on output, varies across different levels of the share of négoce, but they do not control for other potentially relevant factors. A more comprehensive assessment would require a regression analysis incorporating additional controls, such as fixed effects for NACE Rev. 2 sections and countries.

Figure A.3 – GOS, GOR, and Turnover by NACE Rev. 2 sections in Luxembourg, 2019.

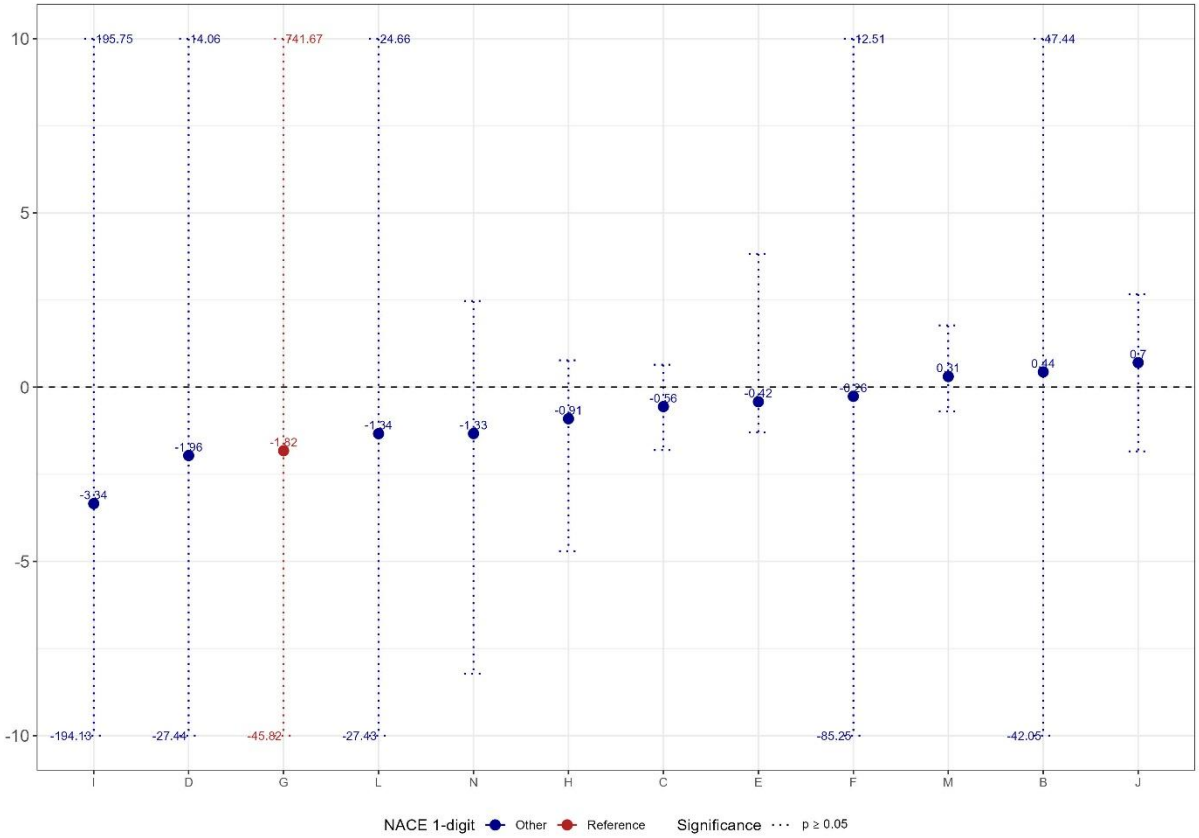


Note: The chart presents gross operating surplus (GOS), gross operating rate (GOR), and turnover for Luxembourg by NACE Rev. 2 sections in 2019. Industry includes B (Mining and quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Water supply; sewerage, waste management and remediation activities). Construction corresponds to the NACE Rev. 2 section F (Construction). Trade corresponds to NACE G (Wholesale and retail trade; repair of motor vehicles and motorcycles). The non-financial services include H (Transportation and storage), I (Accommodation and food service activities), J (Information and communication), L (Real estate activities), M (Professional, scientific and technical activities) and N (Administrative and support service activities).

Source: EUROSTAT SBS data. Authors' calculations.

Figure A.3 displays GOS, GOR, and turnover in Luxembourg using a bubble chart representation. The results for 2019 reveal that sections G and M recorded particularly low GOR values, while simultaneously achieving high levels of turnover and GOS.

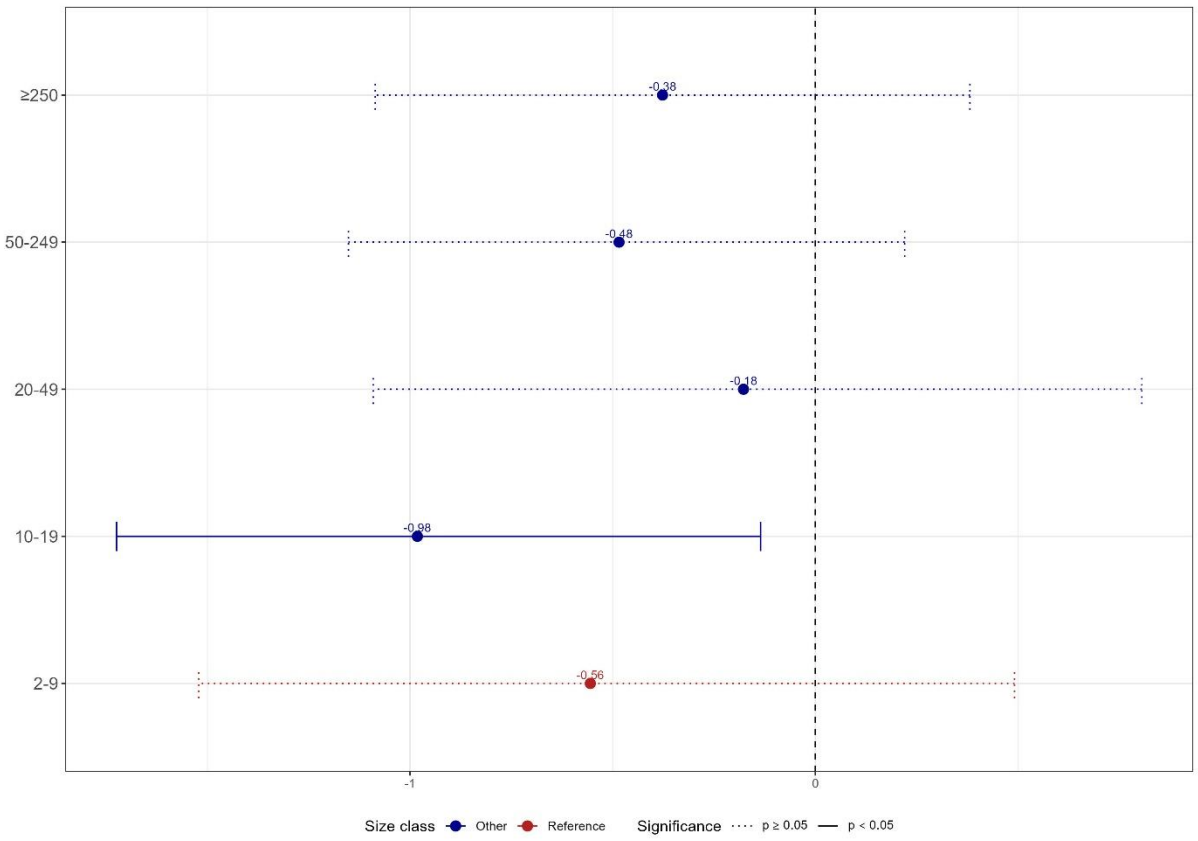
Figure A.4 – Marginal effects of the share of *négoce* on GOR, by NACE Rev. 2 sections, for Luxembourg, estimated with clustered standard errors.



Note: The chart plots the estimated marginal effects of the share of *négoce* on gross operating rate (GOR), for Luxembourg. The estimated specification includes interaction terms between share of *négoce* activities and NACE Rev. 2 section dummies, with controls for firm sizes dummies and labour productivity. In this estimated specification, the standard errors are clustered at the level of NACE two-digit sectors. The following list presents the NACE Rev. 2 classification of economic activities used to categorise industries: B: Mining and quarrying, C: Manufacturing, D: Electricity, gas, steam and air conditioning supply, E: Water supply; sewerage, waste management and remediation activities, F: Construction, G: Wholesale and retail trade, H: Transportation and storage, I: Accommodation and food service activities, J: Information and communication, L: Real estate activities, M: Professional, scientific and technical activities, N: Administrative and support service activities.

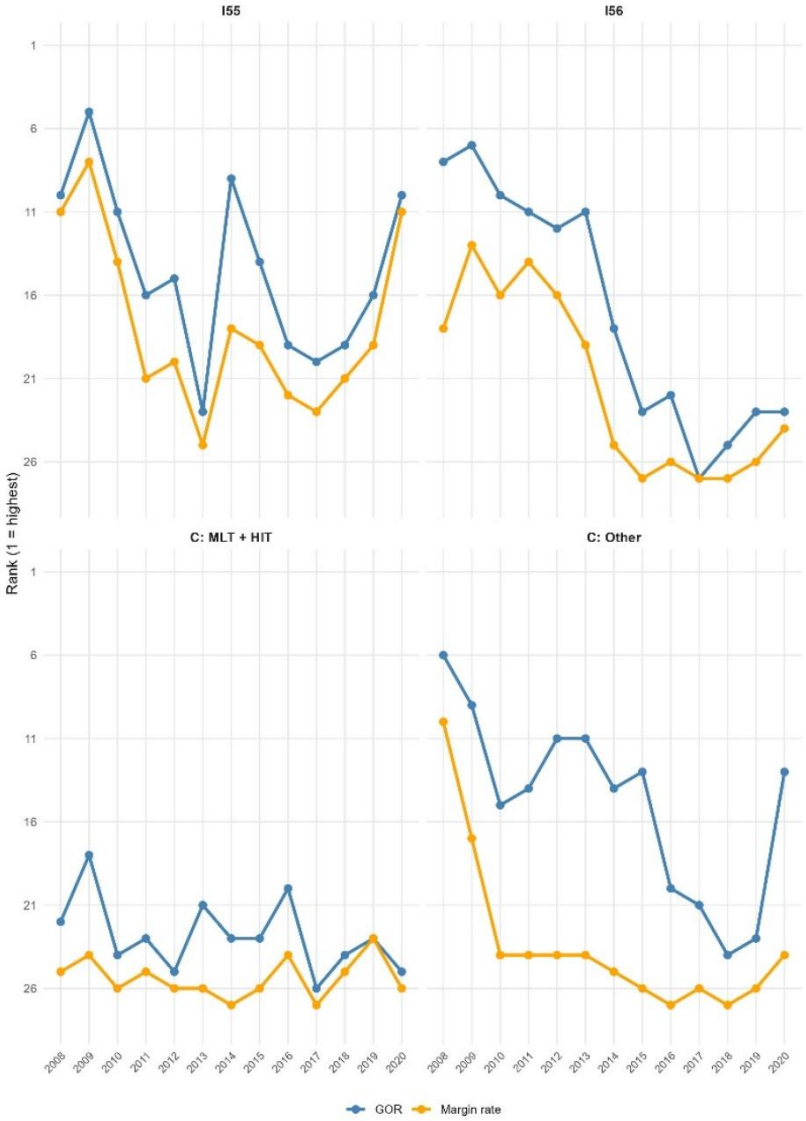
Source: STATEC SBS data for Luxembourg. Authors' calculations.

Figure A.5 – Marginal effects of the share of *négoce* on GOR, by size class, for Luxembourg, estimated with clustered standard errors.



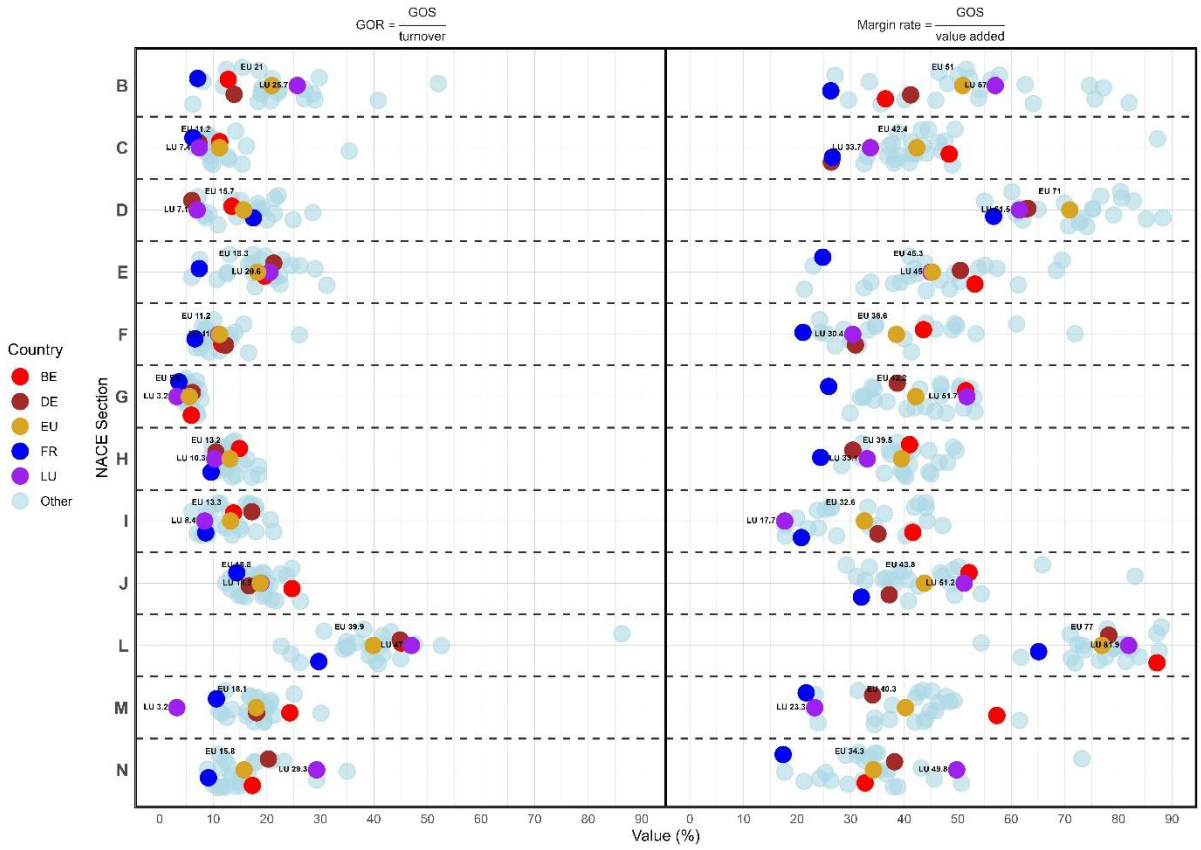
Note: The chart plots the estimated marginal effects of the share of *négoce* on gross operating rate (GOR), for Luxembourg. The estimated specification includes interaction terms between share of *négoce* and firm sizes dummies, with controls for NACE Rev. 2 section dummies and labour productivity. In this estimated specification, the standard errors are clustered at the level of NACE two-digit sectors.
Source: STATEC SBS data for Luxembourg. Authors' calculations.

Figure A.6 – Ranking of Luxembourg for GOR and margin rate, for subsections of Manufacturing and Accommodation and food service activities.



Note: The chart compares gross operating rate (GOR) and the margin rate across selected subcategories within NACE Rev. 2 sections C (Manufacturing) and I (Accommodation and Food Service Activities). Medium-low technology (MLT) and high-technology (HIT) industries are grouped together and compared with the rest of manufacturing. Within section I, we distinguish between I55 (Accommodation) and I56 (Food and beverage service activities).
Source: EUROSTAT SBS data. Authors' calculations.

Figure A.7 – GOR and margin rate. Eurostat data for 2019.



Note: The chart shows Luxembourg's ranking across NACE Rev. 2 sections by the gross operating rate (GOR, left pane) and margin rate (right pane) measures of profitability. The data corresponds to 2019. Circles mark Luxembourg's position relative to Belgium, France, Germany, and the EU average. The following list presents the NACE Rev. 2 classification of economic activities used to categorise industries: B: Mining and quarrying, C: Manufacturing, D: Electricity, gas, steam and air conditioning supply, E: Water supply; sewerage, waste management and remediation activities, F: Construction, G: Wholesale and retail trade, H: Transportation and storage, I: Accommodation and food service activities, J: Information and communication, L: Real estate activities, M: Professional, scientific and technical activities, N: Administrative and support service activities.

Source: EUROSTAT SBS data. Authors' calculations.

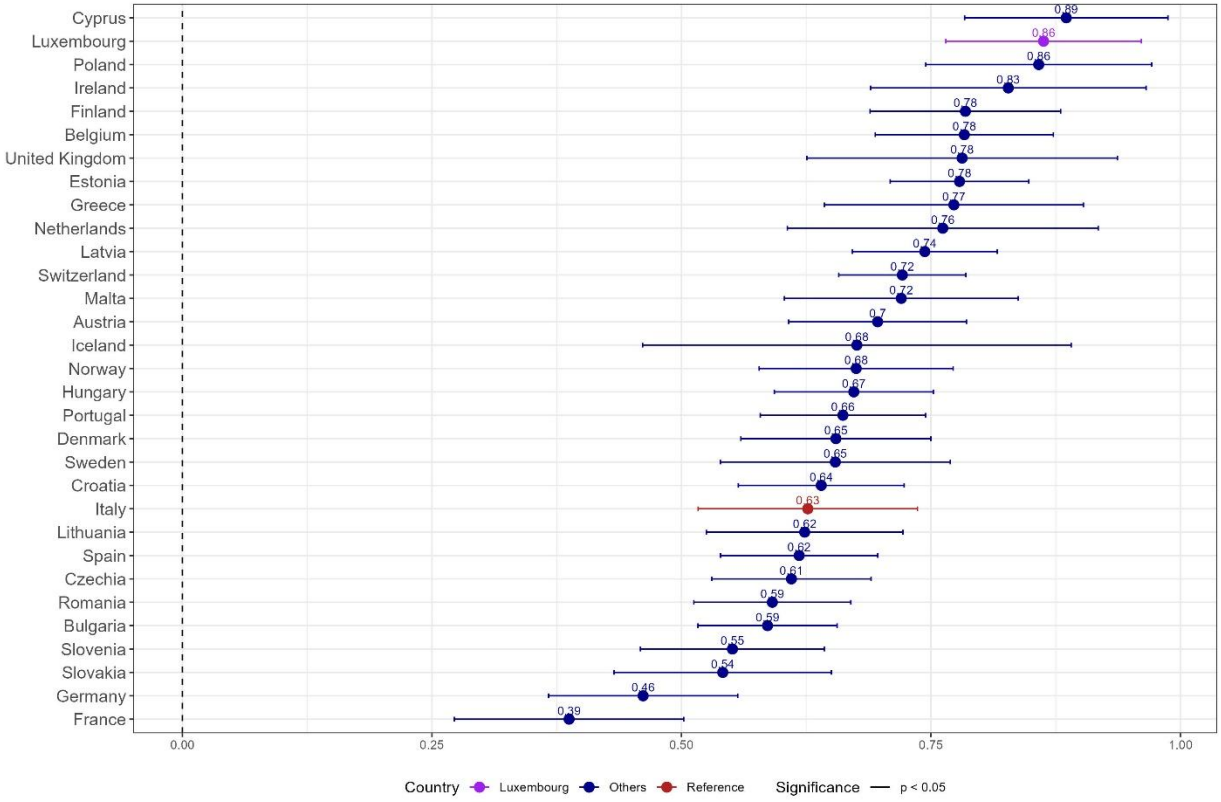
Figure A.8 – Marginal effects of the margin on output component on GOR, by country.

Note: The chart plots the estimated marginal effects of the margin on output component of gross operating rate (GOR). The estimated specification includes interaction terms between margin on output and country dummies, with controls for NACE Rev. 2 section and nominal labour productivity.
Source: EUROSTAT SBS data. Authors' calculations.

We estimate the percentage change in GOR associated with a 1% change of the margin on output and the production ratio components, separately considered. We control for years and industry effects as well as for nominal labour productivity. Moreover, we allow these effects to vary by country. The resulting marginal effects by country are shown in Figure A.8 and A.9.

For the margin on output component, the estimated marginal effects are broadly similar across countries, ranging from 0.91 in Hungary to 1.013 in Iceland. In Luxembourg, the marginal effect is 0.967, meaning that a 1% increase in the margin on output is associated with a 0.967% increase in profitability.

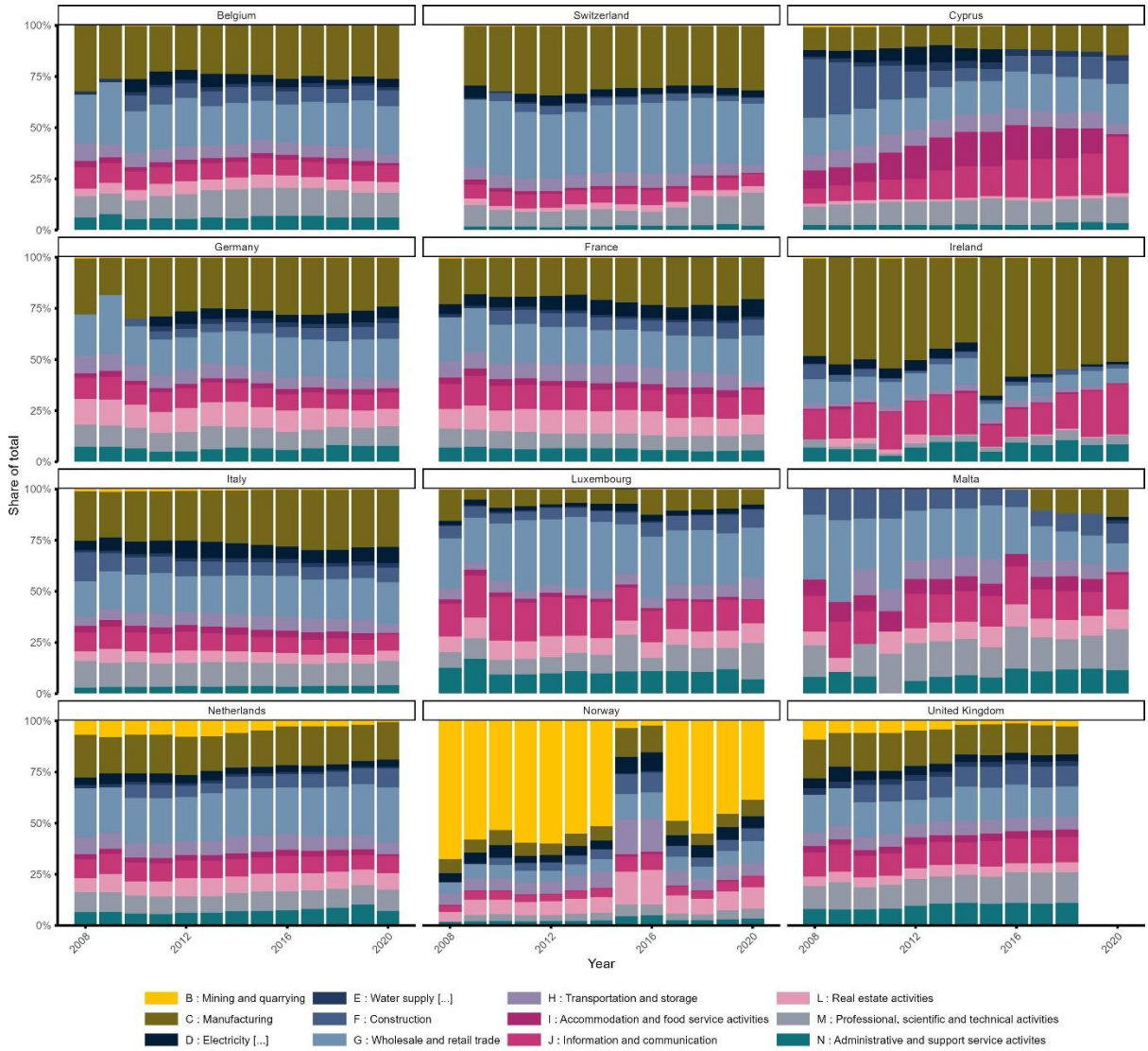
Figure A.9 – Marginal effects of the production ratio component on GOR, by country.



Note: The chart plots the estimated marginal effects of the production ratio component of gross operating rate (GOR). The estimated specification includes interaction terms between production ratio and country dummies, with a control for NACE Rev. 2 section and nominal labour productivity.
Source: EUROSTAT SBS data. Authors' calculations.

By contrast, the impact of the production ratio varies widely across countries: between 0.39 for France and 0.89 for Cyprus, as shown in Figure A.9. In Luxembourg the effect is among the strongest, with an estimated marginal effect of 0.86. A 1% increase in the production ratio is associated with roughly a 0.86% increase in GOR, holding other factors constant. Put simply, Luxembourg's profitability, as measured by GOR, is highly sensitive to changes in the production ratio component.

Figure A.10 – Distribution of GOS by NACE Rev. 2 sections in selected European countries.



Note: The chart plots changes in gross operating surplus (GOS) for selected European countries from 2008 to 2020. Different colors represent the NACE Rev. 2 sections.
Source: EUROSTAT SBS data. Authors' calculations.

Figure A.10 illustrates substantial cross-country differences in the distribution of gross operating surplus (GOS) by NACE Rev. 2 sections across selected European economies over the period 2008–2020. Manufacturing remains a key contributor to GOS in several larger industrial economies such as France, Germany, Italy and the Netherlands. A large dominance of Manufacturing emerges as a distinctive feature for Ireland, where it typically accounts for around 50% of GOS. Luxembourg displays a strong orientation toward wholesale and retail trade. The other significant contributors to the GOS of Luxembourg include information and communication, transportation, professional services, and real estate. Norway is a notable outlier, with mining and quarrying dominating the surplus due to the central role of oil and gas extraction, showing substantial fluctuations over the time. Meanwhile, smaller economies such as Cyprus and Malta demonstrate more diversified patterns across a broader set of service activities. Overall, this figure demonstrates persistent structural heterogeneity in European economies, reflecting differences in specializations and sources of profitability.

Appendix 2. Estimated specifications

Cross-country regressions

The following notation is used in cross-country regressions: *c* stays for country, *i* for NACE Rev. 2 section, *n* for NACE Rev. 2 two-digit division, and *t* is year (2008–2020). *FE* is a vector of fixed effects. We include fixed effects for year, country and NACE 2-digit division.

Figure 6a:

$$\log(GOR_{c,n,t}) = \beta_0 + \sum_j \beta_1^j Country_{j,c} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_m \beta_3^m Year_{m,t} + \beta_4 Négoce\ Share_{c,n,t} + \sum_q \beta_5^q Country_{q,c} \times Négoce\ Share_{c,n,t} + \beta_6 \log\left(Labour\ productivity_{c,n,t}\right) + \varepsilon_{c,n,t}$$

Figure 6b:

$$\log(Margin\ on\ output_{c,n,t}) = \beta_0 + \sum_j \beta_1^j Country_{j,c} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_m \beta_3^m Year_{m,t} + \beta_4 Négoce\ Share_{c,n,t} + \sum_q \beta_5^q Country_{q,c} \times Négoce\ Share_{c,n,t} + \beta_6 \log\left(Labour\ productivity_{c,n,t}\right) + \varepsilon_{c,n,t}$$

Figure 6c:

$$\log(Production\ share_{c,n,t}) = \beta_0 + \sum_j \beta_1^j Country_{j,c} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_m \beta_3^m Year_{m,t} + \beta_4 Négoce\ Share_{c,n,t} + \sum_q \beta_5^q Country_{q,c} \times Négoce\ Share_{c,n,t} + \beta_6 \log\left(Labour\ productivity_{c,n,t}\right) + \varepsilon_{c,n,t}$$

Figure A.8:

$$\log(GOR_{c,n,t}) = \beta_0 + \sum_j \beta_1^j Country_{j,c} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_m \beta_3^m Year_{m,t} + \beta_4 \log(Margin\ on\ output_{c,n,t}) + \sum_q \beta_5^q Country_{q,c} \times \log(Margin\ on\ output_{c,n,t}) + \beta_6 \log\left(Labour\ productivity_{c,n,t}\right) + \varepsilon_{c,n,t}$$

Figure A.9:

$$\log(GOR_{c,n,t}) = \beta_0 + \sum_j \beta_1^j Country_{j,c} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_m \beta_3^m Year_{m,t} + \beta_4 \log(Production\ ratio_{c,n,t}) + \sum_q \beta_5^q Country_{q,c} \times \log(Production\ ratio_{c,n,t}) + \beta_6 \log\left(Labour\ productivity_{c,n,t}\right) + \varepsilon_{c,n,t}$$

Table A.1:

$$\log\left(GOR_{c,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{c,n,t} + \beta_2 \log\left(Labour\ productivity_{c,n,t}\right) + \delta_k FE + \varepsilon_{c,n,t}$$

Table A.2:

$$\log\left(Margin\ on\ output_{c,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{c,n,t} + \beta_2 \log\left(Labour\ productivity_{c,n,t}\right) + \delta_k FE + \varepsilon_{c,n,t}$$

Table A.3:

$$\log\left(Production\ ratio_{c,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{c,n,t} + \beta_2 \log\left(Labour\ productivity_{c,n,t}\right) + \delta_k FE + \varepsilon_{c,n,t}$$

Regressions for Luxembourg

The following notation is used in regressions for Luxembourg: *s* stays for size class, *n* for NACE 2-digit division, and *t* is year (2008–2020). *FE* is a vector of fixed effects. We include fixed effects for year, country and NACE 2-digit division.

Figures 13 and A.4:

$$\log\left(GOR_{s,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \sum_i \beta_2^i NACE\ section_{i,n} + \sum_i \beta_3^i NACE\ section_{i,n} \times Négoce\ Share_{s,n,t} + \beta_4 \log\left(Labour\ productivity_{s,n,t}\right) + \sum_j \beta_5^j Size\ class_{j,s} + \varepsilon_{s,n,t}$$

Figures 14 and A.5:

$$\log\left(GOR_{s,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \sum_j \beta_2^j Size\ class_{j,s} + \sum_j \beta_3^j Size\ class_{j,s} \times Négoce\ Share_{s,n,t} + \beta_4 \log\left(Labour\ productivity_{s,n,t}\right) + \sum_i \beta_2^i NACE\ section_{i,n} + \varepsilon_{s,n,t}$$

Tables A.4 and A.5:

$$\log\left(GOR_{s,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log\left(Labour\ productivity_{s,n,t}\right) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Table A.6:

$$\log\left(MR_{s,n,t}\right) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log\left(Labour\ productivity_{s,n,t}\right) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Table A.7:

$$\log(Margin\ on\ output_{s,n,t}) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log(Labour\ productivity_{s,n,t}) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Table A.8:

$$\log(Production\ ratio_{s,n,t}) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log(Labour\ productivity_{s,n,t}) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Table A.9:

$$\log(GOS_{s,n,t}) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log(Labour\ productivity_{s,n,t}) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Table A.10:

$$\log(Sales_{s,n,t}) = \beta_0 + \beta_1 Négoce\ Share_{s,n,t} + \beta_2 \log(Labour\ productivity_{s,n,t}) + \sum_j \beta_3^j Size\ class_{j,s} + \delta_k FE + \varepsilon_{s,n,t}$$

Appendix 3. Estimation tables

Table A.1 – Cross-country estimation of the association between GOR, share of *négoce* and productivity, with robust standard errors.

	(1) log(GOR)	(2) log(GOR)	(3) log(GOR)	(4) log(GOR)
Négoce share	-0.688*** (0.000)	-0.689*** (0.000)	-0.723*** (0.000)	-0.350*** (0.000)
log(Labour Productivity)	0.165*** (0.000)	0.164*** (0.000)	0.423*** (0.000)	0.460*** (0.000)
R-squared	0.095	0.097	0.249	0.460
Observations	21990	21990	21990	21990
Sample	2008-2020	2008-2020	2008-2020	2008-2020
Year FE		yes	yes	yes
Country FE			yes	
Country×NACE section FE				yes

Notes: The cross-country sample covers the period from 2008 to 2020. Data for 2005–2007 are excluded due to a high proportion of missing values. The dependent variable is logarithm of GOR ratio. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity equals value added in nominal terms divided by the number of persons employed. Regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. *** indicates significance at the 1% level.

Source: Eurostat SBS data. Authors' calculations.

Table A.2 – Cross-country estimation of the association between the margin on output component of GOR, share of *négoce* and productivity, with robust standard errors.

	(1)	(2)	(3)	(4)
Négoce share	0.668***	0.667***	0.695***	0.622***
	(0.000)	(0.000)	(0.000)	(0.000)
log(Labour Productivity)	0.155***	0.155***	0.409***	0.454***
	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.091	0.093	0.243	0.429
Observations	21990	21990	21990	21990
Sample	2008-2020	2008-2020	2008-2020	2008-2020
Year FE		yes	yes	yes
Country FE			yes	
Country×NACE section FE				yes

Notes: The cross-country sample covers the period from 2008 to 2020. Data for 2005–2007 are excluded due to a high proportion of missing values. The dependent variable is logarithm of margin on output component of GOR. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity equals value added in nominal terms divided by the number of persons employed. Regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. *** indicates significance at the 1% level.

Source: Eurostat SBS data. Authors' calculations.

Table A.3 – Cross-country estimation of the association between the production ratio component of GOR, share of *négoce* and productivity, with robust standard errors.

	(1)	(2)	(3)	(4)
Négoce share	-1.355***	-1.356***	-1.419***	-0.971***
	(0.000)	(0.000)	(0.000)	(0.000)
log(Labour Productivity)	0.009***	0.009***	0.014***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.802	0.802	0.825	0.925
Observations	21997	21997	21997	21997
Sample	2008-2020	2008-2020	2008-2020	2008-2020
Year FE		yes	yes	yes
Country FE			yes	
Country×NACE Section FE				yes

Notes: The cross-country sample covers the period from 2008 to 2020. Data for 2005–2007 are excluded due to a high proportion of missing values. The dependent variable is logarithm of production ratio component of GOR. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity equals value added in nominal terms divided by the number of persons employed. Regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: Eurostat SBS data. Authors' calculations.

Table A.4 – Estimation of the association between GOR measure of profitability, share of *négoce*, productivity and firm sizes for Luxembourg, with robust standard errors.

	(1) ln(GOR)	(2) ln(GOR)	(3) ln(GOR)
Négoce share of total purchases	-0.943*** (0.000)	-0.525*** (0.000)	-0.455*** (0.000)
log Labour productivity	0.611*** (0.000)	0.664*** (0.000)	0.969*** (0.000)
10 – 19 persons employed	-0.152** (0.010)	-0.137** (0.016)	-0.110** (0.036)
20 – 49 persons employed	-0.201*** (0.001)	-0.157*** (0.006)	-0.166*** (0.001)
50 – 249 persons employed	-0.182*** (0.000)	-0.134*** (0.008)	-0.106** (0.025)
above 250 persons employed	-0.416*** (0.000)	-0.339*** (0.000)	-0.262*** (0.000)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2725	2725	2725
R-squared	0.233	0.288	0.452

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is logarithm of GOR ratio. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.5 – Estimation of the association between GOR measure of profitability, share of *négoce,* productivity and firm sizes for Luxembourg, with clustered standard errors.

	(1) ln(GOR)	(2) ln(GOR)	(3) ln(GOR)
Négoce share of total purchases	-0.943*** (0.000)	-0.525* (0.069)	-0.455* (0.076)
log Labour productivity	0.611*** (0.000)	0.664*** (0.000)	0.969*** (0.000)
10 – 19 persons employed	-0.152* (0.094)	-0.137 (0.127)	-0.110 (0.207)
20 – 49 persons employed	-0.201** (0.047)	-0.157 (0.120)	-0.166* (0.086)
50 – 249 persons employed	-0.182* (0.077)	-0.134 (0.174)	-0.106 (0.273)
above 250 persons employed	-0.416*** (0.004)	-0.339** (0.011)	-0.262* (0.069)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2725	2725	2725
R-squared	0.233	0.288	0.452

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is logarithm of GOR ratio. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are clustered at the level of NACE two-digits sectors. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.6 – Estimation of the association between margin rate measure of profitability, share of *négoce*, productivity and firm sizes for Luxembourg, with robust standard errors.

	(1) ln(MR)	(2) ln(MR)	(3) ln(MR)
Négoce share of total purchases	0.095** (0.036)	0.210*** (0.007)	-0.006 (0.951)
log Labour productivity	0.840*** (0.000)	0.906*** (0.000)	1.054*** (0.000)
10 – 19 persons employed	-0.160*** (0.001)	-0.153*** (0.001)	-0.140*** (0.002)
20 – 49 persons employed	-0.197*** (0.000)	-0.202*** (0.000)	-0.206*** (0.000)
50 – 249 persons employed	-0.119*** (0.003)	-0.103*** (0.009)	-0.105*** (0.007)
above 250 persons employed	-0.332*** (0.000)	-0.319*** (0.000)	-0.289*** (0.000)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2725	2725	2725
R-squared	0.367	0.432	0.516

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is margin rate. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.7 – Estimation of the association between margin on output component of GOR, share of *négoce*, productivity and firm sizes for Luxembourg, with robust standard errors.

	(1)	(2)	(3)
Négoce share of total purchases	0.584**	0.719***	0.749***
	(0.000)	(0.000)	(0.000)
log Labour productivity	0.636***	0.691***	0.978***
	(0.000)	(0.000)	(0.000)
10 – 19 persons employed	-0.126**	-0.117**	-0.096*
	(0.023)	(0.028)	(0.059)
20 – 49 persons employed	-0.190***	-0.169***	-0.176***
	(0.000)	(0.001)	(0.000)
50 – 249 persons employed	-0.130***	-0.097**	-0.070
	(0.006)	(0.035)	(0.113)
above 250 persons employed	-0.348***	-0.292***	-0.218***
	(0.000)	(0.000)	(0.000)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2722	2722	2722
R-squared	0.229	0.282	0.427

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is margin on output component of GOR. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.8 – Estimation of the association between production ratio component of GOR, share of *négoce*, productivity and firm sizes for Luxembourg, with robust standard errors.

	(1)	(2)	(3)
Négoce share of total purchases	-1.513*** (0.000)	-1.262*** (0.000)	-1.232*** (0.000)
log Labour productivity	-0.011 (0.311)	-0.001 (0.942)	0.010 (0.397)
10 – 19 persons employed	-0.004 (0.768)	-0.006 (0.655)	-0.004 (0.729)
20 – 49 persons employed	-0.011 (0.426)	0.003 (0.807)	0.006 (0.559)
50 – 249 persons employed	-0.037** (0.031)	-0.023 (0.109)	-0.017 (0.177)
above 250 persons employed	-0.063*** (0.000)	-0.039*** (0.003)	-0.038*** (0.003)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	3131	3131	3131
R-squared	0.732	0.810	0.856

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is production ratio component of GOR. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.9 – Estimation of the association between GOS, share of *négoce*, productivity and firm sizes for Luxembourg.

	(1) ln(GOS)	(2) ln(GOS)	(3) ln(GOS)
Négoce share of total purchases	1.597*** (0.000)	-0.253* (0.065)	-0.055 (0.711)
log Labour productivity	1.304*** (0.000)	1.572*** (0.000)	1.759*** (0.000)
10 – 19 persons employed	-0.043 (0.704)	-0.067 (0.459)	-0.158** (0.021)
20 – 49 persons employed	0.471*** (0.000)	0.355*** (0.000)	0.289*** (0.000)
50 – 249 persons employed	1.577*** (0.000)	1.403*** (0.000)	1.291*** (0.000)
above 250 persons employed	2.091*** (0.000)	1.902*** (0.000)	1.723*** (0.000)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2725	2725	2725
R-squared	0.387	0.561	0.739

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is total GOS. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. All regressions use ordinary least squares. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Table A.10 – Estimation of the association between turnover, share of *négoce*, productivity and firm sizes for Luxembourg.

	(1) ln(S)	(2) ln(S)	(3) ln(S)
Négoce share of total purchases	2.540*** (0.000)	0.272** (0.043)	0.400*** (0.004)
log Labour productivity	0.693*** (0.000)	0.907*** (0.000)	0.790*** (0.000)
10 – 19 persons employed	0.109 (0.302)	0.070 (0.385)	-0.048 (0.391)
20 – 49 persons employed	0.672*** (0.000)	0.512*** (0.000)	0.455*** (0.000)
50 – 249 persons employed	1.759*** (0.000)	1.537*** (0.003)	1.397*** (0.000)
above 250 persons employed	2.507*** (0.000)	2.241*** (0.000)	1.985*** (0.000)
year FE	Yes	Yes	Yes
NACE section FE		Yes	
NACE 2-digits FE			Yes
Observations	2725	2725	2725
R-squared	0.401	0.610	0.793

Notes: The sample for Luxembourg covers the period from 2008 to 2020. The dependent variable is turnover. The *négoce* share is defined as the ratio of "Purchases of goods and services purchased for resale in the same condition" to "Total purchases of goods and services". Productivity is defined as value added in nominal terms per person employed. Small firms of the size 2–9 persons employed serve as the reference category. Standard errors are heteroskedasticity-robust. P-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: STATEC SBS dataset. Authors' calculations.

Appendix 4. Weighted least squares regression

In the cross-country analysis, we pooled data for all industries across the EU27, the UK, and the EFTA countries without explicitly accounting for differences in country or industry size. This approach ensured equal representation of all country–industry units and prevented large economies or sectors from dominating the comparative analysis. However, a limitation is that large countries and industries are not represented in proportion to their economic scale, making this approach unsuitable for capturing aggregate economic effects. Similar considerations can be applied to the analysis that focuses on Luxembourg.

A possible methodological solution would be to estimate the specifications using analytical weights equal to the number of enterprises in two-digit-sector × size-class cell. This approach emphasizes the role played by larger and possibly more dispersed sectors, while reducing the influence of smaller and possibly more concentrated activities. It also helps address heteroskedasticity arising from cells of very different scale, preventing small cells with few enterprises from imposing disproportionate influence on the results. Besides the number of firms, other variables may be used as weights. Among these, the number of persons employed is a prominent alternative. It is worth noting that weighting alters the interpretation of the coefficients in terms of the units of the average effect. Weighting by number of persons employed yields a “per-worker” interpretation, whereas weighting by the number of enterprises implies a “per-firm” interpretation.

Meanwhile, there are potential methodological issues related to cell-level weighting. Because each cell aggregates many heterogeneous firms, the analytical weights cannot fully capture within-cell variation or correct for potential composition effects. In fact, the weighting assumes uniform behaviour within size classes, disregarding differences between firms in the same cell. Moreover, if cell sizes correlate with unobserved characteristics, weighted OLS may still suffer from biased standard errors. However, the main limitation is that the structure of our data does not satisfy the requirement that the industry-size cells contain mean values. Taking into consideration these methodological limitations, we do not proceed with weighted least squares regression.

The aforementioned issues can largely be addressed through the use of micro-level data. Using observations at the firm level eliminates the need for cell weights, since each firm enters the sample directly with its true economic weight. Overall, micro data permit more precise identification, richer specification, and more transparent statistical inference.

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