Is export-led growth hypothesis still valid for sub-Saharan African countries? New evidence from panel data analysis

Nicholas M. Odhiambo
Macroeconomic Policy Analysis (MPA) Programme, Department of Economics, University of South Africa, Pretoria, South Africa

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Abstract

Purpose – This study examines the causal relationship between exports and economic growth in sub-Saharan African (SSA) countries during the period 1980 to 2017. The study also examines whether the causality between these two macroeconomic variables depends on the countries' stage of development as proxied by their per capita income.

Design/methodology/approach – The study uses a panel cointegration test and panel Granger-causality model to examine the link between exports and growth. The study also incorporates external debt as an intermittent variable in a bivariate setting between exports and economic growth, thereby creating a dynamic multivariate panel Granger-causality model.

Findings – Although the study found the existence of a long-run relationship between exports and economic growth, the study failed to find any export-led growth response in both low-income and middle-income countries. Instead, the study found evidence of a bidirectional causality and a neutrality response in middle-income and low-income countries, respectively. The study, therefore, concludes that the benefits of an export-led growth hypothesis may have been oversold, and that the strategy may not be desirable to some low-income developing countries.

Practical implications – These findings have important policy implications as they indicate that the causality between exports and economic growth in SSA countries varies with the countries' stage of development. Consistent with the contemporary literature, the study cautions low-income SSA countries against over-relying on an export-led growth strategy to achieve a sustained growth path as no causality between exports and economic growth has been found to exist in those countries. Instead, such countries should consider pursuing new growth strategies by building the domestic demand side of their economies alongside their export promotion strategies in order to expand the real sector of their economies. For middle-income countries, the study recommends that both export promotion strategies and pro-growth policies should be intensified as economic growth and exports have been found to reinforce each other in those countries.

Originality/value – Unlike the previous studies, the current study disaggregated the full sample of SSA countries into two subsets – one comprising of low-income countries and the other consisting of middle-income countries. In addition, the study uses a multivariate Granger-causality model in order to address the emission-of-variable bias. To our knowledge, this may be the first study of its kind in recent years to examine in detail the causal relationship between exports and economic growth in SSA countries using an ECM-based multivariate panel Granger-causality model.

Keywords Granger causality, Economic growth, Exports, Sub-Saharan Africa

Paper type Research paper

1. Introduction

The relationship between exports and economic growth has attracted numerous studies in recent decades. The thrust of the debate has been whether exports drive economic growth or

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whether it is the growth of the real sector that drives exports. While the former view is referred to as the export-led growth (ELG) hypothesis, the latter is popularly known as the growth-led export (GLE) hypothesis. According to the ELG hypothesis, real GDP growth does not only rely on the increase in the amounts of labour and capital, but also on the growth of exports through a multiplier effect. This makes export one of the engines of economic growth. Moreover, an increase in exports as a result of export-oriented policies can also indirectly stimulate economic growth through the efficient allocation of resources, greater capacity utilisation and exploitation of economies of scale (Awokuse, 2003). Apart from stimulating technological enhancement due to foreign market competition, exports also play a critical role in enabling investment and technological transfer, which accelerates the process of globalisation (see Keesing, 1967; Bhagwati and Srinivasan, 1975; Dervis, 1979) [1]. An increase in exports also provides foreign exchange, which can be used for importing capital goods and intermediate goods, thereby leading to higher capital formation, which, in turn, leads to higher economic growth (McKinnon, 1964; Balassa, 1978; Buffie, 1992). Indeed, the remarkable performance by a number of Asian countries can be attributed to the beneficial effects of exports on economic growth (see Salim and Hossain, 2011; Awokuse and Christopoulos, 2009; Lee and Huang, 2002; El-Sakka and Al-Mutairi, 2000) [2]. Although exports can significantly contribute to economic growth, some studies have argued that there is a danger in over-relying on exports to boost economic growth, especially in developing countries. This is mainly because the market for the exports of developing countries is limited by the capacity of industrialised countries. Hence, stagnation in demand in developed countries may lead to overinvestment and excess capacity in developing countries (see Blecker, 2002; 2003; Felipe, 2003). Moreover, some recent studies have argued that the benefits of an export-led growth hypothesis may have been oversold, and that the strategy may not be desirable to some low-income developing countries; hence, a new development paradigm is needed. According to Pillay (2011), there is a need for a shift towards a domestic demand-led growth strategy, while maintaining exports as countries still need exports to pay for their imported inputs and some finished goods that cannot be produced locally (see Pillay, 2011, p. 9).

As opposed to the ELG hypothesis, the GLE hypothesis postulates that an increase in economic growth could also lead to an increase in exports through a realisation of economies of scale and a reduction in the cost of production (see Bahmani-Oskooee, 2009). Previous studies have also argued that an increase in GDP is likely to lead to a corresponding increase in trade, unless an anti-bias trade is created by the growth-induced supply and the corresponding demand (Bhagwati, 1988). The GLE hypothesis has also been supported by the neoclassical trade theory. According to the neoclassical trade theory, economic growth, through its effects on the supply of the economy (factor endowments), may create more demand for exports within a country, thereby affording a country a strong export production base (Mahadevan, 2007).

Although a number of studies have been conducted on the relationship between exports and economic growth, especially since the 1960s, the majority of these studies have mainly been conducted on Asia and Latin America, thereby leaving many SSA countries with little or no coverage at all (see, for example, Ahmad *et al.*, 2018; Ali and Li, 2018; Shakeel and Ahmed, 2020; Dinç and Gökmen, 2019; Kalaitzi and Chamberlain, 2020, among others). Even where such studies have been conducted, the findings on the causal relationship between exports and economic growth remains mixed at best and controversial at worst. In addition, some of these previous studies have fundamental methodological weaknesses. It is against this background that the current study aims to examine the causal relationship between exports and economic growth in 21 sub-Saharan African countries using a panel Granger-causality model. In order to address the omission-of-variable bias, which has been reported in some of the previous studies, the current study uses a multivariate panel Granger-causality model to examine this linkage. In order to examine whether the causality between exports and

economic growth depends on the countries' stage of development as proxied by their per capita income, the study disaggregated the full sample of SSA countries into two subsets – one comprising of low-income countries and the other consisting of middle-income countries.

To our knowledge, the studies that are closest to the current research are based on the work done by Ee (2016) and Ahmad and Kwan (1991). However, the current study differs fundamentally from these two studies in various ways. For example, Ee (2016) used fully modified OLS (FMOLS) and dynamic ordinary least square (DOLS) to test the export-led growth hypothesis, while the current study uses an ECM-based multivariate panel Granger-causality model to examine the short-run and long-run causality between exports and economic growth. In addition, in the current study, two panels of SSA countries are used, namely low-income and middle-income panels. Ahmad and Kwan (1991), on the other hand, used a bivariate Granger-causality model, while the current study uses a multivariate ECM-based Granger-causality model, which reduces the omission-of-variable bias and captures the short-run and long-run causal dynamics.

The rest of the paper is structured as follows. Section 2 reviews some of the empirical literature on the relationship between exports and economic growth in developing and developed countries. Section 3 deals with the methodology, empirical analysis and discussion of the results. Section 4 concludes the study.

2. Literature review

Previous studies on the relationship between exports and economic growth vary significantly between those that are in favour of the export-led growth (ELG) strategy and those that are in favour of growth-led export (GLE) strategy. Theoretically, the export-led growth (ELG) strategy hinges on whether a country should focus on export promotion or import substitution. In the main, the proponents of export-led growth theory support export promotion policy instead of import substitution policy. According to a comprehensive study by World Bank (1987), export-promotion strategy is the best strategy for less developing countries (LDCs) that intends to industrialise and transform their economies into more developed economies (see Tang *et al.*, 2015). This view argues that growth could be achieved better through ELG strategies. A case in point is the growth rate that has been achieved by the Asian economies, such as Hong Kong, Singapore, South Korea, Taiwan, Malaysia and Thailand that were found to have been supported by the export promotions strategies. Over a period of 30 years, these countries were found to have doubled their standards of living every ten years (see Giles and Williams, 2000). According to the proponents of ELG theory, export growth leads to an increase in the demand for the country's output, which leads to an increase in real output. An increase in a country's exports may *inter alia* lead to an increase in the specialisation of export goods, which may, in turn, boost the country's productivity level and eventually leads to output growth (see Giles and Williams, 2000). In addition, the outward-oriented trade policy resulting from the ELG strategy may also give access to advanced technologies, learning by doing gains and better management practices, which may lead to further efficiency gains (see Giles and Williams, 2000; Hart, 1983; Ben-David and Loewy, 1998). Apart from the ELG, recent studies have shown that there is also a potential for growth-led export (GLE). Bhagwati (1988), for example, argues that an increase in GDP generally leads to a corresponding expansion of trade, unless the pattern of growth-induced supply and corresponding demand creates an anti-trade bias. Neoclassical trade theory also stresses the causality that runs from home-factor endowments and productivity to the supply of exports (see Findlay, 1984).

On the empirical front, there are a number of studies that have been conducted to examine the causal relationship between exports and economic growth in both developed and developing countries. However, the findings of such studies remain at best inconclusive and often contradictory. Broadly speaking, previous studies on this subject can be divided into

four groups. The first group includes studies, whose findings are consistent with a unidirectional causal flow from exports to economic growth. These studies include, amongst other, studies such as Boame (1998) for the case of Ghana; El-Sakka and Al-Mutairi (2000) for Iraq, Morocco, Saudi Arabia and Syria; Fountas (2000) for Ireland; Awokuse (2003) for Canada; Shirazi and Manap (2005) for Pakistan; Siliverstovs and Herzer (2006) for Chile; Jordaan and Eita (2007) for Namibia; Narayan *et al.* (2007) for the case of Papua New Guinea in the short run and Fiji in the long run; Dash (2009) for India; Rangasamy (2009) for South Africa; Uddin *et al.* (2010) for Bhutan; Ramona *et al.* (2010) for Romania; Samad (2011) for Algeria; Saad (2012) for Lebanon; Tsaurai and Odhiambo (2012) for Zimbabwe; Dritsaki (2013) for Greece; Abdulkarim (2014) for Saudi Arabia; Bilas *et al.* (2015) for Croatia; Ee (2016) for the case of selected sub-Saharan African (SSA) countries; Ali and Li (2018) for China and Pakistan; Ahmad *et al.* (2018) for ASEAN5 economies; Dinç and Gökmen (2019) for the case of Brazil in the short run; Kalaitzi and Chamberlain (2020) for the case of the United Arab Emirates in the short run; Kim *et al.* (2019) for Myanmar; Shakeel and Ahmed (2020) for a panel of five South Asian countries in the long run.

Unlike the first group, the second group of studies supports a unidirectional causal flow from economic growth to exports. These include studies, such as Oxley (1993) for the case of Portugal; Ahmad and Harnhirun (1996) for the case of ASEAN Countries; Henriques and Sadorsky (1996) for Canada; Baharumshah and Rashid (1999) for Malaysia; El-Sakka and Al-Mutairi (2000) for the United Arab Emirates; Hatemi-J and Irandoust (2000) for the case of Denmark; Panas and Vamvoukas (2002) for the case of Greece in the long run; Shan and Tian (2002) for Shanghai; Reppas and Christopoulos (2005) for the case of 22 less developed Asian and African countries; Cetintas and Barisik (2009) for 13 transition economies; Abbas (2012) for Pakistan; Igbal *et al.* (2012) for Pakistan; Shihab *et al.* (2014) for Jordan; Bonga *et al.* (2015) for Zimbabwe; Gokmenoglu *et al.* (2015) for Costa Rica; Popovici and Călin (2016) for Romania; and more recently, Kalaitzi and Cleeve (2018) for the case of the UAE in the long run.

Apart from the first group and the second group of studies, there is a third (middle-ground) group, which posits that both exports and economic growth Granger-cause each other. In other words, this group argues that there is bidirectional causality between exports and economic growth. Studies whose findings are consistent within this view include studies, such as Kwan and Cotsomitis (1991) for the case of China during the period 1952–1985; Bahmani-Oskooee and Janardhanan (1993) for the case of LDCs; Shan and Sun (1998) for China; El-Sakka and Al-Mutairi (2000) for Algeria, Bahrain, Egypt, Jordan, Mauritania and Oman; Hatemi-J and Irandoust (2000) for the case of Finland, Norway and Sweden; Wernerheim (2000) for Canada; Abdulnasser (2002) for Japan; Awokuse (2005) for Korea; Shirazi and Manap (2005) for Bangladesh and Nepal; Jordaan and Eita (2009) for Botswana; Elbeydi *et al.* (2010) for Libya; Tsen (2010) for China; Rahmaddi and Ichihashi (2011) for Indonesia; Sallem and Sial (2015) for Pakistan; Sunde (2017) for South Africa; Guntukula (2018) for India; Kalaitzi and Cleeve (2018) for the case of the UAE in the short run; Dinç and Gökmen (2019) for Brazil in the long run; and more recently, Shakeel and Ahmed (2020) for a panel of five South Asian countries in the short run.

Despite the overwhelming causal relationship between exports and economic growth reported in the above-mentioned studies, there is the fourth group (i.e. neutrality group) whose empirical findings show that there is no formidable causal relationship between exports and economic growth and that any perceived relationship could be merely mechanical in nature. Although this view is somewhat unpopular, it is currently gaining traction in the empirical literature. Some of the studies whose findings are in one way or the other consistent with this view include those of Ahmad and Kwan (1991) for the case of 47 African Countries; Jin and Yu (1996) for the USA; Abdulnasser and Manucher (2000) for the case of Greece and Turkey; Ahmed *et al.* (2000) for the case of Bangladesh, Pakistan and Sri

Lanka; El-Sakka and Al-Mutairi (2000) for Kuwait, Libya, Qatar, Sudan and Tunis; Shirazi and Manap (2005) for Sri Lanka and India; Tang (2006) for China; Tang (2006) for China; Shirazi and Manap (2005) for Sri Lanka and India; more recently, Kalaitzi and Chamberlain (2020) for the case of the United Arab Emirates in the long run.

Table 1 gives a summary of previous empirical findings on the causal relationship between exports and economic growth in both developed and developing countries, based on these four groups of studies.

3. Empirical analysis

3.1 Model specification – a trivariate Granger-causality model

This study uses panel data and a trivariate Granger-causality model to examine the causal relationship between exports and economic growth in SSA countries. The use of this technique is deemed most suitable in this study because of the various advantages it renders. Firstly, a panel data technique has the ability to test more complicated behavioural models than a single cross-sectional or time-series data technique (see Hsiao, 2003). Secondly, panel data contains more degrees of freedom and more sample variability than cross-sectional or time-series data (Hsiao *et al.*, 1995). Thirdly, panel data analysis generates more accurate predictions for individual outcomes by pooling the data rather than generating predictions of individual outcomes using the data on the individual in question (Hsiao *et al.*, 1989, 1993) [3]. The Granger causality model adopted in this study is expressed as follows (see Odhiambo, 2015):

$$\Delta y/N_{it} = \alpha_{1j} + \sum_{k=1}^{q} \beta_{11ik} \Delta y/N_{it-k} + \sum_{k=1}^{q} \beta_{12ik} \Delta \mathrm{EXPT}_{it-k} + \sum_{k=1}^{q} \beta_{13ik} \Delta \mathrm{DEBT}_{it-k} + \lambda_{1i} ECT_{it-1} + \varepsilon_{it} \quad (1)$$

$$\Delta \mathrm{EXPT}_{it} = \alpha_{2j} + \sum_{k=1}^{q} \beta_{21ik} \Delta \mathrm{EXPT}_{it-k} + \sum_{k=1}^{q} \beta_{22ik} \Delta y/N_{it-k} + \sum_{k=1}^{q} \beta_{23ik} \Delta \mathrm{DEBT}_{it-k} + \lambda_{2i} \mathrm{ECT}_{it-1} + \varepsilon_{it} \quad (2)$$

$$\Delta \mathrm{DEBT}_{it} = \alpha_{3j} + \sum_{k=1}^{q} \beta_{31ik} \Delta \mathrm{DEBT}_{it-k} + \sum_{k=1}^{q} \beta_{32ik} \Delta y/N_{it-k} + \sum_{k=1}^{q} \beta_{33ik} \Delta \mathrm{EXPT}_{it-k} + \lambda_{3i} \mathrm{ECT}_{it-1} + \varepsilon_{it} \quad (3)$$

where:

y/N	Real GDP per capita
EXPT	Exports
DEBT	External debt
Δ	First difference operator
ECT	Error-correction term
ε	White noise error term
i	Individual country
t	Time period
q	Lag length

Author (Year)	Region/Countries	Study period	Causality
Studies in favour of export-led growth [i.e. Exports Granger-cause *economic growth]*			
Boame (1998)	Ghana	1960 to 1992	Exports →Y
El-Sakka and Al-Mutairi (2000)	Arab countries	1970 to 1999	Exports →Y (Iraq, Morocco, Saudi Arabia and Syria)
Fountas (2000)	Ireland	1950 to 1990	Exports →Y
Awokuse (2003)	Canada	1961:1 to 2000:4	Exports →Y
Shirazi and Manap (2004)	Pakistan	1960 to 2003	Exports →Y
Shirazi and Manap (2005)	five South Asian countries	Pakistan: 1960–2003 India: 1960–2002 Bangladesh: 1973–2002 Sri Lanka: 1960–2002 Nepal: 1975–2003	Exports →Y (Pakistan)
Siliverstovs and Herzer (2006)	Chile	1960 to 2001	Exports →Y
Jordaan and Eita (2007)	Namibia	1970 to 2005	Exports →Y
Narayan *et al.* (2007)	Papua New Guinea and Fiji	Papua New Guinea: 1961–1999 Fiji: 1960–2001	Exports →Y Fiji: Long-run Papua New Guinea: Short-run
Dash (2009)	India	(1992[Q1 to 2007 [Q4])	Exports →Y
Rangasamy (2009)	South Africa	1960q1 to 2007q3	Exports →Y
Uddin *et al.* (2010)	Bhutan	1980 to 2005	Exports →Y
Ramona *et al.* (2010)	Romania	1999 Q1 to 2009 Q4	Exports →Y
Samad (2011)	Algeria	1960 to 2005	Exports →Y
Saad (2012)	Lebanon	1970 to 2010	Exports →Y
Tsaurai and Odhiambo (2012)	Zimbabwe	1980 and 2010	Exports →Y
Dritsaki (2013)	Greece	1960 to 2011	Exports →Y
Abdulkarim (2014)	Saudi Arabia	1968 to 2011	Exports →Y
Bilas *et al.* (2015)	Croatia	1996 to 2012	Exports →Y
Ee (2016)	Selected SSA countries	1985 to 2014	Exports →Y
Ahmad *et al.* (2018)	ASEAN5 economies	1981 to 2013	Exports →Y
Ali and Li (2018)	China and Pakistan	1980 to 2015	Exports →Y
Dinç and Gökmen (2019)	Brazil	1960 to 2017	Exports →Y (in the short run)
Kalaitzi and Chamberlain (2020)	The UAE	1975 to 2012	Exports →Y (in the short run)
Kim *et al.* (2019)	Myanmar	1981 to 2015	Exports →Y
Shakeel and Ahmed (2020)	A panel of five South Asian countries	1980 to 2014	Exports →Y (in the long run)
B: Studies in favour of growth-led export [i.e. Economic growth Granger-*causes exports]*			
Oxley (1993)	Portugal	1865–1985	Y →Exports
Ahmad and Harnhirun (1996)	ASEAN Countries	1966 through 1988	Y →Exports
Henriques and Sadorsky (1996)	Canada	1870 to 1991	Y →Exports

Table 1.
Previous empirical findings on the causal relationship between exports and economic growth in both developed and developing countries

(*continued*)

Author (Year)	Region/Countries	Study period	Causality
Baharumshah and Rashid (1999)	Malaysia	1970:1 to 1994:4	Y →Exports
El-Sakka and Al-Mutairi (2000)	Arab countries	1970 to 1999	Y →Exports (the UAE)
Hatemi-J and Irandoust (2000)	Nordic economies	Denmark: 1977.1–1996.1 Finland: 1975.1–1994.4 Norway: 1975.1–1996.1 Sweden: 1980.1–1995.2	Y →Exports (for the case of Denmark)
Panas and Vamvoukas (2002)	Greece	1948–1997	Y →Exports (in the long run)
Shan and Tian (2002)	Shanghai	1990(1) to 1996(12)	Y →Exports
Reppas and Christopoulos (2005)	A sample of 22 less developed Asian and African countries	1969 to 1999	Y →Exports
Cetintas and Barisik (2009)	13 transition economies	1995:2 to 2006:4	Y →Exports
Abbas (2012)	Pakistan	1975 to 2010	Y →Exports
Igbal *et al.* (2012)	Pakistan	1970 to 2009	Y →Exports
Shihab *et al.* (2014)	Jordan	2000 to 2012	Y →Exports
Bonga *et al.* (2015)	Zimbabwe	1975 to 2013	Y →Exports
Gokmenoglu *et al.* (2015)	Costa Rica	1980 to 2013	Y →Exports
Popovici and Călin (2016)	Romania	Quarterly data, 2001 to 2015	Y →Exports
Kalaitzi and Cleeve (2018)	The UAE	1981–2012	Y →Exports (in the long run)
C: Studies in favour of bidirectional causality between exports and economic growth [i.e. exports and economic growth Granger-*cause each other]*			
Kwan and Cotsomitis (1991)	China	1952 to 1985	Exports ↔Y (for the period 1952–1985)
Bahmani-Oskooee and Janardhanan (1993)	LDCs	1973I to 1988IV	Exports ↔Y (in almost all countries in the sample)
Shan and Sun (1998)	China	1987 to 1996	Exports ↔Y
El-Sakka and Al-Mutairi (2000)	Arab countries	1970 to 1999	Exports ↔Y(Algeria, Bahrain, Egypt, Jordan, Mauritania and Oman
Wernerheim (2000)	Canada	1947 to 96	Exports ↔Y
Abdulnasser (2002)	Japan	1966:01 to 1999:01	Exports ↔Y
Hatemi-J and Irandoust (2000)	Nordic economies	Denmark: 1977.1–1996.1 Finland: 1975.1–1994.4 Norway: 1975.1–1996.1 Sweden: 1980.1–1995.2	Exports ↔Y (for the case of Finland, Norway and Sweden)
Awokuse (2005)	Korea	1963 to 2001	Exports ↔Y

(*continued*)

Table 1.

Author (Year)	Region/Countries	Study period	Causality
Shirazi and Manap (2005)	five South Asian countries	Pakistan: 1960–2003 India: 1960–2002 Bangladesh: 1973–2002 Sri Lanka: 1960–2002 Nepal: 1975–2003	Exports ↔Y (Bangladesh and Nepal)
Jordaan and Eita (2009)	Botswana	1996.1 to 2007.4	Exports ↔Y
Elbeydi *et al.* (2010)	Libya	1980 to 2007	Exports ↔Y
Tsen (2010)	China	1978 to 2002	Exports ↔Y
Rahmaddi and Ichihashi (2011)	Indonesia	1971 to 2008	Exports ↔Y
Sallem and Sial (2015)	Pakistan	1973 to 2013	Exports ↔Y
Sunde (2017)	South Africa	1990 to 2014	Exports ↔Y
Guntukula (2018)	India	April 2005 to March 2017	Exports ↔Y
Kalaitzi and Cleeve (2018)	The UAE	1981–2012	Exports ↔Y (in the short run)
Dinç and Gökmen (2019)	Brazil	1960–2017	Exports ↔Y (in the long run)
Shakeel and Ahmed (2020)	A panel of five South Asian countries	1980 to 2014	Exports ↔Y (in the short run)
D: Studies in favour of neutrality hypothesis [i.e. No causality between exports and economic growth]			
Ahmad and Kwan (1991)	47 African Countries	1981 to 1987	Exports ≠Y
Jin and Yu (1996)	US economy	1959:1 to 1992:3	Exports ≠Y
Abdulnasser and Manucher (2000)	Greece, Ireland, Mexico, Portugal and Turkey	1960 to 1997	Exports ≠Y (for Greece and Turkey)
Ahmed *et al.* (2000)	Four South Asian (Bangladesh, India, Pakistan and Sri Lanka)	1970 to 1997	Exports ≠Y (for the case of Bangladesh, Pakistan and Sri Lanka)
El-Sakka and Al-Mutairi (2000)	Arab countries	1970 to 1999	Exports ≠Y (Kuwait, Libya, Qatar, Sudan and Tunis)
Tang (2006)	China	1970 to 2001	Exports ≠Y
Shirazi and Manap (2005)	five South Asian countries	Pakistan:1960–2003 India: 1960–2002 Bangladesh: 1973–2002 Sri Lanka: 1960–2002 Nepal: 1975–2003	Exports ≠Y (Sri Lanka and India)
Kalaitzi and Chamberlain (2020)	The UAE	1975 to 2012	Exports ≠Y (in the long run)

Note(s): Exports →Y means exports cause economic growth; Y→ Exports means economic growth causes exports; Exports ↔Y means there is bidirectional causality between exports and economic growth; and Exports ≠Y means there is no causality between exports and economic growth

Table 1.

3.2 Data

The data used in this study cover the period 1980 to 2017. The studied countries were divided into two panels where data were available – low-income panel and middle-income panel. The data were sourced from the World Bank's World Development Indicators. Although a number of proxies could be used to measure economic growth, in this study, real GDP per capita was used to measure the growth of the real sector. The advantage of using real GDP per capita is that it takes into consideration the effect of a population on economic growth. Some of the studies that have used this proxy include those of Shan *et al.* (2001), Thangavelu and James (2004), Rousseau and Vuthipadadorn (2005), Cooray (2010), Demirguc-Kunt *et al.* (2011), Odhiambo (2014, 2021), to mention a few. The exports variable is measured by the value of the exports of goods and services, while external debt, which has been used as an intermittent variable between exports and economic growth, is measured by the value of the external debt as a percentage of GNI.

3.3 The panel unit root test

In order to identify the order of integration of the variables used in the study, three panel unit root tests are employed: (1) Levin *et al.* (2002); (2) Im *et al.* (IPS) (2003); and (3) ADF Fischer tests. The results are reported in Table 2 for both low-income and middle-income countries.

The results of panel unit root tests reported in Table 2 show that the variables are consistently stationary in first difference.

3.4 The panel cointegration test

Having confirmed the order of integration of the variables used in this study, the next step is to examine the long-run relationship among these variables. For this purpose, two panel cointegration tests are employed in order to ensure the veracity of the findings. These are: (1) the Pedroni (2004) residual cointegration test; and (2) the Kao (1999) residual cointegration test. The cointegration results are reported in Table 3.

Overall, the results of the two panel cointegration tests reported in Table 3 reveal that the variables in the two models (1–2) are cointegrated; hence, the Granger-causality test could be performed.

3.5 Trivariate Granger-causality results

In this section, a dynamic multivariate panel Granger-causality model is employed to examine the causal relationship between exports, debt and economic growth in both low-

	LLC *t*-Statistics		IPS *W*-Statistics		ADF - Fisher Chi-square	
	Level	First difference	Level	First difference	Level	First difference
Low-income SSA countries						
EXP	−0.86612	−11.4343***	−1.61785	−14.3055***	34.6601	102.194***
y/N	−2.06611	−6.28614***	1.26895	−11.7463***	27.7939	126.990***
DEBT	−1.91001	−8.13716***	−0.13487	−10.2718***	25.4644	77.5907***
Middle-income SSA countries						
EXP	−0.48707	−11.9829***	−0.84128	−19.0471***	45.3722	284.127***
y/N	4.20445	−7.10078***	0.80286	−13.0152***	49.2910	219.670***
DEBT	0.80859	−8.53214***	1.11868	−15.2553***	20.8375	235.867***

Note(s): *, ** and*** indicate rejection of the respective null hypothesis at the 10%, 5% and 1% significance levels, respectively

Table 2.
The results of panel unit root tests

Table 3.
Panel cointegration results

	Panel A: Low-income countries		Panel B: Middle-income countries	
	t-Statistic	Probability	*t*-Statistic	Probability
Pedroni residual cointegration test				
Pedroni panel cointegration test – within-dimension				
Panel *v*-Statistic	14.28669	0.0000	2.838063	0.0023
Panel rho-Statistic	−3.458024	0.0003	−2.188797	0.0143
Panel PP-Statistic	−0.192649	0.4236	−1.970811	0.0244
Panel ADF-Statistic	−0.457711	0.3236	−2.161709	0.0153
Pedroni panel cointegration test – between-dimension				
Group rho-Statistic	−2.734473	0.0031	−0.154009	0.4388
Group PP-Statistic	−4.279536	0.0000	−1.542654	0.0615
Group ADF-statistic	−5.138824	0.0000	−2.236847	0.0126
PANEL 2: Kao residual cointegration test				
ADF	−2.627023	0.0043	−2.165364	0.0152

income and middle-income countries. The short-run causality is given by the *F*-statistics, which is expected to be statistically significant (see Asongu, 2014; Odhiambo, 2015). The long-run causality, on the other hand, is based on the coefficient of the error-correction term (ECT), which is expected to be negative and also statistically significant (see Odhiambo, 2021; Asongu *et al.*, 2016). Table 4 presents the Granger-causality results for both low-income and middle-income countries.

Based on the findings reported in Panel A, it is clear that exports do not Granger-cause economic growth in low-income countries. This applies irrespective of whether the causality is estimated in the short run or in the long run. The short-run causality has been rejected by the corresponding *F*-statistic in the growth equation, which has been found to be statistically significant. Likewise, the long-run causality has been rejected by the coefficient of the error correction term in the economic growth in low-income countries' panel, which has also been found to be statistically insignificant. The same findings apply to the reverse causality from economic growth to exports. This can be confirmed by the corresponding F-statistic in the export's equation, which has been found to be statistically insignificant. This finding, therefore, shows that there is no causal relationship between exports and economic growth in either direction in low-income countries. This finding, though contrary to some of the previous studies, is consistent with previous studies, such as Ahmad and Kwan (1991) for the case of 47 African Countries, Ahmed *et al.* (2000) for the case of Bangladesh, Pakistan and Sri Lanka and Shirazi and Manap (2005) for Sri Lanka and India, among others.

In middle-income countries (Panel B), the results show that there is bidirectional causal relationship between exports and economic growth. This applies irrespective of whether the causality is conducted in the short run or in the long run. The causal flow from exports to economic growth has been confirmed by the coefficient of the ECM term and the corresponding *F*-statistic in Panel B, which have been found to be both statistically significant. Likewise, the reverse causal flow from economic growth to exports has been confirmed by the coefficient of the ECT and the corresponding *F*-statistic in the export's equation, which have been found to be both statistically significant. Overall, the results of both low-income and middle-income countries show that the export-led growth paradigm, which gained prominence in the 1970s, may no longer be relevant to the countries under study. Other results show that for panel A, there is a long-run and short-run unidirectional causal flow from economic growth to debt in low-income countries. This is confirmed by the coefficient of the error correction term and the corresponding *F*-statistic in the debt equation, which have been found to be statistically significant. The results also show that for low-

Table 4. Granger-causality results for all models

Dependent variable	Panel A Low-income countries *D*(*y/N*)				Panel B Middle-income countries *D*(*y/N*)			
	D(*y/N*)	*D*(DEBT)	*D*(EXPT)	ECT	*D*(*y/N*)	*D*(DEBT)	*D*(EXPT)	ECT
D(*y/N*)	–	1.0432 [0.353]	1.3140 [0.269]	0.0013 (1.502)	–	0.1376 [0.871]	9.3387*** [0.000]	−0.0013*** (−3.707)
D(DEBT)	3.5232* [0.061]	–	0.00030 [0.987]	−0.0425*** (−7.183)	1.4591 [0.233]	–	3.3745** [0.035]	−0.0167 (−1.508)
D(EXPT)	0.9700 [0.380]	4.9265*** [0.008]	–	−0.0686*** [−3.080]	3.0806** [0.047]	1.6065 [0.202]	–	−0.0234*** (−3.034)

income countries, there is a unidirectional causal flow from debt to exports both in the short run and in the long run. This finding is confirmed by the coefficient of the ECM and the corresponding *F*-statistic in the export's equation, which have been found to be both statistically significant. In Panel B, the results show that there is a short-run unidirectional causal flow from exports to debt. This has been confirmed by the corresponding *F*-statistic in the debt equation, which has been found to be statistically significant. However, no causality was found to exist between economic growth and debt in either direction. This applies irrespective of whether the causality was estimated in the short run or in the long run.

4. Conclusion

In this study, the dynamic causal relationship between exports and economic growth has been examined. The study was motivated by the current debate on the export-led growth versus growth-led export nexus. Unlike in some previous African studies, in the current study, SSA countries are divided into two groups, namely low-income and middle-income countries. In addition, external debt has been used as an intermittent variable in a bivariate setting between exports and economic growth, leading to a multivariate panel Granger-causality model. Using an ECM-based panel Granger-causality model, the study found that there is a long-run relationship between exports and economic growth in both groups of countries. However, the causality between these two variables varies significantly between low-income and middle-income countries. Specifically, the study found a short-run and long-run bidirectional causality between exports and economic growth to prevail in middle-income countries. However, in low-income countries, no causality was found to exist between these two variables in either direction. This applies irrespective of whether the causality was estimated in the short run or in the long run. These findings have important policy implications as they indicate that the causality between exports and economic growth in SSA countries varies with the countries' stage of development. The study, therefore, concludes that the argument that exports always Granger-cause economic growth may have been oversold to many SSA countries. This finding is not surprising given the nature and the composition of the exports of many SSA countries. Indeed, the exports of many SSA countries, especially low-income countries, are dominated by primary products, whose prices are relatively low when compared to those of manufactured goods. Moreover, given the fact that industrialisation in some SSA countries has been relatively slow, some SSA countries have been forced to continue importing some consumer goods that could be produced locally, thereby leading to widening current account deficits. Consistent with the contemporary literature, the study cautions low-income SSA countries against over-relying on an export-led growth strategy to achieve a sustained growth path as no causality between exports and economic growth has been found to exist in those countries. Instead, such countries should consider pursuing new growth strategies by building the domestic demand side of their economies alongside their export promotion strategies in order to expand the real sector of their economies. For middle-income countries, the results show that the expansion of exports through various exports promotion strategies has been an integral component of their economic growth path. Consequently, the study recommends that both export promotion strategies and pro-growth policies should be intensified as economic growth and exports have been found to reinforce each other in those countries.

Notes

1. See Sultanuzzaman *et al.* (2019).
2. See also Furuoka *et al.* (2019).
3. See Hsiao (2007).

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Corresponding author
Nicholas M. Odhiambo can be contacted at: odhianm@unisa.ac.za and nmbaya99@yahoo.com

Using the *Z*-score to analyze the financial soundness of insurance firms

Ignacio Moreno
Financial Economics and Accounting, Universidad Pablo de Olavide, Sevilla, Spain
Purificación Parrado-Martínez
Financial Economics and Accounting, Universidad de Jaén, Jaen, Spain, and
Antonio Trujillo-Ponce
Financial Economics and Accounting, Universidad Pablo de Olavide, Sevilla, Spain

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Abstract

Purpose – Despite the sophisticated regulatory regime established in Solvency II, analysts should be able to consider other less complex indicators of the soundness of insurers. The *Z*-score measure, which has traditionally been used as a proxy of individual risk in the banking sector, may be a useful tool when applied in the insurance sector. However, different methods for calculating this indicator have been proposed in the literature. This paper compares six different *Z*-score approaches to examine which one best fits insurance companies. The authors use a final dataset of 183 firms (1,382 observations) operating in the Spanish insurance sector during the period 2010–2017.

Design/methodology/approach – In the first stage, the authors opt for a root mean squared error (RMSE) criterion to evaluate which of the various mean and SD estimates that are used to compute the *Z*-score best fits the data. In the second stage, the authors estimate and compare the explanatory power of the six *Z*-score measures that are considered by using an ordinary least squares (OLS) regression model. Finally, the authors report the results of the baseline equation using the system-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) for dynamic panel data models.

Findings – The authors find that the best formula for calculating the *Z*-score of insurance firms is the one that combines the current value of the return on assets (ROA) and capitalization with the SD of the returns calculated over the full sample period.

Research limitations/implications – The main limitation of the research is that it addresses only the Spanish insurance sector, and consequently, the implications of the findings must be framed in this institutional context. However, the authors think that the results could be extrapolated to other countries. Future research should consider including different countries and analyzing the usefulness of aggregated insurer-level *Z*-scores for macroprudential monitoring.

Practical implications – The *Z*-score may be a useful early warning indicator for microprudential supervision. In addition to being an indicator of the soundness of insurers simpler than those established in the current regulation, the information provided by this accounting-based measure may help analysts and investors obtain a better understanding of insurance firms' risk factors.

JEL Classification — G22, G28, G32, G33

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Originality/value – To the best of the authors' knowledge, this study is the first to examine and compare different approaches to calculating *Z*-scores in the insurance sector. The few available results on the predictive power of the *Z*-score are mixed and focus on the banking sector.

Keywords Insurance sector, *Z*-score, Economic crisis, Financial soundness, European financial system

Paper type Research paper

1. Introduction

The insurance industry plays a crucial role in the economy by allowing individuals and companies to transfer risk through insurance and reinsurance activities and thus enhances financial stability (Das *et al.*, 2003). This industry, which contributes significantly to economic growth and notably impacts investors and stakeholders, has become an important pillar of the financial sector (Haiss and Sümegi, 2008). Although insurance companies have traditionally been considered less risky than banks because they are less exposed to liquidity risk (Caporale *et al.*, 2017), the increasing interactions among the insurance sector, financial markets and other financial intermediaries, as well as financial innovations, globalization and the deregulation of the financial system, have made the operations of financial intermediaries over the last decades more complex and potentially riskier (Sharpe and Stadnik, 2007). While the contagion effects from the failure of firms in the insurance sector may not be as consequential as those in the banking industry, they have relevant potential to disrupt the financial system and negatively impact the economy (Das *et al.*, 2003). Therefore, the soundness of insurance firms is of major importance not only for the welfare of the financial sector and various stakeholders (Pasiouras and Gaganis, 2013) but also for the stability of the economy as a whole.

Consequently, policy makers are working to upgrade regulatory and supervisory frameworks to reduce insolvency risk and promote confidence in the financial stability of the insurance sector. In this vein, European insurers have recently implemented Solvency II, a risk-based economic approach aimed at adopting solvency requirements that better reflect the risk of companies (Cummins *et al.*, 2017). This new supervisory regime in the EU includes a risk-sensitivity requirement that is based on a prospective calculation to ensure accurate and timely interventions by the supervisor (the solvency capital requirement) [1]. Despite the sophisticated regulatory regime established in Solvency II, analysts should be able to consider other less complex indicators of the soundness of insurers.

The *Z*-score measure, which has traditionally been used as a proxy of individual risk for the banking sector (Boyd *et al.*, 2006; Laeven and Levine, 2009; Lepetit and Strobel, 2013; Baselga-Pascual *et al.*, 2015; Chiaramonte *et al.*, 2015; Khan *et al.*, 2017), may be a useful tool when applied in the insurance sector. The *Z*-score relates a firm's capital level to the variability in its return on assets (ROA), revealing how much variability in returns can be absorbed by capital without the firm becoming insolvent (Li *et al.*, 2017). The popularity of the *Z*-score derives from its relative simplicity and the fact that it can be computed using accounting information alone. In contrast to market-based risk measures, this indicator is applicable when dealing with an extensive number of unlisted as well as listed companies (Chiaramonte *et al.*, 2016).

Our research contributes to the body of knowledge by examining and comparing, for first time, different approaches to calculating the *Z*-score on a sample of insurance firms. The few available results on the predictive power of this indicator are mixed and focus on the banking sector (Lepetit and Strobel, 2013; Chiaramonte *et al.*, 2016; Bongini *et al.*, 2018). Our paper also adds to the literature on the factors that determine the risk of insurance companies. The *Z*-score, as a simple accounting-based measure, may help analysts and investors obtain a better understanding of risk factors in the insurance sector. Finally, we focus on the Spanish insurance sector, which is one of the largest in Europe (IMF, 2017). Specifically, Spain is

among the top ten European countries in terms of gross premiums written and asset volume (EIOPA, 2017), and this country continues to lead in growth among the major Eurozone economies (MAPFRE, 2018). Although the implications of our findings must be framed in this institutional context, we think that our results could be extrapolated to other countries.

The rest of the paper is organized as follows. The next section presents the basics of the *Z*-score calculation. The third section describes the data and methodology. The fourth section analyzes the main results. The final section concludes the paper.

2. Theoretical background and literature review

2.1 Measuring the financial soundness of insurance companies: the Z-score

A broad strand of the literature has focused on the analysis of diverse measures of capitalization (i.e. the actual solvency margin, the required solvency margin, or the solvency ratio) to draw conclusions about the financial soundness of firms (e.g. Cummins and Nini, 2002; De Haan and Kakes, 2010; Rubio-Misas and Fernández-Moreno, 2017; Moreno *et al.*, 2020; among others). Nevertheless, limiting the analysis to insurers' capitalization could be too restrictive, and a wider approach is necessary to examine the different factors that influence the financial soundness of an insurer (see, e.g. Hu and Yu, 2014; Mankaï and Belgacem, 2016; Altuntas and Rauch, 2017; Cummins *et al.*, 2017; Shim, 2017).

The *Z*-score can be considered an alternative measure of risk and thus a good indicator of the financial soundness of insurers that takes into account factors beyond capitalization or the particular event of bankruptcy [2]. Although the *Z*-score is traditionally used as an indicator of individual risk in the banking literature (Boyd *et al.*, 2006; Laeven and Levine, 2009; Maechler *et al.*, 2010; Čihák and Hesse, 2010; Lepetit and Strobel, 2013; Baselga-Pascual *et al.*, 2015; Chiaramonte *et al.*, 2015, 2016; Khan *et al.*, 2017; among others), some recent studies have also used this measure to examine the financial soundness of insurance firms (see, e.g. Shim, 2011; Pasiouras and Gaganis, 2013; Altuntas and Rauch, 2017; Cummins *et al.*, 2017; Shim, 2017; Alhassan and Biekpe, 2018; Gaganis *et al.*, 2019, Pavić *et al.*, 2019; Rubio-Misas, 2020). The *Z*-score may be a simple and effective predictor of insurer failure given the simplicity and transparency of its calculation (Plantin and Rochet, 2007) and because it can be computed for both unlisted and listed firms (Bongini *et al.*, 2018).

This measure can be applied to insurers with different risk strategies (Čihák and Hesse, 2010; Pasiouras and Gaganis, 2013): an institution may have the same or higher *Z*-score than other insurers with lower capitalization if it has higher risk-adjusted returns. Nevertheless, the *Z*-score has some disadvantages to consider. First, as an accounting-based measure, its reliability depends on the quality of the underlying accounting and auditing framework, which is a serious concern in less-developed countries. Additionally, as firms may smooth their accounting data over time, the *Z*-score may offer an excessively positive assessment of insolvency risk (Laeven and Majnoni, 2003). Second, as pointed out by Čihák (2007), the *Z*-score evaluates each firm separately, potentially overlooking the risk that distress in one financial institution may cause losses to other financial institutions in the system. In the same vein, Bongini *et al.* (2018) conclude that the *Z*-score has limitations in the macroprudential monitoring framework for detecting banking crises, at least in emerging economies, because accounting-based measures do not capture all of the dimensions of risk, such as contagion and interconnectedness (i.e. systemic risk) [3], [4].

2.2 Different approaches to calculating the Z-score

As stated previously, the basic principle behind the *Z*-score is to relate the capital ratio to the variability in the ROA so that one can know how much variability in returns can be absorbed by capital without the firm becoming insolvent (Li *et al.*, 2017):

$$Zs = \frac{\text{ROA} + \text{Eq/TA}}{\sigma\text{ROA}} \quad [1]$$

where Eq/TA denotes the equity-to-total assets ratio and σROA represents the standard deviation (SD) of the ROA.

Default is expected to occur when losses consume capital (i.e. when ROA + Eq/TA ≤ 0 or, equivalently, when ROA ≤ − Eq/TA). Then, if we assume that ROA is a random variable, the *Z*-score represents the number of standard deviations between the expected value of the ROA, *E*(ROA) and the negative values of ROA, ROA = − Eq/TA, that would result in insolvency (Hannan and Hanweck, 1988). In other words, it indicates the number of standard deviations that the ROA would have to fall to deplete equity and force a failure. As in the banking sector, equity serves as a buffer against unforeseen losses and is critical for an insurer's ability to meet its obligations (Cummins *et al.*, 2017). Hannan and Hanweck (1988) show that the Chebyshev inequality for any symmetric distribution allows us to assume the following upper bound on the probability of default (PD):

$$\text{PD} \leq \frac{1}{2}\left(\frac{\sigma\text{ROA}}{E(\text{ROA}) + \text{Eq/TA}}\right)^2 = \frac{1}{2}(Zs)^{-2} \quad [2]$$

Therefore, a higher *Z*-score is associated with a higher distance to default (a lower probability of insolvency). It does not require strong assumptions about the distribution of ROA (see, e.g. Strobel, 2011), which represents an especially attractive advantage from a practitioner's point of view.

The literature reports different approaches to calculating this measure. The most basic formulation defines the *Z*-score as the sum of the values in the current period *t* of the firm's ROA (ROA_t) and equity-to-total assets ratio (Eq/TA_t) divided by the SD of ROA calculated with data from the current year (*t*) and the two previous years, i.e. *t*−1 and *t*−2 (σROA_3) (Pasiouras and Gaganis, 2013; Chiaramonte *et al.*, 2016; Cummins *et al.*, 2017) [5]:

$$Zs1_t = \frac{\text{ROA}_t + \text{Eq/TA}_t}{\sigma\text{ROA}_3\ (\text{ROA}_t,\ \text{ROA}_{t-1},\ \text{ROA}_{t-2})} \quad [3]$$

Delis and Staikouras (2011) and Baselga-Pascual *et al.* (2015) derive a *Z*-score measure (*Zs*2) that uses data from the two previous years to calculate σROA at time *t* (σROA_2):

$$Zs2_t = \frac{\text{ROA}_t + \text{Eq/TA}_t}{\sigma\text{ROA}_2\ (\text{ROA}_{t-1},\ \text{ROA}_{t-2})} \quad [4]$$

Maechler *et al.* (2010) and Chiaramonte *et al.* (2016) compute the *Z*-score as the sum of the three-year moving average of ROA ($\text{ROA}_{\mu 3}$) and the three-year moving average of the equity-to-total assets ratio ($\text{Eq/TA}_{\mu 3}$) divided by σROA_3 [6]:

$$Zs3_t = \frac{\text{ROA}_{\mu 3}(\text{ROA}_t,\ \text{ROA}_{t-1},\ \ \text{ROA}_{t-2}) + \text{Eq/TA}_{\mu 3}(\text{Eq/TA}_t,\ \text{Eq/TA}_{t-1},\ \ \text{Eq/TA}_{t-2})}{\sigma\text{ROA}_3\ (\text{ROA}_t,\ \text{ROA}_{t-1},\ \text{ROA}_{t-2})} \quad [5]$$

Yeyati and Micco (2007) compute the *Z*-scores for each firm and year combining $\text{ROA}_{\mu 3}$ with Eq/TA_t and σROA_3:

$$Zs4_t = \frac{\text{ROA}_{\mu 3}(\text{ROA}_t,\ \text{ROA}_{t-1},\ \text{ROA}_{t-2}) + \text{Eq/TA}_t}{\sigma\text{ROA}_3\ (\text{ROA}_t,\ \text{ROA}_{t-1},\ \text{ROA}_{t-2})} \quad [6]$$

Boyd *et al.* (2006) and Chiaramonte *et al.* (2016) calculate the *Z*-score as the sum of ROA_t and $Eq/TA_{\mu 3}$ divided by σROA_3:

$$Zs5_t = \frac{ROA_t + Eq/TA_{\mu 3}(Eq/TA_t,\ Eq/TA_{t-1},\ \ Eq/TA_{t-2})}{\sigma ROA_3\ (ROA_t,\ ROA_{t-1},\ ROA_{t-2})} \quad [7]$$

Finally, Beck and Laeven (2006) and Hesse and Čihák (2007) estimate a *Z*-score measure that combines ROA_t and Eq/TA_t with the SD of ROA calculated over the full period (σROA_T):

$$Zs6_t = \frac{ROA_t + Eq/TA_t}{\sigma ROA_T\ (ROA_1,\ ROA_2,\ \ldots,\ ROA_T)} \quad [8]$$

3. Data and methodology

3.1 Sample

Our sample includes most of the insurance companies operating in Spain from 2008–2017. Data were obtained from the database maintained by the Spanish regulatory authority, the Directorate General of Insurance and Pension Funds (*Dirección General de Seguros y Fondos de Pensiones*) (DGSFP), an administrative body within the Ministry of Economy and Business [7]. However, as some of the components of the *Z*-score employ data from up to two years prior to the calculation date (i.e. $t-2$, $t-1$), this reduces our time span to the period 2010–2017 [8]. In addition, we do not consider social benefit institutions and reinsurance specialists because they have singular characteristics that may distort our analysis. We use unconsolidated financial statements, thereby reducing the possibility of introducing aggregation bias into the results. Merged insurers are considered to be separate firms before the merger and a single company afterward. Finally, we remove observations with abnormal ratios or extreme values from the sample, ensuring that the analysis is not affected by potential measurement error or misreporting. After applying these filters, we obtain a final dataset consisting of an unbalanced panel with 183 insurers and 1,382 observations (see Table 1). We have a minimum of five consecutive observations for each company, with 77.60% of the insurers being observed over the entire period.

3.2 Choosing the best Z-score approach

We explore which of the different methods for computing the *Z*-score reported in section 2.2 is best when using actual data. Following a procedure similar to that employed by Lepetit and Strobel (2013) for the banking sector, we opt for a root mean squared error (RMSE) criterion to evaluate which estimator best fits the data by minimizing the weighted average RMSE of the *N* insurers *j* given by

Table 1. Number of observations in the final sample

Year	Mutual insurers	Stock insurers	Total
2010	29	146	175
2011	29	150	179
2012	30	152	182
2013	30	153	183
2014	30	153	183
2015	30	141	171
2016	29	131	160
2017	26	123	149
	233	1,149	1,382

$$\text{RMSE} = \sum_{j=1}^{N} \frac{T_j}{\sum_{j=1}^{N} T_j} \sqrt{\frac{1}{T_j} \sum_{t=1}^{T_j} \left(x_{j,t} - \mu_{x,j,t-1}^{\text{est}} \right)^2} \quad [9]$$

where x and μ_x^{est} are, respectively, the realized and predicted values of the different variables that are used to compute the time-varying Z-score measures $Zs1$ to $Zs6$ (i.e. ROA_t, $\text{ROA}_{\mu 3}$, Eq/TA_t, $\text{Eq/TA}_{\mu 3}$, σROA_2, σROA_3 and σROA_T). All these equations are calculated for the full sample for each period $t \in \{1 \ldots T\}$.

The RMSE is the square root of the mean of the squares of all of the errors, and it is considered to be an excellent error metric for numerical predictions. Naturally, a lower parameter outcome is preferable.

Moreover, we estimate and compare the explanatory power of the following multivariate empirical model for the Spanish insurance sector:

$$Y_{i,t} = \alpha + \beta \cdot \text{FS}_{i,t} + \theta \cdot D_{i,t} + \gamma \cdot I_t + \delta \cdot M_t + \varepsilon_{i,t} \quad [10]$$

where Y denotes the different approaches to estimating the Z-score (in logarithmic form) for insurer i (i.e. $Zs1$ to $Zs6$) in year t; [9] $\text{FS}_{i,t}$ denotes a set of firm-specific accounting variables that the literature has recognized as good predictors of insurer risk, $D_{i,t}$ represents two dummy variables that control for the specialization (life versus nonlife) and the organizational form (mutual versus stock company) of the insurer, I_t represents a variable that accounts for the possible effect of industry concentrations on insurer risk, and M_t denotes a set of year dummy variables that account for macroeconomic conditions and time-specific effects. In the regression above, α is the intercept term, and β, γ, θ and δ are vectors of coefficient estimates. Last, $\varepsilon_{i,t}$ is the disturbance term.

Table 2 summarizes the explanatory variables that are included in the present study and their expected Z-score signs—remember that the Z-score (i.e. the distance to default) operates in the opposite direction of insurer risk: the higher the Z-score is, the lower the risk.

We use the natural logarithm of total assets to account for the effect of size on risk and expect a positive relationship between size and the Z-score, as financially distressed insurers are typically small in size (Sharpe and Stadnik, 2007). To examine the influence of profitability on insurer risk, we divide profits after tax by total assets (i.e. ROA). Sharpe and Stadnik (2007) conclude that insurers with low ROA are at higher risk of failure. In the same vein, Caporale *et al.* (2017) report that highly profitable insurers are less likely to become insolvent because they manage their expenses effectively and can set competitive premium rates. We include the equity-to-total assets ratio to control for the effect of capitalization on insurer risk. When measuring default risk, the capital used to cover the insurance business is a key factor. Insurance firms should hold enough capital to cover the policies they underwrite (Caporale *et al.*, 2017). Altuntas and Rauch (2017) find that higher levels of capitalization are associated with higher levels of financial stability in the insurance sector. To account for the effect of reinsurance on the Z-score models, we use the ratio of reinsurance premiums paid to total premiums earned. Reinsurance allows insurers to transfer part of their risk to third parties and results in more predictable future losses, thereby reducing the probability of default (Shiu, 2011; Caporale *et al.*, 2017). Consequently, we expect a positive relationship between the use of reinsurance by the insurer and the Z-score. We choose the share of equity securities in total assets to measure the effect of investment risk on insurer risk and expect a negative relationship between portfolio risk and our distance-to-default measures. Similar to Ho *et al.* (2013) and Altuntas and Rauch (2017), we proxy underwriting risk with the SD of the loss ratio, defined as incurred losses divided by premiums earned net of reinsurance, over the sample period. As stated by Cummins and Sommer (1996), underwriting risk refers to the risk that loss payments will be greater than the expected losses allowed for in the premiums

Explanatory variable	Definition	Expected sign	Data source	References
Size	Natural log of total assets	+	Authors' calculation using DGSFP data	Chen and Wong (2004), Pasiouras and Gaganis (2013), Shim (2017)
Profitability	Profits after tax divided by total assets	+	Authors' calculation using DGSFP data	Sharpe and Stadnik (2007), Caporale *et al.* (2017)
Capitalization	Equity-to-total assets ratio	+	Authors' calculation using DGSFP data	Shim (2011), Altuntas and Rauch (2017)
Reinsurance	Reinsurance premiums paid divided by total premiums earned	+	Authors' calculation using DGSFP data	Ho *et al.* (2013), Mankaï and Belgacem (2016), Caporale *et al.* (2017)
Portfolio risk	Equity securities in the asset portfolio divided by total assets	−	Authors' calculation using DGSFP data	Cummins *et al.* (2017)
Underwriting risk	SD of the loss ratio over the sample period, defined as incurred losses divided by premiums earned, net of reinsurance	−	Authors' calculation using DGSFP data	Altuntas and Rauch (2017)
Long-tailed business	Technical provisions (loss reserves) divided by incurred losses	−	Authors' calculation using DGSFP data	Sharpe and Stadnik (2007), de Haan and Kakes (2010), Ho *et al.* (2013)
Mutual	Dummy variable that takes on a value of 1 for mutual companies and 0 otherwise	+	Authors' calculation using DGSFP data	Pasiouras and Gaganis (2013), Shim (2017), Altuntas and Rauch (2017)
Life insurance	Dummy variable that takes on a value of 1 if life technical provisions are at least 80% of overall technical provisions and 0 otherwise	+	Authors' calculation using DGSFP data	Chen and Wong (2004), Pasiouras and Gaganis (2013), Eling and Marek (2013)
Industry concentration	Herfindahl-Hirschman index, calculated as the sum of the squares of all insurance companies' market shares in terms of premiums written (as a percentage)	±	MAPFRE (2018)	Ho *et al.* (2013), Caporale *et al.* (2017)
Year dummies	Dummy variables used to control for macroeconomic conditions and time-specific effects			

Table 2.
Explanatory variables and their expected signs in the *Z*-score regressions

charged to policyholders. We thus anticipate a negative association between underwriting risk and the *Z*-score. To account for the effect of the time lag between the issuance and payment of claims on insurer risk, we use the ratio of technical provisions (i.e. loss reserves) over incurred losses. Long-tail lines of insurance (i.e. insurance with a longer time lag between

policy issuance and the payment of claims) may have a negative effect on insurer solvency because long-tail lines tend to generate less income from underwriting than shorter-tail lines (De Haan and Kakes, 2010). We therefore expect this variable to have a negative effect on the *Z*-score.

We account for the ownership structure of the firm and insurer specialization using two dummy variables [10]. Altuntas and Rauch (2017) report that mutual insurance firms have higher *Z*-score levels because their future cash flows are less risky. In addition, these authors state that the incentive to increase risk after issuing policies should be much lower for mutual insurers than for stock insurers due to their organizational structure. We also expect a positive coefficient for the dummy that identifies life insurance companies, as nonlife insurers are considered riskier than life insurance companies because they operate as "risk takers" (Chen and Wong, 2004). In the same vein, Gründl *et al.* (2016) consider nonlife insurers to be riskier because of the uncertainty of claim payments and the difficulty in predicting threats.

Finally, we measure industry concentration using the Herfindahl-Hirschman index. There is no consensus regarding the expected relationship between industry concentration and insurer risk. The "concentration-stability" view states that because large firms are likely to earn more profits due to their market power, a concentrated industry is more stable. Therefore, this view favors greater values for the *Z*-score. However, the "concentration-fragility" view affirms that the too-big-to-fail protective mechanism may lead to excessive risk-taking by managers (Moreno *et al.*, 2020), resulting in lower values of the *Z*-score. In this vein, Shim (2017) shows that a higher market concentration is associated with decreased financial stability in the US property-liability insurance industry.

4. Results

4.1 Analysis of the different Z-score measures

Table 3 reports some descriptive statistics for the six different time-varying *Z*-score measures. The results for *Zs*1, *Zs*3, *Zs*4 and *Zs*5 are very similar, with means (as calculated per insurer) in the interval of 3.693–3.787. *Zs*2 presents a higher mean and SD. *Zs*6, on the other hand, has results that are very different from those of the other measures, with average means and standard deviations in a lower range as well as a smaller average coefficient of variation (0.320). We also observe that mutual insurance companies present higher mean values than stock companies for each of the six *Z*-score measures considered. Similarly, we find differences in these measures between life and nonlife specialized insurers, although in this case, they are not as large as in the former. Finally, the lowest average *Z*-score is reported in 2010, whereas the highest *Z*-score mean values are found in 2016 and 2017, which is in line with the improvements in the Spanish economy.

Table 4 presents the average correlation coefficients of our six different *Z*-score measures, confirming the existence of three clusters: *Zs*1, *Zs*3, *Zs*4 and *Zs*5 have correlation coefficients close to 1, whereas the coefficients for *Zs*2 and *Zs*6 are much lower.

Table 5 shows the results of the weighted average RMSE for each of the components of the *Z*-scores considered in the current study (i.e. *Zs*1–*Zs*6), indicating that *Zs*6 is the *Z*-score measure that best fits the data. Therefore, according to this criterion, the best way to calculate the *Z*-score is using the values of ROA and Eq/TA in current period *t* together with the SD of ROA calculated over the full sample, as proposed by Beck and Laeven (2006) and Hesse and Čihák (2007).

In Table 6, we estimate and compare the explanatory power of the six *Z*-score measures considered. First, however, we perform a multicollinearity analysis for the previously selected independent variables (see Table 7). We confirm that collinearity is

	*Zs*1	*Zs*2	*Zs*3	*Zs*4	*Zs*5	*Zs*6
Full sample						
Mean	3.787	4.232	3.772	3.780	3.693	3.085
SD	1.290	1.594	1.297	1.307	1.268	0.995
Min	−2.642	−1.967	−2.759	−1.967	−0.389	−2.843
Max	9.817	11.927	9.833	9.817	9.825	8.168
Mutual						
Mean	4.329	4.785	4.307	4.327	4.282	3.517
SD	1.255	1.488	1.252	1.258	1.240	0.927
Stock companies						
Mean	3.677	4.120	3.663	3.669	3.573	2.998
SD	1.269	1.593	1.280	1.290	1.241	0.985
Nonlife specialized insurers						
Mean	3.786	4.200	3.768	3.776	3.651	3.059
SD	1.277	1.548	1.295	1.303	1.334	1.143
Life specialized insurers						
Mean	3.790	4.319	3.781	3.789	3.708	3.095
SD	1.323	1.710	1.306	1.320	1.243	0.933
2010						
Mean	3.585	4.004	3.610	3.598	3.521	3.007
SD	1.342	1.662	1.246	1.274	1.233	1.070
2011						
Mean	3.791	4.235	3.794	3.781	3.707	3.032
SD	1.311	1.588	1.302	1.340	1.283	0.972
2012						
Mean	3.759	4.258	3.731	3.754	3.659	3.055
SD	1.392	1.748	1.391	1.399	1.330	1.009
2013						
Mean	3.751	4.277	3.696	3.724	3.614	3.108
SD	1.304	1.648	1.346	1.375	1.314	0.974
2014						
Mean	3.772	4.077	3.753	3.766	3.670	3.116
SD	1.197	1.444	1.244	1.228	1.229	0.926
2015						
Mean	3.768	4.226	3.758	3.766	3.680	3.110
SD	1.197	1.498	1.191	1.214	1.180	0.999
2016						
Mean	3.939	4.352	3.929	3.933	3.854	3.131
SD	1.262	1.585	1.267	1.282	1.248	1.017
2017						
Mean	3.975	4.481	3.946	3.957	3.882	3.136
SD	1.282	1.532	1.375	1.323	1.309	1.002

Note(s): This table reports descriptive statistics for six different *Z*-score measures. *Zs*1 is defined in Equation [3], *Zs*2 is defined in Equation [4], *Zs*3 is defined in Equation [5], *Zs*4 is defined in Equation [6], *Zs*5 is defined in Equation [7], and *Zs*6 is defined in Equation [8]. All of these measures are calculated in logarithms. Our final dataset comprises 183 insurers (1,382 observations) operating in the Spanish insurance sector during the period 2010–2017

Table 3.
Descriptive statistics of the different *Z*-score metrics

	*Zs*1	*Zs*2	*Zs*3	*Zs*4	*Zs*5	*Zs*6
*Zs*1	1					
*Zs*2	0.7853***	1				
*Zs*3	0.9863***	0.7756***	1			
*Zs*4	0.9943***	0.7825***	0.9928***	1		
*Zs*5	0.9821***	0.7688***	0.9910***	0.9841***	1	
*Zs*6	0.6885***	0.5398***	0.6711***	0.6831***	0.6609***	1

Note(s): This table reports the pairwise correlation coefficients for six different *Z*-score measures. *Zs*1 is defined in Equation [3], *Zs*2 *is* defined in Equation [4], *Zs*3 *is* defined in Equation [5], *Zs*4 *is* defined in Equation [6], *Zs*5 *is* defined in Equation [7], and *Zs*6 is defined in Equation [8]. All of these measures are calculated in logarithms. Our final dataset comprises 183 insurers (1,382 observations) operating in the Spanish insurance sector during the period 2010–2017. ***indicates significance at the 1 percent level

Table 4.
Correlation coefficients for the different *Z*-score metrics

Z-score	ROA_t	$ROA_{\mu 3}$	Eq/TA_t	$Eq/TA_{\mu 3}$	σROA_2	σROA_3	σROA_T
*Zs*1	1.2781		1.2423			1.0464	
*Zs*2	1.5843		1.5630		1.3402		
*Zs*3		1.2702		1.2530		1.0219	
*Zs*4		1.2775	1.2599			1.0297	
*Zs*5	1.2682			1.2134		1.0484	
*Zs*6	*0.9729*		*0.9174*				*0.8203*

Note(s): This table reports the average root mean squared error (RMSE) for the components of the different *Z*-score approaches. Our final dataset comprises 183 insurers (1,382 observations) operating in the Spanish insurance sector during the period 2010–2017. *Zs*1 is defined in Equation [3], *Zs*2 is defined in Equation [4], *Zs*3 is defined in Equation [5], *Zs*4 is defined in Equation [6], *Zs*5 is defined in Equation [7], and *Zs*6 is defined in Equation [8]. ROA_t is the value of ROA in year *t; ROA*$_{\mu 3}$ is the three-year moving average of ROA. Eq/TA_t is the value of the equity-to-total assets ratio in year *t*; $Eq/TA_{\mu 3}$ is the three-year moving average of Eq/TA. σROA_2 is the two-year moving SD of ROA, σROA_3 is the three-year moving SD of ROA, and σROA_T is the SD of ROA calculated over the whole period. The minimum average RMSE is highlighted in Italic

Table 5.
Root mean squared error for the components of the different *Z*-score approaches

not a problem by calculating the variance inflation factor (VIF); the calculated value for this factor is less than 4 (and close to 1) for most of the variables [11]. The regression model that uses *Zs*6 presents the highest explanatory power, with values for the adjusted R^2 slightly higher than 30%. The rest of the models exhibit values close to 20%, except for *Zs*2, for which the adjusted R^2 falls to 12%. Therefore, we confirm that the *Zs*6 model is the best option for explaining insurer risk, in accordance with the results reported by the RMSE criterion [12].

4.2 Analysis of the determinants of insurer risk

Because some of the firm-specific factors that influence insurer risk may be endogenous (e.g. insurers might need to increase their capital ratio if they become riskier) and others are difficult to measure or identify in an equation (e.g. managerial ability), in Table 8, we report the results of our baseline equation using the system-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) for dynamic panel data models. The persistence of risk has been well documented in the banking literature (e.g. Baselga-Pascual *et al.*, 2015). We are able to use the system-GMM method because we have information on all of the analyzed variables for at least five consecutive years for each insurer [13]. As proposed

Variables	(1) *Zs*1	(2) *Zs*2	(3) *Zs*3	(4) *Zs*4	(5) *Zs*5	(6) *Zs*6
Size	0.153***	0.157***	0.139***	0.155***	0.128***	0.145***
	(0.039)	(0.044)	(0.039)	(0.040)	(0.038)	(0.039)
Profitability	3.388**	3.906**	2.642	3.213*	0.189	3.982***
	(1.661)	(1.661)	(1.813)	(1.764)	(1.436)	(1.339)
Capitalization	2.697***	2.716***	2.635***	2.743***	2.691***	2.819***
	(0.415)	(0.429)	(0.420)	(0.424)	(0.409)	(0.380)
Reinsurance	−0.198	−0.086	−0.234	−0.238	−0.214	0.345
	(0.299)	(0.297)	(0.311)	(0.315)	(0.297)	(0.277)
Portfolio risk	0.641	0.391	0.691	0.636	0.676	0.574
	(0.490)	(0.553)	(0.476)	(0.495)	(0.470)	(0.427)
Underwriting risk	−0.116	−0.079	−0.140	−0.126	−0.128	−0.221***
	(0.123)	(0.131)	(0.129)	(0.129)	(0.124)	(0.127)
Long-tailed business	0.013	0.025	0.016	0.015	0.017	0.015
	(0.026)	(0.027)	(0.026)	(0.026)	(0.026)	(0.024)
Mutual	0.633***	0.662***	0.611***	0.642***	0.596***	0.418***
	(0.202)	(0.205)	(0.203)	(0.205)	(0.199)	(0.190)
Life insurance	0.680***	0.699***	0.691***	0.693***	0.613***	0.719***
	(0.206)	(0.214)	(0.211)	(0.210)	(0.208)	(0.206)
Industry concentration	−0.001	−0.003	0.000	0.000	0.000	−0.000
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.000)
Constant	−0.046	1.192	−0.412	−0.452	−0.128	−1.123
	(1.263)	(1.647)	(1.316)	(1.332)	(1.263)	(0.972)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustering level	Firm	Firm	Firm	Firm	Firm	Firm
Number of observations	1,382	1,382	1,382	1,382	1,382	1,382
Number of firms	183	183	183	183	183	183
R^2	19.47%	12.99%	18.23%	19.33%	18.64%	32.60%
Adjusted R^2	*18.53%*	*11.97%*	*17.27%*	*18.38%*	*17.69%*	*31.81%*
F-value	7.97	6.85	8.02	8.16	9.06	12.41
	(16, 182)	(16, 182)	(16, 182)	(16, 182)	(16, 182)	(16, 182)

Note(s): This table reports the ordinary least squares (OLS) regressions for different *Z*-score measures for the Spanish insurance sector during the period 2010–2017. *Zs*1 is defined in Equation [3], *Zs*2 is defined in Equation [4], *Zs*3 is defined in Equation [5], *Zs*4 is defined in Equation [6], *Zs*5 is defined in Equation [7], and *Zs*6 is defined in Equation [8]. The dependent variable is included in its logarithmic form. See Table 2 for a description of the independent variables. Robust standard errors, which are clustered by firms, are reported in parentheses. Significance levels are indicated as follows: *** = significance at the 1 percent level, ** = significance at the 5 percent level, and * = significance at the 10 percent level. The explanatory power of the model is highlighted in Italic

Table 6.
Comparative analysis of the *Z*-score models

by Windmeijer (2005), we employ a two-step estimation procedure with finite-sample corrected standard errors, which provides less biased coefficient estimates and more accurate standard errors. We treat insurer characteristics (except their organizational form and their specialization) as endogenous variables by using suitable instruments for both the equation in levels and the equation in differences [14]. Industry concentration and macroeconomic control variables (i.e. year dummies) are considered strictly exogenous. We verify the validity of the instruments by using Hansen's *J*-test of overidentifying restrictions.

The higher values of the lagged dependent variables (except for the *Zs2* regression) confirm the dynamic character of the model specification, indicating strong persistence; i.e. the adjustment of risk is very slow. As expected, the regression coefficients indicate a positive relationship between size and the *Z*-score; i.e. larger firms are less risky than

Variable	VIF
Industry concentration	6.010
Year 2016	3.870
Year 2017	3.200
Capitalization	3.010
Size	2.480
Life insurance	2.070
Long-tailed business	1.830
Year 2015	1.740
Year 2011	1.560
Year 2012	1.370
Year 2014	1.360
Underwriting risk	1.230
Mutual	1.200
Reinsurance	1.170
Portfolio risk	1.150
Profitability	1.110
Mean VIF	*2.150*

Note(s): This table reports the variance inflation factors (VIFs) for the variables included in the *Z*-score regressions presented in Table 6. See Table 2 for a description of the variables

Table 7. Variance inflation factors for the variables included in the *Z*-score regressions

smaller firms, supporting previous findings in the literature (Chen and Wong, 2004; Pasiouras and Gaganis, 2013; Shim, 2017). We demonstrate a strong positive relationship between ROA and the *Z*-score but only when *Zs*6 is used as the dependent variable. This result supports the hypothesis that highly profitable insurers are less likely to become insolvent because they manage expenses effectively and can set competitive premium rates (Caporale *et al.*, 2017). The relationship with capitalization, as measured by the equity-to-total assets ratio, is positive and statistically significant in all of the analyzed models. This finding corroborates the hypothesis that more capitalized insurers have higher *Z*-scores, in line with Shim (2011) and Altuntas and Rauch (2017). We also report that a greater use of reinsurance may increase the financial soundness of firms; i.e. higher levels of reinsurance result in lower insurer risk by transferring part of this risk to third parties (as found by Alhassan and Biekpe, 2018). However, this result applies only to the *Zs6* approach and has low statistical significance. The positive coefficient we find for the dummy that identifies mutual insurance companies is in accordance with the hypothesis that mutual companies are more financially stable than stock insurers because in mutual companies, the policyholders are also the owners of the firms. Therefore, managers' incentives to increase asset risk are lower in mutual companies than in stock firms (Shim, 2017). Similar to Pasiouras and Gaganis (2013), we also find a positive coefficient for the dummy that identifies life insurance companies, corroborating the hypothesis that life insurers are more financially stable than nonlife insurance companies, which may operate as 'risk takers'. The relationship between industrial concentration and the *Z*-score is negative and significant only for the *Zs6* approach. This result supports the concentration-fragility view, providing empirical evidence against the tendency toward increasing concentration that the Spanish insurance market is currently experiencing. Finally, we do not find statistical significance for the variables that measure portfolio risk, underwriting risk or whether a business is long-tailed in any of the six models considered.

Once again, we observe that the *Z*-score measure that incorporates the most statistically significant variables in the risk model is the one that combines the current values of ROA and capitalization with the SD of ROA calculated over the full period.

Variables	(1) *Zs*1	(2) *Zs*2	(3) *Zs*3	(4) *Zs*4	(5) *Zs*5	(6) *Zs*6
Lagged dependent	0.581***	0.229***	0.666***	0.615***	0.647***	0.749***
	(0.038)	(0.039)	(0.044)	(0.038)	(0.045)	(0.059)
Size	0.159***	0.186***	0.127***	0.156***	0.126***	0.097***
	(0.056)	(0.071)	(0.044)	(0.056)	(0.048)	(0.019)
Profitability	2.156*	2.294	0.261	2.050	−0.268	2.865***
	(1.294)	(1.956)	(1.329)	(1.430)	(1.344)	(0.377)
Capitalization	1.973***	3.058***	1.638***	1.971***	1.714***	1.158***
	(0.486)	(0.827)	(0.522)	(0.530)	(0.529)	(0.294)
Reinsurance	0.009	−0.247	−0.141	−0.086	−0.096	0.138*
	(0.221)	(0.328)	(0.259)	(0.242)	(0.247)	(0.071)
Portfolio risk	−0.177	−0.499	−0.122	−0.148	−0.076	−0.078
	(0.304)	(0.405)	(0.292)	(0.326)	(0.271)	(0.095)
Underwriting risk	−0.050	0.041	0.003	−0.022	−0.065	−0.023
	(0.104)	(0.197)	(0.126)	(0.116)	(0.122)	(0.069)
Long-tailed business	−0.010	0.016	0.001	−0.003	0.001	−0.009
	(0.023)	(0.034)	(0.019)	(0.023)	(0.020)	(0.012)
Mutual	0.249**	0.402**	0.163	0.254**	0.165	0.159***
	(0.101)	(0.176)	(0.102)	(0.102)	(0.107)	(0.060)
Life insurance	0.358**	0.515*	0.242	0.334*	0.266	0.245**
	(0.166)	(0.269)	(0.172)	(0.176)	(0.190)	(0.112)
Industry concentration	0.001	−0.001	0.001	0.001		−0.001***
	(0.001)	(0.002)	(0.001)	(0.001)		(0.000)
Constant	−2.687	−1.256	−2.520**	−2.925**	−1.754	−1.220***
	(1.183)	(1.658)	(1.014)	(1.189)	(1.073)	(0.441)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
z_1	36.24	5.50	30.93	35.01	31.14	31.87
	(9, 182)	(9, 182)	(9, 182)	(9, 182)	(8, 182)	(9, 182)
z_2	2.29 (7, 182)	2.67 (7, 182)	1.75 (7, 182)	2.15 (7, 182)	1.48 (8, 182)	3.84 (7, 182)
m_1	−6.84	−6.71	−6.94	−6.87	−6.86	−2.06
m_2	−1.18	0.17	−0.75	−1.12	−0.75	0.85
Hansen	169.26 (204)	165.26 (204)	161.05 (204)	167.22 (204)	163.37 (204)	174.25 (204)
Number of observations	1,382	1,382	1,382	1,382	1,382	1,382
Number of firms	183	183	183	183	183	183

Note(s): This table presents the determinants of insurer risk in the Spanish insurance sector (2010–2017) according to different *Z*-score measures. *Zs*1 is defined in Equation [3], *Zs*2 is defined in Equation [4], *Zs*3 is defined in Equation [5], *Zs*4 is defined in Equation [6], *Zs*5 is defined in Equation [7], and *Zs*6 is defined in Equation [8]. The dependent variable is included in its logarithmic form. See Table 2 for a description of the independent variables. We use the system-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). Except for *Mutual*, *Life insurance, Industry concentration* and *Year dummies*, all variables are considered endogenous in our model. In model (5), *Industry concentration* is dropped due to collinearity. We report heteroskedasticity-consistent asymptotic standard errors in parentheses, and significance levels are indicated as follows: *** = significance at the 1 percent level, ** = significance at the 5 percent level, and * = significance at the 10 percent level. z_1 and z_2 are Wald tests of the joint significance of the reported coefficients for the continuous and dummy explanatory variables, respectively, asymptotically distributed along an *F* distribution under the null hypothesis of no significance, with degrees of freedom in parentheses. m_i is a serial correlation test of order i using residuals in first differences, asymptotically distributed as *N(0,1)* under the null hypothesis of no serial correlation. *Hansen* is a test of the overidentifying restrictions, asymptotically distributed along a χ^2 distribution under the null hypothesis of no correlation between the instruments and the error term, with degrees of freedom in parentheses

Table 8.
Determinants of insurer risk in Spain according to the different *Z*-score measures

5. Conclusions

Bearing in mind the increasing relevance of risk supervision in the insurance sector, this paper aims to explore insurers' financial soundness from a wider perspective, considering factors beyond capitalization or the particular event of bankruptcy. The *Z*-score, which has been widely used in the banking literature, can be considered an appropriate alternative measure of risk and thus a good indicator of the financial soundness of insurance firms. This measure relates the insurer's capital level to variability in its returns, revealing how much variability in returns can be absorbed by capital without the firm becoming insolvent. Higher *Z*-scores are indicative of a higher distance-to-default ratio and thus greater financial soundness.

By comparing six different approaches to calculating the *Z*-score with a final dataset of 183 insurers (1,382 observations) operating in the Spanish insurance sector during the period 2010–2017, we find that the best measure for calculating the *Z*-score is the one that combines current ROA and capitalization values with the SD of ROA calculated over the full period. This approach (i.e. *Z*s6) has the advantage of enable the construction of time-varying *Z*-scores that do not require initial observations to be dropped (Lepetit and Strobel, 2013).

Information provided by the *Z*-score, in addition to that given by more complex risk-based models, may be helpful for microprudential supervision. Moreover, because this indicator uses accounting data, its results are easily verifiable, providing insurance regulators with a better understanding of risk factors for both listed and unlisted insurance companies [15]. Nevertheless, the use of an accounting measure has some disadvantages that need to be considered. First, its reliability depends on the quality of the underlying accounting and auditing framework. Second, the *Z*-score has limitations in the macroprudential monitoring framework because accounting-based measures do not capture systemic risk, although this element may be less relevant in the insurance sector.

Notes

1. "In order to promote good risk management and align regulatory capital requirements with industry practices, the Solvency Capital Requirement should be determined as the economic capital to be held by insurance and reinsurance undertakings in order to ensure that ruin occurs no more often than once in every 200 cases or, alternatively, that those undertakings will still be in a position, with a probability of at least 99.5%, to meet their obligations to policyholders and beneficiaries over the following 12 months. That economic capital should be calculated on the basis of the true risk profile of those undertakings, taking account of the impact of possible risk-mitigation techniques, as well as diversification effects". [Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of insurance and reinsurance (Solvency II) (recast)].
2. Chen and Wong (2004), Sharpe and Stadnik (2007) and Caporale *et al.* (2017) focus on the particular event of insolvency or bankruptcy and propose models to identify or predict insurers experiencing financial distress. However, researchers undertaking this kind of analysis face the difficulty of finding data on the insolvency of insurance firms—the majority of these companies decide to transfer their business to other insurance firms or to just stop underwriting new business instead of becoming "insolvent" (Caporale *et al.*, 2017).
3. Bongini *et al.* (2018) test the reliability of seven different versions of the *Z*-score in detecting periods of banking crisis on a sample of 20 Central, Eastern and Southeastern European (CESEE) countries during 1995–2014.
4. However, unlike banks, insurers are not the primary drivers of systemic risk. They are not part of the financial payment system and rarely interact with other insurers (except through reinsurance). This contrasts with banks, as they are primary lenders to other banks and thus are highly interconnected (Rudolph, 2017).
5. The three-year rolling window in the SD calculation avoids the problem that *Z*-scores are exclusively driven by changes in ROA and Eq/TA (Schaeck *et al.*, 2012). Although the use of a

longer period for the calculation of the SD could result in more reliable *Z*-scores, we must consider the loss of observations created by imposing a stronger requirement (Pasiouras and Gaganis, 2013).

6. Gaganis *et al.* (2019) use this *Z*-score metric to investigate the interplay between national culture and risk in insurance firms.
7. The database is available at: http://www.dgsfp.mineco.es/es/Entidades/balancesycuentas/Paginas/Balancescuentasentidadesaseguradoras.aspx
8. This restriction does not apply if we estimate the *Z*-score by combining the values of ROA and capital in current period *t* with the SD of ROA calculated over the full period (2008–2017). However, because we want to compare different *Z*-score measures, we use the same observations in all of the analyses.
9. We take the natural logarithms of all the *Z*-score measures to control for the skewness exhibited by the original variables (Laeven and Levine, 2009; Liu *et al.*, 2013; Chiaramonte *et al.*, 2016).
10. We use the same criteria as the DGSFP (2018) to differentiate between life and nonlife specialized insurers.
11. The only variable that has a VIF higher than 4 is the HHI, which is used to account for industry concentration (and has a value close to 6). We regress our models with alternative variables (e.g. the concentration ratio CR5) and even without including that variable, each of which leaves our conclusions practically unchanged.
12. Although the explanatory power (as measured by the adjusted R^2) of the risk models considered is not very high, our results are very similar to those found by Shim (2011), Fields *et al.* (2012), Altuntas and Rauch (2017) and Cummins *et al.* (2017), among others.
13. This is a required condition to test for the absence of second-order serial correlation.
14. We also estimate regressions in which the organizational form and/or the specialization are considered endogenous variables. The results barely differ from those previously obtained.
15. Plantin and Rochet (2007) state that "prudential ratios should be defined simply and derived from public accounts, because these accounts are easily verifiable".

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Corresponding author
Antonio Trujillo-Ponce can be contacted at: atrupon@upo.es

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Innovative outcome through exploration and exploitation – Enablers, barriers and industrial property

Nancy Vargas
Instituto de Telecomunicaciones y ~~aplicaciones multimedia~~, Universitat Politècnica de València, Valencia, Spain
M. Begoña Lloria
Dirección de ~~empresas~~, Facultat d'Economia, Universitat de Valencia, Valencia, Spain, and
Addisson Salazar and Luis Vergara
Instituto de Telecomunicaciones y aplicaciones multimedia, Universitat Politècnica de València, Valencia, Spain

Abstract

Purpose – This research aims to study the effect of R&D (research and development) enablers and barriers as well as industrial property on exploration, their influence on exploitation and finally the possible impact on innovative outcome (IO) as a result variable. The IO can be defined as the orientation towards new or improved products, services and processes, as well as towards penetration and greater market share, which the company has obtained as a result of innovative processes.

Design/methodology/approach – For this purpose, a new relationship model is defined, which is empirically contrasted in a quantitative study. We use a sample of large firms from different economic sectors with a high level of investment in R&D.

Findings – The results indicate a close relationship between exploration and exploitation processes, as well as a positive impact on the innovative outcome. Moreover, the type of relationship that R&D enablers and barriers have with exploration is demonstrated and the lack of a positive effect of industrial property on exploration.

Practical implications – These results may lead to new markets opening up and the creation or improvement of new products, services or processes in diverse sectors of highly innovative firms.

Originality/value – This research aims to study the effect of R&D enablers and barriers and industrial property on learning flows and, finally, the possible impact on the innovative outcome. A new theoretical model of relationships is defined, and it is the first time that it is empirically tested.

Keywords R&D enablers and barriers, Industrial property, Exploration, Exploitation, Innovative outcome

Paper type Research paper

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1. Introduction

Innovation is an activity that is difficult to predict. New products or services or the solutions to problems associated with them are developed through complex, indeterminate processes. However, innovations are important for firms involved in technological activity since they have the potential to open up new markets and products, services or processes that are necessary in a competitive environment such as the current one (Maggitti *et al.*, 2013; Ringberg *et al.*, 2019).

In general, firms can produce new products or services because they explore completely new areas that shift away from their current knowledge base or because they turn current knowledge into new knowledge. Today's literature about the search for innovation based on organisational learning is well-known, with two different but complementary focuses: one on exploration and another on exploitation (Wilden *et al.*, 2018).

Through the focus on exploration, the variety of the search extends to new areas, resulting in innovative products or services (Randhawa *et al.*, 2016). However, the expected returns may spread out over time and, as a consequence, the probability of new inventions, too (March, 1991).

On the other hand, by focusing on the exploitation of the firm's current knowledge, the returns for the firm can be relatively high because the value of the knowledge is already known and can, therefore, increase the frequency of creating new products or services (Knight and Harvey, 2015). In summary, when the search is more exploratory, the results will be more innovative but not more reliable, and when the search is more exploitative, the results will be less innovative but more efficient (Wang and Hsu, 2014; Katila and Chen, 2008).

The value of innovative processes focusing on exploration and exploitation processes to obtain an innovative outcome (IO) has been studied. IO has been defined as new products, services or processes (or improvements) that the organisation has obtained as a result of an innovative process (Crossan and Apaydin, 2010; Vargas *et al.*, 2018). Some empirical studies have shown that firms that explore generate new and more innovative technologies in the long term but infrequently (Greve, 2007). On the other hand, firms that exploit generate new technologies in the short term and do so more frequently (Katila, 2002). However, few works have studied the relationship between exploration and exploitation in a direct way.

This paper contributes to an analysis of the relationship between exploration, exploitation and IO in four important ways.

Firstly, previous studies have only partially analysed the relationship between exploration and exploitation (Guisado-González *et al.*, 2017). Some of them have considered both as independent activities with no relationship, for example, Voss *et al.* (2008) or Jansen *et al.* (2009). Other studies accept the existence of a relationship whereby one substitutes the other because they need to compete for the company's scarce resources (Laursen *et al.*, 2010; Lavie *et al.*, 2011). Finally, other authors have considered the two learning flows as complementary with a range of combinations. These combinations are called ambidexterity in much of the literature in this area (Raisch and Birkinshaw, 2008; O'Reilly and Tushman, 2013; Asif and Vries, 2014; Parida *et al.*, 2016; Tian *et al.*, 2020; Wolf *et al.*, 2019). However, in this paper, we present and test the direct relationship between exploration and exploitation, with good results.

Secondly, other works propose theoretical models that are original but which, in the end, are not empirically contrasted in quantitative or qualitative studies. Thus, this area remains a topic of interest in research (Katila and Chen, 2008; Crossan and Apaydin, 2010; Teece, 2012; Vargas *et al.*, 2018; Wilden *et al.*, 2018). In this paper, then, we empirically test our new model in a quantitative study with significant conclusions.

Thirdly, most studies include organisational performance as a final variable (Lubatkin *et al.*, 2006; Raisch and Birkinshaw, 2008; Parida *et al.*, 2016; Arzubiaga *et al.*, 2020). However, we are more specific, and we work with a new variable called IO. (Crossan and Apaydin, 2010; Vargas *et al.*, 2018).

Fourthly, in this paper, we will include other variables such as enablers, R&D barriers and industrial property and study their effect on exploration and exploitation, including the effect on IO as a result variable. For this purpose, a new theoretical model of relationships is defined that is empirically contrasted.

The structure of the paper is as follows. Firstly, the theoretical framework is presented, where exploitation and exploration are defined, as well as the variables that define R&D enablers, barriers, and industrial property and their effect on the IO. Their fundamental relationships are studied and transposed into a theoretical model. Next, the hypotheses to be tested are presented. These hypotheses are tested in a quantitative study in highly innovative firms with high spending on R&D. There are firms in the economic sectors of software and telecommunications, pharmaceuticals, space aeronautics construction and more. Finally, the most relevant results, discussion and conclusions are presented, as well as some of the main limitations and future lines of research.

2. Theoretical background

In this first section, we will develop the theoretical framework and define the variables, which will serve as the basis to build our theoretical model of relationships.

2.1 Exploitation and exploration

The tasks of R&D are characterised fundamentally by their complexity and by the heavy investment they demand. Both aspects require a search for enablers (especially for economic investment), overcoming important barriers and protecting the new knowledge generated. In this context, there is also a need to generate learning flows, both internally and externally, to help transfer technological knowledge (Crossan and Apaydin, 2010). These constant and iterative learning flows in all directions lead to innovative processes that, in the medium or long term, enable the company to increase its competitiveness. In addition, they are a condition for sustained change in the state of knowledge of an individual or an organisation, and they represent the transformation of both the way of thinking about things and how to do them within the organisation. Argyris and Schön (1978) and Crossan *et al.* (1999) define these learning flows as the transfer and dissemination of knowledge within and across the boundaries of the organisation.

On this basis, learning flows allow firms to explore new knowledge and exploit existing knowledge to innovate more and better (Benitez *et al.*, 2018). Two important processes emerge: exploration and exploitation, which involve two different learning activities.

The main objective of exploitation is to take advantage of exploiting local knowledge within the limits of what is known, and the activity is more geared towards the selection and standardisation of successful practices. For this reason, the activity of exploitation does not generate originality but stability and the reinforcement of the routines. The flow of learning related to this flow indicates the way in which institutionalised learning affects individuals and groups. It is the process for taking advantage of what exists, focusing resources on improving products and processes; therefore, it includes aspects such as refinement, choice, production, efficiency, selection, implementation and execution (March, 1991).

Exploration, on the other hand, indicates practices that seek and experiment with new knowledge. In other words, this learning flow is related to the transfer of learning from individuals and groups that becomes embedded or institutionalised in the organisation in the form of systems, structures, strategies and procedures (Hedberg, 1981; Shrivastava, 1983).

Along these lines, some authors recognise the exploitation process as an internal function in the company's main dimension (exploitation of existing resources) and the exploration process as a purpose dimension, a fundamentally external function (Marín-Idárraga *et al.*,

2016). Exploitation also implies refining the internal resources that give rise to more routines and more control. It, therefore, helps a company to innovate more, but it hinders high-impact innovation (Greve, 2007). Exploration, on the other hand, involves research into processes and scientific searches. It allows a company to develop high-impact innovations (Danneels, 2002; March, 1996). This includes elements such as searches, variation, risk-taking, experimentation, play, flexibility, discovery and innovation (March, 1991). These elements are associated with possibilities for development beyond the organisational limits, and therefore, they imply relationships with the environment in which the company seeks to absorb new knowledge (Lavie and Rosenkopf. 2006: Bierly *et al.*, 2009; Lloria and Peris-Ortiz, 2014; Peeters and Martin, 2017).

Exchanges between the two processes are inevitable because the two types of learning require orientations, strategies, capacities but substantially different structures (Bauer and Leker, 2013). Both processes are important in the company, but their presence can generate a dilemma to a greater or lesser degree (March, 1996, 2006).

The central aspect of the distinction between the processes of exploration and exploitation, and their relationship with the IO, lies in whether it is better for the organisation to adopt an orientation. This allows the organisation to use its knowledge in the search for improvements within an established framework (i.e. exploitation) to pursue an orientation based on refreshing knowledge towards exploration.

In conclusion, recognising and managing the tension between exploitation and exploration is not an easy task; they are both critical challenges in the theory of organisational learning (Crossan *et al.*, 1999). Therefore, one key aspect in our research is that an organisation should be involved in sufficient exploitation to guarantee its current viability while devoting sufficient attention to exploration to ensure the organisation's future viability (Levinthal and March, 1993). Some studies have used the notion of ambidexterity to refer to the balance between exploration and exploitation (Simsek *et al.*, 2009; O'Reilly and Tushman, 2013; Hill and Birkinshaw, 2014; D`Souza *et al.*, 2017 and others). Other authors simply suggest that ambidexterity is only an approach to explore and exploit simultaneously (Lavie *et al.*, 2010).

2.2 R&D enablers and barriers, industrial property and their effect on exploration

Having explained the concepts of exploration and exploitation and the need to apply them to some extent simultaneously in organisations, we will now define other variables that will help us create our theoretical model. These independent variables are R&D enablers, R&D barriers, industrial property and IO as a result variable.

The tangible and intangible investment in R&D enablers, such as financial resources, equipment, advanced software and hardware or qualified staff, can be considered to be today's challenges to innovative firms (March, 1991; Lee *et al.*, 2018), yet the high costs of exploratory R&D projects are necessary for exploratory activities. In the same vein, Dominguez and Massaroli (2018) show that exploration processes are affected by the use of information technology systems, the autonomy of researchers and learning culture. There are studies that look into investment as an enabler of R&D and relate investment to the performance of exploratory innovation, concluding that spending on resources, in terms of both finance and qualified personnel, is essential and facilitates the innovative processes (Basu *et al.*, 2011; Lee *et al.*, 2018). Likewise, investment in innovation has been related to exploratory learning outcomes in order to achieve the most efficient method for firms (Battistini *et al.*, 2013). The contemporary vision proposes that R&D enablers provide strong support for success in exploration activities, contributing to the organisation by encouraging the creation of new ideas and knowledge while generating a more innovative context. Finally, innovative activity, when successful, generates profits from internal resources, which allows

firms to overcome the barriers associated with financing innovative projects and reduces dependence on external financial sources (Castillo-Merino *et al.*, 2010).

Based on these statements, we propose the first hypothesis of this study.

H1. R&D Enablers have a positive impact on exploration.

During the R&D process, firms are forced to face numerous challenges, impediments and obstacles. These are often called innovation barriers (D'Este *et al.*, 2012; Sandberg and Aarikka-Stenroos, 2014). Research on barriers to innovation has been scarce. However, this approach to barriers is particularly useful since it allows potential specific problems to be identified that can potentially affect innovation, as explained by Hölzl and Janger (2012). Paradoxically, the latter affirms that barriers can be considered advantageous since they filter out the most unrealistic innovation projects and help identify resources for the objectives of the project that is to be carried out.

In Kleijnen *et al.* (2009), infrastructure barriers, financing, qualified training of R&D workers, technological information, state activity in R&D and other factors are considered to be some of the barriers for firms. Nevertheless, the barriers within innovative firms may mostly be economical due to the expense of trying out new solutions and methods (Mancusi and Vezzulli, 2014). Firms that invest in the challenge of innovations generate barriers related to the uncertainty of success. Innovative firms are repeatedly exposed to various types of barriers; hence, the importance of research into the barriers' influence on exploration or exploitation processes is an issue today (Dougherty, 1992; Coad *et al.*, 2016; Das *et al.*, 2017).

Based on these works, we can propose hypothesis 2.

H2. R&D barriers have a negative impact on exploration.

Innovative companies face a fundamental challenge of competitive advantages, which, in the end, is the search, for knowledge entails the propensity to fail, for imitation and mobility. In this environment, industrial property (IP) is a strategic field as a mechanism to protect inventions (Somaya, 2012; Holgersson and Wallin, 2017; Modic *et al.*, 2019).

Innovative firms with patents increase their capacity to attract greater financing or external investment through a re-evaluation of their assets. Patents make it possible or help firms access external resources and foreign markets, for example, through transfer agreements or patent licences (Großmann *et al.*, 2016). Patents could also be interpreted as an intermediate result of R&D expenditure (Hsu and Ziedonis, 2013). The development of new products requires a broad set of highly specialised technologies, knowledge and skills that are difficult to create internally (Iansiti, 1997). IP such as patents is a source of detailed scientific knowledge-sharing, allowing key knowledge to be extracted about the materials, processes, functions, parameters, considerations and restrictions of proven innovations (Shapiro, 2001). Exploration into the applicability of IP for analysis and decisions in the design stages could help reduce the time it takes to analyse new knowledge through the use of existing information processing (Rosenkopf and Nerkar, 2001; Agarwal *et al.*, 2009). Likewise, Wang *et al.* (2017) and Cammarano *et al.* (2017) have identified that IP and exploration activities have a good influence on innovation implementation. Furthermore, a relationship was found between the number of IPs, classified by exploration activities, with R&D costs and their positive influence on the value of the share price (Yu and Hong, 2016). Based on these arguments, we can pose hypothesis 3 of this study.

H3. Industrial property (IP) has a positive effect on exploration.

2.3 Innovative outcome (IO) as a result variable

R&D is a source of corporate competitiveness and, at the same time, a challenge for the company. Today's competition in business is greater (fiercer) and more uncertain than in the past. For large firms, it is almost impossible to have R&D advantages in all fields because,

generally, there are limits to their resources, and they cannot neglect the R&D barriers (Xu, 2014). That said, once firms are involved in R&D processes, the IO is the endpoint of those processes, and it can be defined as new products, services or processes (or improvements) that the organisation has obtained as a result of an innovative process (Crossan and Apaydin, 2010; Vargas *et al.*, 2018).

According to the literature, the capacity for innovation is the most important determinant of performance in business profits. It is based on a positive relationship between a firm's innovation and profitability measures in order to generate profits (Ramadani *et al.*, 2017). However, there are a few studies available that have looked quantitatively into the effects of exploration and exploitation on IO (Lavie *et al.*, 2010). Among the studies that consider IO to be a key dependent variable for empirical study are the following: Pati and Garud (2020), Vargas and Lloria (2019), Vargas *et al.* (2018), Guisado-González *et al.* (2017) and Crossan and Apaydin (2010). We have considered these previous works as the background for this research.

Authors such as Ahuja and Katila (2001), Rosenkopf and Nerkar (2001), Wang and Li (2008) and others have stated that the IO has a different effect depending on the exploration or exploitation activities. For their part, Quintana-García and Benavides-Velasco (2008) affirm that IO has a stronger effect on exploration activity than on innovative exploitation activity. However, exploitation also involves development processes and covers the search for technology. This empirical evidence suggests that in technological advances, diversity can mitigate the central rigidities and dependencies of routines. This happens especially when improving innovative solutions that accelerate the rate of invention, which shifts the company away from its past activities. In addition, IO was studied in Ahuja and Lampert (2001), suggesting that the pursuit of original technologies or experimentation with new existing technologies is likely to require slack resources but can generate returns. Several outstanding studies have looked into the effects of flows with organisational performance, particularly the alignment model proposed by Bontis *et al.* (2002) and business performance (Jansen *et al.*, 2006).

However, examples demonstrate a growing interest in the literature in the relationship between exploration, exploitation and innovation and the need to go deeper into their relationships in a more direct way (Guisado-González *et al.*, 2017; Wilden *et al.*, 2018; Tian *et al.*, 2020). For the purpose of this work, IO is analysed with the nine characteristics shown in Table A1. For all of these reasons, we propose the following hypotheses *H4* and *H5*.

H4. Exploration has a positive impact on exploitation.

H5. Exploitation has a positive impact on the innovative outcome.

3. Theoretical model to be tested and summary of the hypotheses

Figure 1 shows the proposed predictive causal model of linear relationships. As independent variables, we consider the R&D enablers and barriers and industrial property. Specifically, we will study how industrial property and R&D barriers and enablers affect exploration then the effect of exploration on exploitation and the latter's effects on the IO as a result variable.

4. Research method

This section gives the characteristics of the sample, the measurement scales and the validation of the measurement scales.

4.1 Characteristics of the sample of firms

The dataset used in this paper contains firm-level data from the Spanish Technological Innovation Panel (PITEC). The survey was carried out by the Spanish Institute of Statistics

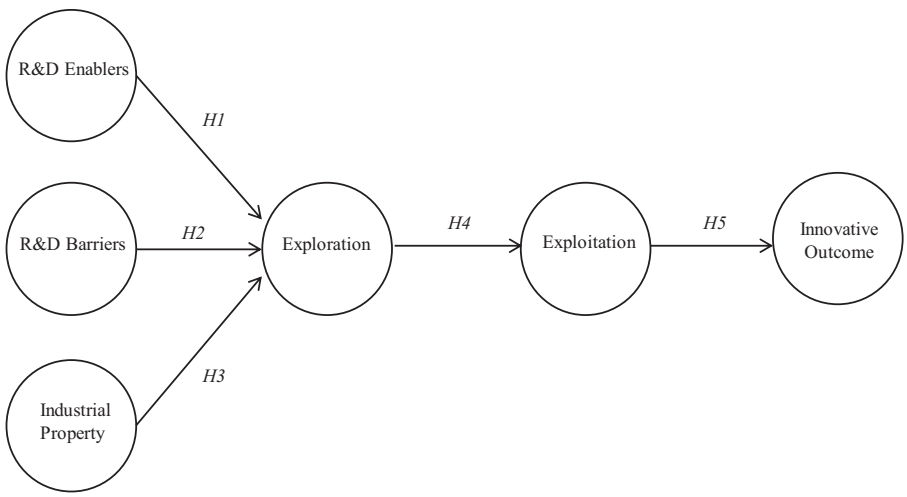

Figure 1.
Theoretical model to be tested

(INE), the Spanish Foundation for Science and Technology (FECYT) and the Foundation for Technological Innovation (COTEC). To create our sample, we selected the sub-samples from the database: (1) large firms with more than 250 employees and more than 50 million euros in turnover (European Commission, May 2003). These are firms that produce differentiated goods with high capital investment and innovation costs. They also have a high concentration of highly qualified workers; (2) firms with high total spending on innovation (above five million euros). In total, the group of firms that met both criteria contained 234 firms. As for the sector, the firms mostly belong to innovative sectors such as the industrial sector of software and telecommunications, pharmaceuticals, and aeronautical and space construction.

The six variables used in the empirical study and their items are shown in Table. The scales of measurements were those used in the questionnaire ite_cues15 called "Survey on Business Innovation 2015 in. All reflective measurements are classified according to the four-point Likert scale (Hair *et al.*, 2017; Vargas and Lloria, 2019). On the other hand, to homogenise the scales of measurement of two variables (R&D enablers and industrial property) with measurements of ratio, where zero represents the absence of the characteristic, a frequency distribution analysis of classes was carried out to group the data into categories and determine the number of classes according to Sturges (1926) and Mason *et al.* (1998).

4.2 Validation of measurement scales

To analyse and validate the data, we used the partial least square (PLS) technique (Wold, 1980, 1985; Fornell and Bookstein, 1982; Bagozzi *et al.*, 1991). Table 1 provides the load (λ) of most of the items. It was found that most of the loads (λ) of the items are greater than 0.7 (Chin, 1998). The results show that all of the reflectively measured constructs' measurements are reliable and valid (Cepeda-Carrion *et al.*, 2018). We examined the values of the variance inflation factor (VIF) and all the values of the items included are below 3.3, verifying the non-collinearity and removing problematic items (Diamantopoulos and Siguaw, 2006). We also include an assessment of convergent validity and internal consistency reliability. Smart PLS 3.0 (Ringle *et al.*, 2015) obtained these values. The evaluation of the quality of the measurement model was carried out by analysing internal consistency, a convergent validity analysis (viable and valid constructs measurements by obtaining the AVE).

Constructs	Items	Loading	VIF	Cronbach's α	Composite reliability	AVE
R&D enablers	EN1	0.822	1.508	0.827	0.878	0.643
	EN2	0.758	2.042			
	EN3	0.851	2.160			
	EN5	0.774	2.035			
R&D barriers	BR5	0.811	2.370	0.848	0.888	0.668
	BR2	0.831	2.111			
	BR3	0.852	1.928			
	BR6	0.702	1.671			
Industrial property	IP1	0.759	1.853	0.750	0.827	0.546
	IP2	0.751	1.538			
	IP4	0.720	1.622			
	IP6	0.803	1.206			
Exploration	EXPLR1	0.913	3.300	0.915	0.940	0.796
	EXPLR3	0.874	3.233			
	EXPLR4	0.898	3.296			
	EXPLR6	0.884	3.022			
Exploitation	EXPLOT1	0.795	1.730	0.834	0.889	0.667
	EXPLOT2	0.813	1.804			
	EXPLOT3	0.802	1.695			
	EXPLOT5	0.884	2.033			
Innovation outcome	IO1	0.793	2.929	0.906	0.928	0.681
	IO3	0.824	3.279			
	IO5	0.812	2.207			
	IO6	0.869	2.972			
	IO7	0.831	2.824			
	IO9	0.823	2.379			

Note(s): EN: R&D enablers; BR: R&D barriers; IP: industrial property; EXPLR: exploration; EXPLT: exploitation; innovative outcome: IO; AVE: average variance extracted; R&D: research and development

Table 1. Assessment of convergent validity and internal consistency reliability

An analysis of discriminant validity was also carried out (Table 2). These analyses show that the results satisfactorily meet the requirements established in the literature.

5. Results

Table 3 shows the results obtained after testing the hypotheses. At first sight, it can be seen that four of the five hypotheses are met with optimal results in the sample of firms analysed (*H1, H2, H4* and *H5*). *H3* is fulfilled but inversely. Each of them is explained below.

Hypothesis *H1* states that the R&D enablers will have a positive impact on exploration: *H1*: β (0.243), R^2 (0.169), and t (2.585**). The results confirm that this hypothesis can be accepted.

Regarding the second hypothesis, *H2*, we stated in the theoretical framework, it is true that the R&D barriers will have a negative impact on exploration: *H2*: β (−0.252), R^2 (0.169) and t (2.215*).

The third hypothesis was that industrial property would have a positive impact on exploration. The results are as follows: *H3*: β (−0.272), R^2 (0.169), and t (3.962 ***). This indicates that the hypothesis is not met with optimal results. Surprisingly, the variable industrial property is strongly related, but negatively, to exploratory activity.

Hypotheses *H4* and *H5* highlight the importance of the IO as a result variable between exploration and exploitation. The results indicate that both hypotheses are met with optimal results: *H4*: β (0.857), R^2 (0.735), and t (27.969 ***) and *H5*: β (0.849), R^2 (0.722) and t (26.246***). Both hypotheses assume the central core of our model, and their results were

	R&D barriers	R&D enablers	Exploitation	Exploration	Industrial property	Innovative outcome
R&D barriers	0.817					
R&D enablers	−0.236	0.802				
Exploitation	−0.174	0.223	0.817			
Exploration	−0.265	0.233	0.778	0.892		
Industrial property	−0.164	0.255	−0.077	−0.169	0.739	
Innovative outcome	−0.172	0.173	0.801	0.808	−0.083	0.826
AVE	0.668	0.643	0.667	0.796	0.546	0.681
Square root AVE	0.817	0.802	0.817	0.892	0.739	0.826

Table 2.
Discriminant validity

Hypothesis	Sample mean (M)	Standardised path coefficient (β)	t-statistics (O/STERRR)	R^2	Q^2 Blindfolding
H1 R&D enablers → exploration	0.243	0.243	2.585**	0.169	0.123
H2 R&D barriers → exploration	−0.252	−0.252	2.215*		
H3 Industrial property → exploration	−0.272	−0.272	3.962***		
H4 Exploration → exploitation	0.857	0.857	27.969***	0.735	0.482
H5 Exploitation → innovative outcome	0.849	0.849	26.246***	0.722	0.487

Note(s): Values estimated using Smart PLS for a bootstrapping sample of 500
Significance: t (0.05; 499) = 1.647345; t (0.01; 499) = 2.585711627; t (0.001; 499) = 3.310124157; Confidence level 95%, 99 and 99.9%. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ based on t (499), two-tailed Student's t-test with $n-1$ degrees of freedom

Table 3.
Summary of results

statistically significant. In the sectors studied, the exploration processes offer optimal results in relation to the opening up of new markets and better products, services or processes.

Finally, we used the bootstrapping technique with a recommended sample size of 500 to evaluate the statistical significance of the path coefficients. In Table 3, we show the summary of the results of the hypotheses. The results of the predictive relevance of the dependent constructs, blindfolding Q^2 (Chin, 1998; Tenenhaus *et al.*, 2005) (exploitation: 0.482, exploration: 0.123, innovation outcome: 0.487) are positive, which confirms the predictive relevance of the model (Henseler *et al.*, 2009). We also calculated the Goodness-of-Fit (GoF) index (Tenenhaus *et al.*, 2005), which was 0.602.

Furthermore, we evaluated the model using PLSpredict (Ringle *et al.*, 2015), following the guidelines for predictive model assessment in PLS-SEM of (Shmueli *et al.*, 2019). In the first step, we found that all of the latent variables items outperform the most naïve benchmark (i.e. the training sample's indicator means), as all the items yield $Q^2_{\text{predict}} > 0$. Comparing the square root of the average (RMSE) values from the PLS-SEM analysis with the naïve LM benchmark, we found that the PLS-SEM analysis produces lower prediction errors for all the indicators (Evermann and Tate, 2016). We used one repetition (i.e. $r = 1$) when the predictions should be based on a single model (Shmueli *et al.*, 2019). The prediction summary for the latent variables (exploration, exploitation and innovative outcome) is Q^2_{predict} 0.121, 0.105 and 0.144 in terms of RMSE (0.228, 0.125 and 0.268, respectively), the values reveal that the model has

good predictive abilities. Finally, the values obtained for these evaluation criteria demonstrate the fit of the proposed model.

6. Conclusions

The main objective of this work was to study the effect of industrial property and R&D enablers and barriers on exploitation and exploration processes, considering the IO as a dependent variable.

Since March published his work in 1991 on the flows of learning, exploration and exploitation, there have been numerous subsequent studies. Even today, it remains an area of knowledge with great potential (Wilden *et al.*, 2018). In this paper, we have explained in an original way how both learning flows behave by introducing the IO variable as a dependent variable. In addition, as drivers or brakes on the innovative process, we have also introduced industrial property and R&D enablers and barriers.

After designing a theoretical framework in which we have defined the main variables and their relationships, we formulated five hypotheses. These hypotheses have been tested in a study of a quantitative nature on a sample of 234 large Spanish firms.

A major effort was made to integrate a construct of six variables measured with a four-point scale and to evaluate the measurement model using the PLS technique (internal consistency, convergent validity and discriminant validity), as well as to evaluate the structural model. The values reveal that the model has good predictive abilities. These scales, when validated, can, thus, be used by other researchers, and the model enables explanation and prediction in a fairly acceptable way. This combined attempt is original and contributes knowledge to exploration and exploitation with innovative outcomes, relating to R&D enablers, R&D barriers and industrial property as independent variables.

Five hypotheses were proposed, of which four have been met. Surprisingly, the one that is not fulfilled is actually met inversely to how it was initially proposed. Thus, we provide the following rationale: The interpretation of our findings involves two central considerations. Firstly, we can see the importance of exploration as a process in which new knowledge is sought and experienced. This allows advantage to be taken of what already exists by designing or improving new products, services or processes. Exploration can be driven by a group of enablers, above all financial and technological resources but inhibited by important barriers such as a lack of funding, information or qualified personnel, among others (Mansfield *et al.*, 1981; Dougherty, 1992; Agarwal and Bayus, 2002; Vargas *et al.*, 2016). Secondly, an inverse relationship is seen between industrial property and exploration. Various arguments have been put forward to explain this. One could be that the high costs of innovation and the competitive advantage it provides in the short term encourage firms to exploit their patents for a long period rather than make innovations. Another explanation may be the possibility of being imitated (Lemley and Shapiro, 2005). The patent requires publication of the innovation, and thereafter competitors could develop complementary innovations more easily, eliminating the possibility of competitive advantage arising from being the first (Shapiro, 2001). For this reason, some firms opt for other forms of protection, such as industrial secrecy (Lee *et al.*, 2017).

The main originality and strength of our model lie in the effect of R&D enablers and barriers and industrial property on the exploration process, the latter's relationship with exploitation and the final effect on IO as a variable of results. In this vein, recognising and managing the tension between exploration and exploitation is not an easy task; they are two critical challenges in the theory of organisational learning (Crossan *et al.*, 1999). Therefore, the key aspect in our research is that an organisation should be involved in sufficient exploitation to ensure its current viability and, at the same time, devote sufficient attention to exploration to ensure the future viability of the organisation (Levinthal and March, 1993). The study

confirms these proposals. This indicates that exploration leads to a series of results that, in turn, enhance exploitation. These findings, which may provide an opening to new markets and the creation or improvement of new products, services or processes, can open the doors to standardisation, new routines, efficiency and productivity. Ultimately, managing the tension between exploration and exploitation may give the stability that a company needs to enter new innovative processes in the short, medium and long term.

In terms of the limitations of this investigation, the scope of the sample may be a limiting factor, as the research only included a single country. Recent developments in PLS have emphasised the use of formative models for obtaining good predictive abilities (Chin *et al.*, 2020). However, this is currently an issue under discussion (Shmueli *et al.*, 2019). This work was limited, with a relatively small number of variables and reflective items. The combination of a greater number of new variables related to each other, measured with formative indicators (e.g. cooperation in innovation), would be of interest and is one of our proposals for future research. Furthermore, another model could also be defined based on the exploitation variable in this same data panel and applying new methods developed from the signal-processing framework to the problem proposed in this work (Salazar *et al.*, 2014). Recently, these methods have shown interesting results in data analysis for several applications that could complement the ones obtained by traditional statistical methods.

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Appendix

Variables	Items	Objectives
R&D barriers	BR1	Missing funds within firm
	BR2	Lack of external financing to the firm
	BR3	High innovation cost
	BR4	Missing qualified staff
	BR5	Lack of information technology
	BR6	Lack of information markets
	BR7	Difficulty in finding partners for co-operation in innovation
R&D enablers	EN1	Internal R&D costs: Remuneration researchers, technical and auxiliary, and other trends
	EN2	Acquisition costs of machinery and equipment
	EN3	Acquisition costs of others external knowledge for innovation
	EN4	Acquisition costs of external R&D
	EN5	Introduction cost of innovations in the market cost
	EN6	Training costs for innovation activities
Industrial property	IP1	Spanish patents
	IP2	European patents
	IP3	American patents
	IP4	Patent cooperation treaty
	IP5	Register of utility models
	IP6	Brands
	IP7	Copyright
Exploitation	EXPLT1	Feedback information inside the company or group
	EXPLT2	Feedback supplier information
	EXPLT3	Feedback customer information
	EXPLT4	Feedback competitor information
	EXPLT5	Feedback consultants, laboratories
Exploration	EXPLR1	Share information universities
	EXPLR2	Share public research organisations
	EXPLR3	Share information technology centres
	EXPLR4	Share information conferences, fairs and exhibitions
	EXPLR5	Share information: Scientific journals
	EXPLR6	Share information: Professional
Innovative outcome	IO1	Larger range of goods or service
	IO2	Replacement of outdated products or processes
	IO3	Penetration in new markets
	IO4	Greater market share
	IO5	Higher quality of goods or service
	IO6	Greater flexibility in the production or provision of services
	IO7	Increased production capacity or service provision
	IO8	Lower labour costs per unit produced
	IO9	Fewer materials per unit produced

Table A1. Variables and indicators

Corresponding author
M. Begoña Lloria can be contacted at: maria.b.lloria@uv.es

The mediating effect of consumers' price level perception and emotions towards supermarkets

A. Celil Cakici
Mersin University, Mersin, Turkey, and
Sena Tekeli
Toros University, Mersin, Turkey

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Abstract

Purpose – This study aims to reveal the impact of consumers' price sensitivity on their purchase intention within the scope of supermarkets. Besides, the study aims to examine the impact of consumers' price sensitivity on their price perception level and emotions and the impact of consumers' price level perception and emotions toward supermarkets on their purchase intention. It also aims to detect the mediating effects of consumers' price level perception and emotions toward supermarkets between their price sensitivity and purchase intention.

Design/methodology/approach – The quota sampling method was used to form the study sample. The population was 20–69-year-old consumers. The study sample included 513 consumers, 276 of whom were men, and 237 of whom were women. Data were collected via a questionnaire by the researchers in Mersin's (Turkey) five central counties. Explanatory and confirmatory factor analyses and structural equation models were used to analyze data.

Findings – Consumers' price sensitivity, perception of cheapness, perception of expensiveness and positive emotions toward supermarkets affect their purchase intention. Besides, price sensitivity affects their perception of cheapness while it does not affect their perception of expensiveness. It influences negative emotions, but not on positive emotions. Consumers' perception of cheapness and perception of expensiveness have impacts on positive emotions toward supermarkets. It was additionally discovered that perception of cheapness and perception of expensiveness affected negative emotions toward supermarkets. A contributed finding was that perception of cheapness had a partial mediating role between price sensitivity and purchase intention.

Practical implications – The study provides managerial implications in terms of understanding consumers' behavioral changes, developing effective pricing strategies and achieving competitive advantages over the other retailing companies.

Originality/value – The study illustrates that consumer behavior can be explained by a theoretical construct considering the price perception levels and emotions toward supermarkets in examining the effect of consumers' price sensitivity on their purchase intention. Therefore, it contributes to explain consumers' behavior by bringing the stimulus–organism–response (SOR) model into a theoretical construct.

Keywords Price sensitivity, Price level perception, Emotion toward supermarkets, Purchase intention
Paper type Research paper

Introduction

Brand perception and attention, attitudes toward brands, purchasing intention and actual purchasing behavior are the possible consumer reactions. These occur as a result of the consumer purchasing decision process (Pirachi, 2019). To understand how consumers make their purchasing decisions, it is necessary to identify the factors under these behaviors

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(Kotler and Keller, 2012). Different studies (Rana *et al.*, 2015; Mondal *et al.*, 2017; Hanahsya, 2018) reveal the factors influencing consumers' purchasing behaviors in retailing.

Various models are trying to explain from different perspectives how and why consumers behave as they do. One of the widely used theoretical models to explain consumers' behavior is Mehrabian and Russell's (1974) stimulus–organism–response (SOR) model (Zhu *et al.*, 2015; Hetharie *et al.*, 2019). According to the SOR model, an environmental stimulus (S) affects someone's internal evaluation (O), which leads to a response (R) (Mehrabian and Russell, 1974 cited in Hetharie *et al.*, 2019). In other words, marketing mix variables and other environmental inputs, such as visual appeal, information, atmosphere, social cues, accessibility and customer services (Vergura *et al.*, 2020), influence consumers' emotions (Mowen and Minor, 2002; Zhu *et al.*, 2015), environmental interpretations, conscious and unconscious perceptions (Donovan and Rossiter, 1982) and attitudes (Zhu *et al.*, 2015), which result in purchase intention or actual purchase behavior (Zhu *et al.*, 2015).

Since it has broad applicability, many researchers have adopted the SOR model in their study context and integrated cognitive and affective factors into the framework (Kim *et al.*, 2018). There have been research (Donovan and Rossiter, 1982; Chang *et al.*, 2011; Viera, 2013; Goi *et al.*, 2014; Zhu *et al.*, 2015; Hetharie *et al.*, 2019) in retailing modified the SOR model. Even though research-modified SOR models exist, the results are not consistent, and general models have not been proposed (Goi *et al.*, 2014). Besides, Graciola *et al.* (2018) suggested examining price sensitivity within the scope of both lower and higher-level stores including the impact of negative emotions on price image. Thus, guided by the SOR model and consumers' purchasing behavior literature in this study includes price sensitivity toward supermarkets as the independent variable (the stimulus), consumers' price level perception and emotions toward supermarkets as the mediator (the organism) and purchase intention as the dependent variable (response).

Price sensitivity, which is one of the influential factors in consumers' purchasing decisions (Chua *et al.*, 2015; Uslu and Huseynli, 2018), explains how consumers react to changes in price levels (Mamun *et al.*, 2014). If managers have more information about consumers' reviews and their reaction to prices, they find effective ways to appeal to certain consumers and become more successful in increasing profitability rates (Ramirez and Goldsmith, 2009). While price level reflects the amount of money paid to buy the same good or service (Zielke, 2006), the price level perception reflects how cheap or expensive the store is according to consumers' point of view (Zielke, 2010). The results of the consumers' price level perception include consumer beliefs (price evaluations and price justice) and consumer behavior (store selection, selection delay and purchase amount) (Hamilton and Chernev, 2013). Apart from the price level perception, both positive and negative emotions can affect the purchase intention significantly (Kim *et al.*, 2016; Graciola *et al.*, 2018). Purchase intention can be defined as the desire to buy a product from a particular store (Rana *et al.*, 2015).

The present study intends to confirm the causal relationships between the stated variables within the scope of supermarkets, depending on Mehrabian and Russell's (1974) SOR model. The main objective is to examine the influence of consumers' price sensitivity on their purchase intention. The second objective is to detect whether consumers' price sensitivity affects consumers' price level perception – both perception of cheapness and perception of expensiveness – and positive and negative emotions toward supermarkets. The third objective is to scrutinize the influence of consumers' price level perception and emotions toward supermarkets on their purchase intention. The fourth objective is to examine whether consumers' price level perception influences their positive and negative emotions toward supermarkets. The last objective is to detect the mediating role of consumers' price level perception – both perception of cheapness and perception of expensiveness – and positive and negative emotions toward supermarkets between their price sensitivity and purchase intention.

As a result, it is expected to contribute both theoretically and practically to the understanding of the consumers' behaviors within the scope of supermarkets. At the theoretical level, contributions are provided in terms of the modification of the SOR model, the confirmation of the previous studies and the mediating impacts of consumers' price perception and emotions. At the practical level, contributions are stated in terms of understanding consumers' behavioral changes, developing effective pricing strategies and achieving competitive advantages over the other retailing companies.

Theoretical framework and research hypotheses

Purchasing behavior is a process that involves a particular set of efforts to solve a problem. The consumer decision-making process involves five steps: determining a problem, searching information, evaluating alternatives, purchase decisions and postpurchase evaluation. Knowing and understanding every step involved in consumers' decision-making process helps marketing professionals to communicate with consumers. In addition, this enables marketers to reach successful results in guiding consumers to purchase products or services (Clow and Baack, 2016). Purchase intention is one of the possible consumer reactions that occurred as a result of the consumer decision-making process (Pirachi, 2019). Purchase intention is "the willingness of a customer to buy a product or service in a certain condition" (Usman and Okafor, 2019).

Different studies have adapted the SOR model to explain the factors affecting consumers' purchase intention. According to the SOR model, developed by Mehrabian and Russell (1974), an emotional, cognitive and process element exists in humans to receive a stimulus and then respond it. Thus, the process starts with receiving a stimulus then continues in a response through eliciting the organism itself (Meylina and Chandra, 2018). In the original model, stimulus refers to the element affecting an individual's internal state. The organism is defined as the internal process and the outcome of the stimulus. It usually has a mediating role between the stimulus and the response. The response is the final outcome such as purchase intention or actual purchase behavior (Emir *et al.*, 2016). The model has been used in advertising, computer and website experience, and many other consumer behavior domains (Islam and Rahman, 2017).

Chang *et al.* (2011) adapted the SOR model in their study conducted in the retailing domain. They included the social, ambient and design characteristics of the retail environment, consumers' positive emotional responses to the retail environment, impulse buying behavior and the moderating effect of hedonic motivation into the model as variables. Viera (2013) conducted a meta-analysis to summarize the findings of the studies based on the SOR model. Both arousal and pleasure create a variation on utilitarian and hedonic motivation while shopping. Comparing to other variables searched in the studies, arousal-hedonic and pleasure-hedonic relationships form strong influences. Hetharie *et al.* (2019) modified the SOR model by including the stimuli from the store environment, social factors and consumers' fashion involvement in impulsive buying; consumers' emotional gratification as the organism and impulsive buying and postpurchase regret as the response. Based on the SOR framework, Laato *et al.* (2020) proposed a structural model by including exposure to online information as the stimulus and unusual purchases and voluntary self-isolation as the responses.

As it was stated in the introduction, this study includes price sensitivity as the independent variable (the stimulus), consumers' price level perception and emotions toward supermarkets as the mediator (the organism) and purchase intention as the dependent variable (response). It examines the direct and indirect relations between these variables in the retailing domain within the scope of supermarkets, which is one kind of the retail stores (Kotler and Armstrong, 2012) and use a combination of price, goods and services to influence consumers' purchasing decisions (Leal, 2014).

Price sensitivity is a fundamental element to evaluate the target customers since it has a strong effect on companies' bottom line. Businesses need to understand the price sensitivity in determining pricing strategies (Uslu and Huseynli, 2018). Price sensitivity is the extent to which consumers differ in their response to price differences and changes in a product (Kagan, 2020). Price sensitivity may vary according to the different conditions. The situational factors such as income consumption conditions and social content have an impact on price sensitivity. The difference in price sensitivities in functional consumption and hedonic consumption increases as income increases (Wakefield and Inman, 2003). Price sensitivity can stand out among the brands in the same product category, among the product categories in the same store and among the product categories in different stores (Hoch *et al.*, 1995). Even when the packages of competitive products are the same size, when unit price is mentioned, consumers are more motivated to choose cheaper goods. This effect causes changes in consumers' preferences in favor of low-priced products. In addition, unit pricing increases consumers' price sensitivity in the context of price reduction (Yao and Oppewal, 2016). According to Ghali-Zinoubi and Toukabri (2019), consumers' price sensitivity and involvement are effective in consumers' intent to buy an organic product, if the product is regional, and consumers' involvement is high, but price sensitivity is low. Similarly, Walia *et al.* (2020) found price sensitivity is one of the significant factors affecting the consumers' purchase intention within the scope of retail outlets selling green products. Accordingly, the following hypothesis can be established as follows:

H1. Consumers' price sensitivity affects their purchase intention.

Price sensitivity involves awareness of price distribution, requiring considerable time and psychological effort. The number of alternative retail outlets has been increasing. Thus, households with more substitution possibilities may have more price sensitivity unless the prices in different stores are equivalent (Hoch *et al.*, 1995). In general, while consumers with high price sensitivity respond strongly to a price change, consumers with low price sensitivity have a relatively weak response to the price change (Han *et al.*, 2001; Kagan, 2020). The fundamental issue is whether the customers notice the changes in price and respond to these changes as expected. Thus, customers' way of price level perception is as important as the price itself. What consumers perceive does not always match with what retailers provide. A traditional grocer determines such a price to align price perception with high-end value (Heda *et al.*, 2017). The price level perception reflects how cheap or expensive the store is according to consumers' point of view (Zielke, 2010). Consumers with low price sensitivity can positively evaluate the expensive perception of supermarkets and start thinking they are not expensive (Backman and Crompton, 1991). Therefore, it can be concluded that consumers' price sensitivity may affect their price level perception and emotions. The hypotheses based on this conceptual information are as follows:

H2. Consumers' price sensitivity affects their perception of cheapness.

H3. Consumers' price sensitivity affects their perception of expensiveness.

H4. Consumers' price sensitivity affects their positive emotions toward supermarkets.

H5. Consumers' price sensitivity affects their negative emotions toward supermarkets.

Price level perception can differ according to consumers. Some consumers can evaluate a market's price level by comparing it with the other markets' price levels. Thus, they reach a judgment regarding the low or high price level of that market. Some consumers assess the sacrifices made with the benefits obtained. This results in a perception of whether the market is reasonable in terms of price–performance ratio (Zielke, 2011). While the price perceived as very high by the consumers causes them to hesitate while purchasing a product, the price

perceived as reasonable or suitable for the product enables consumers to be willing to buy a product (Boonpattarakan, 2012). In their study conducted within a grocery-shopping context, Fecher *et al.* (2019) found price presentation (unit price and retail price) affects price perception depending on the size and the package of the product; thus, consumers' price level perception influences their purchase intention. The hypotheses created based on this conceptual information are as follows:

H6. Consumers' perception of cheapness affects their purchase intention.

H7. Consumers' perception of expensiveness affects their purchase intention.

Apart from the price level perception or the value obtained in return for the money paid, emotions can affect the purchase intention significantly (Kim *et al.*, 2016; Graciola *et al.*, 2018). Emotional responses play a significant role in forming consumers' impressions. While evaluating products, consumers depend on their emotions (Ladhari *et al.*, 2017). Emotion is intimately connected with cognition, and how these psychological processes interact with each other to affect behavior has been an active field of research (Shukla *et al.*, 2019). Emotions are formed with high intensity, rapid change and short-lasting (Spinelli and Monteleone, 2018). In short, emotion is "a complex reaction pattern, involving experiential, behavioral and physiological elements, through which an individual attempts to deal with a personally significant matter or event" (American Psychological Association [APA], 2020). Positive emotions can be defined as pleasant responses toward the world, which are complex and targeted. On the other hand, negative emotions can be considered unpleasant or unhappy responses to the environment. A negative emotion discourages people. While satisfaction, interest, joy, amusement, happiness, love, serenity, awe and contentment are some common positive emotions, sadness, rage, anger, loneliness, disgust, melancholy and annoyance are most commonly felt negative emotions (Ackerman, 2021).

According to Zielke (2011), low prices can reduce negative emotions such as distress and anger by adding value. If negative emotions decrease, consumers' purchase intention may increase. In other words, positive emotions affect purchase intention positively. Some customers can feel embarrassment while buying from cheap retailers or think cheap prices might be caused by the unethical retail policy. In addition, customers can associate their own experiences with negative emotions such as excitement, unhappiness and anger related to certain retail prices. Customers' negative emotions affect their purchase intentions negatively. According to Ladhari *et al.* (2017), positive emotional satisfaction increased by service quality and service environment leads to a high recommendation, perceived high product quality, patronage intention and purchase intention. In her study conducted within the scope of factors affecting the purchasing decisions of consumers who shop online, Cinar (2020) found out consumers' positive emotions increase the frequency of shopping, while their negative emotions decrease this frequency. The hypotheses based on this conceptual information are as follows:

H8. Consumers' positive emotions toward supermarkets affect their purchase intention.

H9. Consumers' negative emotions toward supermarkets affect their purchase intention.

According to Hamilton and Chernev (2013), when consumers associate a price with stores with low prices, they consider them more negative compared to stores with high prices. In a sense, they relate the level of cheapness and quality in the opposite direction. However, living conditions and income inequalities lead consumers to search for cheap and quality products (Ceylan *et al.*, 2016). Compared to alternative supermarkets, consumers think that they are shopping at more affordable prices and are satisfied with the price advantages offered, continuous shopping intentions, perceptions of value, high product and service quality

perceptions are important significant indicators. By contrast, compared to alternative supermarkets, the perception of prices as expensive by consumers may be an indicator of their perception of the quality of goods and services (Duman and Yağcı, 2006). Therefore, it can be concluded that consumers' price level perception affects their emotions. The hypotheses created by synthesizing this conceptual knowledge in the literature are as follows:

H10. Consumers' perception of cheapness affects their positive emotions toward supermarkets.

H11. Consumers' perception of cheapness affects their negative emotions toward supermarkets.

H12. Consumers' perception of expensiveness affects their positive emotions toward supermarkets.

H13. Consumers' perception of expensiveness affects their negative emotions toward supermarkets.

The results of the consumers' price level perception include reactions such as consumer beliefs and consumer behavior (Hamilton and Chernev, 2013). Emotions can affect both the result of a consumption experience and the evaluation of consumption experiences (Bagozzi *et al.*, 1999). Individuals with negative emotions process information in more detail and make more accurate judgments by analyzing their external environment more accurately. Positive emotions can distract individuals because they concentrate on their positive thoughts, and they can give subliminal reactions while thinking more creatively (Forgas, 2013). In other words, if people are in a positive emotional state, they make consumption preferences suitable for a positive emotional state (Di Muro and Murray, 2012). Therefore, it can be assumed that any consumer who is sensitive to price will be prone to behaviorally purchasing when there are products that he/she finds affordable. His/her price level perception and emotions can mediate this relationship. Accordingly, the following hypotheses can be established as follows:

H14. Consumers' perception of cheapness mediates the relationship between their price sensitivity and purchase intention.

H15. Consumers' perception of expensiveness mediates the relationship between their price sensitivity and purchase intention.

H16. Consumers' positive emotions toward supermarkets mediate the relationship between their price sensitivity and purchase intention.

H17. Consumers' negative emotions toward supermarkets mediate the relationship between their price sensitivity and purchase intention.

Figure 1 shows the conceptual model of the research developed based on the theoretical background and literature. The hypotheses developed through synthesizing the literature have been presented below, and within the framework of this model, 17 hypotheses have been tested.

Method

Measurements

The data were collected through a questionnaire developed based on the literature. The four scales in the survey were from Graciola *et al.*'s (2018) study. There were five items on the price sensitivity scale and six items on the price level perception scale for supermarkets. On the

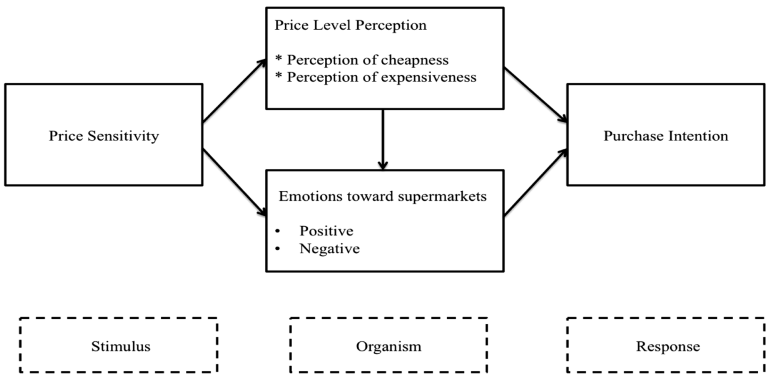


Figure 1.
Conceptual model

emotion scale toward supermarket, there were 11 items, four of which were positive and seven of which were negative. The purchase intention scale had five items. The response categories of all items were subjected to the five-point Likert rating. The original items were in English. First, an English instructor, who has been doing a Ph.D. at the department of business administration, translated the scales' items into Turkish. Then, another English lecturer translated them into English again. There were not any semantic differences in scales' items when compared to the original versions.

Sampling

The population of the research was defined as the consumers aged 20–69 years. For the sampling framework, the consumers in the provincial center of Mersin were considered. Mersin is a port city located on Turkey's Mediterranean Coast. It has 13 counties. Mersin's Free Trade Zone, Turkey's second-largest one, has a prominent place in Mersin and country trade. Therefore, there are a lot of business centers and shipping and customs companies in Mersin. A lot of different kinds of fruits and vegetables are grown. Various souvenirs reflecting the local characteristics of Mersin are produced. It is possible to see beautiful examples of handicrafts in carpets, rugs, Mezitli cloth, various souvenirs made of banana fiber and colorful needle lace. Mersin cuisine including food, drinks and desserts is presented in each county of it. Mersin province is extremely rich in shopping centers. Various kinds of fruits, vegetables, clothes, food, drinks, desserts and souvenirs can be found and bought from these shopping centers (Mersin Provincial Directorate of Culture and Tourism, 2021).

We may explain why we selected to survey in Mersin. First, it is a metropolitan city. The second one is per capita income in Mersin is 8538 US$, while it is 10,602 US$ in Turkey (Turkish Statistical Institute, [TurkStat], 2019). Mersin has become 10th place through her per capita income among Turkey's 81 provinces. The third reason is that there are many brands of supermarkets such as Metro, CarrefourSA, Migros, BİM, A101 and Şok belonging to national and international supermarket chains, and Groseri, Ekorama, etc. belonging to local supermarket chains. The last one was the convenience of the data collection since the researchers were living in Mersin.

The survey was conducted in October and December 2018. The research sample was created by the quota sampling method, one of the nonprobabilistic sampling techniques. In the quota sampling method, subjects are appropriately selected from the targeted groups according to a predetermined number or quota. It is useful to use a particular group in situations where participation is critical (Sekaran and Bougie, 2016). The reason for preferring the quota-sampling method is that older consumers may be different from younger

ones with regards to price sensitivity and purchasing intention. Gender and age quotas were determined. A total of 312,266 men and 321,622 women in 20–69 age groups have lived in Mersin's selected counties – Yenisehir, Akdeniz, Toroslar and Mezitli –through the end of December 2017. Because the study's population is $N > 10{,}000$, the ideal sample size is 384. But, the sample size was extended to 500 in order to form a sample of more or less 250 for each gender, and sample size of at least 30 for five age groups. These age groups were established depending on the age intervals obtained from the Turkish Statistical Institute. After calculations and rounding's made in the fractions, a sample size of 502 of which 255 were male and 247 female was determined. In the field study, 520 respondents were reached.

Data analysis

The data were analyzed in a two-step process just as Anderson and Gerbing (1988) suggested. As it was stated, at first, measurement quality was determined. For this purpose, the measures were subjected to reliability analysis and confirmatory factor analysis (CFA), which is utilized for testing how well the measurement variables represent the constructs (Hair *et al.*, 2014). At this step, psychometric assessment via internal consistency reliability, convergent and discriminant validity were done. In the second step, the hypotheses were tested using the structural equation model (SEM). SEM, which is a multivariate technique using, especially, factor analysis and multiple regression analysis, provides knowledge on interrelated dependence relationships among measured variables and latent constructs (Hair *et al.*, 2014). The normed chi-square, the root mean square error of approximation (RMSEA), the root mean square residual (RMR), standardized root mean residual (SRMR), comparative fit index (CFI), normed fit index (NFI) and nonnormed fit index (NNFI) were utilized to assess model fit for the measurement quality in CFA and structural models in SEM.

Before detecting measurement quality, the multivariate outliers were determined by calculating the Mahalanobis distances (MD^2). These distances transformed into MD^2/df (Hair *et al.*, 2014) and then the questionnaires having MD^2, which exceeded the theoretical *t*-value at α: 0.001, were deleted (Kalayci, 2006). In each of the price sensitivity and the purchase intention scale, there were five items, and *t*-value was 6.869 at α: 0.001. The scale of emotions toward supermarkets had 11 items and *t* value was 4.437, and the price level perception scale had six items, having *t*-value was 5.959. There were seven questionnaires that had MD^2 exceeding the cut-off values, and those seven questionnaires were deleted. After deleting multivariate outliers, 513 questionnaires were retained for the analysis. In short, the study sample included 513 participants; 276 of which were male and 237 of which were female, which meant that the survey met the predetermined quotas.

It may be accepted that the sample size increased statistical power since the larger the sample size is, the greater precision in the test due to the less variation in the coefficients. CFA and SEM are required to have a large sample size, and it is highly advised to have 10–20 participants for each indicator variables, especially when robust estimation techniques, such as robust maximum likelihood, are used in case of the data had no multivariate normality (Kyriazos, 2018). Therefore, it was accepted that the sample size used was sufficient to conduct CFA and SEM and is larger than 500 – the minimum recommended sample size if the number of factors is larger than six (Hair *et al.*, 2014) – which provided greater precision in test and increased statistical power.

Since there were four constructs (price sensitivity, price level perceptions, emotions toward supermarkets and purchase intention) that had interrelated dependence relationships, the data were at first subjected to CFA and then SEM. To run SEM, it is compulsory to provide multivariate normality. For this purpose, Mardia's Kappa test of multivariate normality was used. It was found that the chi-square value was significant (χ^2: 1459.6; $p < 0.001$), showing evidence for not providing the multivariate normality. Therefore, robust maximum likelihood was used to predict the parameters.

Findings

Profile of the respondents

Of the participants, 53.8% were women and 46.2% of them were men. Almost half of the sample was 20–39 year olds; the other half was 40–69 year olds. While 40% of the participants graduated from high school and below, approximately half of the participants had a bachelor's degree. Participants' monthly income was transformed into US$, based on the exchange rate of Turkish Lira on the 1st of July 2018. A quarter of the sample's monthly income was about the minimum wage – 600 $. Nearly, half of the participants' monthly income was between 401 $ and 850 $ (Table 1).

Variables	*n*	%	Variables	*n*	%
Gender			Level of education		
Female	276	53.8	High school and below	210	40.9
Male	237	46.2	Undergraduate	268	52.2
			Postgraduate	35	6.8
Income groups 1 $: 4,10 TL (July 1, 2018)			*Age groups*		
400 $ and less	128	25.0	20–29	114	22.2
401–600 $	138	26.9	30–39	127	24.8
601–850 $	106	20.7	40–49	106	20.7
851–1200 $	94	18.3	50–59	96	18.7
1201 $ and more	47	9.2	60–69	70	13.6

Table 1. Participants' demographic profile (*n*: 513)

Assessment of psychometric properties of measures

At the first step, reliability of the scales was assessed via checking the minimum and the maximum corrected item-total correlations squared multiple correlations and Cronbach's alpha values (Table 2). There were four items in each of the dimensions –the perception of cheapness and positive emotions toward the supermarkets –, but one item from each was excluded since they had lower squared multiple correlations. Squared multiple correlations were preferred to be higher than 0.300 (Hair *et al.*, 2014). While testing the measurement model, one item of the purchase intention scale was excluded to decrease the χ^2/df fit statistics. As seen in Table 2, all the dimensions have sufficient composite reliability (CR) scores that was stated to be higher than 0.700 (Hair *et al.*, 2014).

For controlling validity, CFA was conducted (Table 2). The CFA results yielded acceptable model fit statistics: (χ^2: 608.05; df: 237; $p < 0.0001$; χ^2/df: 2.56 < 3; RMSEA: 0.055; (%90 CI for RMSEA: 0.050–0.061); RMR: 0.067; SRMR: 0.047; CFI: 0.98: NFI: 0.96; NNFI: 0.97). A widely used goodness of fit (GOF) index is normed χ^2. Calculated normed chi-square was lower than 3 and CFI was 0.98. Additionally, lower values than 0.08 of SRMR and lower values than 0.07 of RMSEA with higher values than 0.92 CFI were assessed as the better fit provided. By taking account of the 0.96 value of the NFI and the 0.97 value of the NNFI provided extra evidence for model fit (Hair *et al.*, 2014). Lower RMR, SRMR, RMSEA, normed chi-square with higher CFI, NFI and NNFI values represented a better fit of the model. It was also found that all of the standardized loadings were greater than 0.50, and all t-values were statistically significant at 5% significance level. Therefore, it is possible to say that construct validity was ensured.

For construct validity, the GOF statistics were evaluated. At first normed chi-square value was calculated as 2.56, just slightly below the cut-off point of 3. The RMSEA was 0.055, where RMSEA was required to be below 0.5 or 0.08, and it was between 0.05 and 0.061 with 90% confidence. Besides RMSEA, RMR and SRMR were assessed, and it was found to be 0.067 and 0.047, respectively. The lower RMR and SRMR values, the better fit. For SRMR, it is

Variables	St.values	*t*-values	Error
Price sensitivity (PS); alpha: 0.82	*AVE: 0.49; CR: 0.86*		
I Buy as much as possible sale/discounted prices	0.61	14.27	0.62
Supermarkets with the lowest prices are usually my choice	0.70	16.77	0.52
I am willing to put in extra effort to find lower prices	0.80	20.35	0.36
I usually go and check the products and their prices in several supermarkets before buying	0.76	18.89	0.42
Price is more important than the supermarket brand	0.62	14.44	0.62
Perception of cheapness (PC); alpha: 0.85	*AVE: 0.67; CR:0.86*		
The price of this supermarket is very low	0.85	22.63	0.27
This is a cheap supermarket	0.90	24.53	0.18
The price of this supermarket is lower compared to other supermarkets	0.69	17.04	0.52
Perception of expensiveness (PE); alpha: 0.90	*AVE: 0.83; CR: 0.91*		
The price of this supermarket is very high	0.87	22.11	0.24
The price of this supermarket is expensive	0.96	24.61	0.11
Positive emotion (POE); alpha: 0.94	*AVE: 0.75; CR: 0.90*		
The price of this supermarket makes me feel happy	0.82	22.04	0.32
I am very satisfied with the price of supermarket	0.92	25.98	0.16
I like the price of this supermarket	0.85	23.11	0.28
Negative emotion (NEE); alpha: 0.93	*AVE: 0.66; CR: 0.96*		
The price of this supermarket makes me feel sad	0.75	19.68	0.43
I feel depressed when I think about the price of supermarket	0.74	19.11	0.46
I feel sad when I think about the price of supermarket	0.85	23.63	0.28
I feel angry when I think about the price of this supermarket	0.84	23.23	0.29
I am afraid to pay too much for the price of this supermarket	0.74	19.32	0.45
The price of this supermarket makes me feel unhappy	0.89	25.34	0.21
The price of this supermarket makes me angry	0.86	24.32	0.25
Purchase intention (PI); alpha: 0.88	*AVE: 0.64; CR: 0.88*		
I plan to do most of my future shopping in this supermarket	0.77	19.86	0.40
If I go shopping today, I will go to this supermarket again	0.87	23.76	0.24
I do most of my shopping in this supermarket	0.74	18.87	0.45
When I go shopping, I consider this supermarket first	0.82	21.56	0.33

Note(s): χ^2: 608.05; df: 237; $p < 0.0001$; χ^2/df: 2.56 < 3; RMSEA: 0.055; RMR: 0.067; SRMR: 0.047; CFI: 0.98: NFI: 0.96 and NNFI: 0.97

Table 2.
The results of CFA

recommended to be lower than 0.10 (Hair *et al.*, 2014). In our large sample ($n > 500$) with 24 indicator variables in total, SRMR is advised to be less than 0.08 with a higher CFI value exceeding 0.92. In our case, SRMR is 0.047 and CFI is 0.98. It is said that CFI values above 0.90 are usually associated with a model that fits well. To explain validity better, in addition to CFI, NFI and NNFI were reported as incremental fit indices. They were found to be 0.96 and 0.97, respectively, where the higher values indicate better fit (Hair *et al.*, 2014). By taking into account the GOF statistics reported, it could easily be said that some strong evidence were found for construct validity.

To explain the validity better, convergent and discriminant validity was examined. The average variance extracted (AVE) formed by price sensitivity was 0.49. The AVE of PC and PE were 0.67 and 0.83 respectively, while AVE for POE toward supermarkets was 0.75 and for NEE was 0.66. AVE of PI was calculated as 0.64. It was assessed that significant loadings, model-fit-statistics and AVE by latent variables showed sufficient evidence for the convergent validity (Anderson and Gerbing, 1988; Fornell and Larcker, 1981).

For discriminant validity; the maximum shared variances (MSVs), the average shared variances (ASVs) and AVE values were assessed. It was found that MSVs and the ASVs for all dimensions were less than their respective AVE values. Therefore, it was accepted discriminant validity was provided (Hair *et al.*, 2014). Additionally, the square roots of the

AVE value for all of the dimensions were assessed. It was supported that if they were greater than shared coefficients of correlations, they provide additional evidence for the factors' discriminant validity (Hair *et al.*, 2014) (Table 3).

For reliability, additional checks were done through the CFA results. CR values calculated from CFA results and correlations among the dimensions were evaluated (Tables 2 and 3). All CR were greater than 0.700 (Hair *et al.*, 2014). All the AVE values were found to be greater than the shared correlation coefficients of the factors. Therefore, it means that all measures' reliabilities were ensured (Bagozzi and Yi, 1988).

Hypothesis testing

In the present study, 17 hypotheses were suggested. These hypotheses were tested using SEM) with robust maximum likelihood. After CFA, SEM produced acceptable fit statistics: (χ^2: 584.56; df: 239; $p < 0.0001$; χ^2/df: 2.45 < 3; RMSEA: 0.062 (%90 CI for RMSEA: 0.057–0.068); RMR: 0.13; SRMR: 0.09; CFI: 0.96: NFI: 0.93; NNFI: 0.95). SRMR statistics were found to be 0.09, slightly greater than the common cut-off points of 0.08 when the number of observed variables were between 12 and 30 and the sample size was bigger than 250 (Hair *et al.*, 2014, p. 584). However, lower normed chi-square and RMSEA values with higher CFI, NFI and NNFI ensured evidence for acceptable model fit (Hair *et al.*, 2014).

As it might be seen from Figure 2 and Table 4, except for three of 13 hypotheses related to direct ways, all *t*-values are greater than 1.96, which is the cut-off point at α: 0.05 level significant. The *t*-value of H6 (the way from PC to PI) is 1.958; p: 0.05, just being at the cut-off points; thus, it requires being cautious. Therefore, it could be claimed that ten hypothesized relations were supported.

The main hypothesis (H1) that consumers' price sensitivity affects their purchase intention (β: 0.17) was supported. Our argument was built on that PS had the impacts on PC and PE. While PS had a positive impact on PC (β: 0.29) (H2), it did not affect PE (β: −0.08) (H3). Another investigation was on that PS might affect the emotions toward the supermarkets. SEM showed that PS had no impact on POE (β: −0.03) (H4), but impacted NEE (β: −0.37) negatively (H5).

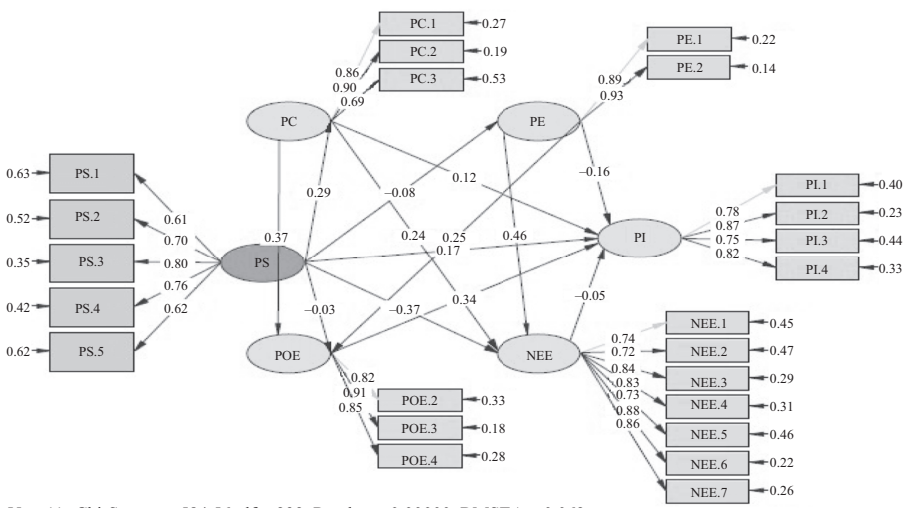
In our argument, there were two mediator variables, each of which had two dimensions. One of them was the price level perception; it had two factors, namely PC and PE. Hypothesized relations claiming PC (H6→ β: 0.12) and PE (H7→ β: −0.16) had impacted the PI were evidenced by the data. For the dimensions of second mediator variable, it was found that POE toward the supermarkets had influenced PI (β: 0.34) (H8), while NEE toward the supermarkets had no impact on PI (β: −0.05) (H9).

In the study, there were additional inquiries on the issue of how price level perception of supermarkets influenced the emotions toward the supermarkets. It was determined that PC

	$\bar{x}$	SD	MSV	ASV	CR	PS	PC	PE	POE	NEE	PI
PS	3.21	0.99	0.09	0.05	0.86	*(0.70)*					
PC	2.68	0.99	0.14	0.09	0.86	0.31**	*(0.82)*				
PE	3.33	1.10	0.24	0.9	0.91	−0.10*	0.32**	*(0.91)*			
POE	2.95	1.05	0.18	0.10	0.90	0.08	−0.38**	0.31**	*(0.87)*		
NEE	3.59	1.04	0.24	0.11	0.96	−0.30**	−0.21**	0.49**	0.43**	*(0.81)*	
PI	3.46	0.87	0.10	0.04	0.88	0.26**	−0.24**	−0.04	0.31**	−0.02	*(0.80)*

Note(s): PS: Price sensitivity, PC: Perception of cheapness and PE: Perception of expensiveness
POE: Positive emotions, NEE: Negative emotions, PI: Purchase intention
SD: Standard deviation. The numbers in the cells of diagonal line are squared root of AVE
**. Correlation is significant at the 0.01 level (two-tailed)
*. Correlation is significant at the 0.05 level (two-tailed)

Table 3.
Means, standard deviations and correlations of the factors



Note(s): Chi-Square = 584.56, df = 239, P-value = 0.00000, RMSEA = 0.062

Figure 2.
Model testing through SEM

	Relationship	Standardized path coefficients	*t*-values	Result
H1	PS → PI	0.17	3.03	Supported
H2	PS → PC	0.29	5.76	Supported
H3	PS → PE	−0.08	−1.68	Not supported
H4	PS → POE	−0.03	−0.66	Not supported
H5	PS → NEE	−0.37	−7.83	Supported
H6	PC → PI	0.12	2.25	Supported
H7	PE → PI	−0.16	−2.79	Supported
H8	POE → PI	0.34	6.36	Supported
H9	NEE → PI	−0.05	−0.86	Not supported
H10	PC → POE	0.37	7.40	Supported
H11	PC → NEE	0.24	5.46	Supported
H12	PE → POE	0.25	2.25	Supported
H13	PE → NEE	0.46	9.97	Supported

Note(s): χ^2: 6584.56; df: 239; $p < 0.0001$; χ^2/df: 2.44 < 3; RMSEA: 0.062 (%90 CI for RMSEA: 0.057–0.068); RMR: 0.013; SRMR: 0.09; CFI: 0.96: NFI: 0.93; NNFI: 0.95
PS: Price sensitivity, PC: Perception of cheapness and PE: Perception of expensiveness
POE: Positive emotions, NEE: Negative emotions and PI: purchase intention

Table 4.
Path estimates of structural models

and PE had impacted POE (H10→ β: 0.37; H12→ β: 0.25) and NEE (H11→ β: 0.24; H13→ β: 0.46) positively.

Utilizing the path coefficients of variables on PI, the regression formula can be written as follows. It was determined that one unit increase in POE resulted in 0.340 units in PI, and NEE had no statistically significant impact on PI. While one unit increase in PC increased PI 0.124 and PE decreased 0.155 units in PI. On the one hand one, unit increase in PS resulted with an increase 0.170 in PI. It has been found that the model predicted 22% of the variation in PI. If R^2 has a minimum of 0.04, it might be interpreted from the practical; if it has a minimum of 0.25, it may be accepted as the moderate effect (Ferguson, 2009). Although it is very near to moderate effect, the results of the model should be commented from the practical perspective.

$$PI = 0.170 \times PS + 0.124 \times PC - 0.155 \times PE + 0.340 \times POE - 0.0509 \times NEE \left(R^2 : 0.221\right)$$

In our conceptual framework, there were four mediation-related hypotheses. These hypotheses were indicating that there were mediation roles of price level perception and emotions toward supermarkets between the price sensitivity and the purchase intention. Each mediation-related hypothesis was separately tested via SEM, and results were presented in Table 4. For mediation tests, the direct way and all indirect ways should be statistically significant (Baron and Kenney, 1986). It was found that PS had a statistically significant impact on PI (β: 0.17). For the first mediation (H14), all conditions were satisfied. However, for the rest (H15; H16 and H17), one of the conditions was not met, resulting in not executing the mediation test. The last condition can be satisfied if the parameter estimate between price sensitivity and purchase intention becomes insignificant (full mediation) or less significant (partial mediation) than the parameter estimate in a direct way.

The hypothesis (H14*: Consumers' perception of cheapness mediates the relationship between their price sensitivity and purchase intention*) was supported by the data. The direct impact of PS was β: 0.27, but when analyzed with adding PC into the model, it decreased to β: 0.21, and it was still significant, indicating the partial mediation. The indirect effect is weaker than the direct effect. Therefore, it was determined that PC of supermarkets had partially decreased the impact of PS on PI.

Discussion

The present study is based on Mehrabian and Russell's (1974) SOR model. The direct and indirect relations among price sensitivity (dependent variable), price level perception (mediator), emotions (mediator) and purchase intention were investigated within the scope of supermarkets. In other words, the impact of price sensitivity on price level perception, emotions and purchase intention; the impact of price level perception on emotions and purchase intention and the impact of emotions on purchase intention were examined. In addition, the mediating effect of price level perception and emotions between price sensitivity and purchase intention was examined. The results of the study are discussed in terms of three basic subjects: scales, model and hypotheses.

In terms of scales, it was determined that the variables – consumers' price sensitivity, emotions toward supermarkets and purchase intention – examined in the study were loaded to the correct dimensions as in the original scales (Noyan and Şimşek, 2012; Graciola *et al.*, 2018). Yet, one-dimensional price level perception scale was loaded into two dimensions called as perception of cheapness and perception of expensiveness. The results of the analysis supported the data obtained through four scales are quite reliable and valid. Thus, it can be concluded that these four scales are effective within the different contexts of research and provide reliable and valid results. The measurement tool has measured the structure it aims to measure and the properties related to this structure following the purpose.

It can be said that consumers tend to make extra efforts to purchase low-priced products. By examining the prices of products in different supermarkets, consumers shop at supermarkets where low-priced products are sold. For this reason, consumers are generally satisfied with the product prices of the supermarkets they shop for. In addition, consumers' perception of product prices in different supermarkets as cheap or expensive shows that they can distinguish the price differences between the supermarkets. Consumers tend to buy products from a supermarket where they usually shop.

As it was stated in the introduction and theoretical framework and research hypotheses, different research studies (Chang *et al.*, 2011; Viera, 2013; Hetharie *et al.*, 2019; Laato *et al.*, 2020) have adopted the SOR model in their own context by integrating cognitive and affective factors into the model. The present study provides an adequate theoretical framework to

explain consumers' behavior by including price sensitivity as a stimulus, price level perception and emotions as organism and purchase intention as a response.

In total, 10 of the 13 research hypotheses developed to examine direct relations between the variables were supported, but three of which were not supported by the data. The result of the study supports the conclusion that the price sensitivity is effective in purchase intention obtained through studies conducted by Noh *et al.* (2013), Chua *et al.* (2015), Uslu and Huseynli (2018), Ghali-Zinouhi and Toukabri (2019) and Walia *et al.* (2020). Oppose to the findings of Backman and Crompton (1991), it was found that consumers' price sensitivity does not affect their perception of expensiveness toward supermarkets but affects their perception of cheapness. There are many supermarkets offering similar products at different prices. Consumers choose the most affordable one for them by comparing supermarkets with each other. In short, consumers, who are sensitive to price, may think that the products' price is not cheap. Consumers, with low price sensitivity, may think that the products' price is not expensive.

When the direct relation between price sensitivity and emotions was examined, it was that price sensitivity was influential on negative emotions but not on positive emotions. Consumers' price sensitivity affects their negative emotions positively. In other words, it turns negative emotions into positive ones. However, price sensitivity does not change positive emotions toward supermarkets. The main reason for this may be the fact that consumers prefer supermarkets where they are satisfied with the product prices and where they usually shop. As Yao and Oppewal (2016) and Fecher *et al.* (2019) stated, the other reason might be that the price presentation (unit price or retail price), size and package lead consumers to satisfy and continue to buy goods by controlling the impact of consumers' price sensitivity on positive emotions. The result of the study supports the conclusion that consumers' price level perception, both perception of expensiveness and perception of cheapness, is effective in purchase intention obtained through studies conducted by Duman and Yağcı (2006), Hamilton and Chernev (2013) and Fecher *et al.* (2019).

While positive emotions are influential in consumers' purchase intention, negative emotions are not effective in consumers' purchase intention. This result supports the results obtained through the studies conducted by Zielke (2011), Ladhari *et al.* (2017) and Cinar (2020). Through different effective pricing strategies or other strategies such as sales promotions, effective advertising positive emotions can be improved, and negative emotions can be decreased. Thus, this leads to more frequent purchases.

Each dimension of price level perception affects both consumers' positive emotions and negative emotions toward supermarkets. This finding supports the finding of Duman and Yağcı (2006), Hamilton and Chernev (2013) and Ceylan *et al.* (2016). Consumers assume price level is an indicator of the quality of supermarkets and their goods and services. Thus, when they think they buy affordable good-quality goods, they are satisfied and express positive emotions. In conclusion, it can be said that consumers' price level perception regarding supermarkets affects their emotions toward supermarkets positively.

One of the four research hypotheses developed to examine mediating relations between the variables was supported, but three of which were not supported by the data. The present study established evidence for partial mediation. Consumers' perception of cheapness partially decreased the impact of price sensitivity on purchase intention. Consumers usually try to maximize their benefits when they buy products. Thus, the price has an influential role in the purchasing process. Consumers subconsciously consider price levels of certain product types more than others. If frequently bought products, products needed more or such infrequently purchased products leading to the purchase of complementary products are at affordable prices, even price sensitive consumers will perceive the price level of these products as low and buy them or remember its price comparing to other supermarkets. In this context, although consumers' price sensitivity influences their purchase intention, consumers' perception of

cheapness in relation to the prices they see in the supermarkets where they shop at is also effective on purchase intention, even reducing the effect of price sensitivity alone.

Theoretical implications

First, the academic significance of this study lies in the modification of the SOR model. Various studies in retailing modified the SOR model, but the results are not consistent and general models have not been proposed. The present study modified the SOR model using variables price sensitivity, price level perception, emotions toward supermarkets and purchase intention. It illustrates the SOR model is an adequate theoretical model to explain consumers' behavior and thus contributes to the marketing literature since its main focus is the factors affecting consumers' purchase intention.

Second, this study examines the factors affecting consumers' purchase intention within the scope of supermarkets. In the literature, it was suggested that retail brand reputation should be examined with regards to price sensitivity and the impact of negative emotions on price image in both lower and higher level stores (Graciola *et al.*, 2018). Thus, the effects of consumers' price sensitivity on their price perception, emotions toward supermarkets and purchase intention were examined. The study also examined the effects of consumers' price perception and emotions toward supermarkets on purchase intention. The results obtained related to the influence of price sensitivity on purchase intention; price sensitivity on the perception of cheapness; sensitivity on negative emotions; both perception of cheapness and expensiveness on purchase intention; positive emotions on purchase intention and both perception of cheapness and expensiveness on positive and negative emotions supported the previous studies (Backman and Crompton, 1991; Duman and Yağcı, 2006; Zielke, 2011; Noh *et al.*, 2013; Hamilton and Chernev, 2013; Chua *et al.*, 2015; Yao and Oppewal, 2016; Ladhari *et al.*, 2017; Uslu and Huseynli, 2018; Graciola *et al.*, 2018; Fecher *et al.*, 2019; Ghali-Zinoubi and Toukabri, 2019; Cinar, 2020 and Walia *et al.*, 2020). Oppose to the previous studies, it was found that price sensitivity did not affect the perception of expensiveness and positive emotions. Besides, negative emotions were not effective on purchase intention. In these respects, the study makes a major contribution to the literature. These findings can be supported by similar results obtained through different future studies. It can be examined why negative emotions do not change the purchase intention negatively or positively. Similarly, it can be investigated why price sensitivity is not effective on positive emotions or perception of expensiveness. By including variables such as pricing strategies (unit pricing, retail pricing, etc.), size and package of goods, distance to the supermarket and the atmosphere in the supermarkets, it can be examined whether similar or different results can be obtained.

Third, this study examines the sufficient mediating impacts of consumers' price perception and emotions toward supermarkets between price sensitivity and purchase intention. Since the previous studies (Duman and Yağcı, 2006; Hamilton and Chernev, 2013; Fecher *et al.*, 2019) based on the direct effects of price level perception, the present study provides evidence for partial mediation of consumers' perception of cheapness. This leads to an area of research related to the mediation effects of price level perception and its causes.

Practical implications

The way consumers process information and their familiarity with supermarket prices have an impact on their PS. Consumers' price level perception and emotions toward supermarkets will affect consumers' PI weakly or strongly depending on their PS. Understanding how price level perception changes over time helps retail managers better understand changes in consumers' behavior. Determining the impact of consumers' price sensitivity, price level perception and emotions toward supermarkets can lead supermarket managers to understand the behavioral changes and consumers' perceptions and to offer affordable products that can affect consumers' purchasing behavior by developing pricing strategies.

Retailers should give more importance to the price level that reflects whether the store is cheap or expensive according to customers.

Creating pricing strategies has become difficult in a changing economy and technological environment. Today, various competitive companies have been providing similar products. They decide on prices considering differences in geographical demands, costs, market segmentation needs, purchasing time, levels of orders and other factors such as lower market share, economic stagnation and cost inflation. Depending on these changing conditions, they can change prices. But companies should carefully manage consumer perceptions when they increase or decrease prices. They should position the price correctly in order to make consumers think that the prices seen on the shelves or price lists at an appropriate level and ultimately buy it. When positioning price, the cost of the product, whether the price reflects the value of the product, whether it is suitable for the target consumers, the price levels of rival enterprises, discount terms, additional products or services and whether the predicted price is perceived by consumers easily should be investigated.

Consumers who find the price level high do not buy the product without trying it or knowing its features and may buy another product or brand. When determining the price, companies can apply psychological pricing considering that showing the price level lower than the actual level it is, can affect consumers' purchasing decision and encourage their purchase. Various pricing policies such as discount pricing, segmented pricing, fixed pricing and promotional pricing can be preferred depending on the product and its features. In order to attract more consumers to supermarkets and increase consumers' shopping frequency and quantity, reasonably priced goods and services that affect consumers' perceptions, attitudes and emotions and that satisfy them.

In order to be preferred by consumers and achieve a competitive advantage over others, retailers should focus on consumers' perceptions and emotions. They should aim to develop positive emotions and better perceptions leading to purchase intention. In order to achieve this aim, they should determine consumers' needs, desires and wants, depending on these facts they should create an effective marketing strategy and position products. In addition, they should develop a relationship between the products features offered and consumers' emotions. In short, retailers should get consumers' attention and leave a mark on them to create loyal and satisfied consumers. Therefore, it is assumed that this study provides practical evidence for retailers.

Limitations and future research

The main limitation of this research is the distance to supermarkets; in other words, supermarkets' closeness to consumers has been ignored. Consumers who are less sensitive to price prefer closest stores, frozen food and home delivery; even if the price is too high, they perceive time and effort more costly (Zeithaml, 1988). The research examined consumers' emotions toward supermarkets on their purchase intention, focusing only on the price sensitivity and the price level in supermarkets. In addition to price, consumers consider criteria such as the location of the supermarket, product line depth and width, advertisement and sales development, services provided and employees (Engel *et al.*, 1990). Ignoring other factors that consumers consider when choosing a supermarket is another limitation of the research. In future studies, research topics can be developed by adding nonprice factors to model. The SOR model can be tested including the location of supermarket, product line depth and width, advertisement and sales development, services provided and employees into the model in future studies.

Collecting data by quota sampling is another limitation of this research since quotas were determined through sex and age group ratios. Since the research data were not collected considering individuals' income levels, the income levels of the participants in the sample may be similar. Therefore, it cannot be determined whether consumers' behavior regarding price

and purchase intention differs depending on their income status. If data collected through quota sampling considered individuals' income levels, different findings might be obtained.

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Corresponding author
Sena Tekeli can be contacted at: sena.tekeli@toros.edu.tr

Market orientation in service clusters and its effect on the marketing performance of SMEs

Marcelo Royo-Vela
Department of Commercialization and Market Research, University of Valencia, Valencia, Spain
Juan Carlos Amezquita Salazar
Departamento de Management, Universidad ICESI, Cali, Colombia, and
Francisco Puig Blanco
Department of Management, University of Valencia, Valencia, Spain

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Abstract

Purpose – This paper aims to address research gaps with regard to the relationship between market orientation and marketing performance when small- and medium-sized enterprises (SMEs) are located within a service cluster. The three main objectives of this research are to determine the effect that the cluster can have on both the market orientation of clustered companies and their marketing performance and to furthermore evaluate the effect of the market orientation of companies in the cluster on their marketing performance.

Design/methodology/approach – This research used executive-level data that were obtained by carrying out a survey involving a unique dataset of 133 Colombian health-related businesses located in the city of Cali (Colombia) in 2014. A system of equations was modeled using SMART PLS. This analysis was complemented by a qualitative study that involved conducting in-depth interviews in six companies.

Findings – The results showed that, among the SMEs, membership in an urban services cluster did not significantly influence marketing performance or the implementation of marketing orientation practices. No differences were observed in internal managerial practices implemented between companies that were co-located and isolated. However, a higher level of competitor orientation was associated with greater marketing performance. Given the verified absence of moderating and mediating effects, our work provides a reasonable basis for proposing future research and practical recommendations.

Originality/value – While research has demonstrated the relationship between a company's market orientation and marketing performance, this type of analysis has not been carried out on service SMEs in geographic concentrations or clusters.

Keywords Location, Service cluster, Market orientation, Marketing performance, Health sector

Paper type Research paper

1. Introduction

There are increasingly more cases of geographical agglomerations of companies that belong to the same sector, and in many cases, their geographical scope is purely local (Arai *et al.*,

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2004). However, there is still a lack of literature on this subject (McCann and Folta, 2009). When the main activities of urban clusters include restoration, retail distribution, or health care and health services, we also find geographical areas within the same city that are characterized by a concentration of activity in restaurants and cafes, fashion stores and health clinics. There are two main characteristics of this variant in the location model, namely, the high geographical proximity between competitors and the fact that they are mainly SMEs. We dedicate this work to the study of this variant, which we term SME Service Clusters (SME-SCs).

According to Delgado *et al.* (2014), clustered SMEs have a competitive advantage over companies that remain isolated, as they achieve greater collective efficiency through the externalities generated by the dynamics of the cluster. Therefore, it is logical to theorize that restoration, retail distribution, health care or service companies in Colombia, which are mostly SMEs, would tend to implement a geographical concentration strategy to benefit from the efficiencies and externalities generated by the cluster.

The clustering of service companies constituted the object of this research, while the market orientation (MO) construct and its potential existence in the cluster formed were conceptual reference. MO can be understood as an organizational culture that supports the generation of competitive advantage by enhancing customer value (Narver and Slater, 1990; Zhou and Nakata, 2007; Kaur and Gupta, 2010). Kirca *et al.* (2005) concluded that MO had a positive impact on overall organizational performance. Alrubaiee (2013) demonstrated that, in addition to the impact that it has on financial performance, MO had a positive effect on the company's marketing performance (MP). Although some studies have examined the impact of MO on MP, little research has evaluated this relationship in clustered environments and health service SMEs.

However, despite the popularity and importance of the existing literature on clusters and on MO, there is a lack of research that interconnects both variables, especially in the services sector, which are characterized by their atomization in emerging economies. Therefore, the three main objectives of this research are to examine the effect of the cluster on the MO of clustered companies, on the MP of these companies, and the effect of MO on the MP of companies in the cluster. Therefore, this article is structured as follows: First, a literature review was carried out to create a conceptual framework of business clusters and MO, with a view to developing the hypotheses from the perspective of service SMEs, the effect of localization on MP, the effect of localization on MO, the mediating effect of MO on the relationship between location and MP and, finally, the moderating effects that localization can have on the relationship between MO and MP. Second, we describe the methodology that was adopted for the development of the study, and furthermore outline the qualitative and quantitative techniques, samples and variables that were used. The partial least squares (PLS) method was employed for our data analysis which was causal, and we conducted in-depth interviews to complement the analysis of the results. Finally, we present our conclusions and business implications, and highlight some limitations of the study, while proposing directions for future research.

2. Literature review and hypotheses setting

2.1 The location effect on MP

According to Porter (1998), a service cluster can be defined as an important geographic agglomeration of service companies, which are mostly SMEs that are geographically close, productively interconnected, linked by common aspects and that are complementary to the development of their activities.

The strategic implications of the formation of business clusters have been termed externalities. Delgado *et al.* (2016) argued that the origin of the externalities of a cluster is

based on three closely related elements: (1) customer/supplier relationships that are based on a certain principle of productive specialization between companies located within it; (2) the existence, in the local area, of a large qualified labor market, which allows companies to easily access specialized labor; and (3) the constant exchange of information and knowledge that occurs between its members due to its physical proximity and commercial interaction.

It has long been established that MP is very important for a company's overall performance, including SMEs (Langerac, 2003; Kara *et al.*, 2005). Similarly, Deakins (1991) and Gilmore *et al.* (2006) posited that, by creating networks and relationships with the owners and/or managers of other companies, SMEs can address their resource restriction problems, as well as strengthen their marketing activities. Lamprinopoulou and Tregear (2011) concluded that clustering had a positive impact on the MP of SMEs. Accordingly, one might think that the relationships between the members of a group of co-located SMEs will provide a greater probability of achieving better MP. From this point of view, the study of the MP of services SMEs in clusters becomes especially relevant.

To measure the "location effect," studies in the literature have analyzed the differences in performance between clustered and non-clustered firms within the same industry (McCann and Folta, 2009; Claver *et al.*, 2019). More recent research carried out in the hotel sector also shows this influence of location on the competitiveness of hotels (Rodriguez-Victoria *et al.*, 2017). However, in the literature on services and clustering companies, some authors warn of the negative externalities that arise from such agglomerations as a result of commercial cannibalization (Baum and Mezias, 1992). These factors have led authors, such as McCann and Folta (2009), to demand new models and theoretical approaches to fill the research gap that exists with regard to these realities.

The management literature evokes an essential debate about whether or not the location effect is context-independent (McDonald *et al.*, 2007). That is, although the location effect can be analyzed by comparing companies in the same sector located inside and outside that model, it can also be expected that the effect will not always be either positive or uniform, nor will it be observed among all of the companies that share a location within the analyzed sector (Molina-Morales and Martinez-Fernandez, 2003). Indeed, this effect may not occur within all of the locations that share a sector of activity (Rodriguez-Victoria *et al.*, 2017; Puig *et al.*, 2013). This becomes more relevant when studying a multidimensional concept such as MP and a location in an emerging economy. However, given the abundance of previous literature that supports a location or cluster effect on the performance of companies, especially among smaller ones, we propose the following hypothesis:

H1. SME-SCs will show a higher MP than their non-clustered counterparts.

2.2 The location effect on MO

MO is a subject that has long been studied within the context of business strategy (Castellanos-Ordoñez and Solano-Arboleda, 2017). MO can be understood as the extent to which a company implements marketing concepts (Kohli and Jaworski, 1990) or as the culture of the organization that most effectively and efficiently stimulates the behaviors that are necessary to generate superior value for the buyer and, therefore, a continuous superior performance for the business (Narver and Slater, 1990). In respect to the latter, these behaviors are based on the buyer's knowledge, with a view to generating a higher value, understanding the strengths and weaknesses of the competition, and the role that management plays in coordinating business resources.

According to Najib *et al.* (2011), clusters are one of the main tools that strengthen the innovative behavior and MO (as well as their components) of the SMEs that are located within them. In addition, it should be remembered that a cluster is a concentration, wherein companies benefit from the externalities that are generated by the dynamics of the model.

Thus, they are, in part, co-located to take advantage of the number of clients that are attracted by similar companies in the same location. Porter (2000) stated that strong competition is observed within concentrations, such that companies not only strive to attract new customers but also compete to retain them. In short, an emphasis is placed on making the client a strategic focus of the organization (McEachern and Warnaby, 2005), with a view to improving performance (Kumar *et al.*, 2011a, b; Boachie-Mensah and Issau, 2015). Thus, the following hypothesis is proposed:

H2a. SME-SCs will show a higher customer orientation than its non-clustered counterparts.

Competitors play an important role in the strategy formation of organizations to improve their performance (Gatignon and Robertson, 1993). A competitor orientation can strengthen the response of organizations toward satisfying the needs of their customers, generate greater value, loyalty and increased profitability (Martin and Grbac, 2003). Porter (1980) stated that, in highly concentrated markets, the leading competitors have an opportunity to significantly alter their market competition conditions, which can translate into an increase in tactics, such as aggressive pricing, advertising and the introduction of new products and services. Furthermore, if customers perceive these companies as being similar, the companies will intensify competition to attract and retain customers (Porter, 2000). Therefore, it is essential that companies monitor its closest competitors and adopt an attitude of vigilance toward them (Slater and Narver, 1994). Based on this reasoning, the following hypothesis is proposed:

H2b. SME-SCs will be more competitor-oriented than their non-clustered counterparts

Through interfunctional coordination, organizations guarantee communication between functional areas that support the creation of market conditions in order to generate superior customer value (Asomaning and Abdulai, 2015). The geographic location of a company that is concentrated in the same sector, as seen in the case of a cluster, should serve to stimulate the company to develop a more coordinated management model between the different areas, which is in contrast to a company that is not located in such a competitive environment. However, many SMEs, for example, lack functional areas, so this line of reasoning is difficult to adopt. Narver and Slater (1990) supported the idea that, in SMEs, businesses are managed by a single person, which means that decisions are not taken by different divisions, but by a single decision-maker.

Levy and Powell (1998) suggested that, due to their structure, SMEs do not have effective communication systems or models that allow them to integrate customer information, which can make interfunctional coordination difficult. Lautamäki (2010) stated that the socialization of customer knowledge and competition may not be the most critical issue in the context of SMEs since the entrepreneur has centralized decision-making and strategic development. Furthermore, research carried out by Balakrishnan (1996), Haugland *et al.* (2007), O'Dwyer and Ledwith (2009) and Smirnova *et al.* (2011) showed that interfunctional coordination had no effect on business performance. Thus, it seems that this component of MO does not play a significant role in SMEs, which led us to formulate the following hypothesis:

H2c. SME-SCs will show a similar, albeit insignificant, level of interfunctional coordination when compared with their non-clustered counterparts.

2.3 The effects of MO on MP

Marketing scholars suggest that, as a business increases its MO level, it will also increase its level of MP (Levitt, 1960; Webster, 1988; Kotler, 2002). Alrubaiee (2013) was able to demonstrate that MO had a direct impact on a company's MP. The study stated that, as a

business increases its MO level, it will also increase its MP level (Lukas and Ferrell, 2000; Armario *et al.* 2008; Carr and López, 2007; Carbonell and Rodríguez, 2010) However, the multidimensional nature of the MO construct leads us to question whether MO is always directly related to MP in the case of SMEs. On the one hand, numerous studies have concluded that highly customer-oriented and competitive companies achieve better organization performance (Narver and Slater, 1990; Jaworski and Kohli, 1996; Slater and Narver, 2000; Cheng and Krumwiede, 2010; Tsiotsou, 2010; Kumar *et al.*, 2011a, b; Boachie-Mensah and Issau, 2015). On the other hand, Pelham and Wilson (1995) noted that, in the case of SMEs, customer orientation was significantly and positively related to company performance. Coviello *et al.* (2006) suggested that SMEs can develop better customer orientation through proximity to and knowledge of their clients. Accordingly, one might expect that customer orientation in SME-SCs will positively influence MP. Moreover, a company that is more effective than its competitors at creating, delivering and communicating a higher value to its target markets will have a better MP, and by monitoring its competitors, the company can better anticipate their strategies (Slater and Narver, 1994; Kotler and Keller, 2006). However, as we have argued, when companies are small in size, they have a limited ability to implement interfunctional coordination, which supports our argument that it will not have a significant effect on MP (Levy and Powell, 1998; Lautamäki, 2010; Smirnova *et al.*, 2011; Marjanova *et al.*, 2015). Therefore, the following hypothesis is proposed:

H3. SME-MO affects MP in the dimensions of customer orientation and competitor orientation and does not affect the interfunctional coordination dimension.

2.4 The moderating effects of clustering on the interrelation between MO and MP

As mentioned above, the literature continues to evoke debate about how the context influences the location effect. This aspect has its origin in that within the same activity; clustered companies may differ in their size and the strategies that they adopt, and not all companies benefit equally from the externalities that are generated by the cluster (Puig and Marques, 2011; Puig *et al.*, 2013). Studies that have specifically examined service companies also showed that MO had a positive impact on overall organizational performance (Van Egeren and O'Connor, 1998; Wood *et al.*, 2000; Sin *et al.*, 2005; Panigyrakis and Theodoridis, 2007). This relationship can also be extended to service companies MP (Ghosh *et al.*, 1994; Pitt and Jeantrout, 1994; Raju *et al.*, 2000; Panigyrakis and Theodoridis, 2007; Boachie-Mensah and Issau, 2015). However, authors such as Subramanian and Gopalakrishna (2001) and Raju *et al.* (2011) suggested the need to measure the ways in which the context affects the MO–MP relationship. Clusters generate externalities that, in some way, affect environmental conditions. Therefore, we can argue that, in the case of service clusters, it is also possible to find a certain moderation effect between both variables, namely, MO and MP, due to clustering among firms. This is because clusters generate externalities that affect the conditions of the competitive environment by creating a type of market that is organized in a useful way and that benefits the companies that operate within it (Maskell and Lorenzen, 2004; McCann and Folta, 2009).

Authors such as Raju *et al.* (2011) suggested that a customer-oriented service company could be expected to generate higher MP than companies that are not located within the cluster. This is justified, given the fact that business concentrations not only establish horizontal relationships with competitors but also vertical relationships with companies that complement the value chain, which has a positive impact on MP (Grunert *et al.*, 2005). Accordingly, we formulated the following hypothesis:

H4a. The effect of customer orientation on MP will be higher for companies that belong to the cluster than for their non-clustered counterparts.

Considering the relationship between competitor orientation and company performance, this has been validated by several studies (Kirca *et al.*, 2005; Ellis, 2006; Kaliappen and Hilman, 2013). Having carried out a study that focused on the health services sector (hospitals), Kumar *et al.* (2011a, b) demonstrated the impact of competitor orientation on organizational performance, which showed a strong relationship when these types of companies adopted a differentiation strategy. The fact that a company is within a cluster, where there are many competitors and, thus, a high level of competition, stimulates companies to develop cost leadership or differentiation strategies. As such, monitoring competitors becomes fundamental (Slater and Narver, 1994). Since competitor orientation has an impact on the overall organization and its MP (Kirca *et al.*, 2005; Suliyanto and Rahab, 2012; Webster, 1988; Kotler, 2002), we therefore propose the following hypothesis:

H4b. The effect of competitor orientation on MP will be higher for companies that belong to the cluster than for their non-clustered counterparts

Interfunctional coordination is the basis for successful planning and the successful implementation of organizational marketing (Piercy and Lane, 1996). Kumar *et al.* (2011a, b) showed that all MO components had an impact on organizational performance, and Mohsen and Eng (2016) found a positive relationship between interfunctional coordination and organizational MP. However, Marjanova *et al.* (2015) found that small companies had a low level of interfunctional coordination. Similarly, the work of Liu (1995) demonstrated that a company's size affected its ability to generate MO, with smaller companies being the least capable of doing so. According to the above, one might theorize that SMEs in clustered environments would find it difficult to create a high level of interfunctional coordination, and therefore, we propose the following hypothesis:

H4c. Interfunctional coordination will have no significant effect on MP and no difference will be observed between companies that belong to the cluster and those that do not.

In summary, the structural model (including variables, factors and their interrelations) that we have analyzed in this paper is shown below in Figure 1.

3. Methodology

This study aimed to analyze the predictive capacity of a model composed of a dependent construct (MP) and to maximize its explained variance by means of predictive variables (i.e. location and MO). Thus, the partial least squares (PLS) method was employed for the analysis (Cepeda and Roldan, 2004).

3.1 Population, sampling frame, sample and questionnaire

As the third leading economy in Latin America, with 48 million inhabitants, Colombia and its main cities, such as Bogotá, Cali and Medellín, are characterized by health clusters that are a

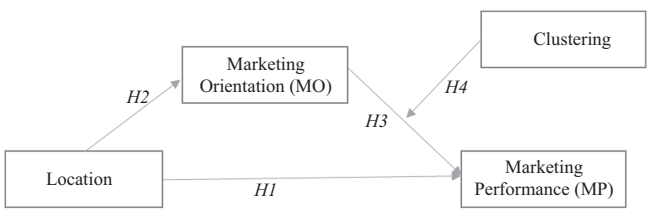


Figure 1.
Model for testing hypothesis

clear example of the phenomenon described in the introduction. These agglomerations are formed by SMEs that have arisen in response to the characteristics of atomization and the public–private duality of the Colombian health services, as well as to the demand for personalized services and cosmetic surgery which are not covered by the public healthcare sector (Rojas *et al.*, 2013).

In accordance with the objective of this paper, the population-based sample of our research consisted of 670 health service companies located in the city of Cali (Colombia), of which 133 firms were included in the sample used in this study. These firms were identified from that sampling frame and all of the firms completed the questionnaire that had previously been distributed to them in March 2014.

The sample consisted of companies that were in Levels 1 and 2 of the cluster, according to Porter's classification (1990). Level 1 comprised hospitals and clinics, specialized consultancies, odonatological services, alternative medicine centers and beauty/spa centers. Level 2 included organizations that consisted of the group of suppliers or distributors that serviced the Level 1 companies, i.e. clinical laboratories and diagnostic imaging, insurers, paramedical services and suppliers of consumables, medicines and medical and hospital equipment. Of the 133 companies surveyed, 33.8% (45) were located inside the Tequendama neighborhood cluster and 66.1% (88) were located outside of it, though all of the companies were based within the city of Cali.

We decided to approach each establishment's manager or owner directly and request them to take part in a phone survey which was conducted by one member of the research team. The questionnaire consisted of four parts (classification data, MO, business performance, strategies and public actions) and 50 questions (available under request). Roughly 86% of the respondents were CEOs, while the other 14% held high-level positions, e.g. operations or marketing manager. In respect to the length of service, 60% of the employees had held their posts for five years or less, 24% for 5–10 years and the remaining 16% for more than 10 years. Approximately 85% of the surveyed businesses employed up to 25 workers, 9% employed between 26 and 50 employees and the remaining 6% employed more than 50 workers.

To elucidate our understanding of the findings obtained from the quantitative analysis, the authors carried out a qualitative study in 2017 by conducting six in-depth interviews which were between one and two hours in duration. The individuals who were interviewed belonged to companies in the sample and they had strategic responsibilities within their organization, e.g. managing director, partner or administrator. The topics covered the following: strategy, decision making, competitive advantages, functional areas, customer value, market information, knowledge of the competitor and its strengths and weaknesses. Of the six companies, two were medium to large-sized companies and four were small companies. In addition, we specifically selected three companies that were located within the cluster and three that were based outside of it. Four of the companies were in Level 1 and two operated in Level 2. The companies were randomly selected by applying these criteria. Interviews were recorded, transcribed and analyzed by categorizing topics and related questions. To avoid any subjectivity bias in respect to the interpretation and to enhance the reliability of the analysis, an independent researcher verified our interpretation of the results.

3.2 Variables and factors measurement

In our analysis, the *dependent variable* was MP. To measure MP, this study used a scale similar to that proposed by Camisón and Cruz (2008), which consisted of 14 items, of which three items represented the variable in question, i.e. price, ability to adapt to customer requirements and marketing activities. The measurement of each variable was carried out in

a subjective manner. That is, for each item, the respondents compared themselves with their competitors. The scale scores ranged from 1 (much worse than competitors) to 7 (much better than competitors).

In this study, the *independent variables* were defined according to the hypotheses, which focused on one structural characteristic (location) and one strategic characteristic (MO) of the firms when the companies were competitors in the health service sector. We also included a *control variable* in the analysis, i.e. company size.

Location (Cluster): The literature evidences that no general consensus has been reached regarding the methodology that is most appropriate for identifying and delimiting a cluster (Martin and Sunley, 2003). Given the characteristics of our research, we followed the suggestions of Alcacer and Zhao (2016), who established a process based on three stages: (1) Definition of the activity (health sector) and phenomenon (city of Cali); (2) establishment of the unit of analysis on the subsequent examination (business units); and (3) the establishment of a number of agglomerated firms to label that area as a cluster. As Arai *et al.* (2004) stated, the locational analysis of the companies was obtained by utilizing Geographical Information System (GIS) techniques (see the results in Figure 2). After this analysis, we delimited the Barrio de Tenquedama as the urban cluster of Cali. We defined this variable as a dummy. Of the 133 companies surveyed (black boxes in Figure 2), 33.8% (45) belonged to the urban cluster (see chart on the right) and 66.1% (88) of the companies were located outside of it.

The MKTOR model was used to measure MO (Narver and Slater, 1990; Van Egeren and O'Connor, 1998; Slater and Narver, 2000; Harris, 2001; Sin *et al.*, 2005; Haugland *et al.*, 2007; Boachie-Mensah and Issau, 2015), as this model utilizes the most widely adopted scale to measure MO in highly diverse sectoral and national contexts (González *et al.*, 2005). Accordingly, we selected a set of 15 indicators that were used to construct the MO scale. Customer orientation was measured using six indicators, competitor orientation was measured using four indicators and inter-functional coordination was measured using five items. The items were assessed according to Likert-type scale ranging from 1 (total disagree) to 7 (total agree), such that 4 indicated indifference (neither agree nor disagree).

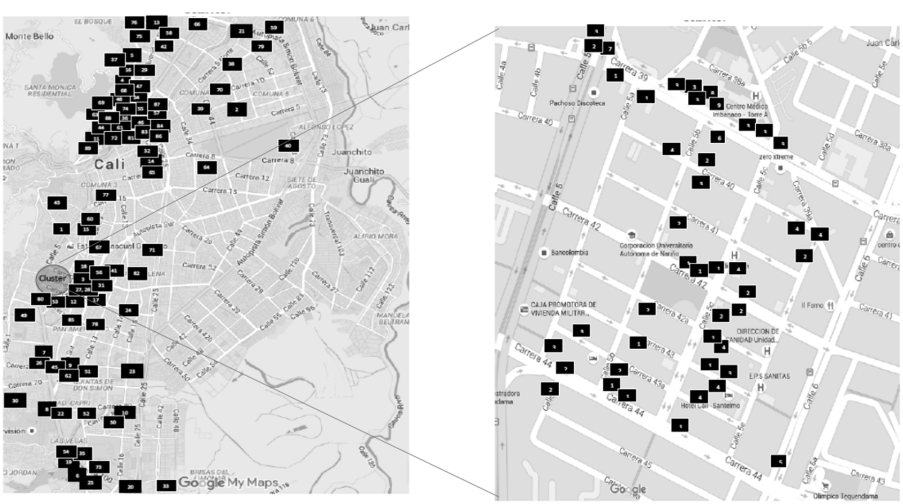


Figure 2.
Localization of the analyzed firms

Size: The total annual number of employees during the last full year (i.e. 2013) was included to control the possible impact of size on MP. It is important to note that 98% of the companies in the sample were SMEs. This was transformed by means of the natural logarithm in order to control for the effect of units of measure when making a comparison with the other dependent variables.

3.3 Exploratory analysis

To identify the underlying structure of the dimensions, we performed an exploratory factor analysis using SPSS version 22. We subsequently checked the model using SMART PLS version 3 software (Ringle *et al.*, 2015).

The factor analysis identified four factors with eigenvalues greater than 1.0, which accounted for 73.14% of the variance. The Equimax rotation offered a clearer solution since it contained the lowest number of high cross-loadings between items and factors. Bartlett's test of sphericity was statistically significant ($p < 0.001$). The Kaiser–Meyer–Olkin measure of sampling adequacy was 0.842, which exceeded the minimum threshold of 0.50 proposed by Kaiser (1974). Therefore, the factor analysis was logical and we were then able to conduct the PLS analysis. The MP factor was formed by the expected three items. Only customer orientation was composed of five items. The indicator related to *postsalesservice* was dropped from the analysis (item-total correlation was below the cut-off point of 0.5). The competitor orientation and interfunctional coordination factors showed the expected 4 and 5 indicators, respectively.

We included all of these items in their respective latent constructs, the variable *Location*, and the control variable *Size* in the subsequent path analyses using PLS.

3.4 PLS procedure, confirmatory path analysis, data adequacy and convergent validity

The PLS procedure is designed to explain the variance (R^2) of the dependent construct MP. This procedure is more robust than a multivariate regression in the presence of possible mediating relations in conditions of small- to medium sample sizes (Chin, 1998). In line with Hair *et al.* (2012) and Henseler *et al.* (2009), to implement this technique, it is necessary to verify the following: (1) Data adequacy for PLS and test potency for the dependent variable (R^2); (2) reflective outer model evaluation (indicator reliability, internal consistency reliability, convergent validity and discriminant validity); and (3) formative inner model evaluation (endogenous constructs' explained variance; effect size; relative predictive relevance; path, indirect and total effect coefficient and significance).

In terms of the data, an initial concern relates to the sample size, depending upon the number of relations that need to be evaluated. Chin's (1998) widely used rule of thumb was applied, and it states that the overall sample size is 10 times the largest of two possibilities: (1) The block that has the largest number of indicators or (2) the dependent variable that is impacted by the largest number of independent variables. In our model with interaction effects, the first possibility was equal to five (*customer orientation),* while the second was equal to four (the number of arrows arriving at *MP)*. Accordingly, the minimum sample size was $5 \times 10 = 50$ and the sample under analysis contained 133 cases. Additionally, we calculated the test power for the dependent variable (R^2) for four predictors, $\alpha = 0.005$, and a moderate effect size of 0.15. The minimum level for social sciences is 0.8 (Cohen, 1998). The result shows a test power ($1-\beta$) over 0.95 for a sample size of 133 ($n = 129$; $1-\beta = 0.95$). In relation to variables measurement, according to Hair *et al.* (2012), PLS can process nominal (categorical), ordinal, interval and ratio scaled variables, so it can accommodate the analysis of our data.

To evaluate the convergent validity, a bootstrap test was conducted over 5,000 resamples, with no sign changes in the resampling. Thereafter, we compared the results

with sign changes at the construct level and in relation to individual changes. We used a one-tailed test with a significance level of 0.05. The results were consistent across the three methods. All of the indicators were loaded above 0.7 in terms of their respective reflective constructs. In addition, an analysis of the cross-loadings of the indicators with all of the latent variables did not show any indicator whose construct should be changed (see Table 1).

Finally, construct reliability was assessed using Cronbach's alpha (CA) as the standard criterion (Nunnally and Bernstein, 1994), though only for the MP factor. As Cronbach's alpha tends to underestimate the internal consistency reliability of latent variables in PLS path models (Werts *et al.*, 1974), we applied different measures for the reflective constructs (Chin, 1998). In respect to composite reliability (CR) (Fornell and Larcker, 1981), scores of around 0.6 are acceptable (Bagozzi and Yi, 1988). As can be seen in Table 2, all of the constructs exceeded the minimum thresholds of CA = 0.7 and CR = 0.60. Convergent validity between the reflective constructs was assessed by the average variance extracted (AVE). All constructs scored higher than the minimum threshold of 0.5 suggested by Hair *et al.* (2012). Fornell and Larcker (1981) proposed an additional check of discriminant validity: The square root of each

Table 1.
Reflective and formative constructs: variables loadings and weights

Indicator	Loadings Customer orientation	Competitor orientation	Interfunctional coordination	Weights (FIV) Marketing performance
OM1		0.762		
OM2	0.730			
OM3		0.783		
OM4	0.864			
OM5			0.937	
OM6			0.836	
OM7	0.807			
OM8			0.826	
OM9	0.952			
OM10	0.927			
OM12		0.837		
OM13			0.690	
OM14		0.928		
OM15			0.734	
MP1				0.347 (1.287)*
MP2				0.544 (1.223)*
MP3				0.430 (1.191)*

Note(s): *t value significant at $p < 0.001$ level

Table 2.
Reflective factors reliability and convergent validity assessment

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)	Correlation matrix Fornell–Larcker criterium		
Competitor orientation	0.848	0.898	0.689	0.830		
Customer orientation	0.911	0.933	0.739	0.484	0.859	
Interfunctional coordination	0.866	0.904	0.655	0.498	0.659	0.809
Marketing performance	0.620					

latent variable's AVE should be greater than the correlations between the latent variables, a requirement that our results met (see Table 2). In addition, we ran the heterotrait–monotrait ratio (HTMT) (Henseler *et al.*, 2015) to test discriminant validity. All of the HTMT ratios in absolute value were below the threshold of 0.90, which indicated that discriminant validity existed between the reflective factors.

4. Analysis and discussion of results

Beforehand, we carried out a descriptive analysis of data. Table 3 shows the average scores and standard deviations of the three MO factors, as well as the MP construct in relation to its location inside or outside the urban health cluster in Cali. The inside cluster factors scored slightly higher. Competition orientation showed the largest difference among the MO factors. In general, service companies within the cluster had a better MP.

To assess the structural model, we analyzed the variance of the dependent latent variables, which was explained by the predictive constructs. Therefore, the *R*-squared statistic was applied, and this criterion should be higher than 0.1 (Falk and Miller, 1992). In addition to *R*-squared, Hair *et al.* (2012) suggested the use of the effect size (f^2), as well as path coefficients with their respective *t*-values for models with reflective indicators. We also assessed the cross-validated redundancy index (Q^2) by means of blindfolding (Stone, 1974; Geisser, 1975), which, along with *R*-squared, provides information about the predictive capacity of endogenous constructs, with values above zero indicating that the model has predictive relevance (Chin, 1998). In the case of mediation, they proposed that total and indirect effects should be reported and compared, in addition to the estimated path effect. At this point, we used the results of 5,000 bootstrap resamples.

Table 4 shows the PLS results without interaction effects. At first glance, it can be observed that, on the one hand, location did not have a significant direct effect (path coefficient = −0.009) on MP. This result neither supported hypothesis H1 nor the conclusions

Factor	Outside cluster (n = 88)	Inside cluster (n = 45)
Customer orientation	6.13 (0.78)	6.16 (0.63)
Competitor orientation	5.72 (0.83)	5.86 (0.83)
Interfunctional coordination	6.11 (079)	6.16 (0.68)
Marketing performance	5.27 (0.95)	5.44 (1.03)

Table 3.
Factors' descriptives

Variables	Standard path coefficient	*t*-value (bootstrap)	f^2	Q^2	R^2
Location→Marketing performance (MP)	−0.009	0.117	0.000	0.115	0.248*
Location→Customer orientation	0.025	0.297	0.011	−0.000	0.001
Location→Competitor orientation	0.106	1.194	0.001	0.003	0.011
Location→Interfunctional coordination	0.037	0.426	0.001	−0.002	0.001
Customer orientation→MP	0.067	0.661	0.003		
Competitor orientation→MP	0.422	4.799*	0.166		
Interfunctional coord→MP	0.068	0.598	0.003		

Note(s): *$p < 0.001$

Table 4.
PLS results without interaction effects

reached by Lamprinopoulou and Tregear (2011) which found that geographical clustering had a positive effect on the MP of SMEs. The control variable *Size* was not significant (−0.095; $t = 1.135, p = 0.128$). Therefore, it seems that, regardless of the company's size, networks and relationships with other companies were not intensively developed within the cluster. In addition, in contrast to Deakins (1991) and Gilmore *et al.* (2006), marketing activities were not strengthened and, as such, MP was not affected. This result supported the concerns of McDonald *et al.* (2007) and Molina-Morales and Martinez-Fernandez (2003) regarding the context-independent location effect, such that the location effect is not always observed in a positive or uniform manner among all of the companies within the cluster.

On the other hand, and in contrast to the ideas proposed by Najib *et al.* (2011), clusters did not strengthen the MO (and its components) of the SMEs that comprise them. In other words, location did not have a significant effect on MO. This means that Consumer Orientation (0.025), Competitor Orientation (0.106) and Interfunctional Coordination (0.037) in clustered health business did not increase the level of MO when compared with non-clustered health businesses. Therefore, these results led to the rejection of hypotheses H2a and H2b, although they offered support for hypothesis H2c.

On the one hand, these findings suggest that, in the case of health SMEs, the acquisition of clients was not a strategic focus nor did the companies regard monitoring their closest competitors as essential, which was pointed by McEachern and Warnaby (2005) and Slater and Narver (1994). On the other hand, in terms of interfunctional coordination, no difference was observed between service SMEs that were based in a cluster and those that were located outside of it. This was mainly due to conditions related to the size of the companies (SMEs), which was in line with the findings and conclusions of Levy and Powell (1998), Lautamäki (2010) or Narver and Slater (1990). These studies proposed that small businesses lack adequate customer information, which is necessary for coordination. Moreover, decision-making and strategic development tend to be centralized to the extent that they are the responsibility of a single individual. The above findings were corroborated by the results of the qualitative analysis in this study, which showed that, in companies within the cluster and those outside of it, client-related strategic decisions were taken by the partners or by the manager or administrator directly. The following phrases reinforce this argument:

> . . . as I am observing, I (Manager) am the one who took them . . . Specialized Clinical Laboratory Manager Nohemy Cruz (February 9, 2017)

> . . . The important needs of the client, and mainly the owner, who is also in the provision of service. . . Pediatric Global Administrative Leader (February 4, 2017)

Furthermore, in Table 4 we can observe the path coefficients of MP. With the exception of Competitor Orientation (0.422) ($p = 0.001$), the other two factors were not significant. These results did not support the findings of Coviello *et al.* (2006), which suggested that SMEs can increase MP through customer orientation. However, hypothesis H3 was partially supported, since competitor orientation did increase MP. Therefore, in the case of businesses that were located in the cluster and those that were not, competitor orientation led to a significant increase in the MP of these companies. Having studied the hotel sector, Dev *et al.* (2009) found that, in developing-country markets, which differ from developed economies in which customer orientation has a greater impact, competitor orientation had a greater impact on performance. The above was corroborated by statements made by several of the respondents who participated in the qualitative study, who stated that the current conditions of the Colombian Health System had affected the financial solvency of companies in the sector, including companies outside of the cluster as well as those that comprised it:

> . . . (The income) Look. . . unfortunately, they have not grown. They have not grown because this is an IPS that depends on an EPS, then who affiliates is the EPS. If the EPS does not affiliate, there will be no users. . . the population falls, and unfortunately, with this EPS, the population has dropped . . . Servimedic Quirón Manager (February 10, 2017).

> . . . (profitability) has also grown although it is affected by the portfolio, because one sells more, sells many services, but the recovery of the wallet is hard, and that affects the profitability . . . Nohemy Cruz Specialized Laboratory (February 9, 2017).

Finally, in order to analyze the moderating effect of the cluster on the effects of MO on MP, we checked the results of Q^2. In Table 4, we can see that the latent variables achieved values close to (0.003) or below zero (−0.000; −0.002) in the inner model. However, the Q^2 of the relations to MP achieved 0.115, which was interesting, and this indicated that the model had a certain predictive capacity. This result led us to perform an additional analysis to check the possible moderating effect of clustering on customer orientation, competitor orientation and interfunctional coordination (see Table 5).

After applying the product indicator option and a bootstrapping procedure over 5,000 samples, no significant moderating effect was found. Although these results implied that the cluster did not moderate the effects of MO on MP, and only supported hypothesis H4c, they were consistent with the results obtained in respect to the H2c hypothesis, which verified that, in SMEs, interfunctional coordination was difficult to implement, given the centralized decision-making environment.

According to the previous literature review, we could expect a certain positive moderation effect between MO and MP, because of externalities generated by the cluster, as well as the horizontal and vertical relationships that are observed between geographically clustered companies, which strengthen customer and competitor orientation (Grunert *et al.*, 2005; Maskell and Lorenzen, 2004; McCann and Folta, 2009). However, in respect to customer and competitor orientation, the cluster did not have a moderating effect on MP (hypothesis H4a and H4b), which could, on the one hand, be largely attributed to the fact that health companies located in the cluster had not yet managed to establish strong horizontal relationships (with their competitors) to achieve alliances that would strengthen their competitiveness. On the other hand, vertical relationships were observed (suppliers and partners of the value chain), but they were not yet strong, which indicated that the cluster was still in a consolidation stage. The following extracts present the statements of an administrator who worked for one of the companies in the cluster when asked about their relationship with other companies in the cluster:

> . . . Relationship not much, patients are referred sometimes, but it is not that we have agreements with them, no alliances or agreements have been made . . . just this year we will begin to look for those alliances and agreements . . . Administrative Leader of Global Pediatric (February 4, 2017).

In order to test the effect of location, as a mediator, on MP and MO, we analyzed the total, indirect and direct (path) effects in the model (see Table 6). We followed the approach adopted by Chin (2010), who proposed a two-step process using PLS. First, the direct and indirect paths were included in a bootstrap resampling that yielded the estimation for total, indirect

Table 5. Cluster moderating effects on market orientation

Moderating effect	Path coefficient	*t*-value	*p* value
Cluster × Customer orientation	−0.156	0.913	0.181
Cluster × Competitor orientation	0.200	1.298	0.097
Cluster × Interfunctional coordination	0.126	0.126	0.200

and direct effects. Second, the significance was estimated using a percentile bootstrap method, which produced a 95% confidence interval.

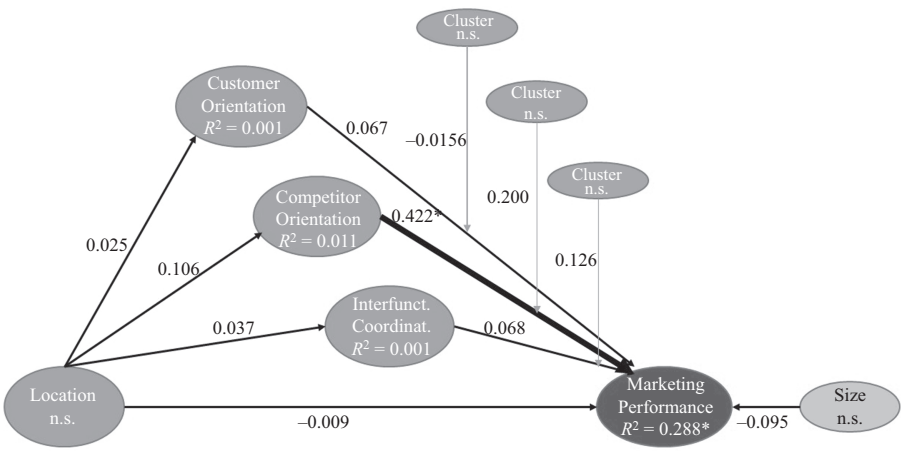
Since the confidence intervals included zero, all of the effects were not significant. These results led us to conclude that there was no mediation effect. In fact, the analysis of the confidence intervals in the upper limit implied that both direct and indirect effects had a similar albeit insignificant impact on MP. Figure 3 shows the refined path analysis.

The result obtained for the indirect and direct effects of the cluster on MP was consistent with the findings obtained in regard to the previous hypotheses. The relationship, both direct and indirect, between location and MP, will be fundamentally affected because, within the cluster, factors such as horizontal relationships (i.e. alliances and agreements with the companies that provide the same services), must still be strengthened. In fact, of the three companies in the cluster that were interviewed, only one maintained formal relationships with other companies in the cluster; the others maintained occasional relationships or simply had no relationships. In addition, when asked to comment specifically on their performance in relation to their marketing activities, companies both inside and outside of the cluster stated that they did not conduct formal marketing activities; at best, such activities were more informal and sporadic. Although the cluster companies had better overall

Mediator effect	Point estimate coefficient	*t*-value	CI 95% Lower	Upper
Total effect of location on marketing performance	0.04^{ns}	0.402	−0.110	0.195
Direct effect of location on marketing performance	-0.009^{ns}	0.116	−0.139	0.127
Indirect effect of Location through marketing orientation implementation (point estimates)				
Location through CustOrientation $0.025 \times 0.067 = 0.001675$	0.049^{ns}	1.057	−0.030	0.124
Location through CompOrientation $0.106 \times 0.422^{*} = 0.0447$				
Location through InterfCoordination $0.037 \times 0.068 = 0.002516$				

Note(s): No significant based on *t*(5,100), one-tailed test

Table 6.
Total indirect and direct effects of location on marketing performance through marketing orientation



Note(s): $^{*}p < 0.001$

Figure 3.
Path model

performance, the quantitative results indicated that this relationship (direct/ indirect) was not significant.

5. Conclusions

The main objective of this study was to examine the interconnected relationship between co-located SME service companies in clusters, the implementation of MO and the MP of these firms. We analyzed these potentially causal relationships by studying a primary sample of 133 Colombian health services companies, which was complemented by a qualitative analysis. As a result of this research, we have been able to provide a better explanation of the Location–MO–MP relationship that is observed in SME-SCs in the health sectors of emerging countries.

This paper carried out an original analysis of three different factors including the effect of geographical clustering on MP, how the cluster influences the MO of the companies within it and the moderating and mediating effects of location on that Cluster–MO–MP relationship, which previous literature has largely failed to explore, particularly from a SMEs–SC context. In this study, we utilized the multi-dimensional MO construct developed by Naver and Slater (1990) and analyzed the relationships between the factors, as well as the effects that can be observed on dimensions including Customer Orientation, Competitor Orientation and Inter-functional Coordination. While the latter is not context-dependent, its lack of significance confirmed our previous hypotheses: In SMEs, location is not associated with differences in internal management. These companies lack a formal internal structure, which means that important decisions about enhancing customer value are made by the managers or owners. Thus, there is no coordination between the different areas or levels within the companies. This question was also considered in the qualitative study, which showed that, in general, managers were took client-related strategic decisions.

However, when we analyzed the effect of the urban cluster on the first two MO components, we found only partial support for one of our hypotheses: SMEs, in environments that are characterized by strong rivalry and geographic proximity, direct their actions towards competitors, mainly because they offer greater value for their clients. Our exploration also detected that clustering had no moderating and mediating effects on the MO–MP relationship. Nevertheless, the quantitative results showed that location played a positive moderating role in terms of the effects of Competitor Orientation on MP ($p < 0.1$), which requires further research. A cluster that strengthens neither the dynamics nor the integration of its components will hardly moderate the relationship between MO and MP. One of the most important conclusions of the present study is that, although the services cluster, which primarily consisted of SMEs, had high visibility, it was also in need of a certain level of development and maturity to generate sufficient internal and external relations. The dynamics of the cluster depend not only on the physical presence of the companies but also on the will and strategic clarity of each of its members. The strength and maturity of a company's network of relationships determines the extent to which the externalities of a cluster have a positive impact on MP.

Some other conclusions reached in our study indicated that, in general, the SME-SCs increased their marketing efforts, especially those related to customer orientation. The latter does not imply that the managers or leaders of the companies had a closer relationship with their clients; rather, they were more efficient in exploiting the information that they obtained from the client. Confronted with this finding, Lautamäki (2010) stated that the biggest challenge for SMEs is to understand the nature and context of customer information, since it is easy to obtain, but interpreting the results requires a deep understanding of the context, and it is perhaps this issue that prevents the cycle from being

closed. Something similar is observed in the case of competition orientation. This should be an important tool to confront the high level of competition that exists within clusters; however, we found that companies, at best, carried out informal, non-systematic analyses of their competitors, which prevented the use of information that is needed to strengthen the value proposition for the client.

Furthermore, with regard to the SME-SCs, we showed that these firms were located in the cluster largely because the area had developed a reputation for providing these types of services. However, significant weaknesses were observed in relation to the shortage of vertical (value chain) and horizontal (among competitors) relationships that was maintained between them. The latter is a topic that is of great relevance, because it means that it is difficult to generate externalities within the cluster (Molina-Morales and Martinez-Fernandez, 2010; Perles *et al.*, 2017). At present, although the cluster of health services in the Tequendama neighborhood is highly recognized, it fails to generate the impact and synergies that its participants expect. The evolution of the clusters depends not only on the physical presence of the companies but also on the will and strategic clarity that each of its participants has (Potter and Watts, 2011). The extent to which companies begin to densify relationships (i.e. form alliances) determines whether or not the cluster has a significant positive effect on performance, which is necessary to ensuring that companies can cope more effectively with strong international competition.

Finally, we acknowledge some limitations of our study in relation to the sample, variables and techniques that were employed, which future research should address. First, the sample in our study included a small number of cases and the analysis focused on just one city and sector. Future research could benefit from replicating our work in both similar and dissimilar contexts; business size and services, and larger samples will allow for more accurate measurements of the effects of the actual factors and variables. Second, we only measured MO. The inclusion of other types of marketing paradigms (e.g. relational marketing) may shed additional light on how the SME-SCs use marketing in these clusters. Third, regarding the quantitative analysis techniques, future studies could adopt a complementary regression approach. The OLS and PLS estimations inform us about what happens at the mid-point, but several scholars have warned that the impact of the cluster may be unequally distributed among the firms.

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Corresponding author
Marcelo Royo-Vela can be contacted at: marcelo.royo@uv.es

Performance of large firms in Greece during the unstable period of 2011–2016: lessons from the weak parts of Europe

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Maria Tsiapa
Department of Planning and Regional Development, University of Thessaly, Volos, Greece

Abstract

Purpose – The unprecedented economic crisis in Greece deeply affected entrepreneurship, which was traditionally characterised by low levels of innovation and competitiveness, the dominant presence of micro-sized enterprises and the weak signs of prosperity in large firms. This paper, in acknowledgement of the necessary transformations that production incurred due to the crisis, attempts to detect the characteristics of large manufacturing firms that contributed to their greater resilience during the unstable period of 2011–2016 by analysing the determinants of the higher profitability of firms. The analysis shows that firms that improved their productivity and sales levels and in parallel are flexible, in the sense that they have limited amounts of both assets and liabilities and thus a small risk, are those that presented higher profits during the period under study. Initial conditions, sectoral characteristics and the broader national environment do not seem to have a strong contributive role in firms' profitability.

Design/methodology/approach – The analysis follows a dynamic system generalised method of moments (GMM) estimation based on a panel data set of 125 Greek large firms over the time span 2011–2016.

Findings – The analysis shows that firms that improve their productivity and sales levels and in parallel are flexible, in the sense that they have a limited amount of both assets and liabilities and thus a small risk, are those that present higher profits during the period under study. Initial conditions, sectoral characteristics and the broader national environment do not seem to have a strong contributive role in firms' profitability.

Research limitations/implications – The present paper attempts to explain the performance of the most dynamic large manufacturing firms in Greece by investigating the role of some of the most important determinants of firm profitability (according to data availability), acknowledging, however, some analysis' limitations as the absence of some other parameters like the export activity or the incorporation of any innovative features in the firms

Originality/value – The novelty of this paper lies in two points. First, the subject of the analysis is the large firms in Greece, which have not received much attention as Greek entrepreneurship was traditionally based on the light, labour- or resource-intensive production and the main bulk of the literature was not on that topic. Second, during the deep and protracted crisis that Greece has experienced, several production transformations have taken place that remain partly undiscovered. The present paper attempts to analyse the characteristics of large firms that drove their profitability and improved their resilience during the crucial time period 2011–16.

Keywords Large firms, Profitability, Greece, Economic crisis

Paper type Research paper

1. Introduction

Greek firms were largely characterised by their small sizes, inferior technological and innovative bases and low levels of productivity and competitiveness. The "Greek

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eccentricity" was composed of too many very small firms with very few large firms. Recent data obtained have revealed that micro firms (with less than 9 employees) continue to exceed 90% of the manufacturing sector, while large firms (over 250 employees) have seriously lower shares in terms of employment and value-added, in relation to the European Union.

The entrepreneurship in Greece during the recent deep economic crisis has importantly shrunk (Notta and Vlachvei, 2014; Voulgaris *et al.*, 2015) without presenting strong signs of resilience and recovery. The anemic economic recovery is related to investment penury and companies' low yields (PWC, 2017). The influence of the economic shock on firms was catalytic and decisive as it contributed either to keep (or further boost) firms to a vicious cycle of stagnancy or to motivate them to strive for their viability through proceeding to crucial structural changes. Under this context of upheavals, rearrangements and transformations that were preceded, it was expected that at the tail end of the economic crisis, the skewed production base in general and the structure of large enterprises in particular would have been affected. Specific firms showed greater resilience, which is reflected, initially, by their viability and next by a series of economic performance indicators. The pattern of their characteristics is under question.

This paper aims to investigate those characteristics that were apparent in large firms and contributed to their greater resilience and competitiveness by their higher profitability (Liargovas and Skandalis, 2008) during the crisis period of 2011–2016. These concern the firms' characteristics (firm age, size, employment change), financial characteristics (liabilities, sales growth), efficiency (productivity), sectoral-specific characteristics (kind of sectoral intensity), national characteristics (national growth, corruption) and time-specific characteristics. The year 2011 was the year that has the full application of austerity policies, and the year 2016 was the year that has the most recent full data. In this period of pursuit of the production capacities and of proper transformations in Greece, the detection of the production pattern that would be related to higher gains and profitability constitutes an important issue.

Several studies have investigated the impact of the crisis on the performance of Greek firms, focusing, however, on specific sectoral fields (Voulgaris *et al.*, 2013; Voulgaris and Lemonakis, 2014; Agiomirgianakis *et al.*, 2013; Magoutas *et al.*, 2016). Large firms, to the best of our knowledge, have not been so far the main body of any analysis, so this paper sheds some light on those characteristics of large industries that helped them to be profitable and therefore more resistant during the recessional period of 2011–2016. Moreover, the present analysis gives insight on how a less dynamic production part of a developed country (that is, the Greek large industries) was affected by the recent severe economic crisis by proving that only a limited range of factors played a significant role in its growth as its weakness did not permit the exploitation of any cumulative experience and context of favoured initial conditions (economic performance, strong specialisations) for its reinforcement.

The remainder of this paper is organised as follows: Section 2 provides a literature review; Section 3 presents a general view of the role of large firms in Greece and explains some methodological issues. Section 4 specifies the econometric model and presents the empirical results. Finally, Section 5 offers conclusions.

2. Literature review

2.1 The determinants of firm profitability

A widely used firm performance indicator is the firm profitability which has been investigated by several aspects and research fields. In industrial organisation economics and the market-based view (the structure-conduct-performance model is employed by this school), although firm profitability is explored from both the firm- and industrial-levels, the industry factors are considered as the primary determinants of firm profitability

(Ravenscraft, 1983; Schmalensee, 1985; Goddard *et al.*, 2005). In the strategic management and the resource-based view (by firm effects models), the internal environment and firm characteristics have a major role in profitability (Hawawini *et al.*, 2003). In the accounting and finance literature, the random walk model is important in analysing firm profitability (Callen *et al.*, 1993). Recent studies have oriented towards the synthesis of empirical models of the three aforementioned research strands providing a more integrated aspect of firm profitability (Goddard *et al.*, 2005).

Based on this argument, the determinants of firm profitability range among firm-specific factors, industry factors, national factors and global factors (Schmalensee, 1985; McGahan and Porter, 2002). The firm-specific factors arguably explain more than twice the variations of profits in relation to the factors of industry (Asimakopoulos *et al.*, 2009; Spanos *et al.*, 2004).

Firstly, the *firm size* is one of the most cited variables where its influence is investigated on profitability. It has been proxied by different measures such as the employment (Voulgaris *et al.*, 2002), the gross sales (Hermelo and Vassolo, 2007; Alessi *et al.*, 2012) or the fixed assets (Chen and Lu, 2003). Nevertheless, conclusions are not consistent as the analyses arrived at different conclusions. On the one hand, a positive effect of firm size on profitability emanated from the explosion of economies of scale and of economies of scope, the lower cost to access capital than smaller firms, the generation of higher income, the better access to capital markets or the lower cost of borrowing (Titman and Wessels, 1988; Barbosa and Louri, 2005; Stierwald, 2009; Argyrou *et al.*, 2016; Genovevo da Costa *et al.*, 2017). On the other hand, studies have found a non-important (Ha-Brookshire, 2009) or a negative effect of firm size on profitability (Zhou and de Wit, 2009; Yasuda, 2005; Almus and Nerlinger, 2000; Bottazzi and Secchi, 2006; Calvo, 2006; Dunne and Hughes, 1994; Goddard *et al.*, 2002), which is due to increased monitoring costs, bureaucratisation, policies based on non-pecuniary benefits, diseconomies of scale or diversified production structure (Glancey, 1998; Barbosa and Louri, 2005). The influence of firm size on profitability during periods of economic recessions seems to be positive as the recession affects stronger smaller firms (Bugamelli *et al.*, 2009).

In the same vein, studies that explored the influence of *firm age* on profitability have reported controversial results. A positive relation has been highlighted based on the benefits of experience, know-how, established network of relationships and reputation, lack of liabilities and newness and therefore a superior performance (Stinchcombe, 1965; Glancey, 1998; Kueng *et al.*, 2014), as well as a negative one justified by the fact that the older firms are prone to inertia, bureaucracy and a less flexibility to adapt to external rapid changes in market conditions (Agiomirgianakis *et al.*, 2006; Glancey, 1998; Marshall, 1920; Papadogonas, 2007). As concerns the association of firm age on profitability by the crisis effect, young businesses seem to be more cyclically sensitive (Burger *et al.*, 2013).

The level of *leverage* constitutes another factor that might determine the firm's performance as a high value might hint risks, while a low value might ensure greater financial security (Fu *et al.*, 2002; Kester, 1986) but also low ability for important profits and growth opportunities (Jensen and Meckling, 1976). A negative correlation of financial leverage and firm performance is more often met (Opler and Titman, 1994; Jandik and Makhija, 2005), while a positive correlation of financial leverage is more limited (Niskanen and Niskanen, 2007). The relationship between leverage and firm performance during crisis periods differs among industries with different characteristics, although the general prediction underlines a positive one (Knudsen, 2011). More analytically, a high leverage at the pre-recession period is correlated with a more deteriorated firm performance (Geroski and Gregg, 1993), while highly leveraged firms that seem to have lost more market shares have fewer chances of resisting the pressures of economic recession (Kester, 1986; Burger *et al.*, 2013) and experiencing higher drops in operating profits during economic downturns compared to firms with lower debt levels (Opler and Titman, 1994). On the contrary, highly (poorly) leveraged firms have been found to be related with positive (negative) performance

characteristics when other parameters coexist (e.g. less liquid assets, low-debt industries, Campello and Fluck, 2006).

Arguably, the serious Greek sovereign debt crisis has created a peculiar environment and has made the subject of liabilities a burning issue. The evolution of debt to GDP has dramatically increased since from 109% in 2008 to 181% in 2018. The imposition of capital controls in 2015 restricted the movement of capital, and a chain of causal effects followed the linking of liquidity shortages with lower credit and resulting in weaker economic activity (Louri and Migiakis, 2019).

Other factors emerged which brought about a more unambiguous and clear contribution to firms' performance and profitability. The *growth of sales* is related, in general, to the dynamism and good market standing (Agiomirgianakis *et al.*, 2006), while in periods of crisis this relationship more often appears to be stable (Tailab, 2014) than the inversed one (previous profits do not define the following sales) (Fuertes-Callen and Cuellar-Fernández, 2019). Parameters that dominate in periods of instability, like uncertainty or less liquidity and tight loan repayment, have also a decisive role in the relation of sales growth with profitability (i.e. young firms are prone to the liabilities of newness, and this possibly explains why the positive effect of growth on profitability is not obvious especially in periods of instability (Lee, 2014)). In other cases, the positive relationship between sales growth and profitability might be less strong or profound (Coad, 2010) as it depends on the applied strategies. For instance, sales growth retains its positive relation to profitability in periods of short-term economic downturn through a restriction of investments in growth, while in periods of long-term recession through (public) investments in R&D which alleviate the cost burden and boost the dynamism of sales growth (Yoo and Kim, 2015). Moreover, sales growth in firms that apply growth-focused strategies may not be associated with cost reductions and consequently with high profits (Jang and Park, 2011). *Productivity* is related to higher returns, although some empirical studies have not found robust evidence (Bottazzi and Secchi, 2006). In periods of recession, firms with higher productivity are expected to be more resistant to the economic recession, but at the same time, firms might be, on average, more tempted to increase productivity by *reducing the number of employees* (Burger *et al.*, 2013).

Apart from the firm-specific factors, other factors at the industrial, national or global level are studied in order to achieve a more integrated aspect in explaining the variability of profitability. The industrial effects are considered to be the second largest influence on firm profitability after the firm effect (Kattuman *et al.*, 2011). The *sector* in which a firm operates co-determines importantly its growth dynamics (Burger *et al.*, 2013). A better economic performance has been detected in sectors of financial nature due to the high financial leverage, or of high technology due to the rapidly enhancing innovation in this sector (DeAngelo and Stulz, 2013; Genovevo da Costa *et al.*, 2017). In other studies, it has been evidenced that sector effects are present but play a minor role (Stierwald, 2009).

The national environment might also influence the firms' performance (Goddard *et al.*, 2009). Entrepreneurship and *national growth* have been found to be correlated in a causative way (Wong *et al.*, 2005; van Stel *et al.*, 2005), where entrepreneurship fosters economic growth and the latter reinforces entrepreneurship. The influence of national environment in firm performance has been proved to be significant even more in emerging countries than in developed countries as they are in a different stage of economic development and record high growth rates (Burstein Goldszmidt *et al.*, 2011). In periods of economic contraction, this trend shifts as firms revert on their idiosyncratic competencies and strategies. Yet, there is not a clear relevance of country effects on firm performance during varying economic conditions (Bamiatzi *et al.*, 2016). Moreover, there is a knowledge gap in the relationship between national growth and firm profitability as regards the recent economic crisis, which the present paper attempts to cover.

The quality of institutions has also a decisive role in a firm's growth (Dollar *et al.*, 2005). *Corruption* distorts markets, opposes the adoption of new technologies, discourages investments and prevents the viability and expansion of their firms (Hudson *et al.*, 2012). On the contrary, other views support that corruption has no impact on firm performance in either crisis or steady-state conditions (van Essen *et al.*, 2013), or claim a positive aspect of corruption in firm efficiency. This may occur when corruption plays the role of grease in the wheels of a deficient environment in which firms behave corruptly to surpass market failures (i.e. bureaucratic environment) and to increase their profits especially in crisis periods (Hanousek *et al.*, 2019; Ayaydın and Hayaloglu, 2014; Gaganis *et al.*, 2019).

2.2 The firm profitability in the case of Greece

As regards the bibliography that analyses the profitability of *Greek firms*, Table 1 reports the main findings of the papers that studied the determinants of firms' profitability in Greece for various time periods. Concisely, for the pre-crisis period (in 1990s or 2000s), the factors that have been detected with a positive influences on the profitability are the firm size, the investments, the human capital, the sales to assets ratio and the export activity (Agiomirgianakis *et al.*, 2006; Liargovas and Skandalis, 2008; Magoutas *et al.*, 2011; Papadogonas, 2007; Asimakopoulos *et al.*, 2009; Caloghirou *et al.*, 2004). On the contrary, an ambiguous relationship with the profitability has been found (as it is not clear by both positive and negative relationships of variables with profitability in different papers) for the age of firms, the exports and the leverage (Agiomirgianakis *et al.*, 2006; Liargovas and Skandalis, 2008; Magoutas *et al.*, 2011; Papadogonas, 2007; Kapopoulos and Lazaretou, 2007).

As regards studies that investigated the profitability of Greek firms separately or exclusively during the crisis period (post-2008 period), they were mostly focused on specific production sectors and are characterised to be limited. Specifically, large dairy firms during the period of 2009–2011 were found to be more profitable when they were associated with large market shares and loyal customers, with high liquidity that contributed to their survival during downturns and with low liability (Notta and Vlachvei, 2014). Firms with high fixed assets efficiency (for firms of the chemicals and plastics industries), labour efficiency (pharmaceutical firms), gross profit margin (pharmaceuticals and chemicals firms) and with small size (chemicals and plastics firms) have been proven to be more profitable during the period of 2008–2011 (Voulgaris and Lemonakis, 2014). For the tourism sector, the determinants of firm profitability that have been reported are the age of the firm, the size, the market share, the low high market share, the capitalisation, the investments, the turnover and the low leverage and cost-efficiency (Magoutas *et al.*, 2016; Agiomirgianakis *et al.*, 2013; Dimitrić *et al.*, 2019; Dimitropoulos, 2020).

Other studies have analysed the profitability of firms based on a more extensive period that includes both pre- and during the crisis period. Specifically, it has been detected that agricultural firms in the period of 2004–2011 with high exports, fixed assets, labour efficiency, liquidity and leverage in time intervals with high national growth and low inflation are related to high profits. Moreover, the competitiveness of agricultural firms constructed by a composite indicator that entails *inter alia* both the level and the change of profits has been found to be related to high age, size, liquidity and growth in net fixed assets for the period of 2009–2011 (Lemonakis *et al.*, 2016). In the hotel sector, the lagged profitability, cash flow to operating revenue, net asset turnover and company age are positively related with profitability (Dimitrić *et al.*, 2019).

3. Descriptive analysis

The firms' size in Greece was traditionally too small with the share of micro firms (1–9 employees), especially in the manufacturing sector, which is to be much higher than the EU

Author(s)	Theme of study	Period	Main results
Agiomirgianakis *et al.* (2006)	Manufacturing sector (3,094 corporate private firms)	1995–1999	Firm size, age, exports, sales growth, reliance on debt on fixed assets and investment growth, as well as efficient management of assets influence profitability
Agiomirgianakis *et al.* (2013)	Tourism sector (134 hotels)	2006–2010	Age of firm, firm's size and low-cost access to bank financing have positive effect in profitability; leverage and economic crisis have negative effect
Argyrou *et al.* (2016)	Manufacturing sector (25,181 firms)	2006–2013	Age is significantly correlated to profitability before the crisis, and negatively after. Employment is related positively with profitability with the exception for the years 2011 and 2012. Exports are related positively in the pre-crisis period and negatively in the crisis period. A controversial impact has been found also for sales
Asimakopoulos *et al.* (2009)	Non-financial firms (119 firms)	1995–2003	Firm profitability was positively affected by size, sales growth and investment, and negatively by leverage and current assets. Additionally, the EMU participation and the adoption of the euro were negatively related to firm profitability
Caloghirou *et al.* (2004)	Manufacturing, SMEs and large firms, firms with turnover exceeding 3 million euros in 1999, questionnaire analysis (280 firms)	1999	Industrial growth (by sales) and financial assets have a significant positive relation, while technological assets a negative relation to the profitability of large firms
Dimitrić *et al.* (2019)	Hotel companies (1,314 firms for Greece)	2007–2015	Lagged profitability, cash flow to operating revenue, net asset turnover and company age have positive significant effect in profitability
Dimitropoulos (2020)	Non-financial corporations (3,332 firm-year observations)	2003–2010, 2011–2016	Size, change in sale revenues, net working capital and flows to total assets have positive effect in profitability, while liabilities a negative one. R&D investments have a negative impact on the profitability of sample firms before the crisis and positive during the crisis (2011–2016)
Georgopoulos and Koumanakos (2007)	Affiliates of foreign TNCs (82 affiliates)	1999–2002	Weak empirical support of intra-firm trade impact on profitability

(*continued*)

Table 1.
Literature overview on the determinant factors of firm profitability in Greece

Author(s)	Theme of study	Period	Main results
Kapopoulos and Lazaretou (2007)	Random sample of firms in all sectors (175 firms)	2000	Market concentration is related positively with profitability, while debt-to-assets ratio negatively
Lemonakis *et al.* (2016)	Agri-food sector (251 agri-food firms)	2004–2011	Positive effect of subsidies on competitiveness (which includes a strong component of profitability) is interesting only for the fruit-vegetable-cereal farms.
Lemonakis *et al.* (2013)	Agri-food sector (290 agricultural firms)	2004–2011	Exports, fixed assets and labour efficiency, good liquidity condition and careful use of foreign capital, along with economic growth, contribute to the profitability of agri-businesses
Liargovas and Skandalis (2008)	Manufacturing (102 industrial firms)	1997–2004	Leverage, export activity, location, size and the index for management competence significantly affect firm competitiveness (profitability)
Magoutas *et al.* (2011)	Manufacturing (287 firms)	2004–2006	Human capital, firm size, investments, assets to turnover ratio and dummy for location in the two metropolitan regions are related positively with profitability, while leverage negatively
Magoutas *et al.* (2016)	Tourism sector (4,433 firms)	2005–2011	Increased market share, decreasing leverage, a more efficient managerial performance, capital investment based on the principles of capital budgeting and innovation are crucial factors for financial performance during a period of economic crisis. Age is positively related with profitability only in the pre-crisis period and investments only in the crisis period.
Notta and Vlachvei (2014)	Food manufacturing firms (128 firms)	2006–2008, 2009–2011	Market share, liquidity and leverage have significant effect on profits for the crisis period, and only market share is related significantly with profits in the pre-crisis period
Papadogonas (2007)	Manufacturing (3,035 firms)	1995–1999	Size, managerial efficiency, debt structure, investment in fixed assets and sales growth affect significantly firm profitability

Table 1. (*continued*)

Author(s)	Theme of study	Period	Main results
Salavou (2002)	SMEs in food industry, questionnaire analysis (745 firms)	1995–1997	Market orientation, in terms of customer responsiveness and market-driven pricing policy, and product innovation interact in affecting business profitability
Spanos *et al.* (2004)	Manufacturing firms with size of at least 20 employees (1,921 firms)	1995–1996	Firm-specific factors explain more than twice as much profit variability as industry factors
Tzelepis and Skuras (2004)	Food and drinks manufacturing firms (1,005 firms)	1982–1996	Market growth is related positively with profitability
Ventoura *et al.* (2007)	Chemical and textile industry (163 firms)	2001	Positive influence of productivity on profitability

Table 1.

average (93.1% vis-à-vis 82.5% of EU28, Table 2); reflecting a series of problems such as lack of financial resources, obsolete management methods, lagging innovation performance and competitive weakness. Large industries, on the antipode, after the serious deindustrialization waves in the 1980s and 1990s, never had a major role in the Greek economy due to the dominant light and labour-intensive industry.

The recent economic crisis led industries to a new deindustrialisation process by reducing the number of large industries and downsizing their production value, and thus shrinking the production base of the country. Inevitably, in both the pre-crisis and at the tail end of the crisis period, the contribution of large firms to the economy in terms of turnover ranged at low levels (Table 3) (National Bank of Greece, 2018).

	Manufacturing			All sectors		
	Greece	EU28	EU-15	Greece	EU28	EU-15
1–9 persons employed	93.07	82.54	80.34	96.54	92.91	92.53
10–49 persons employed	5.68	13.31	15.33	3.06	5.93	6.31
50–249 persons employed	1.07	3.39	3.55	0.35	0.96	0.97
>250 persons employed	0.18	0.76	0.77	0.05	0.19	0.19
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Source(s): Author's elaboration from OECD (2018)

Table 2.
Share (%) of firms in each firm size category in Greece and the EU, 2016

	Pre-crisis period (2006/08)		Tail end of the crisis period (2015/16)	
	Greece	EU28	Greece	EU28
Small firms	56	39	53	37
Medium firms	19	20	19	20
Large firms (except fuel)	21	39	21	41
Large firms (fuel)	4	2	7	2
Total	*100*	*100*	*100*	*100*

Note(s): Small firms are defined those with turnover <10 million€ or <50 employees, medium firms with turnover 10–50 million€ or 50–250 employees and large firms with turnover >50 million€ or >250 employees
Source(s): National Bank of Greece (2018)

Table 3.
Share (%) of turnover in each firm size category in Greece and the EU

Undoubtedly, large firms experienced a serious decline in their profits during the period of 2008–2016, similar to that of small- and medium-sized firms [1]. However, the gap is widening between the profitable firms that managed to resist to the shock of crisis and the prejudicial firms in specific sectors (New Times, 2018).

The present paper, taking into consideration the unprecedented deep recession in which the Greek economy plunged into, the prominent small size of productive firms, the lack of important economies to scale and the inferior competitive position of large firms, aims at studying the performance of large firms in Greece and its determinants during the dramatically unstable period of 2011–2016.

Large firms are defined according to the employment size which is over 250 employees [2]. The list of large manufacturing firms is based on 2011 data which consisted initially of 132 firms. The data are sourced from the ICAP database which contains financial and non-financial information for all the companies that operate in Greece and are required to publish their annual balance sheet. Under this context, *all* Greek large firms of the manufacturing sector are included in the initial data set. From the list, firms from the fuel and the defence sector are excluded, as well as firms that closed down during the period of 2011–2016 or without any recently published recent data, reducing thus the number of firms to 125. Some basic figures about the profile of firms are displayed in Table 4. By the juxtaposition of the year 2011 with the year of 2016, it is profound that the ongoing crisis has led to further deviations between firms' characteristics (mainly in the earnings to sales ratio and the liabilities to assets ratio) that reflect the different ability of firms to respond to the shock and result eventually to a greater gap between the more profitable and the more prejudicial large firms.

4. Econometric analysis

The aim of this section is to clarify the parameters that define the performance and the competitiveness of large firms in Greece during the period of 2011–2016 by econometrically investigating the determinants of their profitability. The analysis follows an integrated approach of detecting determinants of firm profitability that includes firm-specific, industry-specific and national factors. Particularly, the following econometric dynamic panel model was estimated:

$$\mathrm{PROF}_{it} = \mathrm{LPROF}_{it-1} + \mathrm{AGE}_{it} + \mathrm{ASSETS}_{it} + \mathrm{LIAB}_{it} + \mathrm{SALESGR}_{it} + \mathrm{PROD}_{it} + \mathrm{EMPCH}_{it} + \mathrm{RESLAB}_{it} + \mathrm{SCIEN}_{it} + \mathrm{NGR}_{t} + \mathrm{LNGR}_{t-1} + \mathrm{CORRCH}_{t} + \mathrm{TIME}_{t} + e_{it}$$

where i is the firm, t the year and e the error term. The analysis used an unbalanced panel data of 125 large firms over the time span of 2011–2016 (750 observations).

More analytically, for the determination of firm performance, the firm profitability was used (PROF) and specifically the variable of return on sales which measures how much a

	Base year (2011)				Final year (2016)			
	Mean	Stdev	min	max	Mean	Stdev	min	max
Earnings to sales ratio	−1.2	15.4	−82.4	68.9	−4.8	46.6	−451.8	50
Number of employees	489.6	305.7	220	1900	499.5	306.6	105	1494
Firm age	35.9	21.9	1	123	40.9	21.9	6	128
Liabilities to assets ratio	64.5	22.6	8.5	130.2	69.8	48.9	9.5	427.6

Source(s): Author's estimations from ICAP (2018)

Table 4. Descriptive statistics of the dataset

company earns in relation to its sales (Liargovas and Skandalis, 2008). The indicator reveals the ability of a firm to withstand the competition forces as well as the deteriorated economic environment during the period under study which is characterised by rising costs and shrinking domestic market (in Table 5 is presented a description of the variables).

In the independent variables, the firm characteristics were primarily included in the model and explored for the firms' performance so as to detect those that are related to higher profitability and competitiveness of firms but also to delineate the pattern of the most dynamic and resilient firms that managed to resist to the crisis, to achieve higher profits to sales ratio and to hold a competitive position.

Firstly, the lagged profitability being a significant determinant of current profit margins (Pratheepan, 2014), accounts for a dynamic component in firms' profitability (Stierwald, 2009) and reveals the extent of profit persistence (Gschwandtner and Hirsch, 2018); for this reason, it is included in the model by the variable LPROF.

The firm age (AGE) was explored as a potential determinant of firm profitability. Its contribution is precarious as old firms might be associated with greater experience, lack of liabilities and newness, smaller sensitivity in recession periods (Stinchcombe, 1965; Fort *et al.*,

Variables	Explanation	Source
PROF	Firm profitability proxied by the return on sales that is the net profits by sales ratio $\text{PROF} = \left(\text{NET PROFITS}/\text{SALES}\right)*100$	Author's estimations from ICAP (2018)
AGE	Firm age estimated by the number of years since the foundation of the firm	Author's estimations from ICAP (2018)
ASSETS	Logarithmic form of firm assets	Author's estimations from ICAP (2018)
LIAB	Liabilities to assets ratio	Author's estimations from ICAP (2018)
SALESGR	Growth of firm sales $\text{SALESGR}_i = \left(\text{SALES}_{i,t+1} - \text{SALES}_{i,t}/\text{SALES}_{i,t}\right)*100$ where i the firm and t the year under study	Author's estimations from ICAP (2018)
PROD	Productivity proxied by the profits to employment ratio $\text{PROD} = \text{PROFITS}/\text{EMPLOYMENT}$	Author's estimations from ICAP (2018)
EMPCH	Change of employment, $\text{EMPCH}_i = \left(\text{EMP}_{i,t+1} - \text{EMP}_{i,t}/\text{EMP}_{i,t}\right)*100$ where i the firm and t the year are under study	Author's estimations from ICAP (2018)
RESLAB	Resource-intensive sector	Author's estimations from OECD (1987)
SCIEN	Science-intensity sector	Author's estimations from OECD (1987)
NGR	National growth rate of GDP/cap $\text{NGR} = \left(\text{GDPCAP}_{t+1} - \text{GDPCAP}_t/\text{GDPCAP}_t\right)*100$ where GDPCAP is the per capita GDP of the country (constant prices) and t the year under study	Author's estimations from ELSTAT (2018)
CORRCH	Change of corruption index $\text{CORRCH} = \text{CORR}_{t+1} - \text{CORR}_t$, where CORR is the corruption index of the country and t the year under study	Author's estimations from (Transparency International (2018))
TIME	Continuous variable of time	

Table 5.
Description of the variables

2013), as well as with bureaucratic and less flexible structures (Burger *et al.*, 2013; Glancey, 1998). The variable of age is defined as the number of years since the foundation of the firm.

The firm size is broadly recognised as an important component of firm profitability (Stierwald, 2009; Steinerowska-Streb, 2012; Ito and Fukao, 2010). As this paper studies exclusively the performance of large firms defined by their employment size (over 250 employees), an additional measure has been added to capture the economic size of firms through the variable of firms' assets (ASSETS). Its contribution to profitability depends on whether size generates gains from economies of scale and scope, or losses from diseconomies of scale and diversification (Goddard *et al.*, 2005). In general, studies have shown that large firms during periods of crisis seem to be more flexible and resistant in relation to small firms that appear to be more sensitive (Burger *et al.*, 2013; Agiomirgianakis *et al.*, 2013).

The low levels of indebtedness and a small dependency on external sources of financing of a firm are associated with a better financing environment in which a firm has greater opportunities to resist any pressures of economic recession (Burger *et al.*, 2013; Manova *et al.*, 2015; Bricongne *et al.*, 2012). This view is extremely crucial for the viability of Greek firms as they have been operating in a suffocated financial environment characterised by a sovereign deep and protracted debt crisis and a lack of financial liquidity in the previous years. In order to confirm whether a higher leverage ratio conceals a greater risk in the Greek firms during the recessional and unstable period of 2011–2016 and therefore undercuts their profitability, the variable of the liabilities to assets ratio (LIAB) was included in the econometric model.

Sales growth indicates a dynamic presence of firms in the markets, but its contribution to firms' profitability is not granted as it could be affected by an array of other (endogenous or exogenous) costs. The variable estimated the positive and statistically significant correlation of the variable of sales growth (SALESGR) to firms' profitability which signifies the margins left in the firms to convert their revenue to net profit, overpassing thus any high operational costs but especially the high taxes that Greece has overall imposed.

Although productivity is a key parameter to the firms' expansion and competitiveness, empirically, this association is not always confirmed (Bottazzi and Secchi, 2006) may be due to the fact that productivity rise might not be based on competitiveness improvements but on other inferior adjustments. This issue is crucial for Greece as traditionally, at national as well as at firm levels, the competitiveness was lagging behind, while this weakness is furthermore closely related to the recent deep crisis (Ioannides and Pissarides, 2015). The investigation of the relationship between productivity (PROD) and firms' profitability in the present analysis would shed some light if these two parameters have an associated improvement during the period of 2011–2016.

Importantly, while firms of higher productivity are expected to be more resistant to economic recessions, firms might be more tempted to increase productivity by reducing their employment (Burger *et al.*, 2013), a fact that has taken place extensively in Greece. In order to test this case, the variable of employment change (EMPCH) was included in the econometric model with the aim to explore its association with firms' profitability.

The performance and response of firms in any internal or external stimuli differentiate substantially from sector to sector (Genovevo da Costa *et al.*, 2017). With the aim to disentangle these different effects and to capture any industry-specific influences, a series of dummy variables was included in the econometric model defined according to the sectors of OECD classification, that is, the sectors of resource- and labour-intensity, of scale- and specialised-intensity, of science-intensity and the sector of services (RESLAB, SCSPEC, SCIEN and SERV respectively).

Finally, the determinants of firm profitability might lie not only along with firm-specific characteristics [3] but also along with national macroeconomic characteristics. National high growth rates indicate the country's economic health and the prosperity of the economic

environment in which firms operate. Therefore, the national growth rate (NGR) and its time lag (LNGR) are arguably expected to influence firms' profitability.

Among the factors of national socio-economic conditions, corruption might also affect the firms' performance and profitability. Corruption is one of the most pervasive obstacles to economic growth (Mauro, 1995), while partially the Greek crisis and the collapse of GDP are attributed to the high levels of corruption (Ormerod, 2016). Due to the significant role of the elimination of corruption for economies in general and for Greek firms in specific, the variable of change in the corruption index (CORRCH) was included in the model. High values of the corruption index indicate high transparency, so a positive change of the index signifies diminution of corruption.

Lastly, as the crisis shock is gradually expected to fade off and the entrepreneurial environment to be purged diachronically, the time variable (TIME) was included in the model in order to capture any positive developments in firms' profitability that are associated with their entry in a new phase of economic and entrepreneurial recovery.

To tackle any potential endogeneity issues, a generalised method of moment (GMM) estimator (Arellano and Bond, 1991; Blundell and Bond, 1998) was implemented which treated explanatory variables as potentially endogenous (Aiello and Scoppa, 2009; Kloss and Petrick, 2014; Kosfeld *et al.*, 2006). This methodological approach used GMM estimators and moment conditions from a system of equations which had better properties in terms of bias and efficiency than that of the GMM estimators for differences (Arellano and Bover, 1995; Blundell and Bond, 1998), in which it combines the first-differenced regression with the level equation which uses the lagged first differences of the dependent variable for instruments.

The results of the econometric analysis are displayed in Table 6 where the econometric model of firm profitability relied on dynamic panel GMM estimation which treats explanatory variables as potentially endogenous. The methodological approach of the dynamic GMM (Arellano–Bover/Blundell–Bond) uses the estimators and moment conditions from a system of equations which has better properties in terms of bias and efficiency than that of the GMM

Independent variables	Dependent variable: firm profitability (1)	(2)	(3)
Constant	375.35(0.123)	328.52(0.161)	345.01(0.184)
LPROF	−0.34(0.260)	−0.35(0.302)	−0.34(0.297)
AGE	34.74(0.159)	25.56(0.090)*	19.77(0.332)
ASSETS	−27.21(0.066)*	−25.06(0.074)*	−25.72(0.070)*
LIAB	−0.34(0.036)**	−0.31(0.035)**	−0.32(0.030)**
SALESGR	0.014(0.118)	0.010(0.083)*	0.009(0.071)*
PROD	0.0009(0.074)*	0.0008(0.046)**	0.0008(0.035)**
EMPCH	26.26(0.394)	24.85(0.311)	18.00(0.514)
RESLAB		49.58(0.514)	53.17(0.490)
SCIEN		57.42(0.521)	60.59(0.485)
NGR			−1.36(0.446)
LNGR			0.86(0.501)
CORRCH			0.67(0.340)
TIME			2.75(0.459)
Nb of firms	122	122	122
Nb of observations	594	594	594
Hansen test (*p*-value)	0.854	0.833	0.819
Arellano–Bond test (*p*-value)	0.112	0.108	0.110

Note(s): The numbers in parentheses denote *p*-values. The number of asterisks denotes the significance level of the coefficients: ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level. The number of instruments is less than the number of groups

Table 6.
Econometric results of dynamic GMM model

estimators for differences (Arellano and Bover, 1995; Blundell and Bond, 1998), and combines the first differenced regression with the level equation in addition to the usual lagged levels as instruments for equations in first-differences. The use of robust standard errors provides consistent estimates in the presence of heteroscedasticity and autocorrelation. Problems of multicollinearity have not been detected [4]. The Sargan test for the validity of restrictions shows that the instruments are valid.

According to the results, the lagged profit rate (LPROF) is correlated negatively and statistically insignificantly with the dependent variable, signifying that profitability is not serially correlated over time. Thus, high levels of profits in the previous years do not seem to predetermine equally significant profits of firms in the following years (potentially by reinvestments in R&D or innovation processes, Stierwald, 2009).

The firm age (AGE) is not considered as an important determinant of firms' profitability according to the positive but statistically insignificant coefficient of the variable. Older and mature firms are not strongly related to levels of higher profitability, indicating that their long-established position in the market has not brought important economic gains and resilience during the crisis period.

Firms that are classified as large ones according to their employment size (> 250 employees) but of smaller economic size defined by the magnitude of their assets (ASSETS) are associated with higher profitability. Thus, large firms, in economic terms, seem to confront serious constraints that confine their profits, as in a deeply recessional environment, parameters like a feeble banking sector and steep tax increases escalate the instability of large firms.

A higher debt and leverage level expressed by the liabilities to assets ratio (LIAB) in firms is correlated to lower profitability, an outcome which expectably shows that a high firm risk by an important financial leverage could not lead to gains under fiscal austerity and a weak banking system such as in the period under study. Therefore, despite the widespread perception that large firms are more favoured in an environment of limited financial resources (Latham, 2009), the present analysis proves that liabilities constitute one of the greatest burdens in the Greek large firms in the recent crisis.

Sales growth (SALESGR), on the contrary, seems to contribute to the firms' profitability, highlighting the ability of firms to channel their gains from sales to profits exploiting any profitable opportunity.

Productivity (PROD) is related positively and statistically significant to firms' profitability, while the employment change (EMPCH) is related positively but statistically insignificantly to the dependent. This signifies that high productivity levels, which are not maintained overwhelmingly on employment losses, are associated to profits' rise. However, firms with higher profitability are not related to production transformations and technological advancements that are able to lead to strong recruitment of employees.

The profit potentials are not similar among firms in different sectors. However, despite the dissimilar performance of firms regarding their profits during the period under study, which is reflected by a positive coefficient of the variable of labour- and resource-intensity (RESLAB) as well as of the science-intensity firms (SCIEN), there is no profound distinction between profitable and non-profitable firms according to their sector, as the statistical significance of the coefficients of the defined variables is not important.

Not only firm-specific characteristics but also national ones might influence the firms' performance. However, this analysis shows that their influence is weak. Specifically, the one-year lag of national growth rate (LNGR) seems to positively affect the firm profits but not in an important degree, verifying the fact that the Greek economy has not yet obtained the appropriate momentum. Similarly, the improvements in the transparency by reductions in corruption (CORRCH) have a positive but weak influence in firms' profitability. It should be mentioned, nevertheless, that changes in both national growth and transparency have not

been high enough so far, to act as stimulus for the recovery of the entrepreneurship and the growth of firms. Lastly, the variable of time (TIME) has a statistically insignificant positive effect on firms' profitability, signifying that the gradual improvement (but not totally restored) of economic and entrepreneurial conditions in the country has not contributed substantively to the growth of firms' profits [5].

5. Conclusions

The production base in Greece was traditionally of low quality, with technological ability or value-added focusing on light, labour-intensive industry and on traditional or endowments-based services. The recent deep economic crisis led firms to experience a strong shock but also revealed a different degree of resistance and recovery ability in each firm. The goal of this paper was to study the performance of large manufacturing firms in Greece during the fragile period of 2011–2016 and to detect the determinants of their profitability in this unstable economic and entrepreneurial environment.

The analysis was based on all the large firms (defined by their employment size, namely over 250 employees) recorded for the period of 2011–2016, apart from those from the fuel or the defence sector. The econometric estimation was based on the GMM system methodology which resolves any endogeneity issues and offers efficiency in its results. The parameters that seem to play an important role in the firms' profits are the high sales growth and productivity, and the low leverage level and assets. Thus, firms that manage to improve their productivity levels and to increase their sales seem to create suitable conditions to confront the controversial conditions of the period under study and to perform better. Moreover, large firms with smaller economic size in terms of assets and lower liabilities to assets ratio signify that a manageable economic size and a low financial leverage and risk are those characteristics that lead to higher viability and profitability of firms in difficult periods of fiscal austerity and financial weakness.

On the contrary, high profit rates from previous years or a high firm age does not present any important influence on firms' profitability. This signifies two things: firstly, that previous high profits during the unstable crisis period do not in any way indicate a stable and viable growth of firms. As long as economic and business conditions fluctuate, the profitability of firms will be precarious. Secondly, historical parameters, which might be linked with experience and favourable initial conditions, do not play any significant role in the evolution and the positive route of large firms. This outcome eventually indicates the inability of large firms to evaluate past cumulative benefits and their inflexibility to be effectively restructured either in the past or in the present, resulting in a lack of resilience and of high profitability during the crisis.

Similarly, industrial-specific factors, such as broad sectors in which firms belong to, or national factors, such as the national growth rate or the corruption decline that could positively affect firms, have, on the contrary, a weak influence on firms' profitability, verifying the feeble growth of the Greek economy as well as the low rate of structural changes which are unable to adequately foster the entrepreneurship. The distortions, market rigidities and institutional inefficiencies that characterise the economy not only deter investments but allow an entrepreneurial environment to persist in being weak and introverted, as well as in relying on wrong practices. In the same vein, the time variable has not significantly affected the firms' profitability, highlighting the persistent weakness of the country to change the entrepreneurial environment and to enter into a viable cycle of vigour and growth.

Overall, the flexibility and adaptability seem to be some of the key parameters that favour the Greek large firms to be profitable and competitive in the seriously adverse socio-economic conditions of the period of 2011–2016. Manageable and flexible (in the sense of non-large) sizes of assets and liabilities are related to higher profitability as they seem to confine any

risks and to verify the imperative need for stable and viable changes in a continuing unbalanced environment. Moreover, timely adjustments, rather than favourable initial conditions, have played a decisive role in firms' profitability. This signifies their low ability to efficiently convert gains of previous years into cumulative value-added and significant transformations in production and to develop immunity to potential shocks. The restructuring and the smooth management of difficult situations, rather the extension (by employment increase), appeared to be the solution for the survival and growth of large industries. Finally, the Greek economy seems to be in a lethargic situation which unambiguously makes harder any effort of firms to recover and establish a strong position in the markets. Its weakness to improve the key elements of the business environment with targeted interventions just perpetuates a climate of instability and underperformance in which firms are called to operate.

The present paper has attempted to explain the performance of the most dynamic large firms in Greece investigating the role of some of the most important determinants of firm profitability. Its academic contribution lies in the fact that it gives insight on how a less traditionally competitive production part of Greece accommodated a severe crisis and on which characteristics are associated with a more resilient behaviour, an important issue for the evolution of large industry in the country, especially after the rebirth of industrial policy in the European Union (EU). The paper acknowledges, however, some analysis' limitations as the absence of some other parameters like the export activity, the incorporation of any innovative features in the firms, the sales markets, the foreign presence in the firm's operation or their role in the global value chains. Given these concerns, future research should explore a greater variety of factors that influence firm profitability, extending the analysis in the range of determinants as well as in the period (e.g. including the whole restoration period to the pre-crisis levels). Additionally, a similar analysis in large firms of another country with equally strong experience of an economic shock would reveal more the peculiarities of the production system of Greece.

As the production and financial system in Greece would gradually be improved and rationalised, future studies should shed light on those parameters that could determinedly restructure the Greek industry but also highlight in which degree the large industry has prospects to be developed in Greece or will remain limited under the persistent pattern of the domination of (micro) small-sized firms. Large manufacturing industries do not only need to survive and grow following "regularities", as this paper has shown, but also to extend looking for new competitive paths. Any enhancement at the present time would improve the initial conditions and the resilience to a future crisis, but the question is how possible is this?

Notes

1. The turnover of large firms presented a decline of 29%, of small firms 31% and of medium firms 28%. However, greater reduction of turnover in large firms was presented in the services in relation to the industrial sector (National Bank, 2018).
2. According to the official EC definition of SMEs, it takes account of three different factors (level of employment, level of turnover, and size of the balance sheet). This paper is based on the simplest definition of large enterprises that OECD also follows.
3. From which the variable of export activity is not included in the analysis due to data limitations in an annual time period.
4. The VIF test ranges from 1.01 to 1.37 across the variables (mean VIF: 1.14).
5. In the analysis alternative indices of profitability (in the place of the dependent variable of the econometric model) (Georgopoulos and Glaister, 2018) have also been used in order to be investigated the role of firm and national characteristics in firms' performance under different aspects. However, in the case the return of assets is used as a proxy of firm performance (net profits to assets ratio), only

the variable of the liabilities to assets ratio appears to have a significant (negative) role, while in the case of return on equity (net profits to equity ratio), no variable seems to play a significant role.

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Corresponding author
Maria Tsiapa can be contacted at: mtsiapa@uth.gr

The nexus between firm size, growth and profitability: new panel data evidence from Asia–Pacific markets

Inder Sekhar Yadav
Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur, Kharagpur, India
Debasis Pahi
School of Commerce and Economics, Kalinga Institute of Industrial Technology (KIIT) Deemed to be University, Bhubaneswar, India, and
Rajesh Gangakhedkar
Institute of Public Enterprise, Hyderabad, India

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Abstract

Purpose – The purpose of this paper is to examine the correlation between firm size, growth and profitability along with other firm-specific variables (like leverage, competition and asset tangibility), macroeconomic variable (like GDP growth-business cycle) and stock market development variable (like MCR).

Design/methodology/approach – Using the COMPUSTAT Global database this work uses panel dynamic fixed effects model for nearly 12,001 unique non-financial listed and active firms from 1995 to 2016 for 12 industrial and emerging Asia–Pacific economies. This interrelationship was also examined for small, medium and large size companies classified based on three alternate measures such as total assets, net sales and MCR of firms.

Findings – The persistence of profits coefficient was found to be positive and modest. There is evidence of a negative size-profitability and positive growth-profitability relationship suggesting that initially profitability increases with the growth of the firm but eventually, overtime, gains in profit rates reduce, as size increases indicting that large size breeds inefficiency. The relationship between firm's leverage ratio and its asset tangibility is found to be negative with profitability. The business cycle and stock market development variables suggest a positive relationship with the profitability of firms. However, the significance of estimated coefficients was mixed and varied among different selected Asia–Pacific economies.

Practical implications – The study has economic implications on issues such as industrial concentration, risk and optimum size of firms for practicing managers of modern enterprise in emerging markets.

Originality/value – The analysis of the relationship between the firm size, growth and profitability is uniquely determined under a dynamic panel fixed effects framework using firm-specific variables along with macroeconomic and financial development determinants of profitability. This relationship is estimated for a large and new data set of 12 industrial and emerging Asia–Pacific economies.

Keywords Firm, Size, Growth, Profitability, Panel fixed effects, Asia–Pacific

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1. Background

The present work tries to empirically examine two traditional questions of business and industrial economics: first, what is the relationship between firm size and profitability? and second what is the association between firm growth and profitability? Both theoretical and empirical discussions have led to inconsistent and contradictory conclusions. A basic proposition of economic theory is that, under perfect competition, profit rates of all firms tend to be equal (Hall and Weiss, 1967). However, when imperfect markets are taken into consideration, the size of a firm becomes an important factor of producing profits. Accordingly, early theories of business economics have recognized the role of economies of scale (Alexander, 1949; Stekler, 1964; Hall and Weiss, 1967; Scherer, 1973) and other technical and economic efficiencies associated with larger business firms. For example, Baumol (1959) in his seminal work hypothesized a positive relationship between firm size and business profitability. Baumol argued that, *"at least up to a point, increased money capital will not only increase the total profits of the firm, but because it puts the firm in a higher echelon of imperfectly competing capital groups, it may very well also increase its earnings per dollar of investment even in long-term"*. Accordingly, Baumol (1959) contended that large firms are capable of enhancing the investment opportunities, which bring larger profit rates, but the smaller firms cannot take them because of financial difficulties. Besides, large firms have an advantage over smaller firms as they can enter in varieties of product lines, which gives them the benefits of both the scale and the size. Consequently, the large firms are in a position to take full advantage of technical and pecuniary economies of scale in manufacturing, marketing, supervision and in raising capital. Hence, Baumol (1959) states his hypothesis on the firm size and profitability as, "o*ther things being equal, the large firm can ordinarily obtain profits at least as large, and perhaps larger, than the smaller enterprise*".

Contrary to Baumol's hypothesis, certain works on industrial theory and organization have also recognized limits to the growth of firms (Yadav *et al.*, 2020) which may negatively impact their profitability. For example, earlier works of Robinson (1934), Coase (1937), Penrose (1955) and Williamson (1975) have all argued that firm growth breeds inefficiency and therefore, there are limits to growth. According to them, as firms grow larger and larger, diseconomies of scale may appear and a firm may reach a size at which the benefit from the last internalized transaction may be offset by management failure or some other internal or external factor. Also, according to them, large firms cannot undertake the options open to small firms as efficiently as the small firms undertake. Hence, profitability may decline with the growth of firms postulating a negative relationship between them.

Thus, contradictory theoretical arguments exist regarding the relationship between the firm size, growth and profitability. In this context, several empirical studies (discussed in next section) have revealed a mixed evidence. Additionally, many studies have also noted that other control factors like market structure, entry barriers and firm strategies may also determine the profitability of firms. Also, certain macroeconomic variables may affect the profits of firms from time to time. Thus, there is an interesting but inconclusive debate about this issue and therefore, it becomes important to empirically investigate the relationship between firm size, growth and profitability, particularly for emerging markets. Further, in context of selected emerging Asia–Pacific markets, the analysis of the relationship between the firm size, growth and profitability becomes important for the following economic implications: (1) *industrial concentration:* a positive relationship between average profitability and size would suggest that the degree of industrial concentration is likely to increase by large firms growing at a faster average rate than small firms (Whittington, 1980). Further, if the relationship between profitability and growth is positive, it will lead to higher growth rate, because higher profits provide both the means and better accessibility of money from retained earnings or from the capital market and the incentive for a higher rate of return from new investment (Whittington, 1980). (2) *measure of risk:* the variability of profitability

through time, measures the firm risk (Whittington, 1980). Lower variability would imply that the average return had desirable risk characteristics, so that even if the average rate of profit did not vary with firm size, one would expect declining variability of profitability with respect to firm size to provide an incentive for relatively high growth of large firms (Whittington, 1980). (3) *optimum size:* if average profitability increases with size, then profitability is not constrained by size. In such a situation, it will be a positive inducement for the firms to grow more and more suggesting that there is no optimum size.

This study provides some important contributions to the existing empirical literature. First, the analysis of the relationship between the firm size, growth and profitability is uniquely determined under a dynamic panel fixed effects framework using firm-specific variables along with macroeconomic and financial development determinants of profitability. This relationship is estimated for a large and new data set of 12 industrial and emerging Asia–Pacific economies. The macroeconomic and financial development determinants along with size and growth variables have not been used before in a single framework. Second, the persistence of profits of firms is also investigated in a single dynamic panel framework which provides additional evidence on the convergence of profit rates across all firms in the long run. This further adds to the existing literature. Third, the interrelationship between firm size, growth and profitability is also examined for small, medium and large size companies classified based on three alternate measures such as total assets, net sales and market capitalization ratio of firms which further provides additional evidence based on different size classes using alternate size variables. Overall, this work contributes to better understanding of correlation between firm size, growth and profitability along with macroeconomic and financial development determinants for 12 cross countries which have important economic and firm level policy implications.

2. Empirical literature [1]

2.1 Size and profitability

Traditional research on determinants of profit rates, primarily focused on industry-level determinants of competition such as concentration, entry and exit barriers and economies of scale (Goddard *et al.*, 2005). One such early work was by Bain in 1951 where he sought to test statistically, whether the profit rates of firms in American manufacturing industries of high seller concentration on average is larger than those firms in industries of lower concentration from 1936 through 1940. His statistical work suggested that the average after-tax return on equity of eight leading firm's concentration ratio was positive. Also, the study did not find any association of concentration to other potential determinants of profitability, nor were other such determinants significantly related to profit rates. More importantly, absolute size of firm as measured either by assets or by net worth did not appeared to be significantly related to profit rates. Later, Bain in 1956 maintained that actual or potential entry is an important determinant of performance of manufacturing firms in American industry. He hypothesized that, greater the structural barriers to competition from new sellers, farther will industry performance be from the competitive optimum.

However, as noted before, Baumol (1959) shifted the focus from concentration, entry and exit barriers to economies of scale and operational efficiencies associated with larger firm size. From time to time, empirical studies exploring the relationship between firm size and profitability have shown mixed evidence. For example, early empirical work of Stekler (1964) found that the variability of the profit rates of firms in a particular size class is inversely correlated with size for US manufacturing firms during 1947–1958. However, the empirical work of Hall and Weiss (1967) strongly contended that size does tend to result in high profit rates for 341 US largest industrial corporations during 1956–1962 supporting the Baumol's hypothesis. But again, Samuels and Smyth (1968) found that the profit rates and firm size are inversely related for a cross-section firms of United Kingdom during 1954–1963.

Likewise, Marcus (1969) tried to reevaluate the firm size and profitability hypothesis using new data within an improved analytical framework over three years: 1959–1960, 1960–1961, 1961–1962. His study found that the size of firm influences profitability in some, but not in all, industries; in 74 of 118 industries the null hypothesis that size has no effect on the rate of return could not be rejected at a five per cent probability level. Later, Shepherd (1972) found that size carries a negative coefficient with profitability, perhaps owing to X-inefficiency (the gap between actual and attainable profit of large absolute scale) for a panel of 231 large United States industrial firms during 1960–1969. Similarly, Caves and Porter (1977) and Porter (1979) held that the association between size and profit rates may vary across industries. Further, Whittington (1980) found that the average profitability of United Kingdom listed manufacturing firms during 1960–1974 was largely independent of firm size, and if such relationship exists, it tends to be negative. The study also observed that the inter-firm dispersion of profitability tends to decline with firm size, although the relationship was not strong. Even, Amato and Wilder (1985) found no relationship between firm size and profit rate, using a data set which covers a wide range of firm sizes (largest 500 firms to a much larger range of firm sizes in the manufacturing sector) for the years 1966 and 1975.

Recent evidence on the relationship between firm size and profitability is also found to be mixed. For example, Amato and Amato (2004) argued that the typical firm size-profitability relationship established for manufacturing firms does not hold in retailing industries. Goddard *et al.* (2005) found a negative size-profitability relationship for manufacturing and service sector firms in Belgium, France, Italy and the UK, for the period 1993–2001. However, Gschwandtner (2005) noted that larger US firms tend to enjoy higher long-run profit rates. Subsequently, Lee (2009) found evidence for positive correlation between profitability and size for over 7,000 US publicly-held firms during the period 1987–2006.

2.2 Growth and profitability

The tangible effect of firm growth on profitability has also been found to be inconsistent in theories and empirical studies. Alchian (1950) argue that fitter firms realize positive profits as a result of which they grow and survive suggesting that profitability of firms reflect the degree of fitness and accordingly envisage that profitable firms will grow. Equally, Myers and Majluf (1984), argued that an increase in retained earnings leads to an increase in investment and consequently to further expansion. That is, profit is an important source of finance for expansion. However, the classical perspective argues that if firms have higher profitability they would grow to exploit further growth opportunities that are less profitable but still create additional profits (Jang and Park, 2011) suggesting the following: the profit rates converge to zero; high profit rates have a positive impact on growth rates until the profit rate reaches zero and firm growth has a negative influence on profit rates (Jang and Park, 2011). Likewise, the neoclassical perspective argues that firms first exploit most available profitable growth options before considering less profitable opportunities until the marginal profit from the last growth opportunity is equal to zero (Jang and Park, 2011). Thus, profitable firms first maximize their overall profits through most available profitable growth options but later experience a decrease in profit rates. Further, Kaldor (1966), Verdoorn (1949) asserted that growth increases productivity and in turn enhances productivity through increased profit rates. Therefore, the above arguments theoretically explain the inter-relationship between growth and profitability of firms.

However, as noted before, empirical studies related to growth and profitability have found mixed evidence. For example, Capon *et al.* (1990) found that growth of the firm was related to high profitability, but this was not significant in some industries. Likewise, Chandler and Jansen (1992), Mendelson (2000) and Cowling (2004) found a significant positive correlation between firm's sales growth and profitability, whereas Markman and Gartner (2002) reported insignificant association between growth and profitability. Furthermore, Reid (1995) reported

that growth had a negative effect on profitability for young micro-firms (less than ten employees) in Scotland during 1985–1988. As well, some of the recent studies such as Coad (2007), Coad (2010), Coad *et al.* (2011), show a positive influence of growth on profits while Jang and Park (2011) show a negative effect of growth on profits. Thus, overall evidence suggests that different studies have drawn different conclusions regarding the relationship between firm size, growth and profitability.

3. Data and econometric model

3.1 The data and sample

The sample consists of an unbalanced panel data for about 12,001 unique non-financial listed and active firms from 1995 to 2016 for 12 industrial and emerging Asia–Pacific [2] economies. The firm specific variables are collected from COMPUSTAT Global database. The firm year observations and average number of firms of selected Asia–Pacific economies included in the analysis is reported in Table 1.

3.1.1 Classification of small, medium and large firms. In addition, to examine the existence of significant differences between small sized, medium sized and large sized firms, the present study divides the full sample into small, medium and large size companies using three alternate measures viz., total assets (TA), net sales and market capitalization ratio (MCR) which is reported in Table 2. Companies whose total assets is less than or equal to $2955.75 million are classified as small sized companies. Companies whose total assets range from $2955.76 million to $38991 million are classified as medium sized companies. Companies whose total assets are greater than $38991 million are classified as large sized companies (Table 2). Accordingly, using this criterion of classification the sub sample had 39,318 firm

Economy	Total firm-year observations	Average no. of firms	Percentage share (%)
China	26,674	1905	26.721
Hong-Kong	1,170	66	0.930
Indonesia	1,092	42	0.590
India	15,993	1142	16.021
Israel	1,018	68	0.957
Japan	43,790	2255	31.624
South Korea	12,934	809	11.350
Malaysia	6,689	359	5.034
Pakistan	1,973	104	1.459
Philippines	722	39	0.551
Singapore	3,848	217	3.046
Thailand	2,275	123	1.718
All	118,178	7,130	100

Source(s): Authors' calculations based on COMPUSTAT Global Database

Table 1. Number of average firms: select Asian economies

Size/ Measure	TA ($millions)	Total no. of observation	Net sales ($millions)	Total no. of observation	MCR	Total no. of observation
Small	≤ 2955.75	39,318	≤ 2295.1	39,276	≤ 54	41,195
Medium	2955.76 to 38,991	39,410	2295.11 to 37,052	39,451	54.00 to 76.56	38,312
Large	>38,991	39,450	>37,052	39,451	>76.56	38,671

Source(s): Authors' calculations based on COMPUSTAT Global Database

Table 2. Criteria for classifying companies into small, medium and large size companies

year observations for small sized companies, 39,410 firm year observations for medium sized companies and 39,450 firm year observations for large sized companies (Table 2).

Similarly, companies whose net sales is less than or equal to $2295.10 million are classified as small sized companies. Companies whose net sales range from $2295.11 million to $ 37,052 million are classified as medium sized companies. Companies whose net sales are greater than $37052 million are classified as large sized companies (Table 2). Accordingly, using this criterion of classification the sub sample had 39,276 firm year observations for small sized companies, 39,451 firm year observations for medium sized companies and 39,451 firm year observations for large sized companies (Table 2). Finally, companies whose MCR is less than or equal to 54% are classified as small sized companies. Companies whose MCR range from 54.01 to 76.56% are classified as medium sized companies. Companies whose MCR is greater than 76.56% are classified as large sized companies (Table 2). Accordingly, using this criterion of classification the sub sample had 41,195 firm year observations for small sized companies, 38,312 firm year observations for medium sized companies and 38,671 firm year observations for large sized companies (Table 2).

3.2 Measurement of variables [3]

3.2.1 Profitability. (1) Return on assets (ROA): ROA is income before extraordinary items (Item G378), divided by the average of the most recent two years of assets-total (Item G107). This is then multiplied by 100. Income before extraordinary items represents income after the deduction of all expenses, including allocations to untaxed balance sheet reserves (if applicable), income taxes, minority interest, and net items, but before extraordinary items and provisions for dividends while assets-total represents the sum of current assets, net property, plant, and equipment, and other noncurrent assets. (2) Return on equity (ROE): ROE of firms is measured as income before extraordinary items-common (Item G378) which is defined as income before extraordinary items and discontinued operations less preferred dividend requirements, but before adding savings due to common stock equivalents divided by common equity (Item G277 which is defined as the common shareholders' interest in the company.

3.2.2 Firm specific determinants of profitability. (1) Firm size *(S)*: Size of the firm is measured using two alternate variables viz., total assets and net sales. Total Assets (TA) (Item G107) represents current assets plus net property, plant, and equipment plus other noncurrent assets (including intangible assets, deferred charges, and investments and advances). (2) Leverage (LEV): Leverage of firms is measured as a ratio of total debt to equity (DER). This leverage ratio measures the firm's total capital structure and is defined as the sum of long-term debt (Item G135) and debt in current liabilities (Item G132), divided by common equity-total (Item G227). Debt in current liabilities represents the total amount of short-term notes and the current portion of long-term debt that is due in one year. It includes several items like bank acceptances and overdrafts, brokerage companies' drafts payable commercial paper, construction loans, current portion of long-term debt, debt in default, debt due on demand, due to factor if "interest bearing", installments on a loan, line of credit, loans payable to officers of the company, loans payable to parents, and consolidated or unconsolidated subsidiaries, loans payable to stockholders, notes payable to banks and others, notes payable that are included in accounts payable, unless specifically trade notes payable, sinking fund payments. This item may include mortgage indebtedness for banks (included in current liabilities –other, if identifiable). The long-term debt total of a firm refers to the debt obligations due more than one year from the company's balance sheet date or due after the current operating cycle. It includes debt obligations like bonds, loans, mortgages, advances from other firms, installment obligations, line of credit (when reclassified as a non-current liability), loans on insurance policies and long-term lease obligations (capitalized lease obligations). The common equity-total represent the common shareholders' interest in the

company. It includes common stock (including effects of common treasury stock), capital surplus, retained earnings, and treasury stock adjustments for both common and nonredeemable preferred stock. (3) Competition (COMP): Competition is measured by the net sales (Item G608) based Herfindahl-Hirschman Index (HHI). HHI is measured as the total of the squared market share of all firms in the industry "*k*" in year "*t*". To define industries, COMPUSTAT four-digit Standard Industry Classification (SIC) codes are used. Higher HHI implies high industry concentration and low competition, whereas lower HHI implies less industry concentration and more competition. Firms in the highest HHI industries are non-competitive firms, and firms in the lowest HHI industries are competitive firms. (4) Tangibility (TANG): Tangibility is measured as the ratio of net property, plant, and equipment (Item G85) divided by assets-total (Item G107). Net property, plant, and equipment represents the net cost or valuation of tangible fixed property used in the production of revenue while assets-total represents the sum of current assets, net property, plant, and equipment, and other noncurrent assets.

3.2.3 Macroeconomic [4] determinants of profitability. (1) GDP growth (annual %) (ΔGDP) is the annual percentage growth rate of GDP at market prices based on constant local currency. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. (2) Market capitalization ratio (MCR) an indicator of the size of the stock market is measured as the value of listed shares divided by GDP.

3.3 Modeling the determinants of profitability

The following is the specified econometric model:

$$\pi_{it} = \alpha_i + \pi_{it-1} + S_{it} + \Delta S_{it} + \sum_{j=1}^{k} \beta_j X_{j,i,t} + \delta_t + \varepsilon_{it} \ \ldots \tag{1}$$

where π_{it} is the profit variable for firm i in period t, S_{it} is the natural log of size variable for firm i in period t, ΔS_{it} is the growth rate of firm measured as the difference between S_{it} and S_{it-1}, $X_{j,i,t-1}$ is the vector of firm-specific and macroeconomic independent variables, α_i and δ_t are individual and time effects, respectively. ε_{it} is the disturbance term assumed to be normal, independent and identically distributed (IID) with $E(\varepsilon_{it}) = 0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon{}^2 > 0$.

The dynamic specification of Eqn (1) also allows to investigate the "persistence of profits" of firms' overtime. The dynamic panel regression is estimated using the fixed effects (FE) approach and the random effects approach using OLS. For choosing between fixed effects and the random effects model the assumption one makes about the likely correlation between the cross-section specific error component (ε_i) and the X regressors is important. If it is assumed that error component and the X's are uncorrelated, random effects model may be appropriate. However, if ε_i and the X's are correlated, fixed effects models may be appropriate. The formal test developed by Hausman (1978) is used to choose between fixed effects and the random effects approach. In order to reduce the effects of heteroskedasticity on inferences a heteroskedasticity-consistent standard error estimator of OLS parameter estimates (White, 1980; MacKinnon and White, 1985; Long and Ervin, 2000) is employed. This approach employs an alternative method of estimating the standard errors that does not assume homoscedasticity.

4. Empirical results and discussion

4.1 Summary statistics and correlation analysis

Table 3 displays summary statistics of the selected variables. The mean profit rate (ROA) [5] is about 4.40% for the aggregate sample. All the selected economies recorded a positive mean

Table 3.
Sample summary statistics

Countries		ROA	*S*	Δ*S*	LEV	COMP	TANG	ΔGDP	MCR
All	Mean	4.400	188449.200	12.364	0.689	0.625	57.413	4.493	76.964
	Median	3.529	11763.300	5.926	0.385	0.715	53.180	4.094	65.369
	St.Dev	6.058	682971.900	26.208	0.895	0.293	34.988	4.161	46.276
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−5.417	15.248
	Max	25.709	5300000.000	160.228	4.931	0.975	160.038	14.231	303.569
	Skewness	0.330	5.934	3.098	2.387	−0.975	0.608	0.077	2.544
	Kurtosis	6.066	40.802	15.733	9.798	2.816	2.939	2.373	11.410
China	Mean	5.674	8447.900	23.727	0.532	0.744	44.845	9.297	54.583
	Median	4.605	1786.980	13.138	0.304	0.824	40.367	9.400	45.059
	St.Dev	6.314	56124.260	35.968	0.704	0.232	28.104	2.087	24.498
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	6.689	17.579
	Max	25.709	2400000.000	160.228	4.931	0.975	160.038	14.231	126.088
	Skewness	0.457	24.744	2.211	2.764	−1.702	0.784	0.765	1.338
	Kurtosis	5.464	812.179	8.229	13.688	5.533	3.447	2.930	5.234
Hong-Kong	Mean	5.866	53036.130	9.684	0.348	0.188	47.810	3.522	298.857
	Median	5.017	4069.445	6.470	0.182	0.000	41.804	2.762	303.569
	St.Dev	5.972	293823.300	20.791	0.453	0.243	33.691	3.244	18.150
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−5.417	203.431
	Max	25.709	5300000.000	160.228	3.852	0.753	160.038	8.700	303.569
	Skewness	0.017	15.099	3.090	2.576	0.749	0.896	−0.464	−4.662
	Kurtosis	5.390	262.989	19.844	13.386	1.963	3.764	3.251	24.293

(*continued*)

Countries		ROA	*S*	Δ*S*	LEV	COMP	TANG	ΔGDP	MCR
Indonesia	Mean	4.733	1168089.000	17.285	0.989	0.200	62.493	4.775	26.896
	Median	3.874	447455.500	9.724	0.597	0.000	59.647	5.031	26.753
	St.Dev	8.389	1541105.000	30.966	1.150	0.263	31.963	2.551	9.731
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−5.417	15.248
	Max	25.709	5300000.000	160.228	4.931	0.790	160.038	8.220	47.728
	Skewness	0.163	1.705	2.303	1.783	0.807	0.512	−2.566	0.400
	Kurtosis	4.005	4.740	9.877	5.982	2.014	2.941	11.082	2.070
India	Mean	6.882	30073.400	20.652	0.913	0.660	56.553	7.759	78.179
	Median	5.613	3394.700	13.604	0.632	0.743	54.598	7.923	69.206
	St.Dev	6.184	170546.600	29.270	0.994	0.286	30.942	1.743	26.770
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	3.891	46.547
	Max	25.709	5300000.000	160.228	4.931	0.964	160.038	10.260	151.451
	Skewness	0.763	15.189	2.385	1.766	−1.046	0.442	−0.566	1.473
	Kurtosis	4.643	314.973	10.523	6.514	3.081	2.907	2.691	4.798
Israel	Mean	6.748	2671.782	11.765	1.056	0.176	45.579	3.649	75.675
	Median	5.488	370.765	5.847	0.618	0.000	36.489	4.094	67.818
	St.Dev	6.478	11588.960	26.883	1.286	0.247	36.700	1.498	21.155
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	0.025	32.531
	Max	25.709	131442.000	160.228	4.931	0.748	160.038	8.169	131.532
	Skewness	0.529	8.843	3.280	1.716	0.958	1.126	−0.248	0.754
	Kurtosis	5.491	87.857	17.045	5.257	2.337	3.844	3.152	3.590

(*continued*)

Table 3.

Table 3.

Countries		ROA	S	ΔS	LEV	COMP	TANG	ΔGDP	MCR
Japan	Mean	2.634	217380.700	4.030	0.690	0.686	65.106	0.556	66.078
	Median	2.357	42030.500	2.307	0.362	0.753	61.242	0.118	61.847
	St.Dev	4.019	640473.000	13.637	0.927	0.228	38.823	1.909	16.592
	Min	−16.854	384.000	−25.714	0.000	0.000	2.331	−5.417	47.237
	Max	25.709	5300000.000	160.228	4.931	0.951	160.038	4.192	101.847
	Skewness	−0.282	5.812	4.212	2.417	−1.378	0.412	−0.964	1.135
	Kurtosis	9.151	41.049	38.856	9.687	4.468	2.454	5.576	2.861
South Korea	Mean	1.826	814102.900	9.676	0.877	0.557	54.962	3.710	79.339
	Median	2.294	218709.500	5.634	0.563	0.628	53.983	2.933	88.896
	St.Dev	6.932	1408667.000	23.690	1.011	0.294	29.534	2.207	21.419
	Min	−16.854	6014.480	−25.714	0.000	0.000	2.331	−5.417	15.248
	Max	25.709	5300000.000	160.228	4.931	0.971	160.038	11.309	99.994
	Skewness	−0.607	2.374	2.877	2.062	−0.644	0.493	0.202	−1.346
	Kurtosis	4.644	7.424	16.473	7.670	2.270	3.365	7.662	3.585
Malaysia	Mean	5.809	1526.552	10.876	0.446	0.415	56.135	5.112	141.960
	Median	5.340	284.903	6.330	0.225	0.477	54.313	5.473	142.996
	St.Dev	6.610	5128.967	22.892	0.643	0.289	31.216	3.202	35.143
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−5.417	81.988
	Max	25.709	92545.800	160.228	4.931	0.885	160.038	10.003	303.569
	Skewness	0.084	7.773	3.537	3.272	−0.264	0.466	−1.525	2.407
	Kurtosis	5.305	82.036	21.304	18.288	1.637	2.997	5.804	12.498

(*continued*)

Table 3.

Countries		ROA	S	ΔS	LEV	COMP	TANG	ΔGDP	MCR
Pakistan	Mean	9.015	13,244.080	16.200	0.856	0.477	68.480	3.538	20.986
	Median	7.586	2940.710	11.602	0.514	0.491	67.787	2.748	15.248
	St.Dev	6.921	39362.430	23.353	1.015	0.354	31.297	1.713	10.170
	Min	−14.733	54.886	−25.714	0.000	0.000	2.331	1.014	15.248
	Max	25.709	589566.000	160.228	4.931	0.936	160.038	7.667	46.537
	Skewness	0.656	7.562	2.287	1.872	−0.167	0.233	1.085	1.687
	Kurtosis	2.970	77.757	12.282	6.811	1.529	2.961	3.354	4.235
Philippines	Mean	5.971	50940.540	12.030	0.592	0.173	66.860	5.109	58.520
	Median	5.333	8082.405	6.825	0.375	0.000	62.509	5.243	55.520
	St.Dev	6.870	142214.500	24.921	0.742	0.239	37.510	1.848	23.381
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−0.577	22.748
	Max	25.709	1300000.000	160.228	4.931	0.747	160.038	7.632	97.345
	Skewness	0.003	5.518	2.965	2.439	0.940	0.555	−1.100	0.040
	Kurtosis	5.014	39.779	16.430	11.541	2.238	2.756	4.138	1.518
Singapore	Mean	5.922	15,217.490	11.981	0.486	0.302	48.856	5.322	213.032
	Median	5.296	176.643	6.168	0.282	0.298	43.218	5.001	217.081
	St.Dev	6.779	258631.300	25.706	0.652	0.290	33.857	3.940	53.885
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−2.225	104.267
	Max	25.709	5300000.000	160.228	4.931	0.873	160.038	14.231	299.574
	Skewness	−0.138	20.045	2.503	3.189	0.274	0.773	0.302	−0.500
	Kurtosis	4.973	408.325	12.536	17.815	1.559	3.232	2.777	2.233
Thailand	Mean	7.456	19135.290	12.170	0.673	0.253	74.276	3.604	70.503
	Median	6.737	2373.460	6.163	0.386	0.148	72.929	3.444	72.404
	St.Dev	7.121	100721.400	25.823	0.863	0.269	40.986	2.699	26.759
	Min	−16.854	48.608	−25.714	0.000	0.000	2.331	−5.417	15.248
	Max	25.709	2200000.000	160.228	4.931	0.782	160.038	8.120	106.371
	Skewness	0.134	14.123	2.840	2.298	0.448	0.232	−0.724	−0.434
	Kurtosis	4.248	242.517	14.047	9.624	1.616	2.217	3.963	2.162

Note(s): 1. ROA, S, ΔS, TANG, ΔGDP, MCR are given in percentages whereas LEV and COMP are given in ratios
Source(s): Authors' calculations based on COMPUSTAT Global Database and World Bank Database

profit rates which ranged between 9.02% (Pakistan) and 1.83% (South Korea). For economies such as China (5.67%), Hong Kong (5.87%), India (6.88%), Israel (6.75%) Malaysia (5.81%), Philippines (5.97%), Singapore (5.92%) and Thailand (7.46%) the mean profit rates were recorded above the mean profit rate of the aggregate sample reflecting greater buoyancy for these economies. However, for countries such as Indonesia (4.73%), Japan (2.63%) and South Korea (1.83%) the mean profit rates were recorded below the mean profit rate of the aggregate sample. Firm size, as measured by total assets, varied widely across the selected economies (Table 3). On average, the sample firms have about $188449.200 million [$11763.300 million median] in assets (S). The annual average growth of assets (ΔS) is about 12.36% (5.93% Median), ranging from 23.73% (China) to 4.03% (Japan). Indonesia (17.29%), India (20.65%) and Pakistan (16.20%) have experienced growth rates above the sample average.

The mean leverage ratio (LEV) for the sample is about 68.9%. The economies which have leverage ratio above the mean leverage ratio of full sample are Indonesia (98.9%), India (91.3%), Israel (105.6%), Japan (69.0%), South Korea (87.7%) and Pakistan (85.6%). As noted before, market competitiveness is normally considered to be an outcome of market concentration. The mean HHI ratio is about 62.5% for the full sample. The concentration ratio (COMP) of industries in China (74.4%), India (66.0%) and Japan (68.6%) is higher than the mean concentration ratio of full sample. The industries in Israel (17.6%) and Philippines (17.3%) are least concentrated. For the full sample the mean of tangibility of assets (TANG) is about 57.41%, ranging from 74.28% (Thailand) to 44.85% (China). The mean market capitalization ratio (MCR) is nearly 76.96% for the aggregate sample, ranging from 298.86 (Hong Kong) to 20.99% (Pakistan). The annual mean growth of GDP (ΔGDP) is nearly 4.49% for the selected economies, ranging from 0.56% (Japan) to 9.30 (China).

The pairwise correlation among the selected variables is displayed in Table 4. It is observed that coefficient of correlation between the size (S) variable and profitability (ROA) variable is negative and significant positing a negative relationship between the profitability and firm size for the selected Asia–Pacific economies. However, the coefficient of correlation between the firm growth (ΔS) variable and profitability is observed to be negative and significant positing a positive relationship between the two. The other chosen firm specific variables such as leverage (LEV), tangibility (TANG) and competition (COMP) is observed to be negatively and significantly correlated with the firm's profitability. The annual growth of GDP (ΔGDP) and MCR is observed to be positively correlated with the profitability of selected firms during the study period.

4.2 Graphical analysis

Before estimating the econometric models, the visual fundamental relationship between profit rates, firm size and growth is examined graphically using the non-parametric scatter

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ROA	1							
(2) S	−0.257*	1						
(3) ΔS	0.269*	−0.153*	1					
(4) LEV	−0.313*	0.188*	0.014*	1				
(5) COMP	−0.034*	0.050*	0.027*	−0.016*	1			
(6) TANG	−0.135*	0.168*	−0.211*	0.153*	0.002	1		
(7) ΔGDP	0.225*	−0.474*	0.299*	−0.002	0.037*	−0.157*	1	
(8) MCR	0.073*	−0.234*	0.010*	−0.066*	−0.245*	−0.052*	0.057*	1
VIF	1.42	1.39	1.14	1.13	1.10	1.07	1.07	1.19

Note(s): 1. *shows significance at the 0.05 level
Source(s): Authors' calculations based on COMPUSTAT Global Database and World Bank Database

Table 4.
Pairwise correlation among the selected variables

plots presented in Figures 1–4. The scatter plots for profitability (*Y*-axis) and firm size (*X*-axis) for aggregate sample as well as for respective economies though initially have a cloud shape and are a bit scattered horizontally (suggesting no relationship) but are eventually observed to decline overtime as the size of the firm increases depicting a negative relationship between profitability and firm size (Figures 1 and 2). However, the scatter plots for profitability (*Y*-axis) and firm growth (*X*-axis) for aggregate sample as well as for respective economies also though initially have a cloud shape and are bit scattered horizontally but are eventually observed to increase as the growth of the firm increases depicting a positive correlation between profitability and firm growth (Figures 3 and 4).

4.3 Econometric analysis

For the full sample and country-wise, panel data FE regression estimates with unobserved firm-specific or individual effects estimated using Eqn (1) is reported in Table 5. It is important to observe that the FE estimates given by Eqn (1) assume that the slope coefficients of the regressors do not vary across individuals or over time although the intercept may differ across firms but each firm's intercept does not vary over time, that is, it is time-invariant. However, the estimates for the firm-specific intercepts are not reported to save space. In addition to the lagged dependent variable (ROA_{it-1}), Eqn (1) includes 07 [firm-specific firm size (*S*); firm growth (ΔS); leverage (LEV); competition (COMP) and tangibility (TANG) and macroeconomic-GDP growth (ΔGDP); and market capitalization ratio (MCR)] independent determinants of profitability discussed in Section 3.

The coefficient of lagged profit rate (ROA_{it-1}) in Table 5 is found to be positive and statistically significant for the full sample as well as across the individual economies during the estimation period. The estimate of lagged coefficient for the full sample is around 0.278 suggesting that if the past profit rate goes up by one percentage point, holding other explanatory variables constant, the current ROA will increase by 0.278% points reflecting a modest level of "persistence of profits" over time. The dynamics of firm's profitability is being specified as a first order autoregressive process after the seminal contribution of Mueller (1986) where Geroski (1990) provided a theoretical explanation for such an empirical

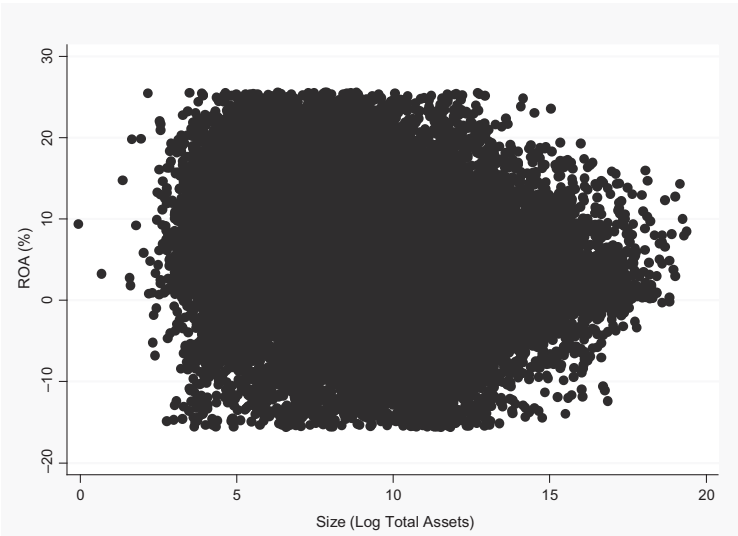

Figure 1.
Firm size and profitablility. Aggregate sample

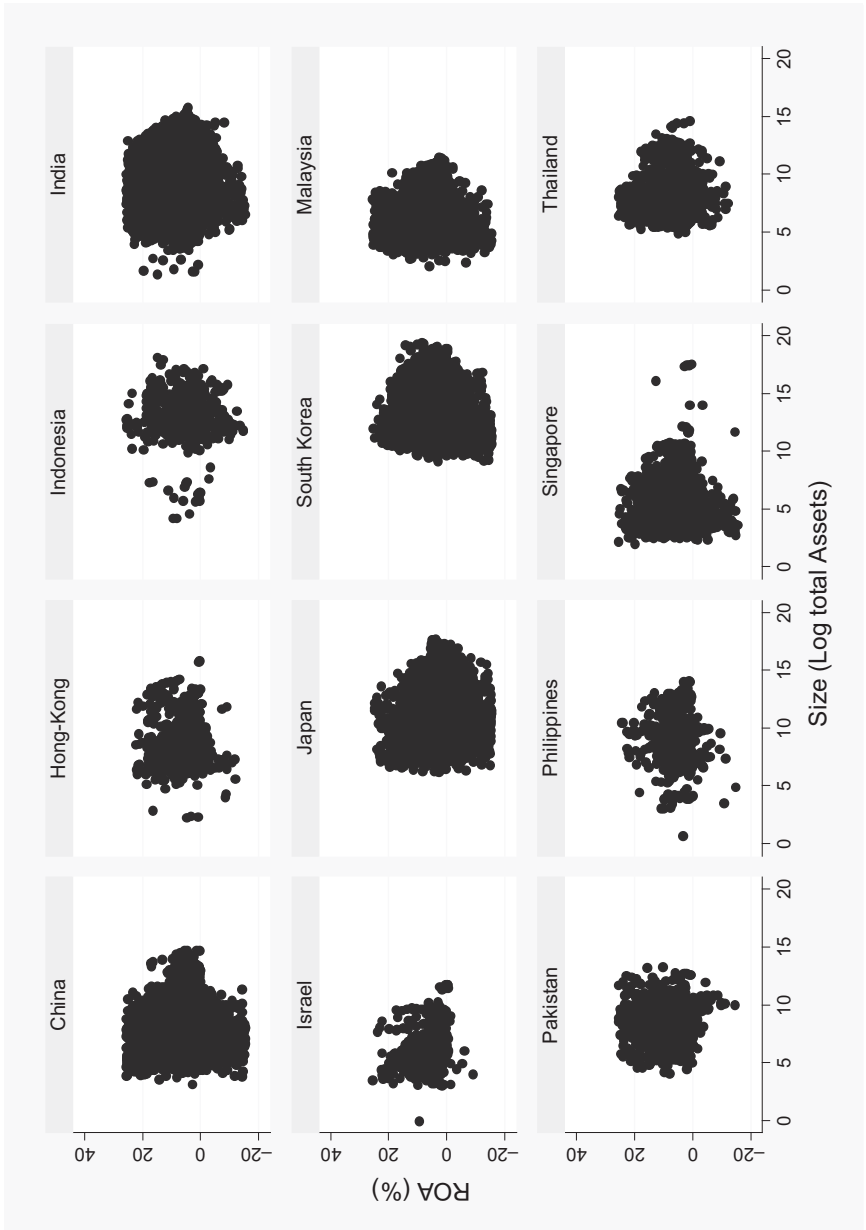

Figure 2.
Firm size and profitablility. Country-Wise

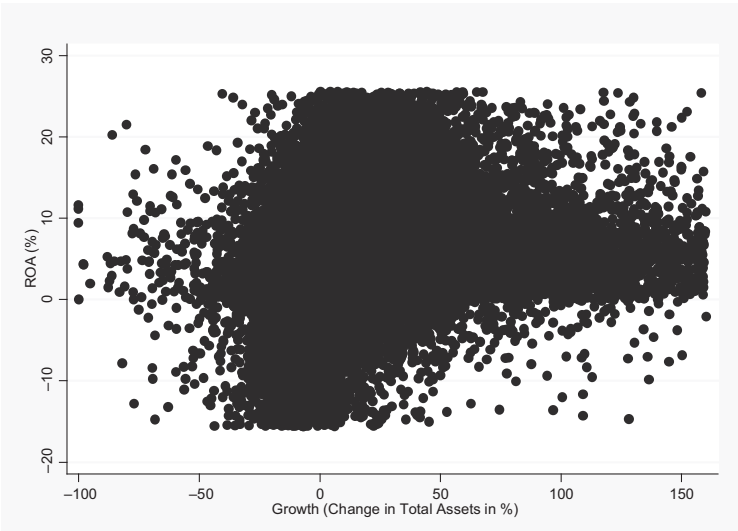

Figure 3.
Firm growth and profitablility. Aggregate sample

measurement, based on the assumption that profits depend on the threat of entry in the market, which in turn depends on past profits (Gschwandtner and Cuaresma, 2013). The contention behind "persistence of profits" is that for reasons like entry and exit barriers, first mover advantages or external shocks, firms might earn profits that are substantially above or below the norm over longer time periods (Gschwandtner and Cuaresma, 2013). The estimates of profitability persistence for full sample and across individual economies in present work is higher than the estimates of Mueller's (1990) and Lee (2009) but lower than Gschwandtner and Cuaresma's (2013) finding for profit data for US firms, spanning data for more than 150 firms over a period of 50 years. However, persistence of profits for economies such as Indonesia (0.108) and South Korea (0.142) is very negligible compared to other selected economies (Table 5).

The first main firm specific absolute firm size variable is estimated to be negative for full sample as well as across all the individual cross-sections indicating that firm size and profitability are negatively correlated during the sample period. However, the estimated size coefficient is significant for cross-sections such as China, India, Israel and Thailand whereas for rest of the selected cross-sections, the size variable is found to be irrelevant. This evidence does not lend support to conventional wisdom of positive firm size-profit relationship as postulated by Baumol (1959). The second important firm specific firm growth variable is estimated to be positive for full sample as well as across all the individual cross-sections indicating that firm growth and profitability are positively related during the sample period (Table 5). However, the estimated growth coefficient is insignificant for economic units such as China, Israel, Pakistan and Thailand whereas for rest of the selected economic units the growth coefficient is found to be relevant (Table 5). The estimates for the firm size and growth variables together suggest that initially profitability increases with the growth of the firm. But eventually, overtime, gains in profitability reduces for larger firms (larger size firms tend to experience lower profitability) apparently lending support to the arguments of Robinson (1934), Coase (1937), Penrose (1955) and Williamson (1975) that large size breeds inefficiency. This unique results corroborates the results obtained from the earlier graphical analysis.

Gale (1972) used leverage to measure risk. *A priori*, the relationship between leverage and rate of return may not be determinate [6] (Hurdle, 1974). Works of Stigler (1963), Scherer

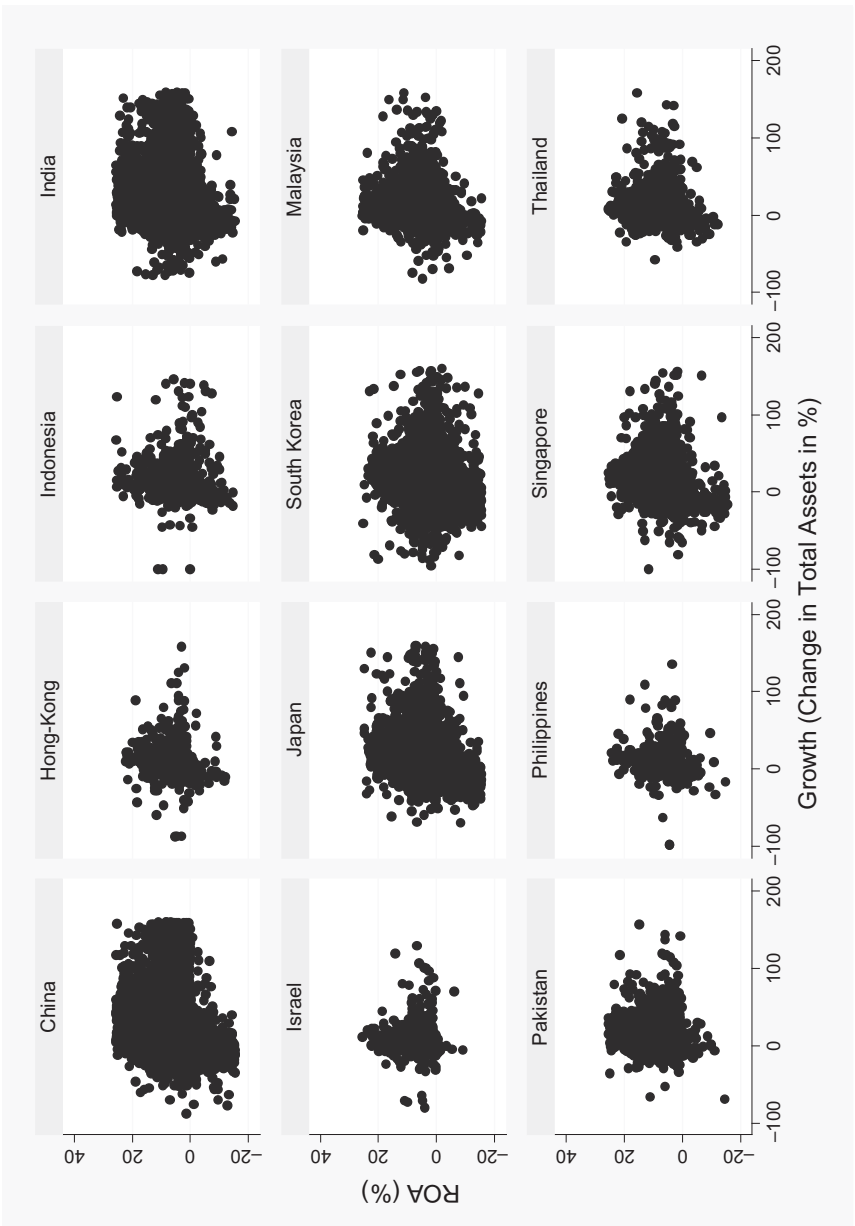

Figure 4.
Firm growth and profitablility. Country-Wise

Table 5.
Panel FE Estimates: Firm size, growth and profitability (All and Country-wise)

	All	China	Hong-Kong	Indonesia	India	Israel	Japan	South-Korea	Malaysia	Pakistan	Philippines	Singapore	Thailand
ROA_{it-1}	0.278***	0.283***	0.337***	0.108*	0.337***	0.362***	0.272***	0.142***	0.325***	0.469***	0.384***	0.238***	0.294***
	(0.007)	(0.014)	(0.047)	(0.043)	(0.016)	(0.061)	(0.012)	(0.017)	(0.028)	(0.039)	(0.088)	(0.034)	(0.058)
S_{it}	−0.730***	−1.163***	−0.441	−0.018	−1.240***	−3.123***	−0.128	−0.332	−0.497	−0.461	−0.315	−0.243	−1.990**
	(0.062)	(0.124)	(0.389)	(0.208)	(0.194)	(0.788)	(0.113)	(0.237)	(0.269)	(0.611)	(0.558)	(0.342)	(0.635)
ΔS_{it}	0.019***	0.002	0.023*	0.032*	0.014***	0.016	0.054***	0.040***	0.033***	0.001	0.045*	0.031***	0.009
	(0.001)	(0.001)	(0.012)	(0.014)	(0.002)	(0.009)	(0.003)	(0.003)	(0.005)	(0.007)	(0.022)	(0.006)	(0.009)
LEV_{it}	−1.724***	−1.645***	−3.286***	−3.386***	−1.641***	−0.921**	−1.419***	−2.327***	−2.179***	−2.228***	−2.653***	−2.870***	−2.282***
	(0.046)	(0.109)	(0.676)	(0.526)	(0.098)	(0.291)	(0.069)	(0.125)	(0.306)	(0.311)	(0.689)	(0.425)	(0.465)
$COMP_{it}$	0.703***	0.044	2.424*	2.514	0.287	0.339	0.553	0.802	1.186*	1.252***	0.634	1.600	0.738
	(0.186)	(0.377)	(1.142)	(2.161)	(0.502)	(1.038)	(0.302)	(0.543)	(0.566)	(1.085)	(1.487)	(0.877)	(1.137)
$TANG_{it}$	−0.030***	−0.031***	−0.006	−0.120***	−0.023***	−0.007	−0.029***	−0.027***	−0.027***	−0.032*	−0.046	−0.027*	−0.005
	(0.002)	(0.004)	(0.017)	(0.023)	(0.005)	(0.023)	(0.003)	(0.006)	(0.006)	(0.016)	(0.025)	(0.011)	(0.013)
ΔGDP_{it}	0.114***	0.122**	0.125	0.129	0.179**	0.176*	0.048***	0.065	0.034	0.009	0.439	0.051	0.035
	(0.010)	(0.044)	(0.088)	(0.178)	(0.064)	(0.078)	(0.012)	(0.034)	(0.041)	(0.191)	(0.297)	(0.033)	(0.118)
MCR_{it}	0.003**	0.022***	0.056*	0.138	0.011	0.060*	0.008***	0.014**	0.008**	0.085	0.039	0.015**	0.025
	(0.001)	(0.003)	(0.026)	(0.103)	(0.004)	(0.025)	(0.002)	(0.005)	(0.003)	(0.064)	(0.042)	(0.005)	(0.024)
CONS	10.943***	14.045***	−15.463	17.086***	15.611***	16.752***	4.784***	1.523	6.644***	7.410	10.051*	1.916	19.919***
	(0.618)	(1.298)	(8.240)	(4.573)	(1.666)	(4.655)	(1.255)	(2.779)	(1.623)	(3.849)	(5.013)	(1.954)	(5.005)
Obs.	97966	20850	966	690	13162	626	39925	10258	5329	1378	498	2963	1321
Adj.R^2	0.218	0.233	0.268	0.322	0.271	0.261	0.265	0.200	0.248	0.372	0.367	0.245	0.256
F	336.641	155.171	11.646	56.025	114.080	28.069	166.011	37.311	29.190	30.994	17.603	25.671	10.946
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
rho	0.569	0.440	0.660	0.623	0.511	0.777	0.482	0.535	0.493	0.419	0.584	0.512	0.596
df_m	27	17	22	24	17	22	25	25	25	24	24	25	25

Note(s): 1. The dependent variable is return on assets (ROA_{it}). ROE was also used as dependent variable. Largely, the regression estimates of ROE were found to be consistent with the results of ROA. Therefore, to conserve space the results are not reported. 2. Total assets are used as size measure (S_{it}). 3. The panel firm size, growth and profitability regression model was also estimated using net sales as alternate size variable. The regression estimates were found to be consistent with the results of total assets. Therefore, to conserve space the results are not reported. 4. Heteroscedasticity-consistent robust standard errors are reported in parentheses. 5. Hausman specification test was conducted for appropriate model selection. For all the cases, the Hausman test p-values were small enough to point to a fixed effects model. 6. Year dummies are included in all the regression models. 7. ***, ** and * denotes significance at 0.001, 0.01 and 0.05 percentage respectively

Source(s): Authors' estimations based on COMPUSTAT Global Database and World Bank Database

(1970) and Jean (1970) have suggested that leverage may have an independent influence on profit rates of firms. According to Fazzari *et al.* (1988) and Stulz (1990) highly levered firms tend to be at greater risk of being unable to meet interest and debt repayment commitments. Since large amounts of leverage imply high risks, one would expect a negative relationship between profitability and leverage of firms (Hall and Weiss, 1967). Unanimously, the estimated FE coefficient of leverage (LEV) is found to be negative and statistically significant for the full sample as well as across all the selected economies suggesting that leverage is negatively related with profitability of selected firms (Table 5) supporting the arguments of Hall and Weiss (1967), Fazzari *et al.* (1988) and Stulz (1990). This evidence is consistent with a recent study of Goddard *et al.* (2005) for manufacturing and service sector firms in Belgium, France, Italy and the UK, during 1993–2001.

The estimated coefficient of competition (COMP) is found to be positive for the full sample as well as across the economic units. The positive correlation between profitability and industry concentration (HHI) suggests that as industry concentration (competition) increases (decreases), the firm's profitability increases as higher HHI implies high industry concentration and low competition, whereas lower HHI implies less industry concentration and more competition. Firms in the highest HHI industries are non-competitive firms, and firms in the lowest HHI industries are competitive firms. This finding is consistent with Bain's (1951) and numerous other works. However, the estimated coefficient of COMP is found to be significant for full sample and only for economies such as Hong-Kong, Malaysia and Pakistan.

One of the resource-based view is that management practices and organizational structures represent the main source of differences in performances between companies (Goddard *et al.*, 2005; Gschwandtner and Cuaresma, 2013). Tangible internal resources like financial and physical factors of production, as well as, intangible internal resources as technology, management skills, quality reputation, and customer loyalty, reflect the main abilities of the firm that can lead to sustained profitability (Lippman and Rumelt, 1982; Werenfelt, 1984; Prahalad and Hamel, 1990; Mahoney and Pandian, 1992; Brush *et al.*, 1999 Barney, 2001; Bowman and Helfat, 2001; Winter, 2003; Goddard *et al.*, 2005; Gschwandtner and Cuaresma, 2013). Some of the existing studies such as Griliches and Lichtenberg (1984) for USA; Pusher (1995) for Japan; Deloof (2003) for Belgium; Smith *et al.* (2004) for Denmark; Nucci *et al.* (2005) for Italy and Serrasqueiro and Nunes (2008) for Portuguese have observed a negative relationship between the level of tangible assets and firm's performance. In a recent study, Kamasak (2017) reported that intangible resources contributed more greatly to Turkish firm performance compared to tangible resources. Accordingly, majority of these studies have reported a positive relationship between the level of intangible assets and company's performance. This finding suggests that firms with lower levels of tangible assets (or greater percentage of intangible assets in total assets) are more likely to innovate, which in turn contributes to higher levels of performance (Serrasqueiro and Nunes, 2008).

The FE estimates of asset tangibility (TANG) in the present analysis, is consistently significant and negative across all the economies as well as for the full sample. This finding indicate that that a lower level of tangible assets and greater tendency to innovate may contribute to increased levels of profitability for Asia–Pacific firms.

The estimated coefficient of regressor GDP growth (ΔGDP) reflecting the general macroeconomic condition is found to be positive and significant for full sample suggesting that profit rates are associated with the business cycle. The same is true for economies such as China, India, Israel and Japan. This finding is consistent with the findings of Domowitz *et al.* (1986) and inconsistent with findings of Lee (2009) for over 7,000 US publicly-held firms during the period 1987–2006 estimated using dynamic panel data model. However, the estimated coefficient of ΔGDP reported in Table 5 though found to be positive across all the individual economics is observed to insignificant for majority of the sample countries such as

Hong-Kong, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Singapore and Thailand consistent with findings of Lee (2009) and inconsistent with findings of Domowitz *et al.* (1986). For these sample economies, it seems that profit rates are not associated with the business cycle.

Stock market development plays an important role in mitigating the agency problem that may arise between various stakeholders of a corporate firm (Yadav *et al.*, 2019). Stock markets not only provide entrepreneurs with liquidity but also provide with opportunities to diversify their portfolios (Demirguc-Kunt and Maksimovic, 1996). Based on literature, market capitalization ratio (MCR) is employed to measure the extent of development of stock market. The assertion behind this measure is that overall market size is positively correlated with the ability to mobilize capital and diversify risk on an economy wide basis (Agarwal and Mohtadi, 2004). Therefore, the performance of listed firms is expected to improve. The FE estimates of MCR in Table 5 is found to be having expected positive sign for the full sample as well as across individual economies. For the full sample the estimated MCR coefficient is meaningful whereas for economies such as Indonesia, India, Pakistan, Philippines and Thailand it is not meaningful. The adjusted R^2 from Table 5 indicates that the selected firm-specific and macroeconomic variables explain on average about 28% of profitability variations requiring much to be done in order to better understand the determining factors behind profitability of firms.

4.4 Small, medium and large company analysis

The panel FE estimates of firm size, growth and profitability across small, medium and large size companies is reported in Table 6. The sub sample analysis of firm size, growth and profitability across small, medium and large sized firms also consistently (classified based on total assets, net sales and MCR of firms) indicate that profitability decreases with increase in firm size whereas profit rate increases with growth of the firm. Other selected firm-specific and macroeconomic variables employed in the econometric analysis reveal similar results of full sample across small, medium and large size firms.

5. Summary

This study examined the correlation between firm size, growth and profitability along with other firm-specific and macroeconomic determinants of profitability using panel dynamic fixed effects model for nearly 12,001 unique non-financial listed and active firms from 1995 to 2016 for 12 industrial and emerging Asia–Pacific economies. The dynamic specification also allows to investigate the persistence of profits of firms. This interrelationship was also examined for small, medium and large size companies classified based on three alternate measures such as total assets, net sales and MCR of firms. The firm specific variables included along with firm size and growth variables are leverage, competition and tangibility whereas the macroeconomic determinants of profitability variables were GDP growth and MCR representing the stock market development.

The "persistence of profits" coefficient was found to be positive and statistically significant for the full sample as well as across the individual economies. However, the size of coefficient reflected a modest level of "persistence of profits" over time. Particularly, for Indonesia and South Korea, persistence of profits was very negligible compared to other selected Asia–Pacific economies.

Rejecting the traditional convention of positive firm size-profit relationship, econometric evidence in the present work suggested that the firm size variable had a negative sign for full sample as well as across all the individual cross-sections. This evidence indicates that firm size and profitability are negatively correlated during the sample period. Particularly, the size

Table 6.
Panel FE Estimates: Firm size, growth and profitability (small, medium and large companies)

ROA_{it}		Panel A: Classified based on Total Assets			Panel B: Classified based on Net Sales			Panel C: Classified based on MCR		
	All	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
ROA_{it-1}	0.278***	0.246***	0.251***	0.231***	0.256***	0.234***	0.236***	0.226***	0.294***	0.188***
	(0.007)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.013)
S_{it}	−0.730***	−1.607***	−0.666***	−0.383**	−1.601***	−1.059***	−0.568***	−0.530***	−0.969***	−0.131
	(0.062)	(0.156)	(0.103)	(0.123)	(0.137)	(0.103)	(0.126)	(0.105)	(0.123)	(0.156)
ΔS_{it}	0.019***	0.009***	0.025***	0.035***	0.009***	0.029***	0.035***	0.024***	0.005**	0.031***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
LEV_{it}	−1.724***	−2.380***	−1.760***	−1.676***	−2.093***	−1.874***	−1.632***	−1.829***	−1.444***	−2.485***
	(0.046)	(0.122)	(0.078)	(0.070)	(0.115)	(0.083)	(0.069)	(0.073)	(0.067)	(0.112)
$COMP_{it}$	0.703***	0.799*	1.472***	0.375	0.881**	1.473***	0.033	0.834*	0.392	1.056**
	(0.186)	(0.331)	(0.345)	(0.319)	(0.317)	(0.336)	(0.308)	(0.349)	(0.280)	(0.357)
$TANG_{it}$	−0.030***	−0.036***	−0.034***	−0.030***	−0.031***	−0.038***	−0.031***	−0.040***	−0.026***	−0.030***
	(0.002)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
ΔGDP_{it}	0.114***	0.077***	0.167***	0.074***	0.064**	0.158***	0.070**	0.109**	0.080***	0.121***
	(0.010)	(0.020)	(0.018)	(0.022)	(0.020)	(0.018)	(0.022)	(0.039)	(0.021)	(0.020)
MCR_{it}	0.003**	0.004*	0.000	0.009***	0.005**	0.002	0.007**	0.024**	0.005	0.006**
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.008)	(0.006)	(0.002)
CONS	10.943***	15.085***	9.738***	9.771***	14.518***	13.925***	12.104***	8.593***	13.852***	5.327***
	(0.618)	(1.150)	(0.979)	(1.477)	(1.054)	(0.988)	(1.498)	(1.152)	(1.117)	(1.485)
Obs.	97966	28773	34423	34770	28973	34038	34955	33990	32412	31564
Adj.R^2	0.218	0.198	0.216	0.230	0.207	0.215	0.239	0.223	0.226	0.183
F	336.641	110.960	111.177	106.091	122.905	110.081	107.725	102.883	139.998	77.029
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
rho	0.569	0.566	0.618	0.610	0.536	0.639	0.598	0.622	0.592	0.583
df_m	27	27	27	27	27	27	27	27	24	27

Note(s): 1. The dependent variable is return on assets (ROA_{it}). ROE was also used as dependent variable. Largely, the regression estimates of ROE were found to be consistent with the results of ROA. Therefore, to conserve space the results are not reported. 2. Total assets are used as size measure (S_{it}). 3. The panel firm size, growth and profitability regression model was also estimated using net sales as alternate size variable. The regression estimates were found to be consistent with the results of total assets. Therefore, to conserve space the results are not reported. 4. Heteroscedasticity-consistent robust standard errors are reported in parentheses. 5. Hausman specification test was conducted for appropriate model selection. For all the cases, the Hausman test p-values were small enough to point to a fixed effects model. 6. Year dummies are included in all the regression models. 7. ***, ** and * denotes significance at 0.001, 0.01 and 0.05 percentage respectively

Source(s): Authors' estimations based on COMPUSTAT Global Database and World Bank Database

coefficient was significant for China, India, Israel and Thailand whereas for rest of the selected Asia–Pacific economies it was insignificant. The coefficient of firm growth was found to be positive for full sample as well as across all the individual cross-sections indicating that firm growth and profitability are positively related during the sample period. But the estimated growth coefficient was insignificant for China, Israel, Pakistan and Thailand. The negative size-profit and positive growth-profit relationship together suggest that initially profitability increases with the growth of the firm. But eventually, overtime, gains in profit rates reduces for larger firms (larger size firms tend to experience lower profitability) apparently indicting that large size breeds inefficiency.

Unanimously, the estimated FE coefficient of leverage was negative and statistically significant for the full sample as well as across all the selected economies suggesting that leverage is negatively related with profitability of selected firms. The estimated coefficient of competition was found to be positive for the full sample as well as across the selected Asia–Pacific economies suggesting that as industry concentration increases, the firm's profitability increases. This relationship was significant only for economies such as Hong-Kong, Malaysia and Pakistan. The coefficient of asset tangibility was consistently significant and negative across all the economies as well as for the full sample indicating that a lower level of tangible assets and greater tendency to innovate may contribute to increased levels of profitability for Asia–Pacific firms.

The business cycle variable, GDP growth was positive and significant for full sample and for economies such as China, India, Israel and Japan suggesting that profit rates are associated with the business cycle. The stock market development variable, MCR was positive for the full sample as well as across individual economies. For the full sample the estimated MCR coefficient was meaningful whereas for economies such as Indonesia, India, Pakistan, Philippines and Thailand it was not meaningful. The panel FE estimates of firm size, growth and profitability across small, medium and large size companies indicated that profitability decreases with increase in firm size whereas profit rate increases with growth of the firm. Other selected firm-specific and macroeconomic variables employed in the econometric analysis revealed similar results of full sample across small, medium and large size firms.

6. Policy implications

This paper has some important economic and managerial implications on issues such as correlation between size, growth and profitability, and risk of firms for Asia–Pacific emerging markets. The negative size-profit and positive growth-profit results together suggest that initially profits increase with the growth of the firm. However, overtime, gains in profit rates reduce for larger firms indicting that large size breeds inefficiency suggesting that limits to growth is a dominant characteristic of industrial dynamics and therefore, firms have optimum size. Since profitability is constrained by size, growing firms eventually might experience lower profits implying that if firms focus only on growth, their long-run profits could be endangered. Consequently, growth oriented strategies alone may not be appropriate and desirable for the firm's long-run profitability. Along with growth oriented strategies managers may also focus and understand what breeds inefficiency for a large growing firm on the lines suggested by Robinson (1934), Coase (1937), Penrose (1955) and Williamson (1975) to take the advantage of economies of scale and arrest the problem of diseconomies of scale. This will certainly help the managers to maintain an appropriate level of profit rates. Also, the evidence on leverage-profit relationship suggests that managers may need to maintain an optimum level of debt-equity ratio to maximize firm value and minimize the cost of capital. Firms with high leverage ratios are perceived to have higher business risk and if investors are risk averters would subsequently require a higher return (risk premium) for taking on more risk which will further add cost to the cost of capital.

Notes

1. The empirical studies related to firm size, growth and profits is vast and majority of them have also included concentration, competition barriers and other potential determinants of profitability. However, the same is not extensively reviewed as they fall beyond the scope of this work. The review in this section predominantly focuses on the important contributions that affect the empirical analysis of this study.
2. The Asia–Pacific economies are selected based on the availability of the data. For five Asian countries viz., China (2003–2016); Hong-Kong (1998–2016); India (2003–2016); Pakistan (1996–2016); Philippines (1996–2016)] the data on some of the firm specific variables is not available since 1995 whereas for rest of the seven economics viz., Indonesia (1995–2016); Israel (1995–2016); Japan (1995–2016); South Korea (1995–2016); Malaysia (1995–2016); Singapore (1995–2016) and Thailand (1995–2016)] complete data is available from 1995.
3. The measurement/definition of the selected variables is drawn from respective source of database.
4. Country-wise time series macroeconomic variable is culled from the World Development Indicators (WDI) of the World Bank.
5. Country-wise line plots of average ROA is given in Appendix.
6. High leverage benefits shareholders if profit exceeds borrowing costs (Goddard *et al.*, 2005).

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Corresponding author
Inder Sekhar Yadav can be contacted at: yadavis@hss.iitkgp.ac.in

Appendix

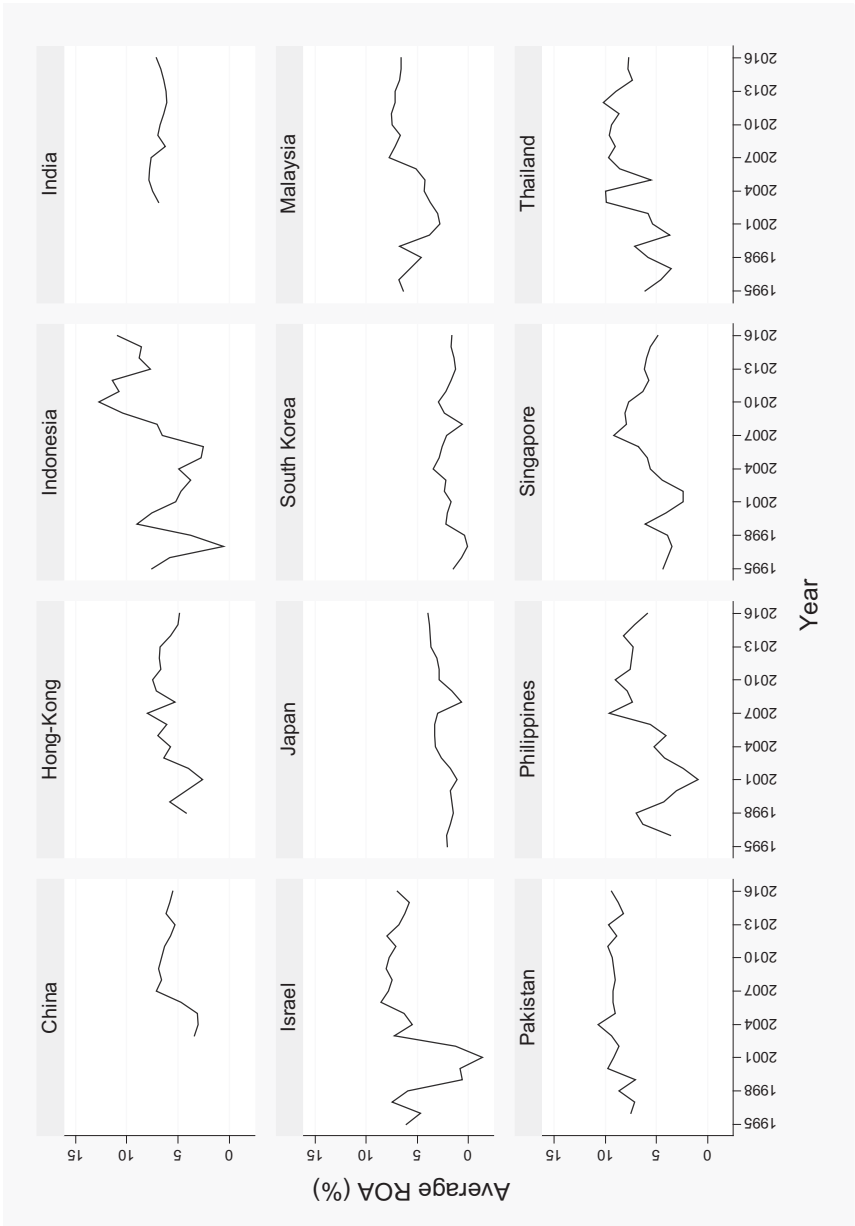

Figure A1.
Average return to assets. Country-Wise