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Methodologies to Measure Market Competition – Note by Greece

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Abstract

1. Concerns over the rising power of retailers in the food sector have led many competition authorities to use existing rules or adopt new rules on superior bargaining power, these rules either forming part of competition law statutes or of other functional equivalents. Supermarkets are the main channel through which households buy a wide range of food products and other consumer goods. The particular importance of purchasing food products and other consumer goods for daily consumption (supermarket items) in terms of social welfare increases the interest for better understanding of how the terms and conditions of supply of firms operating supermarket chains are defined, as they relate to the formation of the final prices offered to consumers. The paper presents the methodology used in a recent sector inquiry of the Hellenic Competition Commission (HCC) regarding basic consumer goods in order to assess vertical market power. First, we present the theoretical contours of the vertical market power concept. Second, we explain the metrics used in the context of this study to measure the degree of vertical competition. Third, we present the empirical results of the implementation of this new approach in the supermarkets sector inquiry recently completed (March 2021) by the HCC.

1. Vertical market power

2. Concerns over the rising power of retailers in the food sector have led many competition authorities to use existing rules or adopt new rules on superior bargaining power, these rules either forming part of competition law statutes or of other functional equivalents.[1]

3. Supermarkets are the main channel through which households buy a wide range of food products and other consumer goods. The particular importance of purchasing food products and other consumer goods for daily consumption (supermarket items) in terms of social welfare increases the interest for better understanding of how the terms and conditions of supply of firms operating supermarket chains are defined, as they relate to the formation of the final prices offered to consumers.

4. In this context, there exists an extensive public debate on the bargaining power (i.e. the power of supermarkets), in relation to their suppliers, in the food retail sector and many competition authorities have conducted sectoral studies for this issue. The Hellenic Competition Commission completed its sector inquiry on consumer goods in basic consumer goods in March 2021[2].

5. The sector inquiry gave the opportunity to the authority to develop methodologies for the assessment of both horizontal and vertical competition[3].

6. In his 'five forces of competition framework', Michael Porter argues that the profitability of an industry is determined by five sources of competitive pressure:

[1] For a comparative analysis of rules on superior bargaining power, *see* ICN, Report on Abuse of Superior Bargaining Position (2008), available at http://www.internationalcompetitionnetwork.org/uploads/library/doc386.pdf.

[2] See, https://www.epant.gr/en/enimerosi/sector-inquiry-into-basic-consumer-goods.html .

[3] For a discussion, see I. Lianos, V. Korah & P. Siciliani, Competition Law (OUP, 2019), chapter 3.

competition from substitutes, competition from new entrants in the industry, competition from established rivals[4]. These can be characterized as sources of 'horizontal' competition. Competition from the bargaining power of suppliers and buyers or between firms generating (mutual) unique or supermodular complementarities[5] can be characterized as sources of 'vertical competition'. Hence, in addition to competing with firms in the same relevant market and/or potential horizontal competitors at each segment of a value chain, there is also vertical competition among the firms forming part of the same value chain or which have a complementary relation in the context of an ecosystem as to which one will be able to capture the largest share of the surplus value generated by the value chain or the ecosystem. Holding certain assets or gatekeeping positions and developing specific competitive strategies will bring a sustainable architectural competitive advantage for the specific firm[6]. Horizontal competition and vertical competition coexist in competition law and complement each other in the representation and implementation of the relations between the players in the relevant market[7].

7. Competition economics has largely focused on horizontal competition from established competitors (producing substitute products), or on the threat of entry of potential competitors and has so far ignored vertical competition although this is an important constraint to the exploitative or exclusionary potential of economic power, in particular in the digital economy. This is however important, in particular if one of the concerns examined by the competition authority is the presence of superior bargaining power, as was the case for the Sector inquiry of the Hellenic Competition Commission (HCC) on basic consumer goods.

8. In this sector inquiry, the HCC developed a specific methodology to assess vertical market power, which can also be implemented in other areas of economic activity[8].

2. A proposition of indicator of vertical market power

9. In contrast with simple or direct vertical (power) theories based on the analysis of the horizontal concentration of the market (e.g. through the use of a concentration or market share index) and thus focusing on horizontal competition, vertical competition theories assess vertical competition between firms belonging to different stages of the value chain. However, there still does not exist a specific metric of that power. Hence, it becomes necessary to develop indicators that bridge the gap between vertical power theories and more traditional horizontal market power theories for the analysis of anti-competitive practices.

[4] ME Porter, 'The Five Competitive Forces that Shape Strategy' (January 2008) *Harvard Business Rev* 25.

[5] M.G. Jacobides, C Cennamo., & A. Gawer, (2018). Towards a theory of ecosystems. *Strategic management journal*, *39*(8), 2255-2276.

[6] See, I. Lianos, Competition Law for the Digital Era: A Complex Systems' Perspective (August 30, 2019). Available at SSRN: https://ssrn.com/abstract=3492730 .

[7] R.L. Steiner (2008), 'Vertical competition, horizontal competition and market power', The Antitrust Bulletin 53(2) 251; I. Lianos, V. Korah, P. Siciliani, Competition Law: Analysis, Cases and Materials (OUP, 2019), 199- 206

[8] See, in general, I. Lianos & B. Carballa Smichowski, Economic Power and New Business Models in Competition Law and Economics: Ontology and New Metrics (March 15, 2021). Available at SSRN: https://ssrn.com/abstract=3818943 or http://dx.doi.org/10.2139/ssrn.3818943

10. These new indicators have their origin in the differential dependency theory of social exchange theory and the important role of a company's central position in a network or ecosystem (according to network analysis), especially with regard to both the possibility of unequal access to essential resources and the different "panopticon power" capabilities provided by the central positioning a company has in a value chain or network/ecosystem with regard to the different flows of information. This is linked to the idea that a firm's differential dependency within a value chain can be a source of vertical power. This is particularly important in today's digital economy where access to data plays a prominent role in the development of competitive advantage.

11. In the context of this study, in order to analyse a metric for vertical power we will recur to network analysis and, in particular, to the notion of centrality to represent a firm's power, in a value chain or ecosystem

12. Central firms are those on which the whole value chain depends more to function because they perform tasks that are more necessary to assure the overall coordination of the value chain. This is also the ultimate reason of resource-based vertical power based on differential dependency. This form of market power is vertical in that it is exerted from suppliers to buyers or vice versa, and it is 'fully' vertical in that it affects the whole value chain and not only the upstream or downstream tiers directly linked to the firm exerting it ("fully vertical market power").

13. The indicator of centrality that better translates the concept of resource-based differential dependency is betweenness centrality

14. If a central firm was to leave the value chain, the value loss for the latter would be greater than if a non-central easy-to-replace firm left (Crook & Combs, 2007[9]). Because "a node [firm] with high betweenness centrality has a great capacity to facilitate or constrain interactions between other nodes [firms] (Freeman, 1979[10]) (Kim, Choi, Yan, & Dooley, 2011, p. 3[11])", its removal affects the network more than the removal of a node (firm) with a low betweenness centrality. This means that central firms are those on which *all other firms* of the value chain or ecosystem depends *more* to function because they perform tasks and/or handle a considerable volume of transactions (sales, user traffic, etc.).

15. . Because in our representation of value chains/ecosystems all the vertices have to be transited (i.e. all the firms participate in value creation at some stage and level), all paths are shortest paths. Then, if we notate a node as N_x where x identifies a particular node in the network, its betwenness centrality can be calculated using Equation 1.

Equation 1: Formula of betwenness centrality of node X

$$BC\ (N_x) = \frac{\text{Number of paths passing through } N_x}{\text{Number of paths in the network}}$$

Where BC stands for "betweenness centrality" and N_x for "node X".

16. However, since we are interested in assessing fully vertical market power, we measure a firms' betweenness centrality relative to other firms' ('relative centrality').

[9] T.R. ***C****rook*, J. G. Combs Sources and consequences of bargaining power in supply chains, (2007) 25 Journal of Operations Management, 546.

[10] L.C. Freeman, Centrality in social networks conceptual clarification, (1978-1979) 1(3) Social Networks 215.

[11] Y. Kim, T. Choi, T. Yan, K. Dooley Structural investigation of supply networks: A social network analysis approach, (2011) 29(3) Journal of Operations Management 194.

Hence, our metric of vertical power has to be able to give us two different values for two firms that belong to different value chains and have the same betweenness centrality but different relative centralities. As shown in Equation 2, this can be obtained by using the share of the sum of the square betweenness centralities of each node (firm) of the value chain. Since vertices represent a firm performing a transaction or task (buying something to another to continue with the production process, providing content to users coming from another firm, etc.), the bigger the share of shortest paths that pass through firm X relative to other firms in the network, the more essential that firm's contribution to the value chain/ecosystem is compared to others.

Equation 2: Resource-based vertical market power based on differential dependency for a node x

$$SSBC = \frac{SBC\ (N_x)}{\sum_{i=1}^{n} SBC\ (N_x)}$$

Where "SSBC" (Share of square betweenness centrality), SBC stands for "square betweenness centrality" and Nx for "node x".

17. In other words, Equation 2 poses that the level of a firm's resource-based value chain/ecosystem-level metric of economic power can be measured as its share of the sum of the square betweenness centralities of each node (firm) of the value chain/ecosystem. It should be noted that given that the indicator is built as a share and that it includes firms downstream and upstream of the entire value chain/ecosystem, it can be interpreted as the share of vertical power each firm holds within the value chain or ecosystem.

18. Since this firm-level indicator incorporates differential dependency between upstream and downstream firms, it can diminish the false negatives and false positives in comparison to a simple market share when assessing a firm´s dominance within a value chain or ecosystem.

19. We have just shown how the share of square betweenness centrality of a firm can be used as a metric of resource-based value chain/ecosystem-level power that draws on the concept of differential dependency. However, because this metric is firm-centric, it does not tell us what is the level of vertical power differentials within a value chain or ecosystem, a piece of information that could be useful to do a more aggregated analysis of power, especially from a competition law perspective. Consequently, with this indicator we cannot say if there is more power concentration in a certain value chain, or ecosystem, than in another one. Therefore, in this subsection we will adapt this metric to overcome these difficulties.

20. Given that each firm's level of power corresponds to its share of the sum of the square betweenness centralities of all of the firms (nodes) of its value chain/ecosystem, a simple way of assessing the level of power imbalances within a value chain/ecosystem consists in calculating the HHI index for all the firms of the value chain/ecosystem using their SSBC instead of their market shares. In that manner, the resulting indicator, "vertical HHI" (VHHI), measures how (un)evenly vertical power is distributed within a value chain or ecosystem. It is calculated following Equation 3.

Equation 3: Vertical HHI indicator for a value chain or ecosystem with n firms

$$VHHI = \sum_{i=1}^{n} SSBC^2$$

Where SSBC stands for "share of square betweenness centrality" calculated as given by Equation 2.

21. Then, the higher the indicator in Equation 3 is, the more imbalanced power is in the value chain, or ecosystem. This indicator would then be analogous to HHI. While the latter measures the level of market power in a market resulting from market concentration, the indicator in Equation 3 measures the level of vertical power in a value chain or ecosystem resulting from differential dependency over a resource. Moreover, since the VHHI indicator is, like the HHI, based on shares, it also ranges from 0 (total absence of vertical power imbalances) to 10 000 (absolute concentration of vertical power by one firm). However, as explained for the SSBC indicator, this does not mean that the thresholds established for HHI to assess the competitive level of a given market should apply to assess the degree of (vertical) competition within a value chain or ecosystem.

3. Resource-based vertical market power: an empirical assessment in the Greek supermarket sector

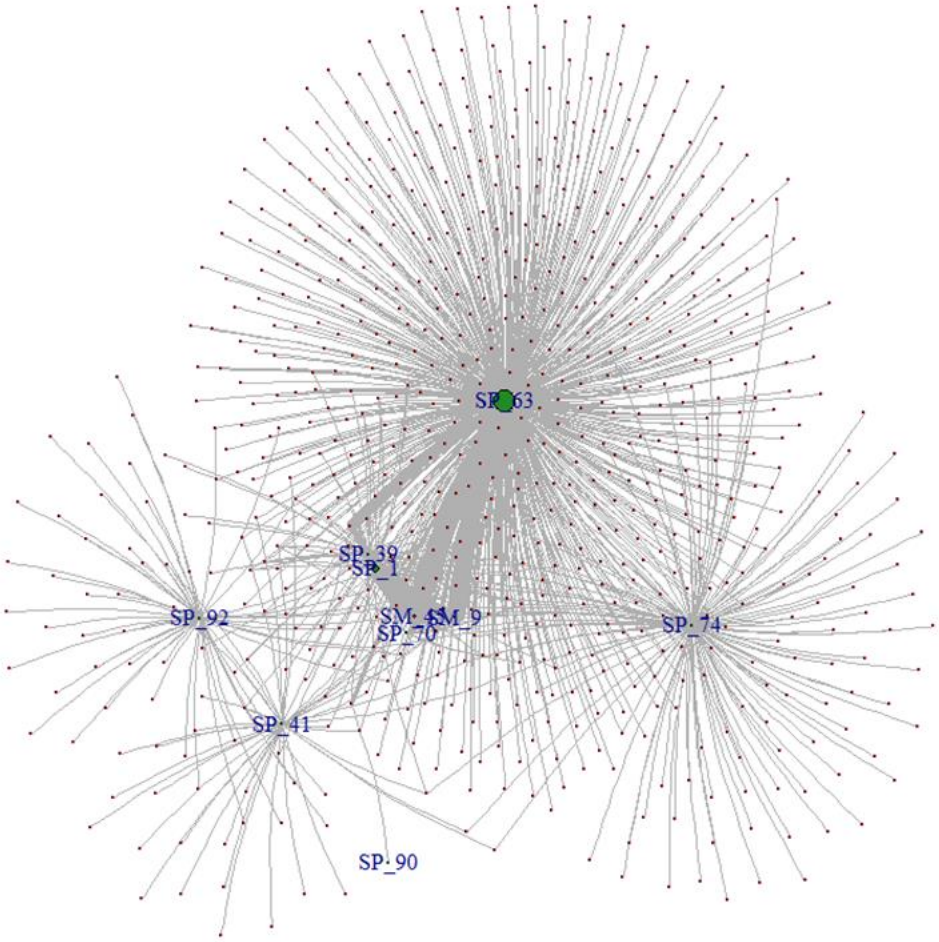
22. Using data from the Greek supermarket sector from 2016 collected in the context of the sector inquiry by the HCC, we applied the SSBC indicator to assess suppliers and retailers´ levels of vertical power for 11 product categories in the Greek supermarket sector in years 2015 to 2019. The dataset used shows, for each supermarket, the total amount of purchases from each supplier in 11 product categories. In this part we will present some salient results from this analysis that will help us illustrate the interest of applying the indicators proposed in the previous Section.

23. We shall now present the result of applying our firm-level resource-based vertical market power indicator in two product markets. These markets illustrate how recurring to this novel indicator to measure vertical market power can reduce false positives and false negatives in assessing dominance. We then conclude with the overall results.

3.1. The pasta supply chain

24. The results for the "pasta'' product category in 2019 illustrate how using the SSBC indicator can reduce the likeliness of false positives. Figure 2 below represents the network of purchases from retailers to suppliers of that product in 2019. Green nodes correspond to suppliers and red nodes correspond to supermarkets. Links' width is proportional to the volume of net sales and nodes' size is proportional to the corresponding firm´s level of vertical market power calculated using the SSBC indicator. It should be noted that the number of paths passing through a node (N_x) is equal to the share of sales/purchases of the node (supplier/retailer). In other words, it represents the share of sales/purchases of the value chain that goes through a given supplier/retailer weighted by its volume measured in monetary terms.

Figure 1. Network of sales/purchases between Greek suppliers and supermarkets for the pasta product category in 2019



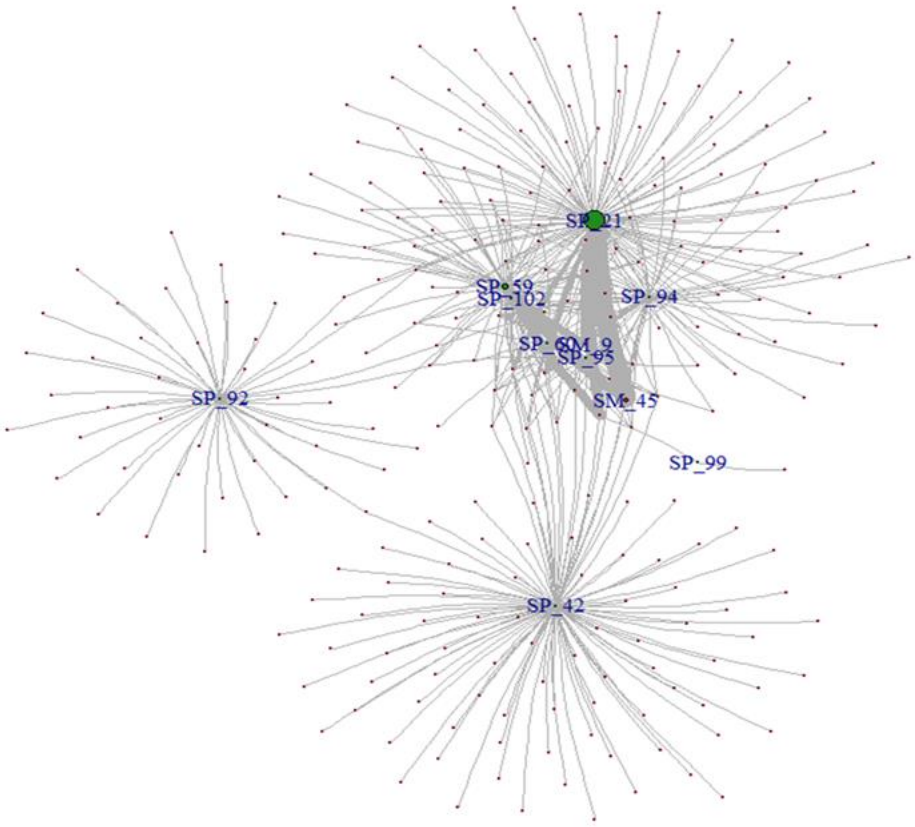
25. As Figure 1 shows, supplier 63 concentrates most (55%) of vertical power in the value chain. The second firm in terms of vertical power is supplier 1 with a SSBC indicator level of 21%. This contrasts with its market share of 36%, which would fall short of European Commission´s threshold of 40% to establish dominance[12]. The reason of this discrepancy between the two indicators lies in the fact that supplier 1's market share is highly concentrated in a single buyer: supermarket 45. The latter, in turn, divides its purchases more equally between suppliers 1 and 63. As a result, supplier 1 has less bargaining power than its market share would suggest. This example illustrates how using an indicator that translates relative dependency can diminish the likeliness of false positives when assessing dominance.

[12] European Commission, "Antitrust procedures in abuse of dominance (Article 102 TFEU cases)", https://ec.europa.eu/competition/antitrust/procedures_102_en.html.

3.2. The soft drinks supply chain

26. Inversely, the SSBC indicator can reduce false negatives. Let us illustrate it with another example from the Greek supermarket sector. Figure 2 below shows the network of purchases of soft drinks from supermarkets to suppliers in 2019. The same graphic interpretations and underlying calculations employed for Figure 1 apply.

Figure 2. Network of sales/purchases between Greek suppliers and supermarkets for the soft drinks product category in 2019



27. Supplier 21 concentrates most of the vertical market power with a SSBC indicator of 52%. However, its market share is 50% because the main buyers, supermarkets 45 and 9, are highly dependent on it to obtain their supply. Although slight, this discrepancy would have a considerable impact in the less interventionist courts of the United States, which have used a 50% threshold to establish dominance. A market share of 50% (49.82% to be precise) could have raised doubts regarding supplier 21's dominance in the eyes of these courts. However, if the SSBC indicator was to be used, even the less interventionist courts would conclude supplier 21 is dominant in the soft drinks wholesale market. As this example illustrates, using the SSBC indicator can reduce false negatives when assessing dominance.

28. Two relevant considerations regarding the application of the SSBC indicator should be pointed out. First, the thresholds to be employed are not necessarily the same ones as

those established by competition authorities in terms of market shares. While the two indicators (market share and SSBC) measure how much one side of the market (the buyer or the seller) depends on a particular firm, they do not measure the same thing. This is all the more so in cases which the indicator is not weighted by the volumes of sales. For example, the SSBC indicator could be used to assess firms' vertical power in terms of dependency on the use of a resource such as know-how, each shortest path representing a production process that requires the firm´s intervention within a value chain for the final product to be built. In that respect, the comparisons between market shares and SSBC we did for the supermarkets sector should be interpreted merely as illustrations of SSBC´s indicator potential to lower false negatives and false positives when assessing dominance within a value chain or ecosystem, an endeavor that would require empirically establishing thresholds that might differ from the current ones, which are based on market shares. Second, the SSBC indicator can be of particular relevance in the context of digital ecosystems, and notably those based on the monetization of data. It can be used to assess how much vertical power a firm has in terms of how much other firms depend on it for the data or their derivatives (e.g. predictions over preferences) to flow within an ecosystem. In a context in which digital ecosystems are under increasing scrutiny from antitrust agencies and regulators, there is a promising avenue for research in applying this indicator for ecosystems, as it is also acknowledged that in this context market shares are usually not indicative of firms´ power[13].

3.3. Supply-chain-level vertical market power for the 11 product categories

29. The Table below shows the results of this calculation for the 11 product categories for the period 2015-2019, using VHHI.

Table 1. Vertical market power (vertical HHI index) in the supply-chain-level for 11 product categories, 2015-2019

	Bread (toast)	Cereals	Pasta	Charcuterie – coldcuts	Yogurt etc	Feta cheese	Pulses	Coffee	Refreshments	Detergernts (powdered)	Toiletpaper
2015	6 185	2 791	3 321	2 299	1 990	5 647	6 856	6 996	6 320	2 791	1 929
2016	5 749	2 578	3 339	2 117	1 991	5 057	6 873	6 187	3 427	2 452	2 271
2017	5 229	2 417	3 302	2 232	1 642	2 466	6 656	5 921	4 446	3 868	1 909
2018	5 346	2 360	3 617	2 330	1 360	2 276	6 425	5 757	3 258	4 014	1 960
2019	5 454	2 464	3 720	2 053	1 396	2 191	6 248	5 803	5 764	6 231	2 152

Note: The color of the cells does not represent a specific threshold. However, it deceipts the supply chains where there is significant vertical purchasing power (in red) and those (in green) where there is limited vertical purchasing power, while the other colors (yellow and orange) represent cases of moderate bargaining power.
Source: Data collected by the HCC

30. The above table draws two important conclusions, apart from the distribution of vertical bargaining power in the market between suppliers and supermarkets in each of the supply chains. First, while some markets are characterised by relatively stable and low[14]

[13] M. Peitz, & T. Valletti, (2015). Reassessing competition concerns in electronic communications markets. *Telecommunications Policy*, *39*(10), 896-912. J. Krämer, & M. Wohlfarth, (2015). Regulating over-the-top service providers in two-sided content markets: Insights from the Economic Literature. *Communications & Strategies, 1(99), 71-90*. J. Prüfer & C. Schottmüller, (2019). Competing with Big Data (TILEC Discussion Paper No. 2017–006).

[14] The use of terms such as "low", "medium" or "high" is based solely on the comparison of the VHHI index of the above 11 product categories for the years 2015 to 2019.

levels of vertical bargaining power between 2015 and 2019 (i.e. breakfast cereals, cold cuts, yogurt and yogurt desserts and toilet paper), others (such as toast, pulses and coffee) are characterised by relatively high levels of vertical market power for the same (time) period. While, respectively, the pasta market consistently showed a medium-low level of vertical power in the market between 2015 and 2019.

31. Second, some markets show significant variations in the level of vertical market power during the above years (2015-2019). Thus, the feta cheese market showed a medium-high level of vertical purchasing power in 2015 and 2016; however, in 2017 it decreased by almost 50% to stabilize at a low level since then.Respectively, for the detergent powdered washing machine products, in 2017 the bargaining power in the market started to increase from low levels to achieve one of the highest prices in 2019. Finally, the soft drink industry showed a differentiation in the level of vertical bargaining power. Specifically, it started at a high level in 2015 and then the level alternates between significant increases and decreases from year to year. In 2019, it reached a rather high level.

32. The table below shows the two "central" companies as they result from the calculation of the (vertical) bargaining power in the supply chain of the 11, under investigation, product categories.

Table 2. Vertical market power distributed among central firms in the 11 aforementioned product categories

	Position and (Share) of vertical market power (SSBC)										
Supplier (SUPL)&Super Market (SM) / Product Category	Bread (toast)	Cereal	Pasta	Cold cuts	Yogurt etc	Feta cheese	Pulses	Coffee	Refreshments	Detergents	Toilet paper
SM_45				1 (25-35)%	1 (25-35)%			2 (15-25%)	2 (5-10%)		2 (15-25%)
SM_9	2 (10-15%)	2 (15-25%)					2 (5-10%)				
SUPL_1			2 (15-25%)								
SUPL_25						1 (35-45)%					
SUPL_12										2 (0-5%)	
SUPl_18								1 (75-85%)			
SUPL_20						2 (15-25%)					
SUPL_4									1 (75-85%)		
SUPL_78										1 (75-85%)	
SUPL_5		1 (35-45%)									
SUPL_52	1 (65-75%)										
SUPL_32							1 (75-85)%				
SUPL_63			1 (55-65%)								
SUPL_98											1 (35-45%)
SUPL_84				2 (25-35%)							
SUPL_85					2 (15-25%)						

33. The table above shows that the supply-chain-level vertical market power is far from being homogeneous across several product categories. Regarding the distribution of vertical market power between suppliers and supermarkets in each of the supply chains, it is observed that in most of the above product markets suppliers hold the first place (most) of the bargaining power in the market in each supply chain, with the exception of cold cuts and yogurt. This could be explained by the strong presence of private label products (especially in cold cuts [15-25]%) and the large dispersion of suppliers' market shares respectively in the second market (yogurt, etc.). It is also pointed out that the level of bargaining power in the supply chain market is highly correlated with the share of suppliers, as shown in the following detailed charts. This indicates, as mentioned above, that the asymmetries in bargaining power are explained by the presence of strong suppliers.

34. Furthermore, it is noted that some supermarkets are part of a supermarket group / chain or buying group / alliance. Each market group / alliance negotiates with suppliers the purchase prices for all its members. Therefore, buying groups / alliances are a means for some supermarkets to offset the bargaining power of suppliers in product markets.

4. Conclusion

35. In addition to te above analysis, the sector inquiry also undertook an econometric analysis of horizontal competition based on the data collected. The objective of the econometric analysis was to examine the interactions between companies operating supermarket chains and their suppliers in the formulation of supply conditions as a result of negotiations between them, which is linked to the supply price as a measure of bargaining power, mostly focusing on horizontal effects (horizontal competition) on specific markets.

36. Both empirical analyses attempted to approach the same issue from a different perspective. It is interesting that common conclusions were drawn. According to the results of the empirical analysis, supermarkets with a larger market share achieve improved bargaining conditions, i.e. a lower purchasing price.

37. In addition, in the context of the second econometric study undertaken, the ability of suppliers with a large market share to achieve better trading conditions was examined and confirmed in the half variants of the model where it was examined. Respectively, in the analysis based on the position/ centrality of a company in the value chain, it was found that suppliers that appear to play a central role in the purchase of products examined have a high market share (and most of them have strong brands).

38. By calculating the vertical power based on social network analysis, it emerged that the level of bargaining power is not homogeneous between the various product categories.

39. Regarding the distribution of vertical bargaining power in the market between suppliers and supermarkets in each of the supply chains, it is observed that in most of the above product markets the suppliers hold the first place (most) of the bargaining power in each supply chain, with the exception of pulses and toilet paper. This can be attributed to the strong presence of private label products in these markets. It is also noted that the level of bargaining power in the supply chain market is largely correlated with the share of suppliers, which suggests that asymmetries in bargaining power are explained by the presence of strong suppliers. These suppliers have strong / recognizable brands that may influence the purchasing power of supermarkets, despite the concentration of the industry having increased in recent years.

40. The analysis of the bargaining power based on the supply price demonstrates the role of a variety of factors in shaping the conditions achieved as a result of the negotiations between the companies operating supermarket chains and their suppliers. The majority of the variants of the model under consideration confirm the negative and statistically significant effect of quantity. An increase in the quantity supplied by supermarkets leads to an improvement in the terms they achieve, understood as a smaller net supply price. Negotiation terms appear to be further improved for supermarkets holding a larger market share, which further reduces the supply price, thus confirming most of the model's variations. Examining also the ability of suppliers with a large market share to influence supply terms confirms the expected improvement in negotiation terms for these suppliers in the half variants of the model under consideration.

41. With regard to private label products, it was found that an increase in quantity has a lesser effect on the net supply price, which applies to all variants of the model. In addition, examining the impact of alternatives on supermarket companies, using the number of suppliers per category and per supermarket, it was found that the expected negative effect of an increase in the number of suppliers in trading terms is confirmed in several variants of the model. On the contrary, the expected positive effect of an increase in the size of a supplier, estimated on the basis of the total value of his products, on the net supply price paid by a supermarket business was confirmed in only a few cases.

42. In conclusion, the concept of vertical market power includes a variety of components that are not easily directly measurable, and this analysis should be seen as a first effort to approach this complex issue.