PRODUCTIVITY AND EFFICIENCY IN GROCERY RETAIL

The
Institute
of Retail
Consumer
Goods (GR)

IELKA

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P. Sarantopoulos, L. Kioses, G. Doukidis

1. Introduction

Since the early introduction of organized retail formats for the distribution of goods to consumers, retail productivity and efficiency have become fields of great interest for industry practitioners and academics alike. In an early discussion of retail productivity Ingene (1982) argues that productivity gains are a vital feature for a higher standard of living in any developed society. The improvement of the performance of an individual sector, or the Greek economy in its entirety, is not an optional objective to attain. Especially under the context of the current economic situation, performance advances form a mandatory step for a prosperous economy and a sustainable society.

Retail trade constitutes a significant portion of the Greek economy, both in terms of value added and of employment. Research on how to assess and eventually improve the performance of retail sector and its respective firms is of great importance nowadays. Dubelaar *et al.* (2002) put an emphasis on the contribution of retail performance studies by relating those to the different levels of decision making. At the tactical level, for a multi-unit firm, control of management and network expansion decisions are processes that can utilize the information drawn from such performance studies. At the strategic level, retail productivity and efficiency insights can be used to differentiate firms in the long run (Ingene, 1982; Thomas *et al*., 1998; Donthu and Yoo, 1998; Dubelaar *et al.,* 2002). Finally, at an industry-level, retail productivity and efficiency studies have been broadly employed to assist in macroeconomic comparisons between retail sectors of different regions and countries (Reynolds *et al*., 2005; De Jorge, 2008 and 2010).

Though there are already various studies in place that address the issue of the performance of the Greek retail sector, Past studies do not touch upon the performance of the intermediary organizations operating in the Greek retail trade sector. Thus, no managerially useful insights can be extracted that can in turn be transformed onto meaningful inputs for a decision making process. Moreover, past studies on the retail sector of Greece, though providing suggestions for policy decision making, draw on conclusions without first evaluating the current position through rigorous academic inquiry and empirical investigation. There is a lack of scholarly research not only on the current performance of the Greek retail sector and its respective firms, but also on the determinant factors of retail performance. Only when this research gap is filled, will retail trade policy and managerial decisions be based on solid ground.

With respect to the existing scholarly literature, the fact that there is a proliferation of conceptual measures and empirical methods for capturing retail productivity and efficiency, has led to an incongruity among academics and makes the comparisons of different studies or the ability to provide normative conclusions difficult (Dubelaar *et al.,* 2002; Reynolds *et al.,* 2005; Higon *et al.,* 2010).

In this study an overview of the prevailing theories and hypothesis on the assessment of retail productivity and efficiency is provided. The major concepts and features of the existing literature are presented and discussed. In this way, a useful background can be established that can also serve as a context-setting stage for future empirical research on the productivity and efficiency of the retail trade sector of Greece and its participating organizations.

2. Definitions

Throughout the course of the literature of retail performance there has been a significant variation with respect to the concepts and research questions authors are concerned with. For the most part of the existing body of literature on productivity and efficiency, of not only retail trade but also the entire service sector, the terms of productivity and efficiency have been used interchangeably (Sellers and Mas, 2006). It is argued though, that such a use is unfortunate since these terms differ in both perspective and scope (Sellers and Mas, 2006) and require further clarification (De Jorge, 2008). Additional differences exist with respect the retail level of analysis authors are examining.

2.1. Productivity

The very conceptual definition of productivity makes reference to the notion of the mean productivity factor, i.e. the amount of output produced per unit of factor employed (De Jorge, 2008). By considering a single factor employed we calculate partial ratio productivity. Such an approach has been traditionally employed by academics, with labor productivity being the most widely used partial ratio productivity measure (Ingene, 1982). Similarly, by considering various factors for the production of output we conclude on total factor productivity (Bucklin, 1978; Good, 1984; Reynolds *et al.,* 2005). Though simple in its definition the process of capturing productivity with the aid of simple ratios of outputs to inputs has been widely criticized (Kamakura *et al.*, 1996).

Retail performance literature has been initially centered to the absolute measure of mean labor productivity for either the entire retail sector or some particular retail subsectors of the economy (Bucklin, 1978, Ingene, 1982; Good, 1984). Measurements of retail productivity are found appropriate when interested in assessing the aggregative performance of the entire retail sector, or some of its subsectors. In addition, productivity measurements can be employed for macroeconomic comparisons among the performance of different regions or countries. However, since significant differences in the structure, operating and regulatory environment exist among different areas, such comparisons should be conducted with ample caution (Dubelaar *et al.*, 2002; Reynolds *et al.*, 2005).

Subsequently, deriving from the measurement of retail productivity, the major concern of retail performance literature shifted to determining the factors, usually exogenous and uncontrollable, that affect retail productivity (Reardon *et al.*, 1996; Thomas *et al.*, 1998; Dubelaar *et al.*, 2002; Reynolds *et al.*, 2005). At that point in time, the interest also moved from assessing productivity at the retail sector level toward the level of the participating organizations (Dubelaar et al., 2002). Per capita income, population density and growth (Ingene, 1982; Kamakura *et al.*, 1996; Thomas *et al.*, 1998), (Ingene, 1982), age of the firm (Donthu and Yoo, 1996; Sellers and Mas, 2009), store density and management experience (Donthu and Yoo, 1996; Thomas *et al.*, 1998) are few of these factors.

2.2. Efficiency

A more recent tendency within the retail performance literature is the examination of how organizations that operate in the retail marketplace utilize their various resources to achieve their results, most of the times being financial (Sellers and Mas, 2006; Barros; 2006). This is captured by the concept of relative retail efficiency (Barros, 2006; Keh 2003, 2006), which can be articulated as the degree of productivity achievement by retail organizations. The efficiency assessment method has attracted substantial interest by researchers, due to its comparative nature and to practitioners, due to the managerial insights provided mostly for cost suppression.

Being slightly differentiated from the mean and absolute nature of productivity the conceptual definition of efficiency refers to the relationship between the resources used, i.e. input, and the transformation results obtained, i.e. output, from different decision making organizations (Donthu and Yoo, 1998; Barros, 2006). De Jorge (2008) suggests that the concept of efficiency is closely tied to the economic feature of opportunity cost. In specific, the concept of efficiency measures how well an organization employed its input resources to achieve its output results, as compared to its full potential. With the latter being associated with the possibility frontier of a production function in business economics. Efficiency measurements are comparative in nature and are centered to the relative to best rather than the average performance as done with absolute measures (Donthu and Yoo, 1998; Thomas *et al.*, 1998; Barros, 2006).

Efficiency measurements provide a relationship between resources, both controlled and uncontrolled by management, and results. Such measurements are better suited for comparing the performance of organizations rather than aggregative sectors. Such studies can fruitfully be used for benchmarking purposes that in term will lead to novel insights for management purposes. Table I, summarizes on the level of analysis and concepts found in retail performance literature.

Retail Level of Analysis	Aggregative/Sector		Organizational/Firm	
Retail Performance Focus	Productivity Measurement	Productivity Determinant Factors	Relative Efficiency	
Timeline	Early Studies ⟶		Recent Studies	

Table I. Level of analysis and concepts

3. Output and input variables

Despite the conceptual and practical differences between productivity and efficiency measurements, both approaches employ output as well as input variables in order to draw their conclusions. It is widely acknowledged, in the literature of both retail productivity and efficiency, that no issue is as controversial as the choice of output and input measures (Reardon *et al.,* 1996; Sellers and Mas, 2006). Perrigot and Barros (2008) argue that it is important for the applicability of any retail performance study that the measures of output as well as input are not only relevant to the objectives of each study but also adequately measureable.

3.1. Output measures

Reynolds *et al.,* (2005) argue that the concept of output lies at the very heart of any productivity analysis. In service industries such as retail trade there are endogenous difficulties in measuring output. Sellers and Mas (2006) suggest that the main problems derive from the lack of consensus on the conceptualization and measurement of retail output. The various types of output and the service element, which is impossible to disentangle in retail offerings, are discussed in both Ingene (1982) and Reynolds *et al.,* (2005). Based on Betancourt and Gautsi (1988) who classify retail services in accessibility, assortment, assurance, information and ambience, Keh and Chu (2003) define the output of a retail firm as a set of explicitly priced market goods accompanied by the previous distribution services that are implicitly priced.

Physical measures, such as number of transactions performed and physical units sold though proposed in literature, do not attract much attention mostly due to the practical implications associated as well as their failure to include the service element of retail offerings (Ingene, 1982). Monetary measures, in contrast, have received much attention in retail productivity and efficiency literature. Mostafa (2010) defines a retailer as a firm that employs resources to achieve its objectives, which are financial in nature, such as profit and revenue as well as the retailer's market value (if publically traded). In addition, Keh et al. (2006), in line with Gronroos and Ojasalo (2004), suggest that financial measures, such as sales, are the only ones that have the ability to incorporate the quality variations caused by the heterogeneity of services and the effects on perceived quality by customer participation in the service process. Finally, Donthu and Yoo (1998) suggest that pure behavioral measures, which are related to the quality of

service offered by retail organizations, are good indicators of the capability of retailers to generate retail outcomes and can be used as a proxy for financial performance. Table II aggregates the various output measures found in retail performance literature.

Variable Type	Variable	Reference
Monetary	Value added	Reardon *et al.* (1996) Barros (2006)
	Turnover (Sales)	Kamakura *et al*. (1996) Donthu and Yoo (1998) Thomas *et al*. (1998) Barros (2006) De Jorge (2008), (2010) Dubelaar *et al*. (2002) Keh *et al*. (2006) Mostafa (2009), (2010ab) Perrigot and Barros (2008) Sellers and Mas (2006), (2009)
	Gross margin	Dubelaar *et al*. (2002)
	Market value	Mostafa (2009), (2010)
	Earnings per share	Mostafa (2009), (2010)
	Expenses	Keh *et al*. (2006)
	Profit	Thomas *et al*. (1998) Sellers and Mas (2006)
	Operational results	Barros (2006); De Jorge (2010)
Customer-based	Customer satisfaction	Donthu and Yoo (1998)

Table II. Output Variables

3.2. Input measures

In contrast with the selection of adequate output measures, the difficulty in the selection of satisfactory input measures is associated with technical and operative but not with conceptual problems (Sellers and Mas, 2006). A first level of classification of the factors used to produce retail offerings is the distinction between managerially controllable and managerially uncontrollable factors (Dubelaar et al., 2002; Sellers and Mas, 2006). Controllable factors, are resources available at company management such labor (number of employees, cost of labor) and capital invested (size of stores, retail formats, use of ICT tools). In addition, inventory levels (Sellers and Mas, 2006) as well as investments in information technology (Reardon *et al.,* 1996) should not be excluded from retail performance studies given the importance of supply chain and general merchandizing retail operations. Reynolds et al., (2005) specifically argue on the problems arising from the use of labor as the sole input in retail productivity studies, with the composition of employment in retail trade (many part-time and seasoned employees) and the timing of the data on an aggregative level being their major concern. Uncontrollable factors, such as differences in demand and completion faced by different retailers (Dubelaar *et al.,* 2002) or environmental conditions (Thomas *et al.* 1998), may be argued that have not been adequately incorporated in literature.

Similarly with the discussion over output measures, researchers tend to rely on either physical or monetary measures of retail inputs (Reardon *et al.,* 1996). The lack of ability to quantify information technology adequately and the tendency to treat each unit of a factor as homogeneous, when is not has been the major critique on physical input measures (Ingene, 1982; Reardon *et al.,* 1996). Monetary input measures have been mostly employed in past literature to assist in describing the factors that are utilized to produce retail service offerings.

According to Reardon *et al.,* (1996) monetary measures of all the productivity determinant factors possess the advantage of implicitly including a market value to adjust for differences between units of a single variable. Table III present the various input measures found in retail performance literature.

Resource	Variable Type	Variable	Reference
Labor	**Monetary**	Payroll	Reardon *et al*. (1996) Thomas *et al.* (1998) Mostafa (2009), (2010ab) De Jorge (2010)
		Promotion/give-away expenses	Donthu and Yoo (1998)
		Average wage level per employee	Sellers and Mas (2006)
	Physical	Number of full-time equivalent employees	Reardon *et al*. (1996)
		Number of man-hours allocated	Kamakura *et al*. (1996)
		Full-time employees per square foot	Thomas *et al.* (1998)
		Full-time to part-time employees	Thomas *et al. (*1998)
		Store manager experience within the firm	Donthu and Yoo (1998)
		Number of employees	Barros (2006) De Jorge (2008), (2010) Dubelaar *et al.* (2002) Perrigot and Barros (2008)
		Number of part-time employees	Dubelaar *et al*. (2002)
		Number of management employees	Dubelaar *et al*. (2002)
Capital	**Monetary**	Rent costs	Reardon *et al*. (1996) Thomas *et al.* (1998)
		Operating Expenses	Thomas et al. (1998)
		Marketing expenses	Keh *et al.* (2006)
		Total expenses	Keh *et al.* (2006)
		Investments on assets	Dubelaar et al. (2002)
		Value of assets	Barros (2006) Dubelaar *et al.* (2002) Sellers and Mas (2006) Perrigot and Barros (2008) De Jorge (2010)
		Inventory	De Jorge (2010)
	Physical	Selling space	Kamakura *et al.* (1996) Donthu and Yoo (1998) De Jorge (2008) Dubelaar *et al.* (2002)

Table III. Input Variables

Resource	Variable Type	Variable	Reference
ICT	**Monetary**	Investments in ICT	Reardon *et al.* (1996)
	Physical	Nr of UPC scanner	Reardon *et al.* (1996)
		Nr of electronic cash registers	Reardon *et al.* (1996)
		Nr of credit card approval devises	Reardon *et al.* (1996)
		Nr of fax machines	Reardon *et al.* (1996)
		Nr of barcode printers	Reardon *et al.* (1996)
		Nr of computer terminals	Reardon *et al.* (1996)
		Nr of laptop computers	Reardon *et al.* (1996)
		Nr of personal or desktop computers	Reardon *et al.* (1996)
		Nr of computer printers	Reardon *et al.* (1996)
		Nr of custom software programs	Reardon *et al.* (1996)
		Nr of electronic check approval devices	Reardon *et al.* (1996)
		Dummy variable for email system	Reardon *et al.* (1996)
		Dummy variable for POS system	Reardon *et al.* (1996)
		Dummy variable for MIS system	Reardon *et al.* (1996)
		Dummy variable for accounting system	Reardon *et al.* (1996)
		Dummy variable for EDI system	Reardon *et al.* (1996)
		Dummy variable for QR	Reardon *et al.* (1996)
		Dummy variable for inventory tracking	Reardon *et al.* (1996)
		Dummy variable for buying ordering	Reardon *et al.* (1996)
Environment	**Dummy**	Store location (within a mall or not)	Donthu and Yoo (1998)
	Qualitative	Economic Growth Potential in the area	Dubelaar *et al.* (2002)
		Population per store in market	Dubelaar et al. (2002)
		Nr of Households	Thomas et al. (1998)
		Household income	Thomas et al. (1998)
		Distance to the nearest competitor	Thomas et al. (1998)
		General consumer demand conditions	Thomas et al. (1998)
Experience	**Physical**	Age of the firm/ store	Thomas *et al.* (1998) Sellers and Mas (2009)
		Employee tenure	Thomas *et al.* (1998)
		Store manager tenure	Thomas *et al.* (1998)

Table III. (Continued)

4. Other retail performance concepts

The time variable in the sense of static or dynamic, seen as snapshot or continuous, seems to be an important discrimination criterion among different retail performance studies. Many authors also disagree on the relationship that exists at different scale levels among input to output variables.

4.1. Time framework

Retail performance studies of both productivity and efficiency scope can be examined at a moment in time or in terms of their rate of change over time (Ingene, 1982). Both approaches provide useful

insights. The examination of productivity or efficiency at a given point in time assesses the impact of market factors on productivity (Keh and Chu, 2003). Cross-sectional analyses can assist in comparisons among retail sectors of different countries (Reynolds *et al.*, 2005) or regions that could face different degrees of regulation (De Jorge, 2008; 2010), levels of technology or cultural-societal setting. Alternatively, examining the growth (or decline) of retail productivity or efficiency longitudinally helps in assessing policy decisions on aggregative retail level. Longitudinal studies provide also insights for the evaluation of management decisions made by retail organizations. Finally, panel data set may be constructed from pooled observations of both cross-sectional and longitudinal sets. Such pooled analysis can also be used to determine overall productivity change, which could be measured as a shift of retail performance over time (Donthou and Yoo, 1998). Such analyses allow for a direct comparison of each comparative unit over time (Donthu and Yoo, 1998; De Jorge, 2008).

4.2. Returns to scale

The process of converting resources to results, described in economics as a firm's production function, is associated with the concept of return to scale. Returns to scale refers to changes in output resulting from a proportional change in all inputs. Increasing returns on scale exist when an increase in all inputs increases output more than proportionately (Ingene, 1982). Similarly we can define decreasing and constant return to scale based on the level of output increase by taking the input increase as the comparative basis. A firm's production function could exhibit different types of returns to scale in different ranges of output. Typically, there could be increasing returns at relatively low output levels, decreasing returns at relatively high output levels, and constant returns at one output level between those ranges (Ingene, 1982; Fare, 1984). Figure I. provides an illustration of the returns to scale relationship between a bundle of inputs and a bundle of outputs.
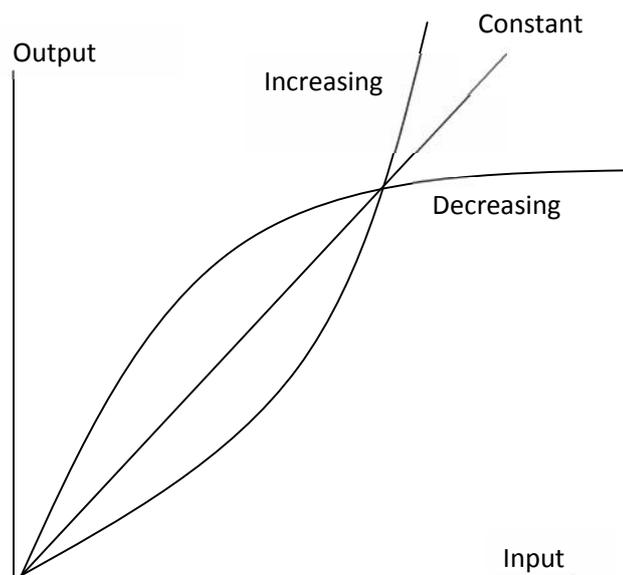

Figure I. Returns to scale

At earlier stages of retail performance literature the assumption on constant returns to scale was prevailing. Long-term retail industry equilibrium was used as justification in aggregative studies (Ingene; 1982), while similarity in store sizes advocated constant return on scale for firm level studies (Thomas *et al*., 1998; De Jorge, 2008). The variable returns to scale hypothesis has been mostly utilized to capture the variances among retail organizations that have significant differences in size and thus exhibit a different scale pattern in their respective production functions (Barros, 2006; Mostafa, 2010). The case that a retail firm or outlet experiences decreasing return to scale means that is too large in size to take full advantage of scale. Similarly when a retailer experiences increasing return to scale, the retailer is too small in size to take full advantage of scale (Perrigot and Barros, 2008).

5. Methodological approaches

The major scientific methods in the retail productivity and efficiency at the micro-level literature are the random or stochastic frontier model (SFM) and data envelopment analysis (DEA). The latter being a non-parametric approach, i.e. does not rely on the assumption that the data belong to any particular distribution, while the former being a parametric approach, i.e. assumes the observed data have been derived from a type of probability distribution and makes inferences about the parameters of the distribution. Both approaches compete for conducting retail empirical investigations, with DEA being adopted more widely than econometric frontier models. Both approaches allow the use of multiple inputs and outputs in the measurement of performance, making them more suitable approaches in the retail context than traditional ratios (Kamakura *et al*., 1996; Assaf *et al*., 2011). Gong and Sickles (1992) suggest that neither technique uniformly dominates the other and that both equally contain advantageous and disadvantageous features.

5.1. Stochastic frontier models

A common approach to the assessment of productivity and production efficiency, of not only the retail sector, is the econometric modeling of the dual of the production frontier (Kamakura *et al*., 1996). In this way, the frontier is estimated stochastically and the difference between the inefficient units and the frontier by the residuals is measured. This is an intuitive approach based on traditional regression and econometrics (Barros and Sellers, 2008). A popular model for the estimation of this stochastic frontier is the translog cost function proposed by Christensen and Greene (1976), which is a generalization of the dual of the Cobb-Douglas production function. A translog or transcendental function is a function that does not satisfy a polynomial equation, and whose coefficients are themselves polynomials, in contrast to an algebraic function, which does satisfy such an equation (Townsend, 2009). Assaf *et al*., (2011) suggested the use of the Bayesian over the maximum likelihood methodology traditionally used to estimate stochastic frontiers. Assaf *et al*., (2011) argue that prior information about parameters in inferences and the drawing of the results in the form of probability density functions allows for better probability statements about the model parameters.

There are several assumptions that are traditionally connected with production functions and their cost duals used in stochastic frontier approaches. Economic theory of the firm assumes the production of homogeneous commodities. Moreover, the hypothesis that retail firms have access to the same technology must hold. Theory of the firm also accepts that managers are rationally seeking profit maximization and that information is free and equally available. The rationale of retail managers seeking to maximize profit seems to be the least debatable assumption since retail firms operate in competitive markets. Regarding the homogeneity of retail production Reardon *et al*., (1996) recommend that if retail output is measured in a monetary fashion, heterogeneity of retail output is cancelled. With respect to the access of the very same technology and information for retail firms, Reardon *et al*., (1996) argue that such assumptions restrict the use of econometric parametric functions to cross-sectional data samples in a single market and in a single period.

Among the advantages of stochastic parametric approaches over their deterministic non-parametric peers, such as data envelopment analysis, is that stochastic parametric frontier models allow for the estimation of efficiency and the determinant factors at the same time (Sellers and Mas, 2009). In addition the stochastic elements of parametric frontier models allow some observations to lie above the production function and account for measurement error and other random factors such as luck (Coelli *et al*., 1998; Sellers and Mas, 2009).

5.2. Data envelopment analysis

Data envelopment analysis is an operations research method for measuring the performance efficiency of decision making units (DMUs) which are characterized, as with the stochastic frontier methods, by multiple inputs and outputs. Charnes *et al*., (1978) were the first to introduce the DEA methodology as an evaluation tool for decision units and as such DEA is particularly useful as a benchmark tool.

DEA computes the relative performance efficiency by employing the best performing DMUs as the basis for comparison. Performance in the context of DEA deals with producing the maximum quantity of outputs for any given amount of inputs (output-oriented) or producing a given set of outputs with the minimum use of inputs (input-oriented). The efficiency computed by DEA assumes that Pareto optimality exist, i.e. that 100% of efficiency is attained for a DMU only when i) none of the outputs can be increased without either increasing one or more inputs or decreasing some of its outputs and ii) none of the inputs can be decreased without decreasing some of its outputs or increasing some of its other inputs. In a retail context, 100% efficiency is defined to have been attained by a retail decision making unit, e.g. an outlet or an entire firm, only when comparisons with other outlets do not provide evidence of inefficiency in the use of any inputs and in creation of any outputs.

The first task of DEA is to find the most efficient units, which form the efficient frontier, analogous to isoquants of microeconomic production functions (Donthu and Yoo, 1998). DMUs lying on the efficient frontier are given an arbitrary efficiency score of one. Units whose efficiency is less than one are positioned inside the frontier (enveloped). Figure II provides an illustrative example for the simplistic case of a two dimensional performance analysis, i.e. one output and one input. A, B, C, D and E are

efficient and lie on the frontier. Units F and G are inefficient, and thus, enveloped by the rest. Unit F may choose to move toward D in an output orientation, or may choose to move toward C, in an input orientation.
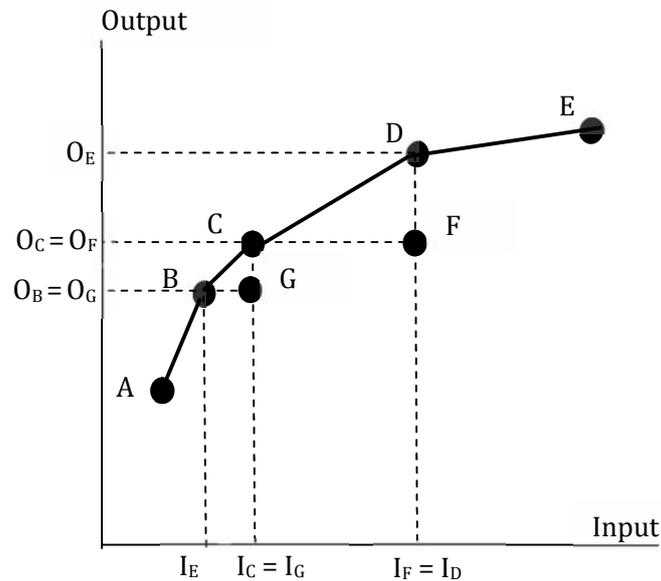

Figure II. DEA illustrative example

Efficiency itself is defined as the ratio of the weighted sum of outputs to the weighted sum of inputs. In the DEA process, the weights are estimated separately for each unit such as its efficiency is the maximum attainable. In output-oriented DEA, the efficiency of any DMU is computed as the maximum of a ratio of weighted outputs to weighted inputs, subject to the condition that similar ratios, using the same weights, for all the DMUs under consideration are than or equal to one.

The maximum efficiency, h_o, for DMU o is:

$$\text{Max } h_o = \frac{\sum_{r=1}^{s} U_r Y_{ro}}{\sum_{i=1}^{m} V_i X_{io}}$$

$$\text{subject to } \frac{\sum_{r=1}^{s} U_r Y_{rj}}{\sum_{i=1}^{m} V_i X_{ij}} \leq 1 \text{ for all } j=1,\dots,n$$

$$U_r, V_i > 0; \; r = 1, \dots, s; \; i = 1, \dots, m;$$

where U_r, V_i are the respective weights for output variable *r* and input variable *i*, Y_{rj} and X_{ij} are the rth output and i^{th} input observations for the jth DMU. The above formulation has *s* output variable and *m* input variables and *n* DMUs. In practice the above formulation is first linearized and then solved using the methods of linear programming. The dual of the linear program is usually estimated as it is much easier to solve (Donthu and Yoo, 1998).

The most cited advantage of DEA is, as mentioned before, the fact that it does not require an explicit specification of the functional form of the production function, prior specification of the weights, or the ordinal scaling analysis often required with parametric approaches (Thomas *et al*., 1998), thus, it can be characterized as a data oriented approach (Donthu and Yoo, 1998). DEA focuses on efficient frontiers rather than central tendencies, as is done in least-squares regression, as transcendental functions. Instead of fitting a regression pane through the center of a data set, DEA constructs a piecewise linear surface that interpolates between the most efficient observations (Thomas *et al*., 1998). An additional advantage of DEA over regression methods is the fact that DEA optimizes on each individual DMU in relation to the performance of all other units. In comparison regression methods perform a single optimization and obtain the average relationship across the entire data set. Regression analysis estimates just one set weights of for all DMUs (Barros, 2006).

Among the weaknesses of DEA are the assumption of complete substitutability of inputs and outputs (Thomas *et al*., 1998), and the requirement that the data set is non-negative for all outputs and strictly positive for all inputs (Mostafa, 2009). The sensitivity of DEA to outliers also consists of a substantial drawback (Kamakura *et al*., 1996). A single DMU operating in unusual circumstances may render all other DMUs inefficient or efficient. The outlier example highlights the fact that DEA, as deterministic in nature, suffers from statistical limitations, such as providing fit statistics such as r-square and p-value that can be used for statistical inferences (Donthu and Yoo, 1998; Assaf et al., 2011).

6. Empirical Studies

There has been a proliferation of empirical investigations in the retail performance literature. At the very heart of all studies lies the idea of benchmarking, i.e. to systematically and continuously monitor the performance of industries or organizations against those that have attained peak or world class performance. In this way strategic insights can be learned and processes may be incorporated that have been proven successful (Bagchi, 1996). Though the differences in the structure, operating and regulatory environment for retailing questions the validity of comparisons of economic retail sectors of different countries (Reynolds *et al*., 2005); firm level judgments are found promising (Sellers and Mas, 2006; De Jorge, 2008). Best practices may internally be found among units, such as outlets, that belong to the same organization. Similarly performance leadership may externally be identified in outlets, or entire retail chains, of direct competitors. Finally, benchmarking can go beyond competition, when searching for functional leadership at units of other retail sectors (Spendolini, 1992). Figure II abstracts the various types of benchmarking processes.
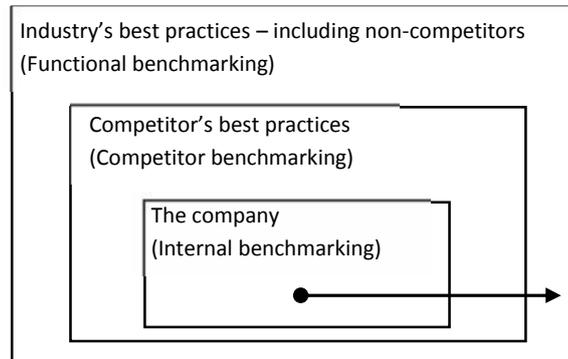
Figure III. Types of benchmarking

Comparative approaches overcome the drawbacks of simple productivity ratios (Kamakura *et al*., 1996). Though simple to define, these ratios fail to account for changes in the quality of inputs and outputs over both time and regions (Good, 1984). Productivity ratio approaches are found incompetent to separate differences in productivity from scale effects (Keh and Chu, 2003; Perrigot and Barros; 2008). In addition, productivity ratios often improperly weight multiple inputs and outputs (Kamakura *et al.,* 1996). Finally, comparative approaches can overcome the before and at the same time may be set on a cross-sectional, longitudinal or panel data framework each providing useful insights both management and policy decisions. Table IV classifies the empirical studies examined with respect to both their benchmarking focus and their time framework.

	Internal	Competitor (cross-firm, one retail sector)	Functional
Cross-sectional	Thomas *et al.*, (1998)	Dubelaar et al., (2002) De Jorge, (2008)	Mostafa, (2009) (2010ab) Reardon et al, (1996)
Panel Data	Kamakura *et al.*, (1996) Donthu and Yoo, (1998) Barros and Alves, (2004) Keh and Chu, (2003) Keh *et al.*, (2006)	Barros, (2006) Seller and Mas (2006) Barros and Sellers, (2008) De Jorge, (2008) Seller and Mas (2009)	Perrigot and Barros, (2008) De Jorge, (2010)

Table IV. Benchmark focus of retail performance empirical studies

Reference	Data set	Methodology	Other methods
Internal benchmarking studies			
Thomas *et al*. (1998)	520 outlets of a US multi-retailer chain	DEA (output oriented)	Assurance regions MANOVA
Kamakura *et al*. (1996)	188 outlets of a Latin American commercial bank	Translog cost function	Clusterwise approach
Donthu and Yoo (1998)	24 outlets of a US restaurant chain (US)	DEA (output oriented)	Linear regressions Sensitivity analysis
Barros and Alves (2004)	47 outlets of a Portuguese grocery retail chain	DEA (output oriented)	Malmquist productivity index
Keh and Chu (2003)	13 outlets of US grocery retail chain	DEA (both output and input)	Three stage approach Spearman correlation
Keh and Chu (2006)	49 outlets of Asian-Pacific hotel chain	DEA (both output and input)	Three stage approach Spearman correlation
Competitor benchmarking studies			
Dubelaar et al. (2002)	800 Australian and New Zealanders pharmacy stores	Structural Equation Modeling	-
Barros (2006)	22 Portuguese hypermarket and supermarket chains	DEA (output oriented)	Bootstrapped Tobit regression
Sellers and Mas (2006)	100 Spanish grocery retail chains	DEA (output oriented)	Spearman correlation
Barros and Sellers (2008)	78 Spanish grocery retail chains	Stochastic parametric function	-
De Jorge (2008)	234 Spanish hypermarket stores of 4 chains	DEA (input oriented)	Two stage approach Hypothesis testing
Sellers and Mas (2009)	42 Spanish supermarket chains	Stochastic parametric function	-
Functional benchmarking studies			
Mostafa (2008), (2010ab)	45 US generalist retailers	DEA (output oriented)	Isotonicity test Spearman correlation Jackknifing Sensitivity analysis Pearson correlation
Reardon *et al*., (1996)	600 US outlets of various retail sectors	Translog production function	-
Perrigot and Barros (2008)	11 French generalist retail chains	DEA (output oriented)	Two stage approach Bootstrapped Tobit regression
De Jorge (2010)	1323 non-specialized retailers from 6 European countries	DEA (input oriented)	Two stage approach Hypothesis testing Malmquist productivity index Kruskal Wallis test

Table V. (Retail benchmarking studies)

7. Regulation and Retail Performance

Retail academics and practitioners alike concede that strict government regulation impedes competition, and as a result, hinders economic performance. There has been a proliferation of publications stressing the negative impact that government regulation has on retail productivity. While the operating inefficiency of the value chain participants, i.e., wholesale and retail firms, counts for a large portion of the productivity performance gap between Greek and the EU15 average retail industries, the largest share of this gap is attributed to the impact of various regulations that exist in retailing. Having in mind that operating inefficiency is rather a question of, more or less, managerial decisions and can be tackled by urging both wholesale and retail firms to utilize their resources more efficiently to produce their results , the rest of the drivers that seem to impact retail productivity are attributed to factors exogenous to the firms. Both format mix and informality drivers are linked to regulatory forces that firms have little if any power on.

7.1. Retail Regulatory Framework

Despite its competitive nature, due to the large number of firms and high entry and exit rates, retail distribution is often subject to numerous regulations. Boylaud and Nicoletti (2001) proposed a framework that categories retail regulations into regulations related to market access and regulations related to retail business operations (Figure IV).

Market access restrictions:
- entry formalities (trade register);
- regulations on the establishment;
- extension and location of commercial premises;
- regulations on specific operations and products;
- the existence of local monopolies in some products;
- legal impediments to the establishment of large outlets

Business operations regulations:
- regulations on opening hours;
- price controls;
- regulations on promotional activities

Figure IV: Retail regulatory framework

With a large number of entries and exits, the retail distribution sector is, in most cases, a sector in which there are few regulations on entry. However, registration in the trade register is a common requirement for operating a business. This requirement may lead to administrative delays before being able to start a business. In addition, regulations concerning real estate and zoning are considered among the greatest barriers to the development of retail services. Moreover, licenses limit the range of goods that can be sold in a retail outlet. It is self-explanatory that the more permits required, the greater the risk of restricting competition by increasing the cost of formalities for new entrants in the market. Finally, it is acknowledged that the main restrictions on market entry in the commercial distribution sector (wholesaling and retailing) are linked to regulation of large stores. The concerns that government officials have on large stores are centered on urban planning policies as well as on private car usage and the associated environmental impacts. There are cases, however, when the protection of small shops from competition is the goal. On the other hand, restrictions on large-scale outlets slow down consolidation and modernization of the sector and hinder efficiency gains from the exploitation of scale and scope economies. Lastly, restrictions on the establishment of new outlets may impede the positive spillover of large commercial centers on "fringe" stores.

The main restrictions affecting operations in the retail sector are on shop opening hours and the freedom to set prices. The deliberation of opening hours is believed to be related to increased flexibility and consumer welfare. In addition, employment is believed to be increased. Gains are also expected mainly from cost efficiency improvements in large outlets due to a better exploitation of economies of scale, an enlargement of product mix and a lowering of product and labor market trends. Price controls are generally concerned with a few retail products, such as pharmaceuticals, tobacco and petrol. Finally, regulation of promotional activities, on the other hand, is frequent. These regulations are justified by considerations relating to consumer protection and measures to counter unfair practices, and need to be set alongside the development of regulations relating to product safety and hygiene, labeling and quality standards.

7.2. Retail Regulation Indicators

In an attempt to assess the magnitude of government regulations in a simple and concise manner, Conway and Nicoletti (2006) introduce the Product Market Regulation (PMR) indicators and tailor them to the non-manufacturing sectors of OECD countries, among them being retail distribution. PMR indicators are used to describe patterns of sectorial regulation and their impact on performance. To the extent that non-manufacturing regulation indicators capture the impact of policies on product market competition, they are a useful tool for testing the consequences of weakly competitive markets for employment, investment, productivity and growth.

The indicators are calculated using a bottom-up approach in which the regulatory data are quantified using an appropriate algorithm and then aggregated into retail summary indicators. The indicators by being objective in nature, measure explicit policy settings and formal government regulations and are only able to capture differences in the enforcement of regulation among different regions or countries.

The PMR indicator for retail distribution proposed by Conway and Nicoletti (2006), in line with Boyland and Nicoletti (2001), consists of entry level regulations, which cover provisions that either raise the cost of accessing retail markets or create explicit barriers for certain types of outlets, and conduct (business operations) regulations, which cover provisions that restrict entrepreneurial choices concerning inputs, supply or pricing (Figure V).

Converting the regulatory data into sectorial indicators of product market regulation involves coding, weighting and aggregation along the pyramidal structure of the indicator system. In the coding phase, qualitative as well as quantitative information in normalized over a scale of 0 to 6. Subsequently, lower level indicators are aggregated to intermediate level indicators by assign a weight in each individual regulatory item. Weights are assigned by running a principal component analysis. After constructing the product market regulation indicators for retail distribution Conway and Nicoletti, (2006) argue that there are large differences in the indicator of retail distribution across OECD countries, suggesting very different policy approaches in this sector. In addition, Conway and Nicoletti, (2006) suggest that there is little change in the cross-country variation of retail regulation between the periods studies, implying little evidence of policy convergence. More specifically, Greece is identified as a relatively strict market in the first period studied (1998) that become slightly stricter in the final period under examination (2003).
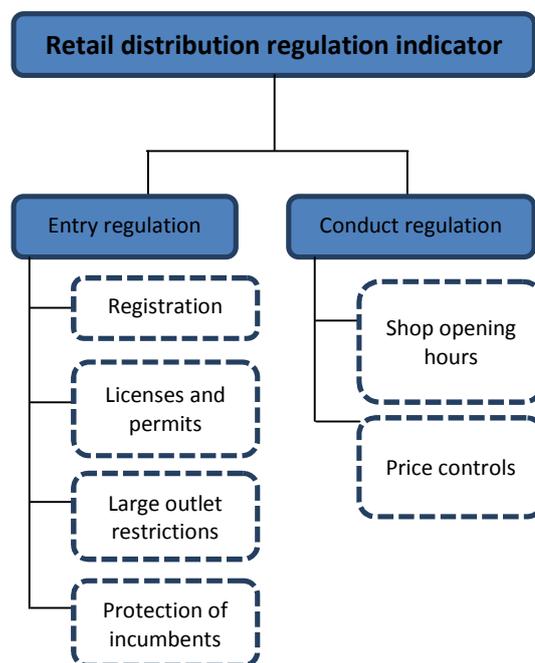

Figure V: The structure of the retail distribution regulation indicator

7.3. Regulation and Multifactor Productivity

It is widely acknowledged that improvements in multifactor productivity (MFP) play a crucial role in the process of economic growth. Cross-country evidence suggests that countries that have extensively reformed their product markets (as measured by the indicators of regulation presented in the previous section) have also experienced an acceleration of MFP growth over the past years. By following an econometric specification of industry-level production functions Nicoletti and Scarpetta (2003) found that various measures of anticompetitive product market regulations significantly curb productivity performance at the industry level. Nicoletti and Scarpetta (2005) similarly argue that by increasing competitive pressures, regulatory reform will promote productivity in each individual industry, regarding to its position with respect to the technology frontier. Finally, Nicoletti and Scarpetta (2005) go forth to suggest that a product market reform that would align industry-specific regulations with those of the most liberal OECD country is estimated to reduce the MFP gap in relation to the leading country by 10%, in the long run, in high gap countries such as Greece, and by 4 to 6 percentage points in several other continental European countries.

7.4. Empirical Studies on Retail Regulation and Performance

Motivated by the relative low productivity growth, high prices and the concentrated market structure of the UK retail sector, Griffith and Harmgart (2008) evaluates the impact of land use regulation on entry into the UK grocery retail industry. The 1996 change in planning regulations in the UK made it much harder for retailers to build large out-of-town stores. UK supermarkets developed and took over inner town small shops (Figure VI). Hence, land use regulation is believed to be one of the root causes of the poor performance of the UK retail sector.
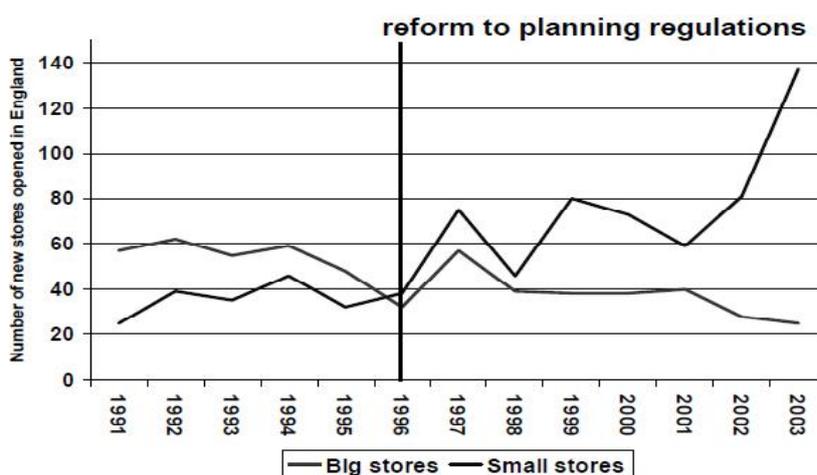

Figure VI: Number of new stores opened by big four UK supermarket chains
(Adsa, Sainsbury, Safeway and Tesco)

Store-level data on the opening of new retail stores from the UK institute of Grocery Distribution were used together with individual-level food prices to estimate the price effects of regulation via competition. Griffith and Harmgart (2008) estimate a change in market structure due to lifting all planning regulations. A general equilibrium model, predicting the probability of having zero, one, two etc. stores in a market, separately for large and small stores is utilized. Moreover, a model linking the price at supermarkets with the local market presence of single supermarket, duopoly, etc. is estimated. The effects on prices are simulated upon a relaxation in planning regulations via the increase in the probability of a local consumer facing more supermarkets. Finally, the change in market structure due to the lifting of all planning regulations is assessed. Among the findings of the analysis Griffith and Harmgart (2008) perform is that controlling for other effects, if more planning regulations had been approved, the resulting market equilibrium would have had more stores, with their strongest, in significance, marginal effects resulting in more large stores. A change in market structure due to lifting of all planning regulations would have been that more large stores would open. A positive relation is evident between denying planning applications and the probability of having local market structures with fewer large stores.

Similarly motivated as in Griffith and Harmgart (2008), Haskel and Sadun (2009) examine to what extent planning regulation is responsible for the poor performance of UK retailing. More specifically, Haskel and Sadun (2009) investigate whether the shift towards smaller stores can explain the poor productivity performance of the UK retail sector over the 2000s.

Haskel and Sadun (2009) assume that the average store size is linked to productivity due to economies of scale, as the trend to smaller stores would lower measured productivity levels and retard growth. In addition, the authors assume that the average store size is linked to productivity due to economies of scope, as the organizational capital is not perfectly substitutable between stores of different sizes. A Cobb-Douglas firm level production function is specified econometrically by using data at the store and firm level from the UK Office of National Statistics business surveys. The coefficients of both an ordinary least square (OLS) and an OLS with fixed effects regression of (gross) output on the standard input (capital, labor and material) are then interpreted. The regression results suggest that, controlling for overall firm size, fixed effects and standard inputs; within-firm store sizes have a statistically significant association with firm productivity. Firms with smaller within-firm store sizes (measured either as median size or fraction of small firms) are associated with lower productivity. Moreover, there is a consistent and statistically significant association between firm-level MFP for multi-store chains and various measures of sizes and size distribution of the stores within the chain, especially in the supermarket segment. Firm-level MFP is positively related with the (log) of median size of within-chain shops, in addition, firm-level MFP is negatively related with the fraction of shops within the chain that are small.

8. Conclusion

The retail performance literature is characterized by an abundance of theoretical and empirical concepts suitable for both management and policy insights. Some of the major contributions of the research to date are the definitions of the productivity and efficiency performance concepts. In addition, the various variables employed to construct and measure performance in retailing are extensively discussed.

There is a clear need for well-founded empirical investigations of the Greek retail sector and its firms. Present studies, though aim at the retail performance improvement, and contain methodological flaws. These flaws are mostly attributed to the simplistic, single-variable, perspective of labor productivity followed. A research gap stands between the policy suggestions present studies offer, based on the productivity ratio approach, and the more sophisticated holistic mindset thoroughly examined in retail sectors and firms others than of Greece. Further research is necessary in order to be able to properly evaluate the current position of Greek retailing. Clearly, this research ought to be scientifically rigorous if to be used to sustain management and policy decisions. The rigorousness needed can be achieved with the analysis of empirical data, as part missing from present studies. A longitudinal investigation of the way Greek retail firms convert their monetary resources to produce monetary results will provide useful information with respect to the impact the macroeconomic turbulence had on Greek retail firms and how these can cope with the pressure austerity measures cause to the available for consumption income. In addition, cross-sectional comparisons of monetary data from major players of the Greek retail sector and their foreign counterparts will assist in the best-class practices identification on a global scale.

Regulatory forces inhibiting competition are found to be also affecting negatively the performance of the retail distribution sector. With market structure (through format mix) and market competition counting for more than half the productivity gap between the retail distribution sectors of Greece and that of the EU 15 average, it is evident that the major forces that hinder productivity are exogenous to retail firms. Especially in grocery retailing, larger formats are found to be generally more productive due to the better exploitation of economies of scale and scope (Boyland and Nicoletti, 2001). The current format mix of the Greek retail distribution sector appears to be attributed apart to the consumer preferences, proximity of smaller stores, to the regulatory costs and restrictions imposed by government (such as the 1996 change in planning regulations studied in the UK). Counting for the sector's large informality and the low online retailing penetration, the market structure appears to be the major driver behind the sector's low productivity.

The efficiency and operating model of retailers as well as wholesalers in Greece appears to be another issue that owes to be tackled if the overall productivity of the Greek distribution sectors is to reach the European average levels. The limited usage of innovative information technology and supply chain management solutions together with the high transportation costs due to the country's geography are identified as the key drivers behind the sector's poor performance. Finally, the high concentration rate of the sector's suppliers, which is driven by the low penetration of private labels and hard discounters, is found to be an additional obstacle in the performance of the sector.

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