



## JRC TECHNICAL REPORTS

# The JRC Statistical Audit of the Retail Restrictiveness Indicator

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## Abstract

Monitoring the restrictiveness of regulations governing the retail companies may help to induce a positive dynamic leading to more open and competitive retail markets in the EU. The Commission services have developed for the first time the monitoring framework for the Retail Restrictiveness Indicator, which is made of 14 types of restrictions, two sub-pillars, two pillars and one overall index across the 28 EU Member States. This exercise inevitably entails both conceptual and practical challenges. The statistical audit discussed in this note was conducted by the European Commission's Joint Research Centre (JRC), and it aims at maximising the reliability and transparency of the Retail Restrictiveness Indicator framework <sup>(1)</sup>. It should enable policy analysts and researchers alike to draw more relevant, meaningful and useful conclusions from the results presented in the Staff Working Document accompanying the Commission Communication *A European retail sector fit for the 21st century*.

Prior to undertaking this statistical assessment, the Retail Restrictiveness Indicator development team and the JRC engaged in previous discussions during fall 2017 and early 2018, whereby earlier versions of the framework were assessed by the JRC. Preliminary JRC suggestions were taken into account for the final computation of the Retail Restrictiveness Indicator and its underlying components.

The present statistical assessment of the Retail Restrictiveness Indicator focuses on two main aspects:

- The statistical coherence of the indicator framework, and;
- The impact of key modelling assumptions on the overall scores and ranks.

This JRC analysis complements the reported Retail Restrictiveness Indicator results for the EU Member States – namely those for the two main pillars, the Establishment restrictions and Operations restrictions - with estimated confidence intervals, in order to better appreciate the robustness of the results to key modelling choices (such as choice of the weights and the aggregation formula).

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<sup>(1)</sup> The JRC statistical audit is based on the recommendations of the OECD & JRC (2008) Handbook on Composite Indicators, and on more recent research from the JRC (Saisana and Saltelli, 2011; Saisana et al., 2005, Saisana et al., 2011). Generally, JRC audits of composite indicators and scoreboards are conducted upon request of their developers, see <https://ec.europa.eu/jrc/en/coin> and <https://composite-indicators.jrc.ec.europa.eu/>

# 1 Construction of the Retail Restrictiveness Indicator

The making of the Retail Restrictiveness Indicator (RRI) is described in more detail in the Staff Working Document accompanying the Commission Communication *A European retail sector fit for the 21st century*. Nevertheless, a brief description of the framework is helpful to put this statistical audit in context and to allow the present note to be read independently if necessary.

The Commission services developed the Retail Restrictiveness Indicator with a view to measure the degree of restrictiveness of restrictions imposed on the retail sector across the EU. The indicator is meant to constitute a factual overview of restrictions in Member States. The development of the RRI conceptual framework benefitted from input received from retailers, competent authorities, trade unions and citizens during the Commission's open public consultation (17 July to 8 October 2017). Member States were consulted through meetings of the Services Directive Expert Group. The RRI framework has also benefitted from original desk-based research of the Commission services who conducted thorough analysis of reports published by international agencies and organisations on retail restrictions and country level original legislation.

As a result, the conceptual framework covers retail-specific restrictions stemming from regulations put in place in the EU Member States by competent authorities and not restrictions created by the behaviour of private operators. Also, the framework takes into account regulations going beyond harmonized EU legislation and not on measures adopted by Member States to implement EU legislation. The RRI conceptual framework, expressed in its main Index, two pillars (one of them split in two sub-pillars) and 14 carefully selected categories of restrictions affecting the retailing industry, is shown in **Table 1**.

Overall, the Retail Restrictiveness Indicator covers two major facets of the sector, namely:

- **'Retail establishment restrictions'** that may significantly affect the possibility to open a shop or hinder the development of specific business models or store formats. These restrictions include specific requirements depending on the retail outlet size, regulations specific to the city centre or periphery, requirements for economic data, level of detail in the use of commercial surfaces defined in the local plans, permits required on planning, building, environmental, special retail authorisation, number of administrative entities a retailer needs to contact in an establishment procedure, number of market studies/impact assessments that the entrants are obliged to submit, length of the procedure to obtain a decision to establish a shop, and whether positive and negative authorisation decisions are published.
- **'Retail operations restrictions'** that may have a negative impact on the daily operations of retail companies and affect their efficiency, productivity and the quality and price of products offered. These are restrictions on weekdays openings and Sunday trading/opening, regulations which restrict the distribution channels for selling non-prescription medicines, alcohol and tobacco to end-consumers <sup>(2)</sup>, regulations which limit retailers' freedom to decide on and conduct promotional activities for their shops (inter alia regulations regarding end-of-season or end-of-business sales), regulations imposing specific taxes and fees on the retail sector (i.e. taxes and fees exclusively levied on retailers), and regulations or practices which limit directly retailers' possibilities for sourcing products (e.g. regulations indicating that a certain share of products must be sourced nationally or within a local supply chain).

The RRI framework is much broader than other relevant frameworks, such the OECD Product Market Regulation (OECD, 2003, 2006, 2009), and it is more EU-focused in

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<sup>(2)</sup> The indicator is meant to constitute a factual overview of restrictions in Member States. Rules on distribution channels for specific products, such as alcohol, tobacco and non-prescription medicines are included for the sake of completeness of the restrictiveness picture. This is without prejudice to the health and societal policy objectives pursued by Member States.

capturing the complexity and diversity of the regulatory frameworks in place in the EU Member States. The information behind the overall RRI scores and the values for particular indicators can help to evidence best practices in the EU and identify areas where countries could still improve. The subsequent versions of the RRI will allow monitoring of the developments over time and are expected to induce a positive dynamic leading to more open and competitive retail markets.

**Table 1. Retail Restrictiveness Indicator: conceptual framework**

Index	Pillar	Sub-pillar	KPI	Retail-specific restrictions (indicators)
Retail Restrictiveness Indicator	1: Retail Establishment restrictions (60%)	Conditions (55%)	1	Size thresholds (20%)
			2	Location-specific rules (10%)
			3	Economic data requirements (15%)
			4	Level of detail in local plans (10%)
		Procedures (45%)	5	Number of permits (10%)
			6	Number of entities to contact (10%)
			7	Number of impact assessments (10%)
			8	Length of procedure (10%)
	2: Retail Operations restrictions (40%)		9	Publication of decisions (5%)
			10	Shop opening hours (20%)
			11	Distribution channels for specific products (20%)
			12	Sales promotions (20%)
			13	Retail-specific taxes and fees (20%)
			14	Sourcing of products (20%)

Notes: Expert-based weights for the indicators and the main components are shown in parenthesis.

Source: adjusted from European Commission, SWD(2018) 236.

Overall 14 types of retail-specific restrictions (indicators) have been selected by the Commission services to populate this framework. Some of these indicators are of a more quantifiable nature (e.g. "number of market studies and impact assessments that entrants are obliged to submit"), while others require an expert judgement (e.g. "location-specific rules"). The original sources of data for each indicator are all referenced in detail in the Staff Working Document. This transparency and detail in the source information lends considerable credibility to the RRI and opens the data for use by policy analysts and researchers alike.

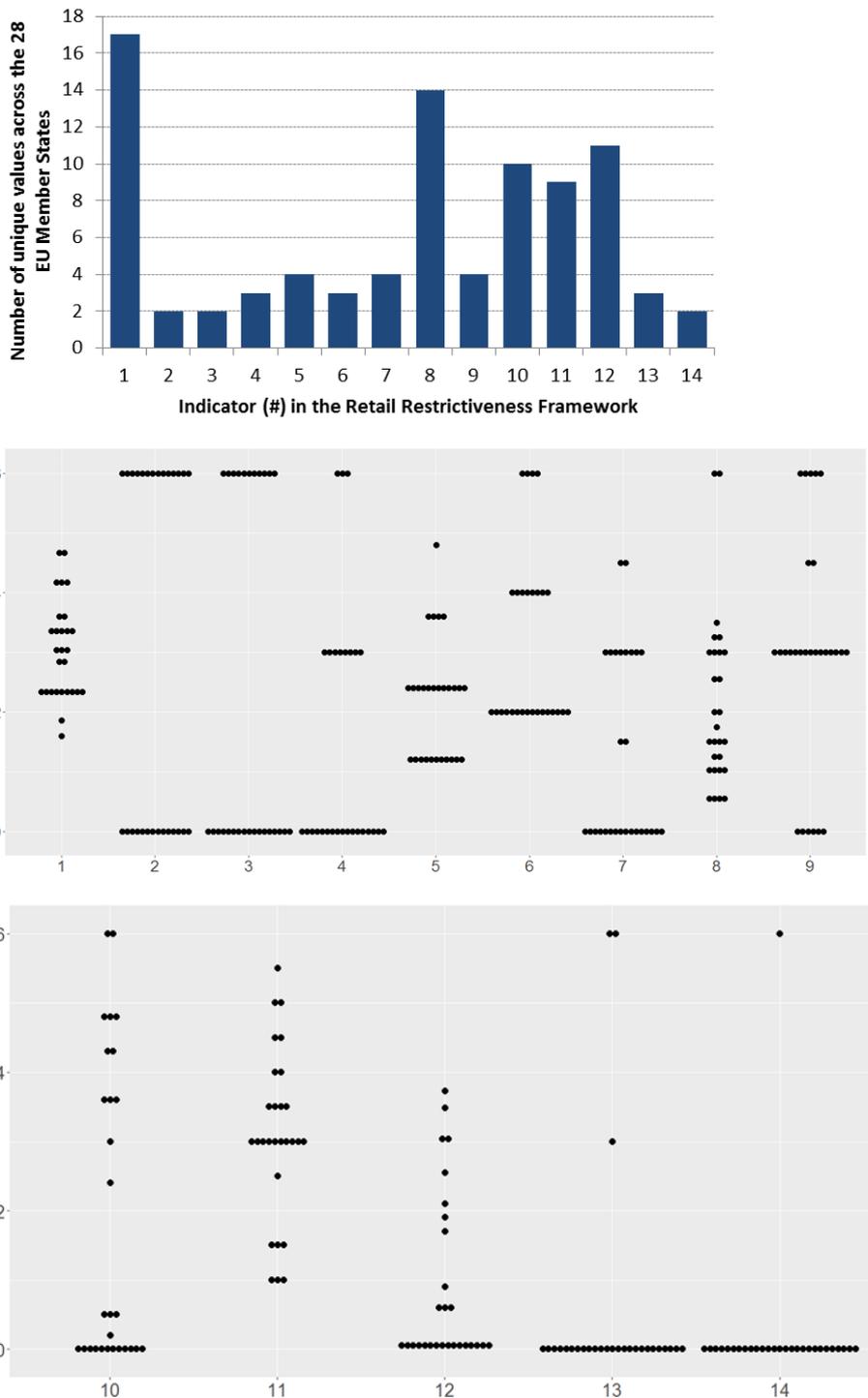
The RRI dataset is 100% complete across the 14 indicators and the 28 EU Member States. All indicators are calculated based on a scoring method, where the maximum possible score is six (most restrictive), and the minimum possible is zero (least restrictive) (see SWD/2018/236 for more details). Every aggregate measure is then calculated as the weighted arithmetic average of the underlying components (weights are shown in **Table 1**). The weights attached to the various RRI components have been derived based on expert judgement and on regression analysis with relevant economic variables, such as birth rates of retail companies, price level indices, market concentration indices and other. Consequently, within the retail establishment pillar, the part covering conditions related to opening a shop is given more importance (55%), as compared to the part capturing procedures related to establishment (45%). Finally, in the overall RRI composite indicator, the part of the indicator covering issues linked to retail establishment (opening of new outlets) has been given a higher importance (60 %), as compared to the part reflecting restrictions to operations (40 %).

## 2 Data analysis and statistical coherence

### 2.1 Exploring the data

This section comprises an exploratory analysis of the dataset at the indicator level and helps to get a first grasp on the type of data that are further aggregated into the components of the Retail Restrictiveness Indicator.

**Figure 1. Number of unique values (and dotplots) for the RRI indicators**



Notes: Indicator names appear on Table 1. Dots (second and third panel) represent indicator scores of each of the 28 EU Member States.

Source: European Commission Joint Research Centre, 2018.

**Figure 1** evidences the “discrete nature” of the majority of the retail restrictiveness indicators. Five indicators are more continuous with close to 10 or more unique values across the 28 EU Member States: Size thresholds (#1), Length of procedure (#8), Shop opening hours (#10), Distribution channels for specific products (#11) and Sales promotions (#12). On the other hand, nine indicators have only a small number of unique values. For example, Location-specific rules (#2) and Economic data requirements (#3) take zero value in half of the countries in the EU and are at the maximum level of restrictions (=6) for the other half. More peculiar appear to be the indicators on Retail-specific taxes and fees (#13) and Sourcing of products (#14) that are zero (least restrictive) for 25 and 27 countries, respectively.

## **2.2. First statistical coherence test for the RRI framework**

The statistical coherence of the Retail Restrictiveness Indicator is a necessary, though not necessarily sufficient, condition for a sound framework. Given that the present statistical analysis of the RRI framework will mostly, though not exclusively, be based on correlations, the correspondence of the RRI framework to a real-world phenomenon needs to be critically addressed because ‘correlations need not necessarily represent the real influence of the individual indicators on the phenomenon being measured’ (OECD & EC JRC, 2008).

The point is that the validity of the RRI framework relies on the combination of both statistical and conceptual soundness. In this respect, the RRI framework has been developed following an iterative process that went back and forth between the theoretical understanding of retail-specific restrictions within the EU on the one hand, and data observations on the other.

A positive outcome of the first coherence test between the RRI conceptual framework and the underlying data comes from an analysis of the correlation structure within and across the two main pillars, the Establishment restrictions and the Operations restrictions. The correlation coefficients within a sub-pillar or pillar are positive and sufficiently strong in most cases. **Table 2** presents the results of this first statistical coherence test.

More specifically, the Conditions sub-pillar of the Retail Establishment restrictions is a good summary measure of all four underlying indicators, namely size thresholds, location-specific rules, economic data requirements, and level of detail in local plans. Similarly, the Procedures sub-pillar is influenced by four out of the five indicators; the publication of decisions being not statistically associated to the sub-pillar (using  $p=0.01$  as a threshold for statistical significance). Interestingly, whilst the indicator on the number of impact assessments belongs to the Procedures-type of restrictions in retail establishment, it is found to have strong association also to the Conditions-type of restrictions. This link of the number of impact assessments and market studies to both conditions and procedures related to the establishment of a shop may be worth of further analysis.

The Retail establishment restrictions pillar is influenced by five out of the nine indicators. The most influential indicators are the location specific rules, followed by the number of impact assessments and the economic data requirements. Instead, the four indicators that seem to have negligible impact in determining country variations in the Retail establishment restrictions pillar are: level of detail in local plans, number of entities to contact, length of procedure and publication of decisions. These indicators would have been “lost in aggregation” should the RRI framework not have included the two sub-pillars. Instead, they are influential at least at the sub-pillar level. This result confirms the choice of the developers to include two sub-pillars under the Retail establishment restrictions in order to maintain the information content of those indicators at least at one aggregation level. The relevant SWD(2018)236 offers in fact additional insights on the conditions and procedures related to the retail establishment restrictions. This type of

information would have otherwise gone unnoticed had the aggregation been done directly from the nine indicators to the (establishment) pillar.

The second pillar of the Retail Restrictiveness Indicator, the Operations restrictions pillar, is influenced by three out of the five indicators, all of them bearing a similar impact to the pillar: shop opening hours, sales promotions and retail-specific taxes and fees. Instead, the two indicators that seem to have negligible impact in determining country variations in the retail operations are distribution channels for specific products and sourcing of products.

**Table 2. First statistical coherence test: associations between the RRI components**

Pillar	Sub-pillar	Retail-specific restrictions (indicators)	Retail Establishment restrictions		Establishment restrictions	Retail Operations restrictions
			Conditions	Procedures		
1: Retail Establishment restrictions	Conditions	Size thresholds	0.55	0.42	0.54	
		Location-specific rules	0.68	0.36	0.69	
		Economic data requirements	0.70		0.66	
		Level of detail in local plans	0.41		0.29	
	Procedures	Number of permits		0.54	0.38	
		Number of entities to contact		0.56	0.35	
		Number of impact assessments	0.61	0.60	0.68	
		Length of procedure		0.47	0.28	0.40
		Publication of decisions	0.18	0.14		
2: Retail Operations restrictions		Shop opening hours				0.47
		Distribution channels for specific products				0.22
		Sales promotions				0.46
		Retail-specific taxes and fees				0.42
		Sourcing of products				0.23

Notes: Numbers represent Kendall-tau rank correlation coefficients between the RRI components and the underlying indicators (for 28 countries). Given the type of data (see Figure 1), Kendall's rank correlation coefficients have been used as statistical measure to detect ordinal relationships between indicators and the RRI components. Correlations that are not significant at the 1% level are left blank. Grey boxes show conceptual grouping of the indicators.

Source: European Commission Joint Research Centre, 2018.

### 2.3. Second statistical coherence test for the RRI framework

Although conceptually enriching the overall RRI framework, six indicators were found not to co-vary with the respective pillars, as a result of the first statistical coherence test. These are four indicators related to establishment restrictions – level of detail in local plans, number of entities to contact, length of procedure, publication of decisions – and two indicators related to the operations restrictions, namely distribution channels for specific products, sourcing of products. This means that high levels of restriction on those indicators can be associated with either high or low values in the respective pillars and the same holds for low pillar scores.

To gain further insights as to whether these six types of restrictions are influential for at least some of the EU Member States, we tested how the country ordering changes when these indicators are eliminated one-at-a-time from the respective pillar. **Table 3** presents the results of the second statistical coherence test, whereby the six types of restrictions that were found not to pass the first coherence test are excluded one-at-a-time. In the retail establishment restrictions pillar, excluding either the number of entities to contact or the publication decisions would have modest impact on the country ordering. Instead, Belgium and Poland would gain 5 and 4 positions respectively - assessed as "less restrictive"- if the restrictions on the level of detail in local plans are excluded from the RRI framework. On the other hand, France would gain 6 positions if the length of procedure is excluded from the RRI framework. In the retail operations pillar, excluding

the distribution channels for specific products would have a noteworthy impact on eight of the 28 EU Member States. In this case, Finland would gain the most, moving from the middle of the scale to being one of the top three least restrictive countries in the EU on retail establishment. On the other hand, Croatia and the United Kingdom would move by eight positions down and appear as more restrictive than currently. Excluding the sourcing of products would favour only Romania, which would gain 9 positions and move from being one of the top three most restrictive countries on retail operations to the middle of the scale.

**Table 3. Second statistical coherence test: excluding one-at-a-time selected types of restrictions**

Retail establishment restrictions pillar without:						Retail operations restrictions pillar without:			
Number of						Distribution channels for specific products			
Level of detail in local plans						Sourcing of products			
Publication decisions									
Most restrictive	Italy	0	0	0	0	Most restrictive	France	0	0
	Luxembourg	2	0	0	0		Spain	2	0
	Cyprus	-1	3	0	1		Romania	0	9
	United Kingdom	-1	-1	3	-1		Austria	2	-1
	Ireland	0	0	-1	0		Portugal	-3	-1
	Denmark	2	-2	-1	0		Belgium	-1	-1
	Germany	0	0	-1	0		Cyprus	1	-1
	Malta	-2	0	0	0		Luxembourg	3	-1
	Spain	0	0	0	1		Germany	0	-1
	Netherlands	0	0	0	-1		Greece	-3	-1
	Sweden	0	0	0	0		Malta	2	-1
	Slovenia	2	3	0	2		Italy	2	-1
	Belgium	5	-1	1	-1		Poland	-3	0
	Austria	-2	-1	1	1		Finland	12	0
	Hungary	-2	-1	-2	-2		Czech Republic	5	0
	Portugal	-1	2	0	0		Netherlands	-4	0
	France	-1	3	6	0		Slovenia	4	0
	Finland	-1	-2	-1	1		Latvia	0	0
	Greece	1	-2	0	-1		Bulgaria	0	0
	Croatia	-1	-1	-2	2		Lithuania	6	0
	Poland	4	1	-1	-1		Slovakia	0	0
	Romania	-1	3	-1	1		Denmark	-4	0
	Lithuania	4	3	-1	-2		United Kingdom	-8	0
	Czech Republic	-2	-3	1	0		Croatia	-8	0
	Bulgaria	-2	-2	3	0		Sweden	-1	0
	Slovakia	-2	-2	-2	0		Hungary	-1	0
	Latvia	-1	0	-1	0		Estonia	-1	0
Least restrictive	Estonia	0	0	-1	0	Least restrictive	Ireland	-3	0
<b>Number of countries shifting 3 positions or more</b>									
		3	6	3	0			13	1

Notes: The six types of restrictions that were found not to pass the first statistical coherence test are included in this analysis. Numbers represent shifts in rank in either the Establishment or the Operations pillar when an indicator is excluded from the framework. Positive shifts imply improvement in a country’s position (less restrictive); negative shifts imply deterioration in a country’s position (more restrictive). Shifts equal to 4 positions or greater are highlighted.

Source: European Commission Joint Research Centre, 2018.

#### **2.4 JRC recommendations based on two statistical coherence tests**

Overall, the results of the two statistical coherence tests discussed above (correlation analysis and impact of excluding an indicator one-at-a-time) suggest that the conceptual grouping of indicators into two sub-pillars and two pillars is statistically confirmed, and that the two RRI pillars are in general influenced by most underlying indicators. Twelve out of the 14 types of restrictions in the RRI framework are influential.

Nevertheless, the tests helped to single out two types of restrictions that appear to have a modest impact on the country ordering, namely Publication decisions related to the retail establishment and Sourcing of products. The JRC recommendation for the next year's release of the RRI is to carefully revise and/or reconsider the inclusion of these two types of restrictions – Publication decisions and Sourcing of products – and eventually replace them with other types of restrictions that may be more relevant for more EU countries.

### 3 Retail restrictions for establishment and operations: two concepts one number?

An overall score on the Retail Restrictiveness Indicator for each EU Member State may better advocate for the need to remove unnecessary restrictions towards more open and competitive retail markets in the EU. In order to arrive at a single retail restrictiveness score for each country, it is necessary to aggregate the country scores obtained for the two pillars, establishment restrictions and operations restrictions. The decision about how to aggregate together the pillars may have a significant impact on the final results. Like any other methodological decision, it should be made given a full understanding of the implications of alternative methodologies and how this relates to the concepts that are meant to be conveyed.

The RRI is calculated as the weighted arithmetic average of the two pillars: the Retail Establishment pillar is assigned a nominal weight of 60%, and the Retail Operations pillar a weight of 40%. The main underlying assumptions in the linear formula used for aggregation are twofold. For one thing, low scores in one of the pillars can be fully compensated with higher scores in the other. For another thing, the higher weight assigned to the Establishment pillar in the formula reflects the idea of that pillar being more “important” to assess the overall restrictiveness in the retail sector in any given country. However, the assumption of higher weights reflecting higher importance in the composite needs to be tested on a case-by-case. In fact, whilst weights are often assigned to the components of an index to reflect the components’ effective importance in the index, in practice, the data correlation structure and the data variances do not always allow the weights assigned to the variables to match their importance (see Becker et al., 2017; Paruolo et al., 2013).

To investigate empirically the relative influence on the RRI of both pillars, a suitable correlation measure is used for calculating the ‘implicit weights’. The implicit weights are calculated here with the squared Pearson correlation coefficient, otherwise known as the coefficient of determination, and rescaled to sum 100%. **Table 4** confirms that restrictions on establishment are indeed more influential than restrictions on operations in determining variations in the RRI country scores. Yet, from a purely statistical perspective, the Establishment pillar has a much higher contribution to the RRI than what it would be expected by considering the expert-based weights.

**Table 4. Expert-based weights and importance measures for the RRI pillars**

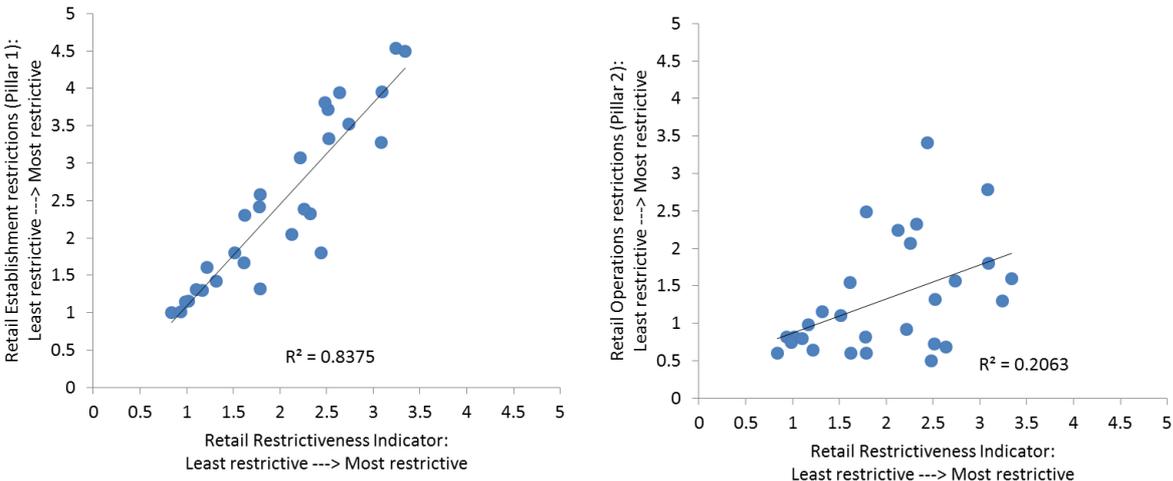
	Retail Establishment restrictions (Pillar 1)	Retail Operations restrictions (Pillar 2)
Expert-based weights	60%	40%
Implicit weights	80%	20%

Note: Pearson correlation is a suitable measure of the statistical association between the two pillars and the overall index given that all three components have continuous distributions. The ‘implicit weights’ are calculated as the squared Pearson correlation coefficients rescaled to 100% sum. Implicit weight for the retail establishment pillar =  $0.8375 / (0.8375 + 0.2063) = 0.80$ ; Implicit weight for the retail operations pillar =  $0.2063 / (0.8375 + 0.2063) = 0.20$ .

Source: European Commission Joint Research Centre, 2018.

A clear visual indication that the establishment restrictions dominate the RRI compared to the operations restrictions is given in **Figure 2**: it shows a strong linear relationship between the Establishment pillar and the RRI, against a weak and diffuse effect of the Operations pillar on the RRI.

**Figure 2. Retail Restrictiveness Indicator vs Establishment and Operations pillars**



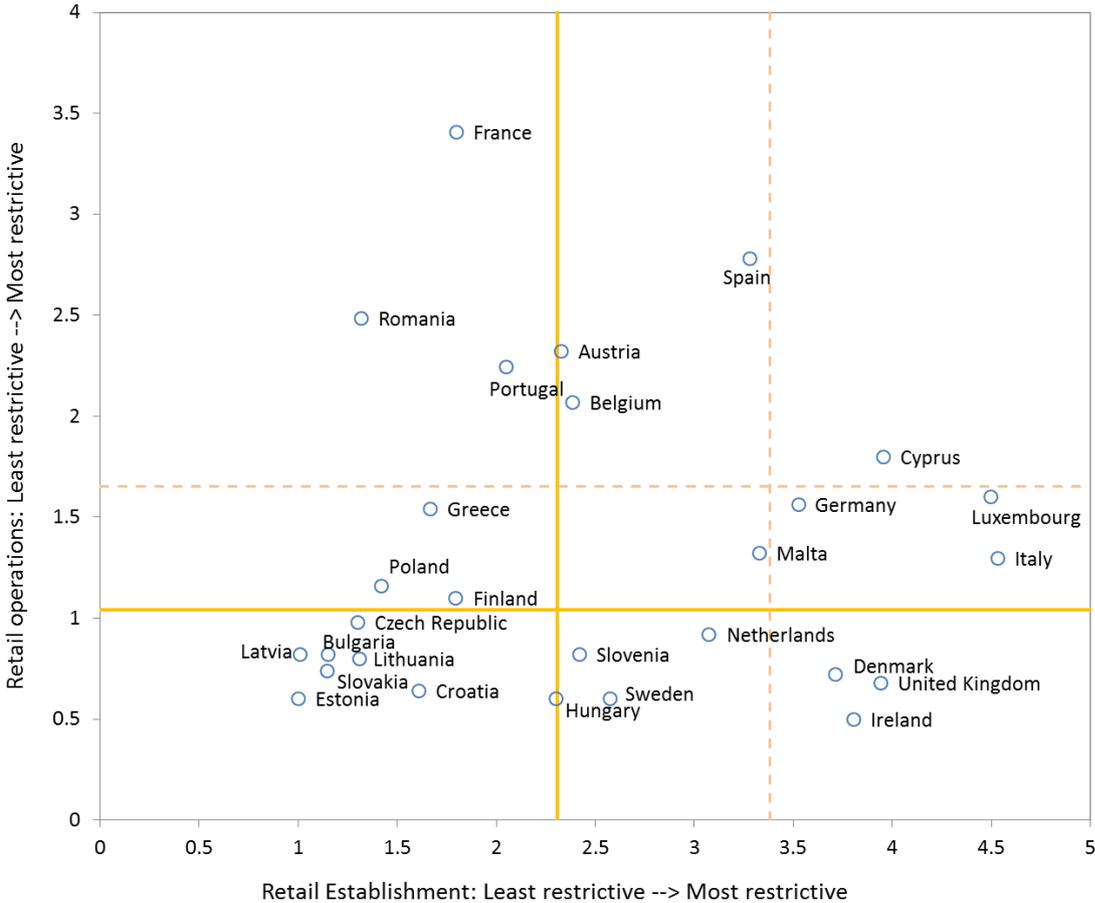
Source: European Commission Joint Research Centre, 2018.

Hence, when analysing the Retail Restrictiveness Indicator one should bear in mind that the overall index is more driven by the Establishment restrictions than by the Operations restrictions. Per se this is not a problem, because in fact the establishment restrictions seem to be more associated to relevant economic variables, such as birth rates of retail companies, price level indices, market concentration indices and other (see SWD/2018/236).

The main challenge to combine the two retail restrictiveness pillars into a single number stems from the negligible association between these two components. The Pearson correlation coefficient between the two RRI pillars is only 0.056 (non significant), which suggests that there is no pattern between these two major types of retail restrictions. This result is clearly visible in **Figure 3**, that shows a diffuse scatter of points corresponding to country performances in each of the pillars. The solid lines in the plot represent the median values of the scores in each pillar; the dashed lines represent the 75<sup>th</sup> percentiles. For example, those countries close to or beyond the two dashed lines at the top right side in the Figure 3 (Spain, Cyprus, Germany and Luxembourg) may need to take action to eliminate unnecessary restrictions at both phases of establishing and operating a shop. On the other hand, countries located at the bottom left quadrant are those countries where most good practices for both establishment and operations restrictions are to be found.

When it comes to measuring retail restrictions in the European Union, the random pattern between establishment and operations restrictions may be seen as reassuring. It suggests that on average countries that have higher levels of restrictions on establishment do not necessarily have high levels of operations restrictions. Yet, from a methodological point of view, this random association between the two main types of restrictions in the EU poses the challenges of aggregation that were discussed and illustrated in this section.

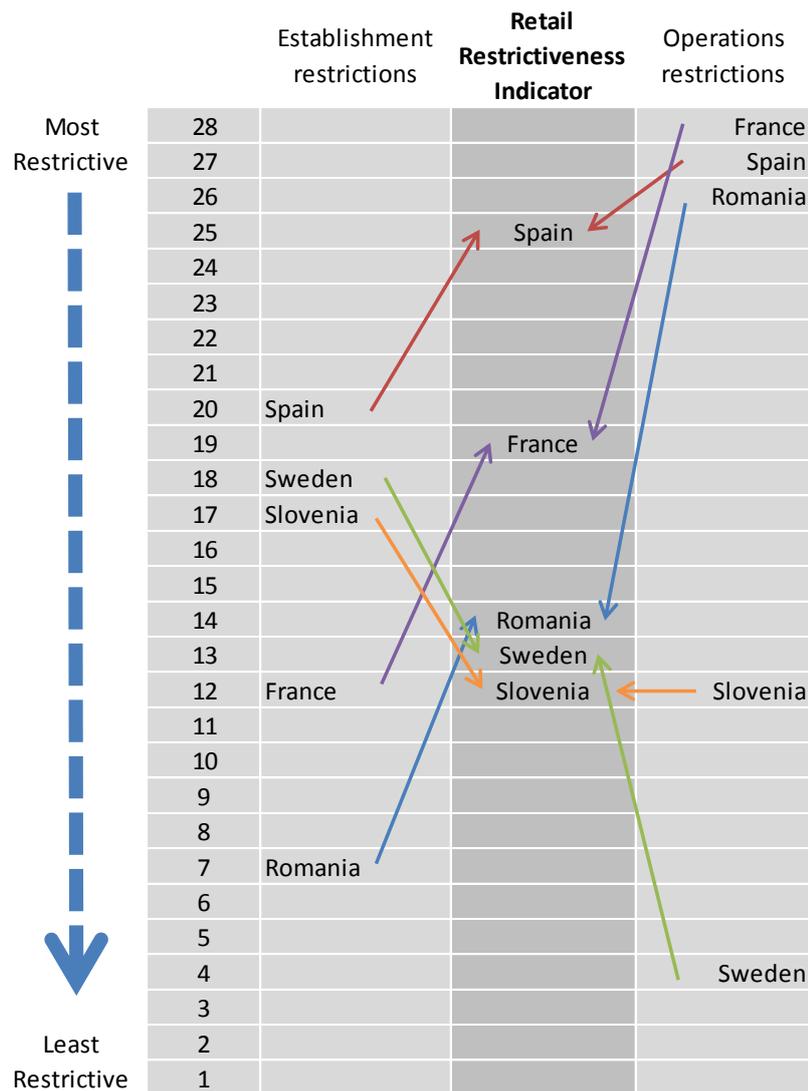
**Figure 3. Retail Establishment restrictions vs Retail Operations restrictions in the EU**



Source: European Commission Joint Research Centre, 2018.

Undoubtedly, the added value of monitoring retail operations restrictions is in putting the spotlight on some countries that may have gone unnoticed had only the retail establishment restrictions been considered. **Figure 4** summarises the biggest differences in the country classification (shifts of 5 positions or more in absolute terms) between the Establishment pillar and the overall index, which stem from the impact of the operations restrictions. The most relevant cases are five: Spain, France, Romania, Sweden and Slovenia. For example, Romania would have been included in the top 10 less restrictive countries in the EU had only the retail establishment restrictions been considered, but due to restrictions on the operations-side of retail shops, Romania arrives in the middle of the overall scale in the Retail Restrictiveness Indicator. In the same vein, France falls from the middle of the overall scale to the 10 most restrictive countries due to strong restrictions on the operations side. On the other hand, Slovenia and Sweden appear to be in the middle of the overall scale, thanks to less restrictive regulations related to operations which compensate for more stringent restrictions when it comes to establishing a shop. In this light, the retail operations restrictions play an important role by singling out those countries that are worthy of further analysis.

**Figure 4. Added value of the operations restrictions in the overall index**



Note: The graph presents the five countries with the biggest shifts (5 positions or more) between the overall classification and the retail establishment restrictions that are due to the operations restrictions.

Source: European Commission Joint Research Centre, 2018.

All in all, from a purely statistical perspective the JRC recommendation would be to put less emphasis on the overall restrictiveness index scores when it comes to analyzing policy implications. The Retail Restrictiveness Indicator may serve as advocacy tool, and help to put the spotlight on countries that may have less restrictions at the establishment phase but impose unnecessary restrictions during the operations stage (e.g. France, Spain and Romania) or countries that impose notable restrictions at the establishment phase but are much less restrictive when it comes to the operations phase (e.g. Sweden and Slovenia). The recommendation for the best strategy to be adopted in order to get an understanding of the restrictions in the retail sector across Member States would be to use the entire RRI framework of indicators and to guide policy recommendations based on the two main types of restrictions, the Establishment and the Operations. As discussed based on the statistical findings above, insights on the conditions and procedures for establishment would help to complement the picture.

The findings in this section confirm that the strategy adopted in the SWD for communicating the results on the Retail Restrictiveness Indicator and its underlying components, is indeed the most suitable given the concept and the data at hand.

## 4 Impact of modelling assumptions on the RRI results

The analysis in this section addresses the following two key questions:

(a) Does the use of one aggregation strategy versus another provide actually a partial picture of the countries' degree of retail restrictions related to the establishment and the operations?

(b) Which countries, if any, have large uncertainty bounds in their establishment and operations restrictions scores (volatile countries) as a result of altering the weights assigned to the indicators?

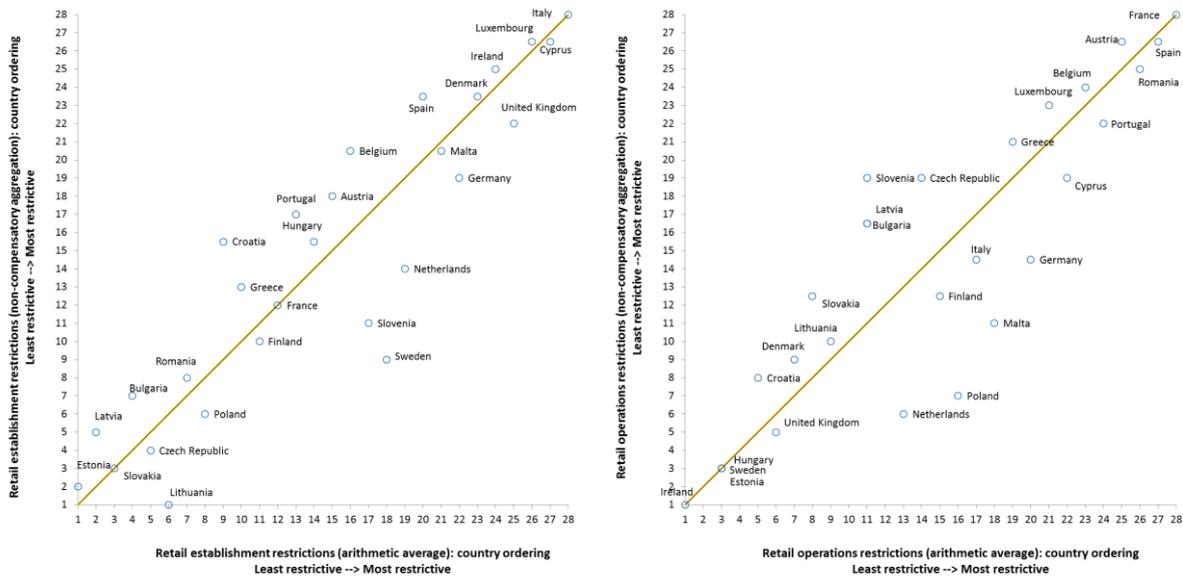
### 4.1 Impact of the aggregation formula

The main aim here is to understand the implications of alternative approaches to aggregate the restrictiveness indicators included in each of the two pillars. The current methodology of the index implies calculating the weighted average of the indicators included in each pillar. However, as a departure from the current methodology, non-compensatory methods could also be used to aggregate the underlying indicators. Non-compensatory methods are recommended for discrete and non-quantitative variables, such as those included in the retail restrictiveness dataset. These methods rely upon the ordinal information contained in the dataset to order the available alternatives (countries). No cardinal information is obtained as a result of the aggregation process, i.e. the final country ordering is not accompanied by country scores. Examples of non-compensatory approaches include the Copeland rule and the Arrow-Raynaud algorithm (OECD/EC JRC, 2008; Munda, 2008). The Copeland rule has been proven to offer a good enough compromise between the efficiency of the algorithm used in the search for the optimal solution and its computational requirements. Accordingly, here we use the Copeland rule as an alternative to the standard arithmetic aggregation approach.

**Figure 5** plots the Establishment pillar ordering (left panel) and the Operations pillar ordering (right panel) resulting from the arithmetic average versus the country ordering obtained with the Copeland method. The solid line represents the hypothetical situation of no shifts (identical country ordering) under both aggregation methods. For the Establishment pillar, the Spearman rank correlation between the two orderings is 0.91. If we subtract this value from 1, we can obtain a loose measure of the "upheaval" of choosing a non-compensatory versus a compensatory approach: 0.09. However, despite the high degree of similarity between the two country orderings, the scatter in the plot is still significant for some countries. Six countries shift 5 positions or more depending on the aggregation formula used: Belgium, Croatia, Lithuania, Netherlands, Slovenia and Sweden. In the case of Sweden, the change in the aggregation methodology would imply an improvement of nine positions in the ordering (from the 18<sup>th</sup> to the 9<sup>th</sup> position). For the Operations pillar, as expected, the level of discrepancy or "upheaval" is higher than that in the first pillar (0.12, corresponding to a Spearman rank correlation value of 0.88). In total, nine countries experience shifts equal to or above five positions: Bulgaria, Czech Republic, Germany, Latvia, Malta, Netherlands, Slovakia, Slovenia and Poland. The biggest impact is found for Poland, which would climb 9 positions had the Copeland rule been used.

Overall, the choice of a non-compensatory versus a fully compensatory approach for aggregating the indicators within each RRI pillar would impact six countries in the case of the establishment restrictions and nine countries in the case of the operations restrictions. Yet, the high degree of association between the country orderings obtained using either the arithmetic average (baseline) versus a non-compensatory approach is reassuring.

**Figure 5. Country ordering in the RRI pillars: average vs non-compensatory algorithm**



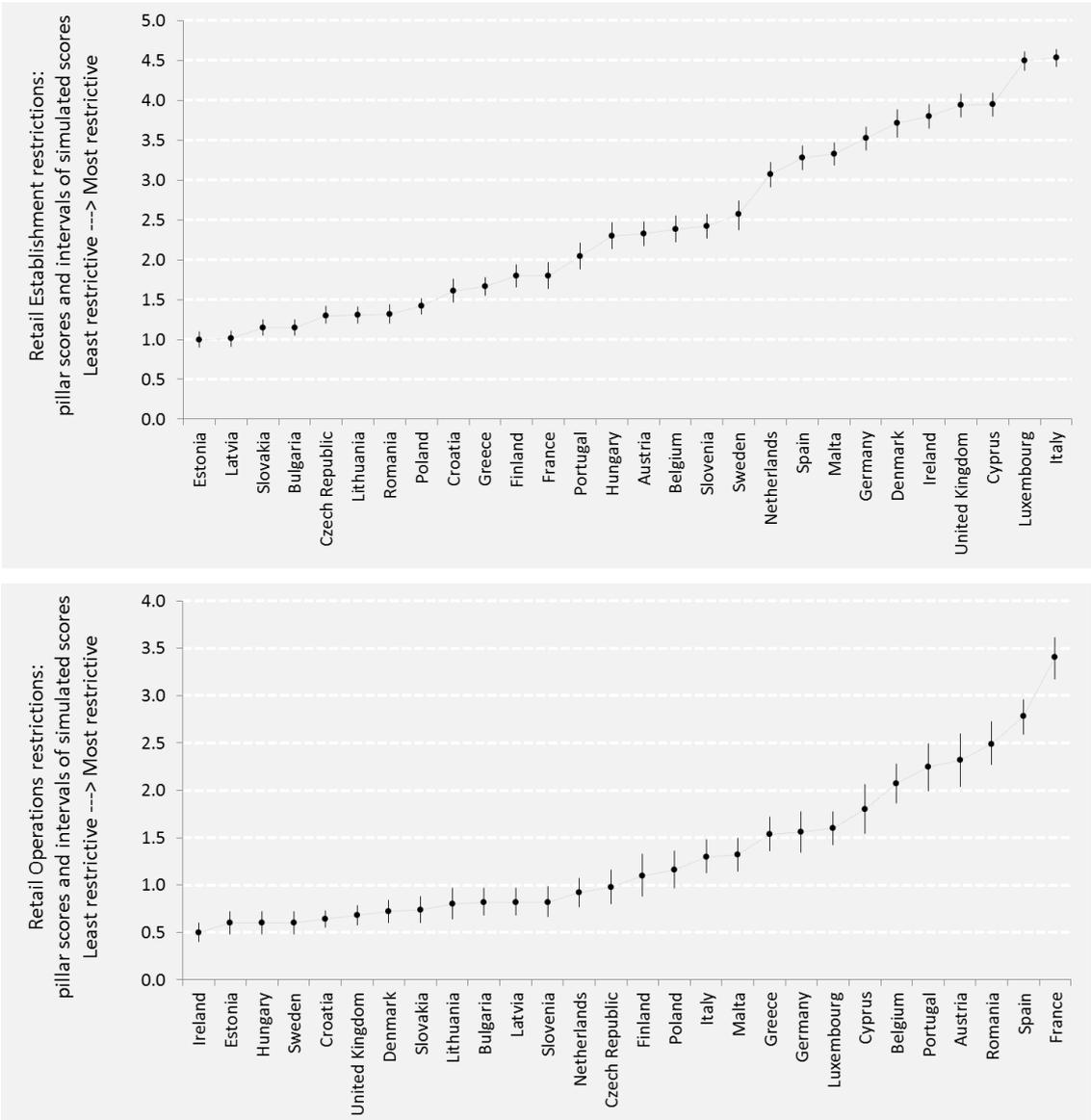
Notes: The Spearman rank correlation between the country orderings obtained using either the arithmetic average (baseline) versus a non-compensatory approach is 0.91 for the establishment pillar (left panel) and 0.88 for the operations pillar (right panel).

Source: European Commission Joint Research Centre, 2018.

**4.2 Impact of the weighting scheme**

The analysis here aims at estimating the effect of varying the weights assigned to the 14 types of restrictions inside plausible ranges. For that purpose, the weights originally assigned to each indicator in each pillar are subject to random shocks (+/- 25%), and subsequently scaled to add up to 1 within each pillar. The distribution of pillar scores over the 1,000 Monte Carlo simulations performed are presented in Figure 6 for the Establishment restrictions (left panel) and Operations restrictions (right panel). The height of the error bars in the plots represents the uncertainty in the country scores associated to the uncertainty in the weights. The dot represents the baseline score (as in the SWD) for each country across the simulations.

**Figure 6. RRI pillars: baseline scores and simulated scores**



Notes: Uncertainty in the country scores for the Establishment restrictions (top panel) and for the Operations restrictions (bottom panel). Intervals (90% confidence intervals) are calculated over 1,000 simulated scenarios based on random weights (+/- 25% around the expert-based weights assigned to the restrictions, as shown in Table 1).

Source: European Commission Joint Research Centre, 2018.

Essentially, the magnitude of uncertainty in both pillars is modest. Altering the weights within reasonable limits (+/- 25% around the expert-based weights) implies a change in the country scores of less than plus/minus 0.2 points for the Establishment restrictions and less than 0.3 points for the Operations restrictions. For the sake of transparency and to better appreciate the robustness of the results, **Table 5** reports the 90% intervals for the simulated scores together with the original (baseline) scores in the two Retail Restrictiveness pillars.

**Table 5. Uncertainty in the weights: original pillar scores and confidence intervals**

	Retail establishment restrictions (Pillar 1)		Retail operations restrictions (Pillar 2)	
	Original score	[Interval]	Original score	[Interval]
Italy	4.5	[ 4.4 4.6 ]	1.3	[ 1.1 1.5 ]
Luxembourg	4.5	[ 4.4 4.6 ]	1.6	[ 1.4 1.8 ]
Cyprus	4.0	[ 3.8 4.1 ]	1.8	[ 1.5 2.1 ]
United Kingdom	3.9	[ 3.8 4.1 ]	0.7	[ 0.6 0.8 ]
Ireland	3.8	[ 3.6 4.0 ]	0.5	[ 0.4 0.6 ]
Denmark	3.7	[ 3.5 3.9 ]	0.7	[ 0.6 0.8 ]
Germany	3.5	[ 3.4 3.7 ]	1.6	[ 1.3 1.8 ]
Malta	3.3	[ 3.2 3.5 ]	1.3	[ 1.1 1.5 ]
Spain	3.3	[ 3.1 3.4 ]	2.8	[ 2.6 3.0 ]
Netherlands	3.1	[ 2.9 3.2 ]	0.9	[ 0.8 1.1 ]
Sweden	2.6	[ 2.4 2.7 ]	0.6	[ 0.5 0.7 ]
Slovenia	2.4	[ 2.3 2.6 ]	0.8	[ 0.7 1.0 ]
Belgium	2.4	[ 2.2 2.6 ]	2.1	[ 1.9 2.3 ]
Austria	2.3	[ 2.2 2.5 ]	2.3	[ 2.0 2.6 ]
Hungary	2.3	[ 2.1 2.5 ]	0.6	[ 0.5 0.7 ]
Portugal	2.0	[ 1.9 2.2 ]	2.2	[ 2.0 2.5 ]
France	1.8	[ 1.6 2.0 ]	3.4	[ 3.2 3.6 ]
Finland	1.8	[ 1.7 1.9 ]	1.1	[ 0.9 1.3 ]
Greece	1.7	[ 1.5 1.8 ]	1.5	[ 1.4 1.7 ]
Croatia	1.6	[ 1.5 1.8 ]	0.6	[ 0.6 0.7 ]
Poland	1.4	[ 1.3 1.5 ]	1.2	[ 1.0 1.4 ]
Romania	1.3	[ 1.2 1.4 ]	2.5	[ 2.3 2.7 ]
Lithuania	1.3	[ 1.2 1.4 ]	0.8	[ 0.6 1.0 ]
Czech Republic	1.3	[ 1.2 1.4 ]	1.0	[ 0.8 1.2 ]
Bulgaria	1.2	[ 1.1 1.3 ]	0.8	[ 0.7 1.0 ]
Slovakia	1.1	[ 1.1 1.2 ]	0.7	[ 0.6 0.9 ]
Latvia	1.0	[ 0.9 1.1 ]	0.8	[ 0.7 1.0 ]
Estonia	1.0	[ 0.9 1.1 ]	0.6	[ 0.5 0.7 ]

Notes: Intervals (90% confidence intervals) are calculated over 1,000 simulated scenarios based on random weights (+/- 25% around the expert-based weights assigned to the restrictions, as shown in Table 1). Countries are ordered from the most restrictive to the least restrictive according to the Establishment pillar of the Retail Restrictiveness Indicator.

Source: European Commission Joint Research Centre, 2018.

## 5 Conclusions

The Commission services developed the Retail Restrictiveness Indicator with a view to measure the degree of restrictiveness of restrictions imposed on the retail sector across the EU. The JRC statistical audit has delved around in the workings of the Retail Restrictiveness Indicator (RRI) framework to assess the statistical properties of the data, and the methodology used in its construction. Overall the RRI framework is well-constructed, into which a lot of thought has clearly been put. One of the greatest strengths is the amount of original research into retail restrictions in the EU and relevant survey data collected, as well as the transparency and detail of all data populating the RRI framework. This transparency and detail in the source information lends considerable credibility to the Retail Restrictiveness Indicator as an ensemble of information and opens the data for use by policy analysts and researchers alike.

The key findings of the statistical assessment conducted herein are the following:

First, two statistical coherence tests (correlation analysis and impact of excluding an indicator one-at-a-time) suggest that **the conceptual grouping** of the 14 types of restrictions into two sub-pillars (Conditions and Procedures under the Establishment pillar) and two pillars (Establishment and Operations) **is statistically confirmed**, and that the two main pillars are in general influenced by most underlying indicators. Twelve out of the 14 types of restrictions in the RRI framework are influential.

Second, the **inclusion of two sub-pillars under the Retail establishment restrictions** pillar was confirmed as **an important choice** because it helps to pass the information content of three indicators to the next aggregation level. The three indicators – level of detail in local plans, number of entities to contact, length of procedure – would have been “lost in the aggregation” should the RRI framework not have included the Conditions and Procedures sub-pillars.

Third, although the indicator on the number of market studies and impact assessments belongs to the Procedures in retail establishment, it is found to have strong association also to the Conditions in retail establishment. This **dual impact of the number of impact assessments and market studies to both conditions and procedures for establishment** may be worth of **further analysis**.

Forth, the tests helped to single out **two types of restrictions** that appear to have a modest impact on the country ordering, namely Publication decisions related to the retail establishment and Sourcing of products. The JRC recommendation for the future release of the RRI is to carefully revise the formulation of these types of restrictions and/or reconsider their inclusion, eventually replacing them with other types of restrictions that may be more relevant for more EU countries.

Fifth, when analysing the **Retail Restrictiveness Indicator** one should bear in mind that the index is **more driven by the Establishment restrictions** (80%) than by the Operations restrictions (20%), although the weights assigned to the pillars are 60-40%. Per se this is not a problem, because in fact the establishment restrictions seem to be more associated to relevant economic variables, such as birth rates of retail companies, price level indices, market concertation indices and other (see SWD(2018)236).

Sixth, the analysis evidenced that there is a **random pattern between** the two main pillars, the **Establishment restrictions** and the **Operations restrictions**. From a methodological point of view, this random association between the two main types of restrictions in the EU poses a **challenge in their aggregation**. Yet, from the retailing industry perspective it may be seen as **reassuring**. It suggests that on average countries that have higher levels of restrictions on establishment do not necessarily have high levels of operations restrictions. This random pattern between the two main pillars suggests that it is preferable to analyse the plot of the two pillars, which helps to evidence two groups of countries: those countries that may need to take action to eliminate unnecessary restrictions at both phases of establishing and operating a shop (Spain, Cyprus, Germany and Luxembourg) and those countries where most good

practices for low levels of retail restrictions at both the establishment and the operation phases are to be found (Bulgaria, Croatia, Czech Republic, Estonia, Latvia, Lithuania and Slovakia).

Seventh, the analysis confirms that the **strategy adopted in the SWD** for communicating the results on the Retail Restrictiveness Indicator framework **is** indeed the **most suitable given the concept and the data at hand**. The SWD rightly places more emphasis and dedicates extended analyses and policy insights based on the two main types of restrictions, the Establishment and the Operations, and downplays the results on the single index. In any case, the Retail Restrictiveness Indicator may serve as advocacy tool for the need to remove unnecessary restrictions towards more open and competitive retail markets in the EU. The index can also help to put the spotlight on countries that may have less restrictions at the establishment phase but impose unnecessary restrictions during the operations stage (e.g. France, Spain and Romania) or countries that impose notable restrictions at the establishment phase but are much less restrictive when it comes to the operations phase (e.g. Sweden and Slovenia).

Eighth, the **robustness analysis** suggests that the choice of a non-compensatory versus a fully compensatory approach (as currently done) for aggregating the indicators within each RRI pillar would impact six countries in the case of the establishment restrictions and nine countries in the case of the operations restrictions. Yet, the **high degree of association** between the country orderings obtained using either the **arithmetic average** (baseline) versus a **non-compensatory approach is reassuring**. Furthermore, the magnitude of uncertainty in both pillars is modest when altering the weights within reasonable limits (+/- 25% around the expert-based weights): country scores change less than plus/minus 0.2 points on the 0-6 scale for the Establishment restrictions and less than 0.3 points for the Operations restrictions.

Readers of the SWD on the Retail Restrictiveness Indicator should hence go beyond the overall index scores and duly take into account the individual indicators and pillars on their own merit. By doing so, country-specific strengths and challenges in regulating the retail sector can be identified and serve as an input for data-informed policy analysis. The Retail Restrictiveness Indicator should not be seen as the ultimate and definitive yardstick of EU countries regulatory frameworks. Instead, the RRI best represents an ongoing attempt by the Commission services to help focus the policy discussions on selected types of restrictions that matter for the EU, continuously adapting the RRI framework to reflect the improved availability of statistics and the theoretical advances in the field.

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