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PORT AUTHORITIES' PERFORMANCE IN TIMES OF CRISIS

A cross-region analysis on factors that assisted port authorities to remain resilient to the financial crisis of 2008

Master thesis

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SUMMARY

This report provides a factual perspective on the immediate responses of port industry to the 2008's economic downturn. Specifically, it investigates the port authorities' performance located in four geographical areas – Europe, Canada, USA and Oceania – in reaction to the current economic crisis. First of all, it translates the general theories on organisations that better adapt to crisis conditions into the practical setting of port authorities. Further, based on comprehensive literature, it concludes that several factors positively associate with better response of organisations, in general, and port authorities, in particular, to difficult economic conditions. The review of the exiting literature allowed formulating the hypotheses basing the application of adaptability of businesses to external economic shocks theories to port authorities. The results after testing the hypotheses are as follows:

Hypothesis	**Result**
H1: The port authorities' response to the economic crisis varies with their geographical location.	Not rejected
H2: There is a strong association between ports' diversification level and their size: the bigger the port the higher the diversification level.	Not rejected
$H2_a$: There is a positive relationship between diversification level of ports and port authorities' financial performance.	Rejected
H3: There is a strong association between port authorities' ownership type and their decision-making autonomy.	Not rejected
$H3_a$:There is a positive relationship between decision-making autonomy of port authorities and their both operational and financial performance.	Rejected

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Irina Dobos

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CONTENTS

1. INTRODUCTION

1.1 Introduction

The "Great Recession" of 2008 "impacted unevenly on industries, regions, countries and firms" (Kitching *et al.*, 2009). In October 2008, the International Monetary Fund (IMF) announced the beginning of a global economy under stress. According to IMF's survey *World Economic Outlook (WEO)* published in October 2008, "the world economy is now entering a major downturn in the face of the most dangerous shock in mature financial markets since the 1930s." Later, in April 2009, the IMF would predict that the global activity would contract by 1.3 percent in 2009 with a recovery projected to re-emerge in 2010, however rather lethargic than past recoveries (WEO, April 2009). The Secretariat of United Nations published in 2010 that, in fact, the world gross domestic product contracted by 1.9 % in 2009 (UNCTAD, 2010).

There are lessons learned the hard way during economic disruptions. One of the most significant is that such economic crisis that emerges into a global crisis usually acts as defining moment that "marks the end of particular eras and any attempts to carrying on businesses as usual is nothing more than a wishful thinking" (Slack, 2010). Under such difficult economic conditions, businesses are required to learn the survival lessons and find their own path through breakdown. Some organisations may adopt a strategy of either cutting costs to conserve their resources or diversifying their business market to take advantage of their competitors' weaknesses. Nevertheless, businesses' performance is greatly unpredictable under economic crisis conditions and there is no either specific strategy that can assure endurance and success or the "best way" to adjust to recession conditions.

This report provides a factual perspective on the immediate responses of port industry to the 2008's economic downturn. Specifically, it investigates the port authorities' performance in four geographical areas – Europe, Canada, USA and Oceania – in response to the current economic crisis. Although the global economy learnt its downturn in the fall of 2008, its waves have been seriously felt during 2009. Consequently, the 2009 financial statements of port authorities showed declining figures in their total sales from port services and operations, comparing to 2008. Also,

it had been observed an immense fall in the total throughput handled at these ports between during the same time span.

Since this crisis strongly hit the international merchandise trade, it provoked the merchandise exports and imports to plunge by 13.7 % and 13.1 %, respectively, in 2009. Seaborne trade volumes were consequently affected sinking by 4.5% in the same period of time (UNCTAD, 2010). Continent wise, port authorities have been unevenly challenged to enable sustainable growth, implement their strategies, obtain their objectives and hit their targets in terms of both throughput and revenues. Therefore, it is motivating to analyse to what extent the port authorities' activity has been affected and whether there are specific factors that helped them manage their way through the economic crisis. In other words, this paper searches for variables that stimulated the variation in ports' performance since "not all ports have been hit equally hard" (Pallis & De Langen, 2010).

The international trade was one of the most affected sectors suffering severe contraction that consequently affected the maritime transport. The interconnectedness of port industry's activity across national borders due to the increasing globalization of economic activity rendered the crisis' impacts to be characterized by huge losses in both financial and non-financial port authorities' wealth. The phase of continued growth of demand prior crisis steered port authorities to heavily invest in equipments, supra- and infrastructures and expansion plans. In the aftermath of international financial crisis ports' activity was slowly translated into over-tonnage, suspended or delayed infrastructure projects, declining rates and increasing laid-up fleets. Therefore, port authorities were required to implement a broad range of measures according to their individual abilities and look for opportunities that would maintain their implication in meaningful ways with their regional and national economies.

In light of economic slowdown, the majority of port authorities were forced to re-evaluate their commitments. The decline in their revenues reduced their long term financial capacity and constrained them to take aggressive action to control operating expenses and prioritize capital spending. Nevertheless, there exist port authorities that managed to turn the crisis into an opportunity by exploiting their capabilities and resources that allowed them to generate economic value and competitive advantage.

Port authorities compete for key factors that are attributable to their success under economic crisis. Achieving strength and performance through diversity represents a well-liked 'excuse' for a number of port authorities that managed to deliver both great financial and operational results in 2009 despite the external challenges. Alongside business diversification, some port authorities 'blame' their positive performance on their geographical setting**.** Coastal ports, for example, that facilitate seaborne transfers, are privileged to act as transhipment hubs that represent a vast interest for major shipping lines (e.g. Port of Piraeus that serves the Black Sea countries, Ports of Cyprus and Valencia serve the Mediterranean countries, Port of Rotterdam that serves Europe).

With all of the above-mentioned, it may be anticipated that port authorities that are able to enhance the survival mode under difficult economic conditions depend on several factors that absorb the impacts of the external economic shocks. Yet, addressing the port performance' dependency on specific factors is questionable. Does the size matter for ports' performance facing tough times? Does the diversity limit the impacts of the economic crisis? Does the right to make independent decision assist port authorities to fare better? Or a combination of these and other factors help port authorities to find their way through crisis?

1.2 Challenged Port Authorities

This section briefly introduces the problem that will be addressed in details all the way through this report. It not only offers an initial overview about port authorities of major ports in four regions that are subject for this study but also on the variation in both their throughput and revenue in response to the turbulent economic climate.

Canada

The seventeen Port Authorities in Canada are autonomous federal agencies created under the terms and conditions of the *Canada Marine Act*. According to the Association of Canadian Port Authorities (ACPA), 90% of Canadian international trade is completed using maritime transportation. As 40% of Canadian GDP relies on trade, the Port Authorities are required to ensure that the necessary infrastructure is in place to facilitate the trade now and well into the future (ACPA, 2009).

The pain of the global recession reached Canada as well in 2008. As result, the cargo volumes handled at the ports collapsed after enjoying unprecedented growth since 2003. Figure 1.1 shows the growth rates in throughput and revenues of major Canadian Port Authorities between 2008 and 2009.

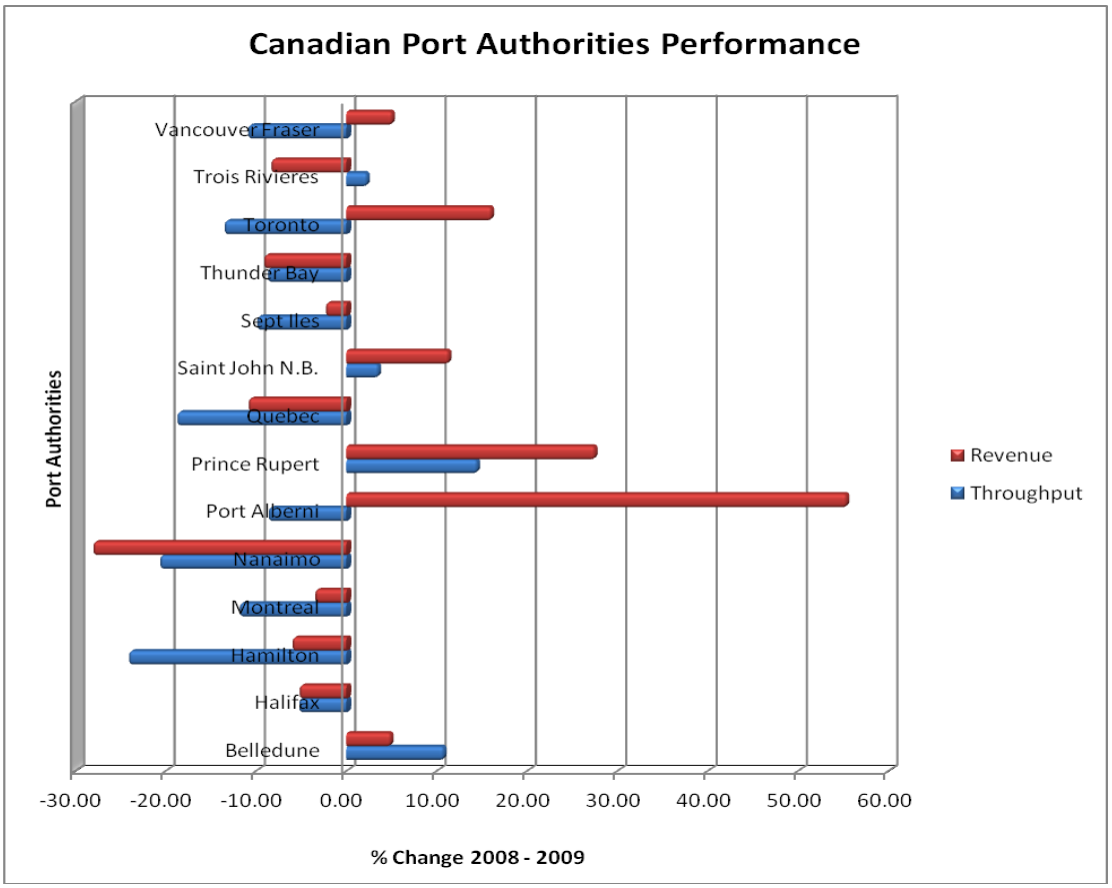

Figure 1.1 Throughput and revenue growth rates of major Port Authorities in Canada

Europe

In the *Fact Finding Report* (2010) publication of European Sea Port Organisation (ESPO), European ports are characterized to significantly vary between regions. Regions are delimited "based on the maritime coastline of the continent" (ESPO, 2010). Within regions they differ in size, objectives and mission, functions, ownerships and autonomy levels.

After a period of almost two decades of "double-digit increase in cargo volumes" (Pallis and De Langen, 2010), European ports' performance has been drastically affected by the crisis. According to ESPO, the European port cargo volumes declined

by 11.9 % in 2009 compared to 2008. Also, the aggregate cargo volumes between Europe and other regions have turned down as Table 1.1 describes.

Table 1.1 Estimated cargo flows on major East–West container trade routes, 2008–2009 *(millions of TEUs and annual percentage change)*

	Europe – Asia –Europe	Asia - Europe	Europe – Asia	USA - Europe - USA	USA - Europe	Europe - USA
2008	18.7	13.5	5.2	6.7	3.3	3.3
2009	17.0	11.5	5.5	5.3	2.5	2.8
Percentage change	- 9.5%	-14.8 %	4.3 %	- 20.1 %	- 25.1 %	- 15.1 %

Source: Secretariat of United Nation Conference on Trade and Development. *Review of Maritime Transport 2010*

According to Eurostat (2010), the first signs of slowdown in EU-27 ports activity was felt in third quarter of 2008 chased by a steep decline in the all following quarters. In the second quarter of 2009 ports activity substantially fell by 16%. The largest decrease between 2008 and 2009 in their handling goods was registered at ports in Romania (-28.5%), Slovenia (-19.3%) and Finland (-18.7%). Only two countries recorded positive results namely Estonia (6.4%) and Malta (0.1%). Although not immune to the international trade crisis, ports of Rotterdam (-8.1%), Antwerp (-17%) and Hamburg (-21.3%) maintained their ranking as top three largest European ports in terms of cargo movement. Figure 1.2 confirms the decline in port activity of major port authorities in Europe in terms of total throughput and revenue.

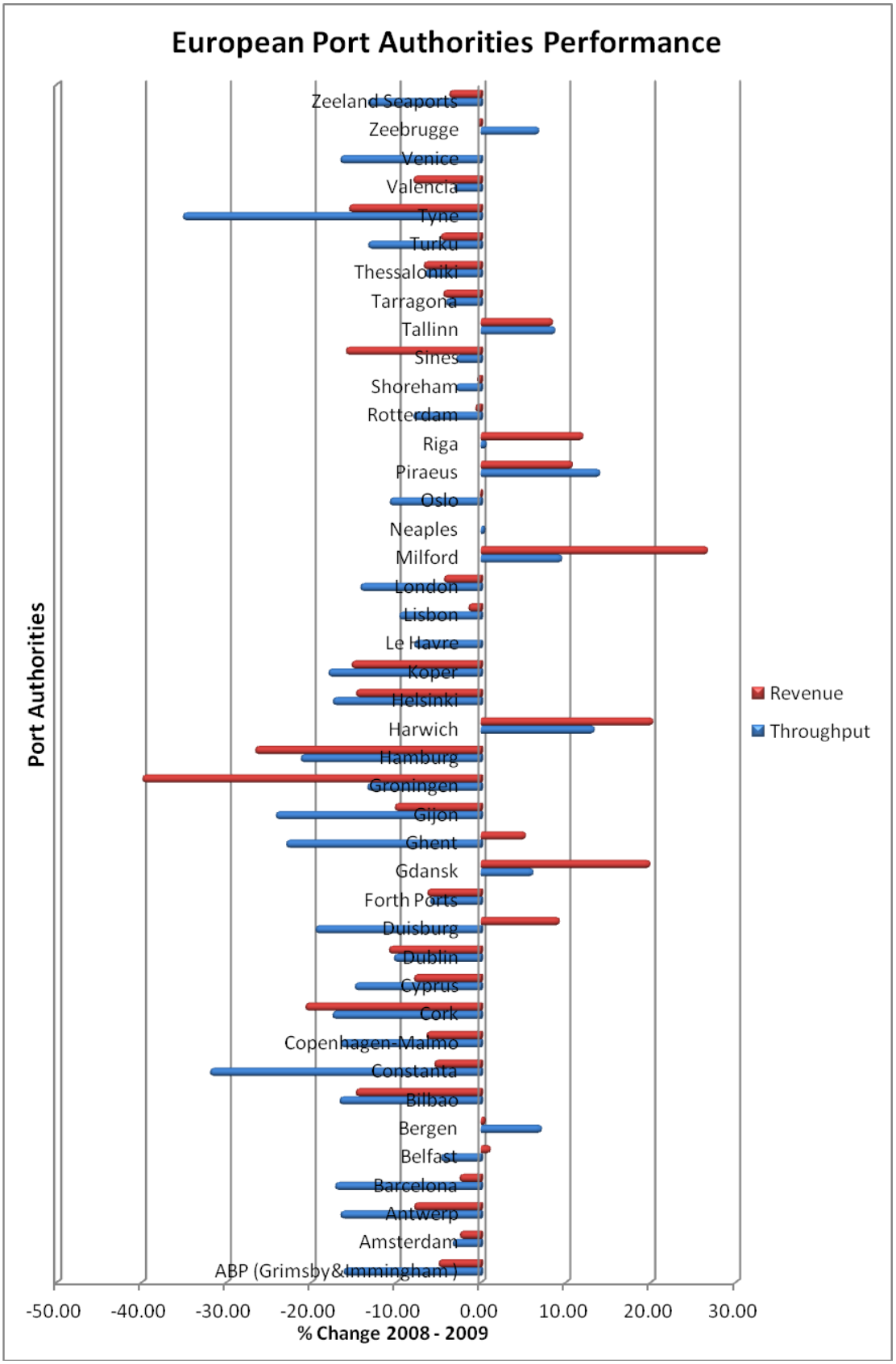

Figure 1.2. Throughput and revenue growth rates of major Port Authorities in Europe

United States of America

According to the American Association of Port Authorities (AAPA), "port authorities in the United States are instrumentalities of state or local government established by enactment or grants of authority by the state legislature" and there are 183 "deep-draft ports dispersed along the U.S. Atlantic, Gulf, Pacific and Great lakes coasts".

In USA, the shake in the national economy was initially felt in December 2007. In the fall of 2008, an old proverb saying that "the rest of the world sneezes when the US catches a cold" was deemed to be accurate as "important economies in the European Union and Japan went collectively into recession" (Verick & Islam, 2010).

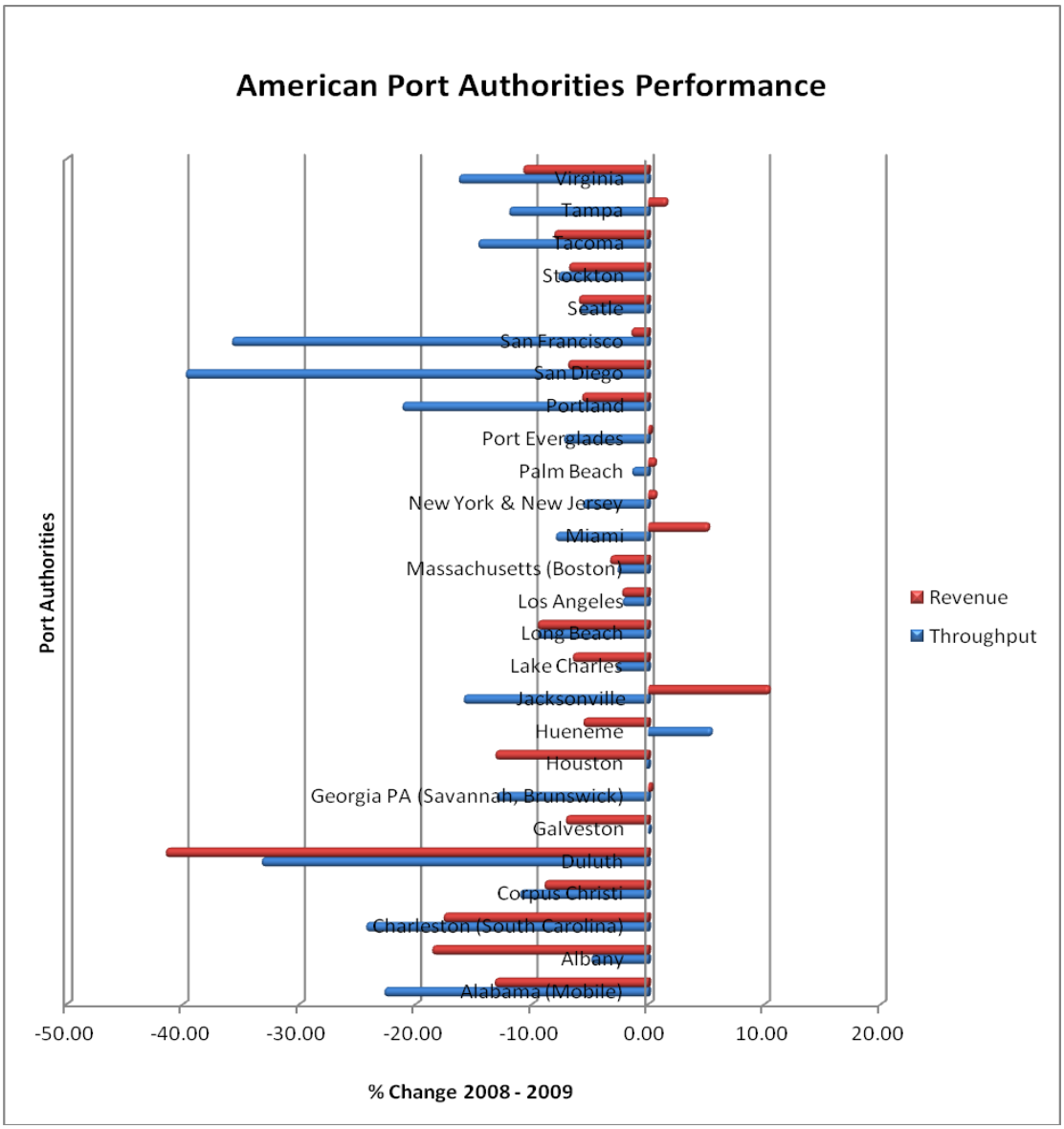

Figure 1.3. Throughput and revenue growth rates of major Port Authorities in USA

The USA's GDP had sharply decreased by 6 % at the end of 2008. Since the trends in seaborne cargo volumes are directly related to patterns in overall economic growth, the port authorities suffered severe declining growth rates as well. According to the U.S. Maritime Administration (MARAD), foreign waterborne trade harshly decreased by 13.7% from January to September in 2009 compared to 2008 (MARAD, 2009). The growth rates in terms of throughout and revenue of major ports in USA are presented in Figure 1.3.

Oceania

Many of Oceania's port authorities adopted the corporate status. They operate as "'for-profit' private business enterprise under the country's company laws, making full payment of taxes and other obligations required of private firms, although ownership may remain vested with the government" (Ircha, 2002). This approach is popular among port authorities in New Zealand, Tasmania and Queensland in Australia.

Despite the global economic crisis, Oceania's port industry achieved good results for the year of 2009. According to UNCTAD (2009), Oceania's seaborne trade increased by 7.94% in 2009 compared to 2008. Figure 1.4 shows the percentage change in throughput and revenue of major ports in Oceania.

1.3 Research Question

This research's objective is to provide a comparison between theory and practice in terms of port authorities' characteristics that absorbed the impacts of 2008's economic crisis on their performance. In addition, it aims to contribute to the empirical knowledge on the determinants of variation in port performance's indicators. As product of these objectives the following general research question has been formulated:

What specific variables did play an important role in differentiation of port authorities' performance in response to the economic crisis?

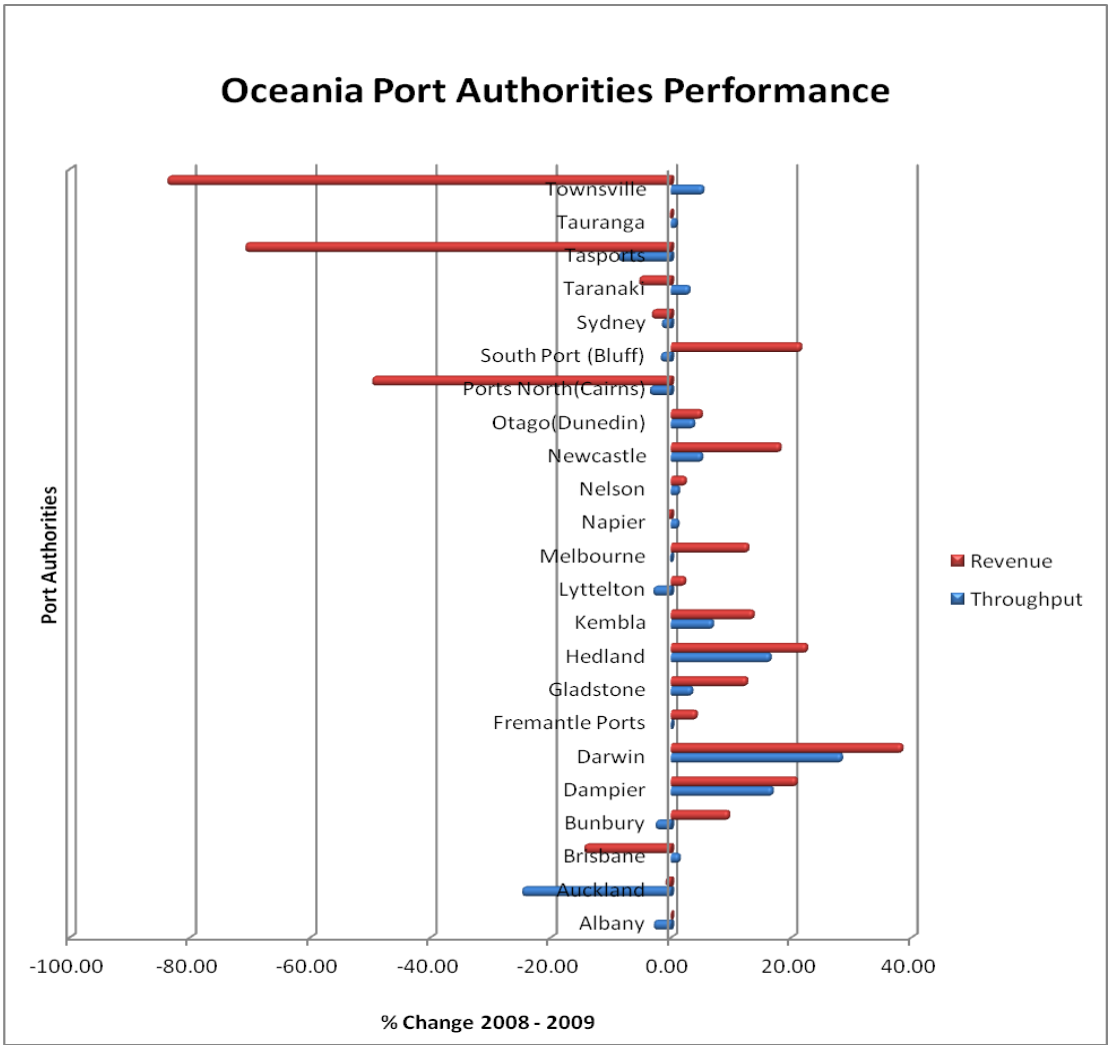

Figure 1.4. Throughput and revenue growth rates of major Port Authorities in Oceania

1.4 Methodology

In order to attain the projected objectives, several research methods are used to analyze the relationships between variables. Before all, data were collected from annual reports, audited financial reports and official websites of 105 sampled port authorities located in Europe, Canada, USA and Oceania (Appendix A). Statistical analysis is carried out in SPSS using a significance level of 95%. First step in analyzing the data is to check for associations between independent variable using cross-tabulation method. Further, in order to make sure that the results of analysis will be as accurate as possible, factor analysis with orthogonal rotation is performed between the dependent variables (the port performance indicators). This method will combine the variables that are highly correlated reducing the data set to a convenient

size while preserving as much of the original information as possible (Field, 2009). The hypotheses are further tested using both parametric and non-parametric tests. Factorial analysis of variance (factorial ANOVA) analysis and Kruskal-Wallis tests are used to test for both differences between the groups and the effects of independent variables on the outcome. The difference between methods, though, is that factorial ANOVA is a parametric test used to detect group differences on a single dependent variable but also the interaction effect between variables in the outcome while Kruskal-Wallis test is a non-parametric test, equivalent to ANOVA, allowing two or more dependent variables to be added to the model.

1.5 Overview of the report

This report consists of five chapters. After an introduction of the topic in chapter, the study continues with chapter 2 that offers an overview of the relevant literature on the adaptability of businesses to economic crisis in general, port authorities in particular. Also, based on the academic review hypotheses are formulated. In chapter 3 the data collection, the variables and their measurements are described. Statistical analysis results and interpretation is revealed in chapter 4. Chapter 5 highlights the most important conclusions, presents the limitations of the study and provides suggestions for further research.

2. LITERATURE REVIEW & HYPOTHESES DEVELOPMENT

This chapter offers a review of the knowledge and ideas that have been established on external economic shocks and organizations' ability to adapt to the competitive environment under difficult economic conditions. It also aims to define the variables that have been revealed to play an important role in the adaptability of businesses in general, port authorities in particular, to the external economic shocks. Besides, this academic overview will help to formulate the hypotheses that will allow testing the theory. As result, the outcomes from testing all these hypotheses will jointly answer the research question.

This academic overview tackles the following questions:

- What are external economic shocks?
- How do highly institutionalised organisations respond to challenging economic environment?
- What business' characteristics absorb the impact of external economic shocks?
- Does the organisational hybrid structure play a role in business' response to the economic shocks?
- How do port authorities fit into the economic crisis background in relation with all of the above-mentioned questions?

According to financial dictionary, an economic external shock is primarily defined as a sudden surprise event that originates from outside of an economic system. Under the impacts of external economic shocks we can distinguish between businesses that experience a decline in their performance due to periods of recession and those businesses undergoing decline due to failure to adapt effectively to descending economic pressure.

Kliesen (2003) studied the duration of all ten post war economic downturns and found out that "the recessions tend to average about nine months", with the shortest lasting six months (1980) while the longest have continued to exist for sixteen months (1973 - 1975). According to U.S. National Bureau of Economic Research (NBER) the size and extent of the economic crisis of 2008 are exceptional because of its long-lasting existence from December 2007 till June 2009 and its spread into a global economic

shock (NBER, 2009). However, it had shared similarities with financial-stress driven recession episodes in the past such as long prior period of rapid credit growth and development of bubbles in real estate sector. Such distinctive unsound economic environment revolves the world into a riskier place, creating new risks and worsening the existing ones with unparalleled speed and severity. Risk managers need to react quickly to unforeseen challenges, make new decision faster and take into consideration their companies' links and interdependencies rather than looking at their risks independently of each other. Consequently, they are called for understanding that a severe economic crisis can drive organizations to a dependency on conditional factors such us business' resources and relations with other groups, competitors or government. Although it shares similarities, the current economic crisis is to some extent different than the previous ones due to its more financially driven facet. Given that companies are financial institutions, one of the crisis' main effects has been to delay projects and further investments until it was known how the economy is going to turn out.

2.1 Responsive organisations to external economic shocks

Levchuck *et al.* (2001) recognize two types of organizations that will easier adapt to the environmental changes or better respond to external economic shocks. They are analysed in part as follows.

Robust organizations

They called the first type *robust*, also termed multi-mission organizations, because they "are able to sustain high levels of performance in dynamic environments without having to change their structures" (Levchuck *et al.*, 2001). The underlying force that drives an organization to be more stable with respect to economic perturbations is revealed by many scholars to be their *diversification* strategy (Keats 1990; Pandya & Rao 1998; Marinelli 2011). They advocate that organisations would be better off, in terms of stability in uncertain economy, if they decide to add different sectors to their core business. Firms that decide to venture out into new businesses, new products or new markets aim at amplifying their profitability through increased sales volumes, on the one hand, and using the profitability as measure for their performance, on the other. A diversifying tactic for organisations is to work in both for-profit and non-

profit sectors. Combining the social mission with for profit status allows organisations to create a hybrid structure that offers more flexibility in distributing their activities. Such diversification approach encourages firms to solicit tax-deductible donations and contributions and limit the liabilities from their core business' activity. In a study aimed to verify the diversification level' impacts on firm performance Pandya & Rao (1998) found out that, on average, diversified firms perform better than undiversified ones. However, their research also revealed that although undiversified firms have a better performance in terms of return their risk is much greater than diversified firms that may have lower returns but they are accompanied by low variance.

In the field of strategic management there are identified two core diversification strategies that lead organisations to superior performance (Rowe & Wright, 1997). (1) The related (concentric) diversification takes place when companies add a related market or product to their existing business. It aims to help firms to create synergies between business units that lead to a greater total effectiveness and profitability that would have been possible for a single entity. It also provides easier expansion since the industry is already knows and the knowledge and experience can be leveraged. (2) The unrelated (conglomerate) diversification is a strategy that allows companies to diversify into business and markets that are not a direct fit to the present business' operations. Since every business has its seasonality of highs and lows, this strategy makes possible to invest in a business line that may have "peaks" when the parent business has "valleys". Marinelli (2011) studied the firms' performance difference across diversifications strategies and observed that the "related diversified firms are associated with low performance". Although diversified firms are linked to low risk levels, the "related diversification does not assure an efficient risk/return performance" (Bettis & Mahajan, 1985).

Gassenheimer & Keep (1995) suggested that when measuring the impact of both related and unrelated diversification on firm performance the firm's *size* is an important issue to consider. The trade-off between firm's size and diversification has been greatly analysed and indentified to have a two-way significance (Grinyer & Ardekani, 1981). Diversification normally leads to larger size driven by high increase in revenues due to the introduction of new products, services and markets. In turn, size allows room for complex technology and development of new products and

hence diversification. Wrapping up the school of thought on factors that harden an organization against the surprises and risk of uncertain future it can be inferred that the agility to foster market diversification, considering size, adds value to creating robust organisations. As well as, experienced risk managers believe that organisations with a robust, enterprise-wide approach to risk are in a better position to handle the impacts of external economic shocks.

Adaptive organisations

The second type of organizations is called *adaptive* or *flexible* because they "are able to generate new strategies and/or reconfigure their structure to potentially achieve even higher performance" (Levchuck *et al*, 2001). In the aftermath of the recession, the economic environment is characterized by rapid unpredictable change and volatility that makes it crucial for organisations to develop a sustainable capacity to adjust. They must become learning entities that change and adapt to suit their changing business environment. In times of crisis businesses' resources become scarce hence organisations are strained to go the extra mile in providing new strategies to maintain their performance. Nevertheless, the right to develop quick specific strategic actions in response to the economic downturn relies, somewhat, on the autonomy in decision-making of each organisation. Andersen (2000) found evidence that the independence of actions of top managers has "positive performance effects across industries" as managers are able to make immediate approachable decisions to enhance stability. Literature on decision-making autonomy shows that there are "systematic variations of autonomy" levels in the sphere of *ownership* structure (Lioukas et al (1993); DeVaro (2005); Boot *et al* (2008)). For *public* firms, the top managers are making decisions based on the expectations of what future investors will consider optimal while within *private* firms managerial autonomy is specifically chose to favour future investors. It has been observed that privatization increases the managerial autonomy in decision-making process (Bowles *et al* 2005) whereas state-owned enterprises "ought to have low strategic autonomy and high operational autonomy" (Lioukas *et al*, 1993). A partnership agreement between public and private sectors (*mixed*) provides the government with possibilities for an active role (e.g. to keep the contracts on track) that is believed to compromise the autonomy of the private party (Raman & Björkman, 2008). All in all, the adaptive characteristic emphasizes the demand for high decision-making autonomy across organizations.

2.2 Port authorities adaptability to external shocks

Port authorities are often established by local, regional and national governments and are intended to promote and support the regional and/or national economic development. The downward pressure on international trade associated with the decline in the total traffic flow handled at ports has highlighted vulnerabilities in port authorities' ability to adapt to crisis. Likewise organizations, port authorities can be constructed based on Levchuck *et al.* (2001) theory to conquer the impacts of the economic crisis.

Robust port authorities

In times of crisis, port authorities need to develop an immediate strategy to avoid either an overall reduction in port activity and financial performance or losing market share to other ports with better facility to adapt to difficult economic conditions. As consequence of the current financial crisis, ports suffered from large loss of cargoes that contracted the port industry activity all over the world. This phenomenon forced port authorities to delay the commencement of projects (e.g. Ports of Albany, Gladstone), to lower ports rates (e.g. Port of Rotterdam) and to search for methods to diminish costs. Cost saving measures were, in many cases, related to decrease in personnel expenses through "downsizing and reorganizing the work" (e.g. Port of Tallinn; Port of Tacoma), to postponed maintenance and repair services (e.g. South Carolina Port Authority), to less "advertising and promotion, services and consultants, materials and supplies, and staff training and development" (e.g. Port of Brisbane).

Meyler *et al.* (2011) proposed two strategies that port authorities need to implement in order to develop and improve the port activity in crisis conditions, namely the "strategy of port activity diversification" and the "strategy of integrations and renewal". By opening new alternatives (e.g. creation of new routes to connect transshipments ports, diversifying the cargo segments, terminals extension projects or adding a new sector to their business), port authorities ensure business continuity and find their way easier through difficult economic conditions. Ports that reported satisfactory operational results in 2009, despite the economic downturn, referred especially to their cargo diversification (e.g. Ports of Gdansk, Darwin, Napier) as driven force. Since the majority of ports have cargo handling as their core business,

the related diversification translated into 'port language' usually refers to the diverse types of commodities processed through the ports distinguished between dry bulk, liquid bulk, containers, general cargo, ro/ro and conventional cargo. Huybrechts *et al.* (2002) define port activity diversification as the "weight of various traffic categories in overall seaport traffic". Through commodity variety ports intend, more or less, to spread risk. While the traffic for one commodity might badly suffer due to crisis (e.g. general cargo for ports like Bergen and Milford), port authorities can take advantage of increased demand for traffic of other commodities (e.g. Ports of Bergen and Milford took advantage of the crude oil sector). Hence, "commodity specialization" represents a "weakness" (Ducruet *el al.,* 2010) for ports facing instable economic environment as they can be hit quite hard if their predominant commodity traffic is the one most affected. Therefore, diversifying their activity by adding service sector, land rentals to their core business port authorities minimize the risk to suffer huge losses in both financial and operational divisions. Since the "trade in goods drops faster than the trade in services" (RTM, 2010), port authorities are able to use the unrelated activities as "backup".

The trade-off between size and diversification applies to ports as well. Ducruet *et al.* (2010) drew an analogy between the relation between variety and size for cities, translated then to ports, and discovered that the relationship is significant. This may yield that the bigger the port the higher the level of diversification of port activity. But also, for ports located in vicinity of big metropolitan areas (e.g. ports of New York and Vancouver) may derive high variety of activity and dominate the neighboring ports that serve small hinterland areas. Besides, such locations facilitate unrelated diversification with port authorities being involved in a wide range of economic development projects for instance real estate, retail or public improvement projects. To emphasize the importance of size, Caldeirinha *et al.* (2009) discovered that ports' size and location are two fundamental dimensions for diversification.

Adaptive port authorities

The fall in trade in the latter half of 2008, continued into 2009, put ports in jeopardy. To minimize the risk, port authorities needed to put more effort in achieving their objectives and maintain their mission schedule. Such tasks require planning flexibility that allows port authorities to react immediately and develop strategies, based on their

resources, in overcoming the crisis. However, not all port authorities are able to make quick independent decisions. Ports that are fully ruled by the government (municipal, regional or national) usually do not have much decision-making autonomy (Verhoeven, 2010). The development of new strategies (e.g. establishing new port charges) involves a complex approach caused by political policies (e.g. ports in Portugal, Cyprus, Greece). Under the *public* status, the investment and port operations' decisions are made at the governmental level and ports officials show low interest in increasing their port performance since they "are not held accountable for the success or failure of the investment decisions" (World Bank, 2007). This is less possible in the context of ports with *mixed* ownership structure that share the control over port activities trying to maintain the equilibrium for the public (port authority) and the private (port industry) interests (e.g. Ports of Rotterdam, Antwerp, New York-New Jersey). However, this mix of public and private objectives "is increasingly being blurred" (De Langen *et al.*, 2010) and can lead to conflicts that may obstruct the operational efficiency. The maximum flexibility to make quick decisions relates to fully privatized ports (e.g. Ports in UK and New Zealand). On the one hand, they can freely decide on port charges, land prices, investments and port operations that make them adapt easier to crisis conditions. On the other hand, the complete loss of the government role makes is difficult to generate policies for development of regional and national economies.

2.3 Hypotheses

The review of exiting literature allows formulating the following hypotheses basing the application of adaptability of businesses to external economic shocks theories to port authorities:

- H1: The port authorities' response to the economic crisis varies with their geographical location.

- H2: There is a strong association between ports' diversification level and size: the bigger the port the higher the diversification level.

    - $H2_a$: There is a positive relationship between diversification level of ports and port authorities' financial performance.

- H3: There is a strong association between port authorities' ownership type decision-making autonomy.

    - $H3_a$: There is a positive relationship between decision-making autonomy of port authorities and their both operational and financial performance.

3. DATA DESCRIPTION & MODEL SET-UP

This chapter provides information on the database and the variables that have been measured for empirical estimation. The models set up used in testing the hypotheses are also described.

3.1 Describing the sample

The annual reports, financial statements and official websites of 105 port authorities represent the sources used in collecting the data for this study. The sample consists of small to very large port authorities spread across four regions. The generally accepted ratio of valid cases to predicting variables for regression analysis is 10 to 1. With 105 valid cases and 5 predictive factors on port authority performance, the ratio for this study is 21 to 1 that satisfies the requirement, although still not sufficient. This research was initially intended to study the variation on ports performance worldwide. However, the language barriers and the poor accessibility/availability of data in other regions such as Asia, Africa and Middle East made this task difficult to perform.

Quantitative data (dependent variables) of both financial and operational port performance indicators were collected from the yearly audited financial statements of 2008 and 2009. The qualitative (independent variables) data relies on the information made available through port authorities' official websites and annual reports. Since this study measures the amount of increase/decrease that port performance has gained/lost due to the recession of 2008 and that the financial figures are expressed in each region/country's currency, the yearly growth rates are calculated. Besides, such approach makes the performance indicators comparable across the sample.

It might be worth mentioning that the quantitative data was not entirely available from a similar time interval, therefore it needed to be rearranged. This refers in particular to the international financial reporting that differs between regions, to some extent. Although the fiscal and the calendar year seem to be one in the same to define a business accounting period, the business world makes a clear distinction between them. A financial (calendar) year usually defines a period of twelve months that begins on January 1 and ends on December 31. In contrast, the fiscal year contains

twelve months as well but can end on the last day of any month. The advantage of the fiscal year is, according to specialists in accounting, that the companies do not have to wait until January 1 to conduct official business but they can begin their operations as soon as they are ready. In Europe and Canada the calendar year is predominantly used in financial reporting whereas in Unites States and Oceania the fiscal year can start on April 1, June 1, September 1 and end on March 31, May 31, and August 30, respectively. Unlike a calendar year, which is the time frame used for this study, the fiscal year covers two calendars year. Therefore, data needs to be adjusted in order to obtain a comparable data set. In other words, to observe the financial performance of port authorities during a calendar year of 2008 and 2009 data from 2007 and 2010, respectively, was also necessary.

3.2 Port performance indicators

Port authority's performance is treated as dependent variable in this study. As the performance stands for a broad organisational goal, there is need to find a way to measure progress towards it. Business management literature defines performance indicators as being those "quantifiable measurements that reflect the critical success factors of an organization" (Fortner Consulting, 2010). As for port authorities, performance indicators can be used for both improving port operations and providing an appropriate basis for planning ports' future development. They are classified as operational and financial indicators. They are also used to compare performance with other ports and to observe the trend in their performance level within specific contexts, in this case under difficult economic conditions. The indicators selected to represent port authorities' performance in this study are described in part as follows.

Throughput

Total throughput in tonnes or TEU (Twenty-foot Equivalent Unit) handled at ports in a definite period of time, most commonly a year, represents one of most popular operational performance indicators used in port rankings and comparisons. For this study throughput is expressed in metric tonnes. Nevertheless, the amount of cargo handled at ports varies with the location of a port, maritime network and distance between ports. Ducruet (2011) studied the determinants of throughput volumes from a network perspective and described "the maximum distance link to another port" as a

"novel and highly correlated indicator" of throughput performance. Tongzon (1994), on the other hand, argues that the volume of throughput changes with the geographical location of a port. He also provides a clear distinction between the cargo volumes at trans-shipment ports located in Singapore, Hong Kong and Rotterdam that are "city states that have entrepot trade as basis for their economies" and the cargo volumes at Ports of Melbourne and Sydney that "are driven by an isolated and small economy".

For this study, the *Throughput* variable is measured as the percentage change in total cargo handled at port between 2008 and 2009. To calculate the change, throughput figures from 2008 and 2009 were necessary which were usually stated on port's annual reports as yearly operational performance. For some ports that did not state their operational performance, other sources were used such as the "U.S. ports ranking by cargo tonnage", "Canadian Port Rankings" and "World Port Rankings" for 2008 and 2009 provided by the American Association of Ports Authorities (AAPA). For some European ports, also information available on ESPO website helped in collecting the throughput figures.

Revenue

In general, revenue represents "income generated from sale of goods or services, associated with the main operations of an organization before any costs or expenses are deducted" (Business Dictionary). Port authorities, in particular, earn their revenues mainly from a group of facilities and services designed for handling different types of cargo including general cargo, containers, grain, dry and liquid bulk, etc. In addition, some port authorities' gross income is obtained from property rentals, licensed pipelines, earnings from investments and commercial tourism. For this study, the *Revenue* variable is stated in percentages and represents the increase or decrease in total sales of goods and services between 2008 and 2009.

Operating Income

According to business dictionary, the operating income most commonly refers to the "income resulting from a firm's primary business operations excluding expenses and extraordinary income". Due to the variation between national accounting systems, in some cases, the preparation of profit and loss account contrasts in terms of calculation

of operating income among regions. However, for this study operating income refers to earnings before interest taxes (also called EBIT) that is said to give a more accurate picture of a firm's profitability than the revenue. To create a comparable data sample the operating income has been obtained applying the following formula to all port authorities:

Operating Income = Revenues – (Cost of sales + Operating expenses)

The *Operating_income* variable is expressed in percentage changes between 2008 and 2009.

Profit

In order to arrive at the profit or net income in an income statement all the charges, costs and expenses are subtracted from the revenues. Put another way, the profit equals the surplus/loss after total costs are removed from total revenue, from which the tax is subtracted and dividend is paid. As for this report, the profit corresponds to the "bottom line" of profit and loss accounts of all port authorities. The *Profit* variable has the same measurement as all other above-mentioned variables: percentage change.

3.3 Port authorities characteristics

The review of the existing literature has indicated several variables that influenced the magnitude of the economic crisis' impacts on ports' performance. They are treated as categorical independent variables and are described as follows.

Region

Port authorities in all regions around the world have faced some of the most difficult challenges due to economic crisis. However, to detect and compare the strategies that each port authority devised for addressing the challenge was only possible in four areas due to accessibility and availability of data. Thus, the variable *Region* has four levels namely Europe, Canada, USA and Oceania. The group *Europe* consists of 42 ports located largely within the EU-27 borders. Twenty-six American ports form the *USA* group while *Canada* is made out of 14 port authorities. *Oceania* group gathers 23 port authorities from Australia, New Zealand and Tasmania.

Diversification

Based on the theoretical background, the level of port activity diversification represents one of the central factors that make variation in ports' performance possible. The diversification level relates to the ability of port authorities to diversify their revenue stream. The determination of *Diversification* variable levels accounts for variation on the breakdown of ports' revenue gained from related and unrelated port activities. To decide whether ports authorities adopted a related or unrelated diversification strategy, the predominant business was first established. There are ports that derive a high percentage of their revenues from a core business such as handling cargo (e.g. Ports of Halifax in Canada, Kembla in Oceania, Virginia in USA, Port of Lisbon in Europe), property rentals (e.g. Port of Albany in Oceania, Port of San Francisco in USA), port services (e.g. Portland Port in Oceania, Port of Palm Beach in USA, Zeeland Port in Europe), transhipments (e.g. Cyprus ports), passengers traffic (e.g. Port of Helsinki). Also, within the handling cargo group, some ports specialize in specific cargo segments such as Lo-Lo and Ro-Ro (e.g. Dublin Ports), dry bulk (e.g. Queensland Ports in Oceania), liquid bulk (e.g. Ports of Bergen, Milford, and Rotterdam), and containerized cargo (e.g. Ports of Montreal, Cork, Riga).

The *Diversification* variable consists of three levels: *Low*, *Medium* and *High*. Low levels of diversification are considered when at least 70% of the total revenues come from a dominant business unit. Medium levels of diversification is when the revenue is gained from related-diversified businesses but the dominant business still accounts for between 40% – 70% of total revenue. It happens that port authorities also acquire non port-related businesses for diversification purpose. Their income is generated by a mix of both related and non-related port activities that is an attempt to yield high level of diversification. Thus, *High* level of diversification refers to revenue that is spread across more business units and none of the business units adds more than 40% to the total revenue.

Size

Ports' size is measured in terms of annual traffic flow. The World Port Source website represented a guide in establishing the levels of *Size* variable. Based on the amount of throughput handled ports are classified as presented in Table 3.1.

Table 3.1. Ports classification by size

Size (count)	Classification range	Count by region
Small (22)	Traffic flow ≤ 5 million tonnes	3 - Europe 5 - Canada 5 - USA 9- Oceania
Medium (27)	5 million tonnes < traffic flow ≤ 20 million tonnes	4 - Canada 4 - USA 5 - Oceania 14 -Europe
Large (30)	20 million tonnes < traffic flow ≤ 50 million tonnes	4 - Canada 4 - Oceania 10 - USA 12 - Europe
Very large (26)	Traffic flow > 50 million tonnes	1 - Canada 5 - Oceania 7 - USA 13 - Europe

Autonomy

A port authority may sound as an entity that is not subject to the supervision or regulations of any type of governmental bodies. However, as seen in chapter 2, port authorities differ in their decision-making autonomy. How far goes a port's ability to govern its fixed and mobile assets, port operations and land depends on its administration model (World Bank, 2007). According to World Bank four categories of port administration models have become known over time: service port model, tool port model, landlord port model and fully privatized port model. Within each port model responsibilities are allocated differently in terms of infrastructure, superstructure, labour, port operations and land. Thus, the level of autonomy can be divided in four categories as well. For this study the *Autonomy* variables consists of the following four levels: low, moderate, high and full. Table 3.2 presents the division between all four autonomy levels. The determination of autonomy levels were also based on both the "Port Authority Strategy Survey"[1] held among port authorities

[1] The survey was partly the input for a "large research conducted by Erasmus University Rotterdam together with the VU University of Amsterdam (Prof. Dr. Lorike Hagdorn) and Eindhoven Technical University (Prof. Dr. Peter de Langen) with the aim to get more insight in the strategy making policies of port authorities worldwide" (Van der Lugt, 2010).

worldwide and the study conducted by Verhoeven (2010) on "European Port Governance".

Table 3.2. Ports classification by autonomy level

Autonomy Level	Port model [1]	Port Authority [2][3]	Responsibilities [4]
Low	Service port	National public corporation	Usually controlled by the Minister of Transportation which owns all land and available assets (infrastructure, superstructures and labour)
Moderate	Tool port	Autonomous municipal/regional corporation	Independent entity, with control over labour, incorporated in municipal/regional government that owns the land, infrastructure and superstructure
High	Landlord port	Private corporation with public capital	Municipal/regional government owns the infrastructure while the superstructure, labour, port operations, and land are owned by the PA
Full	Privatized port	Private company with private capital	Full control over port operations, land, infrastructure, superstructure and labour

Sources: [1] – World Bank, 2007; [2] – Debrie, 2010; [3] –"Port Authority Strategy Survey" & Verhoeven, 2010; [4] - Brooks, 2004

Ownership

The majority port authorities in the sample are governmental entities with "municipal, regional, joint or national supervisory body" (Debrie, 2010). Out of 105, 60 ports authorities (19 Europe, 19 USA, 14 Canada and 8 Oceania) are falling under the

category *Public* as first level of ownership variable. The second common form of ownership identified in the sample is the public private partnerships (PPPs). They are port authorities that rely on a mix of provision of services with private port operators (e.g. cargo handling operators, terminal operators) and publicly financed. There are 36 port authorities in the sample (16 in Europe, 11 in Oceania and 7 in USA) that are governed by *mixed* ownership structures. Only 11 ports are fully private and they are mostly located in Europe (7 in UK and Ireland) but also in Oceania (4 in New Zealand and Tasmania) and together they account as third level of ownership variable, namely *Private*.

3.4 Model set up

The basic idea of Figure 3.1 is to represent schematic the hypotheses formulated in Chapter 2, whose merit requires evaluation. The plus signs present the assumption that, in theory, several factors positively influence the port authorities' performance during crisis conditions.

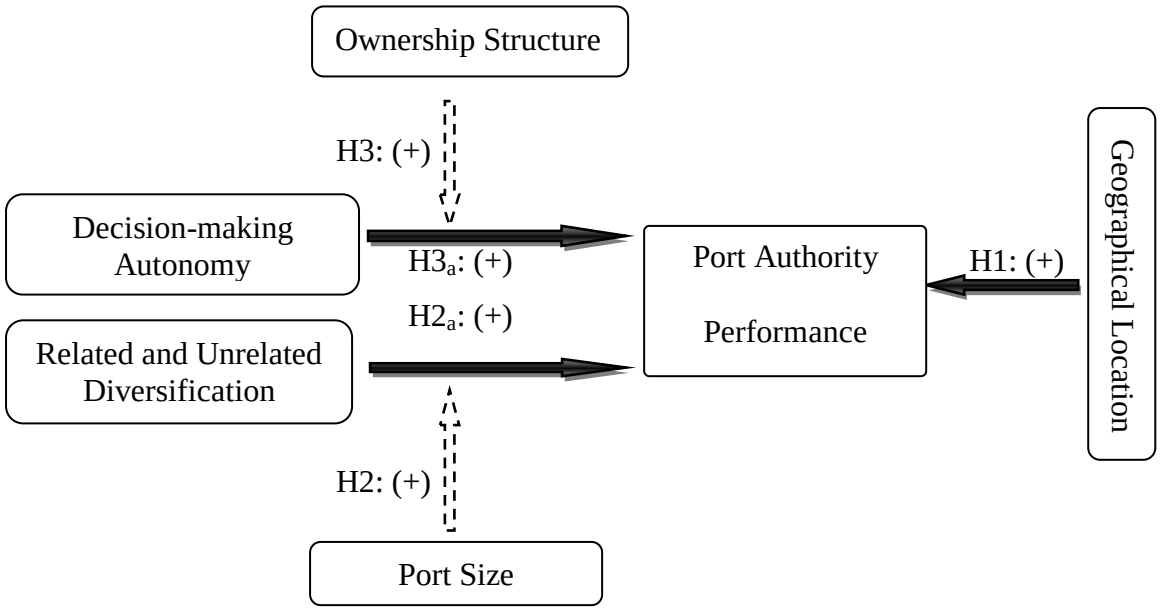

Figure 3.1 Analysis scheme used in testing the hypotheses

As stated earlier, the hypotheses are tested using both parametric and non-parametric tests. Since factorial ANOVA (parametric) test can be conceptualized as regression equation the following model setup has been used:

$$P = f\ (A, D, R, S, O) + Ɛ \qquad \text{where,}$$

P = port authority performance as measured by a vector of quantitative service variables including throughput, revenues, operating income and profit; all expressed in annual percentage change between 2008 and 2009.

A = managerial autonomy level of port authorities

D = diversification level of port authorities

R = geographical location of ports

S = the size of the port (measured in total annual throughput handled)

O = ownership structure

Ɛ = error term

The parametric test is only used to determine the influence of independent variable on the percentage change in throughput since it is the only variable that meets the normality assumption. The factorial ANOVA test permits the interaction effect between the independent variable to account for variation on the outcome variable as well. Thus, the regression model simply extends to the following:

$$\text{Throughput}_i = (b_0 + b_1 A_i + b_2\, B_i + b_3 A{*}B_i) + \mathcal{E}_i \qquad \text{where,}$$

A_i = first independent variable

B_i = second independent variable

$A{*}B_1$= the interaction term between the two independent variables (i.e. the impact of one factor on dependent measure depends on the level of the other factor)

Non-parametric tests make no assumption to the distribution of data. The reasoning is based on ranking which means that to the lowest score a rank 1 is assigned, to the next highest score rank 2 and so on until all the score are assigned a rank. The process allocates high scores to large ranks and low scores to small ranks (Field, 2009).

4. ANALYSIS & DISCUSSIONS

Besides determining whether the five factors limited or unlocked the impacts of economic crisis on port authorities' performance, this chapter also provides evidence that supports the proposition "*in theory there is no difference between theory and practice. In practice there is" (*Yogi Berra).

4.1 Statistical outline

The idea of hypotheses testing relies mainly on the validity of the result. Hence, to facilitate an accurate analysis and to draw proper conclusions about how crisis affected port performance in reality, statistical assumptions have to be checked beforehand. Among others, there are four core assumptions that have to be true in order to obtain accurate results such as normally distributed data of outcome variables, homogeneity of variance, interval data and independence of errors. Since the majority of statistical procedures are parametric tests with the foundation on normal distribution, the assumption of normally distributed data is essential. The Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) tests are most commonly used to see whether the scores in a sample significantly deviate from a normal distribution. A *Sig.* value greater than 0.05 tells that the distribution of the sample does not significantly differ from a normal distribution. In contrast, *Sig.* values lower than 0.05 tell us otherwise. According to the Table 4-1, which shows the results of the above-mentioned tests, only *Throughput* variable complies with the normality rule. For a *Sig.* value equalling 0.20, which is greater than 0.05, the scores in the sample are significantly normally distributed.

Table 4-1. Tests of normality of dependent variables

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Profit	.322	100	.000	.357	100	.000
Throughput	.044	100	.200*	.992	100	.851
Operating_income	.314	100	.000	.381	100	.000
Revenue	.163	100	.000	.873	100	.000

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Alas, all other three dependent variables, *Revenue*, *Operating_income* and *Profit*, do not meet the normality assumption. Under normal circumstance, in order to fulfil the K-S test's conditions, transformations to the data can be applied. Logarithmic transformation (Log transformation) is most popular method and consists in taking the logarithm of the scores with the purpose to compress the tails of the distribution. This method has been applied to the remaining dependent variables and as result the *Sig.* value stubbornly remains the same (lower than 0.05) that implies that no improvement has been achieved. For distributions that badly fail to meet the normality assumption, non-parametric tests can be used. As result, the empirical analysis will be split into two parts and each part's outline is presented in Table 4.2

Table 4.2. Outline empirical analysis

Statistical test	Dependent variables	Independent variables	Main outputs
Factorial ANOVA	Throughput	Autonomy Ownership Region Size	Main effect Interaction effect Helmert contrast Bonferroni test
Kruskal - Wallis	Operating income Revenue Profit	Autonomy Diversification Ownership Region Size	K-W test statistic (H) Mann-Whitney test (U) Effect size (r)

4.2 Exploring associations

After examining the distribution of each of the outcome variables it is also important to gain a sense of associations between port authorities' characteristics. In Chapter 2 several variables were identified as going hand in hand with each other. This section verifies whether the theory behind the connectedness between those variables applies to this study's sample as well. The cross-tabulation method gives a picture of the extent to what two variables inter-relates and searches for patterns of interactions. It also offers a better picture on how port authorities' diversification and autonomy

levels vary with regions, size and ownership types and makes it easier to understand later the impacts of crisis on performance. Below, the inter relations between port authorities in terms of diversification level, autonomy level, location, size and ownerships are described.

Diversification & Region

One may wonder whether a port authority's opportunity to diversify its activity depends on the geographical location of the port. For the port authorities sample considered in this study it may be inferred that indeed the location of a port matters when a port authority decides to expand its activity. As shown in Table 4-3, it can be concluded that region has a significant effect on the level of diversification of ports. The peak percentage (52.4%) of highly diversified port authorities is registered in Europe while the highest number (47.8%) of poor diversified port authorities is in Oceania. This can be explained by the fact that Oceania has an isolated economy depending primarily on agriculture, fishing and mining sectors and therefore port authorities need to keep their activity within close bounds. Market diversification can be difficult to obtain as well due to scarce industrialization since the natural resources and room for development are lacking.

Table 4-3. Cross tabulation Diversification level * Region

Crosstab

			Region				
			Europe	USA	Canada	Oceania	Total
Diversification	Low	Count	10	9	6	11	36
		% within Region	23.8%	34.6%	42.9%	47.8%	34.3%
	Medium	Count	10	8	5	7	30
		% within Region	23.8%	30.8%	35.7%	30.4%	28.6%
	High	Count	22	9	3	5	39
		% within Region	52.4%	34.6%	21.4%	21.7%	37.1%
Total		Count	42	26	14	23	105
		% within Region	100.0%	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V* = 0.202; *Sig.* > 0.05

In contrast, European Union represents one of the largest economies in the world (IMF, 2011) with service industry accounting for 69.4% of its GDP, manufacturing industry for 28.4% and agriculture industry for only 2.3%. In terms of trade, Europe

has an important role for various categories of exports to other big economies such as Unites States, China, Japan and Russia. Quite the opposite, at the majority ports in Oceania trade is mainly based on exports of mining commodities if to believe the annual operational performance reported by ports of Brisbane, Kembla, Darwin and Dampier. The trade is, for the most part, effectuated between Japan, Korea and East Russia.

As for Unites States, the results might be a little astonishing since it represents the world's largest national economy. However, the sample of port authority selected for this study is far too small comparing to the total number of ports across USA. It might be also important to note that many American port authorities, of which San Diego, Tacoma, San Francisco, Albany, Duluth, derive a majority of their revenues from property management. This may be a good reason to explain why the number of low diversified port authorities equals the number of highly diversified ones.

The predominantly high percentages among poorly diversified port authorities in Canada like Price Rupert, Thunder Bay and Alberni can be explained by the fact that revenues from cruise ship services and property rentals account for great proportion of their total income.

With the above-mentioned facts it may be very encouraging to believe that there is a positive relationship between the diversification of ports' activity and their location. However, the strength of this association is an important aspect to be taken into consideration. The Cramer's V^2 measure equals 0.202 and therefore the association between region and the diversification level of port authorities is considered weak. Thus, port authorities' decision to diversify their core activities poorly associate with the region in which they are located.

Diversification & Ownership

This section tests whether governmental owned (either national, regional, joint or municipal) port authorities tend to be rather more diversified than private or mixed

[2] Cramer's V test, which is part of the cross-tabulation output, represents a measure for determining how strong the associations between two variables is. For a value above 0.35 Cramer's V would indicate a "strong" relationship, whereas values between 0.25 and 0.35 denote a "moderate" relationship and below 0.25 a "weak" relationship.

types. Table 4-4 shows that the level of diversification is approximately equally dispersed among public and private port authorities. This means that the level of diversification is independent on these types of ownership structures. This may imply as well that the decision to diversify their activity port authorities relies on other external factors. Though, the diversification dependence on internal factors exists for port authorities based on public-private partnerships since they relate to high diversification levels. An explanation lies on the idea that a PPP framework enables the allocation of resources and risk among all parties involved which, in the end, leads to diminishing the impacts of external shocks.

Table 4-4. Cross tabulation Diversification level * Ownership

Crosstab

			Ownership			
			Public	Private	Mixed	Total
Diversification	Low	Count	21	4	11	36
		% within Ownership	35.0%	36.4%	32.4%	34.3%
	Medium	Count	19	3	8	30
		% within Ownership	31.7%	27.3%	23.5%	28.6%
	High	Count	20	4	15	39
		% within Ownership	33.3%	36.4%	44.1%	37.1%
Total		Count	60	11	34	105
		% within Ownership	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V* = 0.077; *Sig.* > 0.05

Although interesting results have been obtained on mixed ownership structures, the idea that a port authority governance structure might have an influence of its level of diversification is extremely weak (*Cramer's V* equals 0.077).

Diversification & Size

Whether or not the total tonnage handled at a port or the surface under port's jurisdiction accounts for its diversification level is presented in Table 4-5. The results suggest a clear positive relationship between port size and diversification since 77.3% of small ports relate to low levels of diversification and 43.3% and 73.1% of large and very large ports, respectively, correspond to high levels of diversification.

Table 4-5. Cross tabulation Diversification level * Size

Crosstab

			Size				
			Small	Medium	Large	Very large	Total
Diversification	Low	Count	17	10	9	0	36
		% within Size	77.3%	37.0%	30.0%	.0%	34.3%
	Medium	Count	5	10	8	7	30
		% within Size	22.7%	37.0%	26.7%	26.9%	28.6%
	High	Count	0	7	13	19	39
		% within Size	.0%	25.9%	43.3%	73.1%	37.1%
Total		Count	22	27	30	26	105
		% within Size	100.0%	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V = 0.439; Sig. < 0.05*

The diversification occurs simply because large and very large ports cover a big land area that allows more room for development. Port of Rotterdam, for example, covers 10500 hectares of land which logically offers a lot more room to develop and operate a variety of business than Toronto Port Authority that covers only 512 hectares. Also, the hinterland served plays a role in port authorities' ability to diversify. For some ports the captive area can stop at regional/ national level (e.g. Port of Turku in Finland, Port of Tyne in UK) while for other the hinterland covers a number of countries (e.g. Port of Rotterdam, Antwerp, Hamburg that serve European countries).

Considering the results on the strength of the relationship, it can be concluded with no doubt that we can trust the association between size and diversification as being strong and significant. Nothing else can provide a better proof than a *Cramer's V* value of 0.439 and *Sig.* = 0.000 < 0.05.

Autonomy & Region

Regarding autonomy, Table 4-6 investigates whether port authorities' ability to make independent decisions vary with their geographical location. Canada scores highest at the port authorities' right to govern themselves since 78.6% of port authorities relate to high autonomy levels. Since autonomy relates to some extent to the ownership structure the result is quite straightforward. Canadian port authorities are by definition autonomous public agencies with high control over port operations. In contrast, Europe offers a more variety in terms of the administrative body to which port authority has to comply with. The crosstab results show this pattern, though port

authorities with high level of autonomy are most present (40.5%). In United States port authorities power does not vary as much as they must comply to the laws of enabling acts for the state they belong to. High percentage (57.7%) of moderate autonomy level of ports in USA is explained by the fact that the majority of port authorities are integral administrative divisions of county and municipal government.

Table 4-6. Cross tabulation Autonomy*Region

Crosstab

			Region				Total
			Europe	USA	Canada	Oceania	
Autonomy	Low	Count	10	4	0	4	18
		% within Region	23.8%	15.4%	.0%	17.4%	17.1%
	Moderate	Count	8	15	3	2	28
		% within Region	19.0%	57.7%	21.4%	8.7%	26.7%
	High	Count	17	7	11	13	48
		% within Region	40.5%	26.9%	78.6%	56.5%	45.7%
	Full	Count	7	0	0	4	11
		% within Region	16.7%	.0%	.0%	17.4%	10.5%
Total		Count	42	26	14	23	105
		% within Region	100.0%	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V* = 0.307*; Sig.* < 0.05

As expected, Oceania's ports do enjoy a high levels of autonomy since many ports are corporations with control over their main assets, however publicly financial supported. All in all, the region does associate with autonomy level and the strength of this association is significantly moderate (*Cramer's V* = 0.307).

Autonomy & Size

Size matters however not in relation with autonomy level. All four autonomy categories are spread across all size groups. Thus, the right of who's going to decide on port authority's actions is independent on port's size. This conclusion is drawn based on the crosstab output presented in Table 4-7.

Table 4-7. Cross tabulation Autonomy*Size

Crosstab

			Size				Total
			Small	Medium	Large	Very_large	
Autonomy	Low	Count	2	5	7	4	18
		% within Size	9.1%	18.5%	23.3%	15.4%	17.1%
	Moderate	Count	9	6	6	7	28
		% within Size	40.9%	22.2%	20.0%	26.9%	26.7%
	High	Count	8	14	14	12	48
		% within Size	36.4%	51.9%	46.7%	46.2%	45.7%
	Full	Count	3	2	3	3	11
		% within Size	13.6%	7.4%	10.0%	11.5%	10.5%
Total		Count	22	27	30	26	105
		% within Size	100.0%	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V* = 0.127; *Sig.* > 0.05

Cramer's V, whose value is 0.127, shows a very weak association between port authorities' decision-making autonomy and ports' size.

Autonomy & Ownership

The great amount of inter-relation between autonomy level and ownership structure applies to the sampled port authorities as well. As expected, there is a very strong and significant association (*Cramer's V* = 0.861, *Sig.* = 0.000) between as shown in Table 4-8.

Table 4-8. Cross tabulation Autonomy*Ownership

Crosstab

			Ownership			Total
			Public	Private	Mixed	
Autonomy	Low	Count	17	0	1	18
		% within Ownership	28.3%	.0%	2.9%	17.1%
	Moderate	Count	28	0	0	28
		% within Ownership	46.7%	.0%	.0%	26.7%
	High	Count	15	0	33	48
		% within Ownership	25.0%	.0%	97.1%	45.7%
	Full	Count	0	11	0	11
		% within Ownership	.0%	100.0%	.0%	10.5%
Total		Count	60	11	34	105
		% within Ownership	100.0%	100.0%	100.0%	100.0%

Note: *Cramer's V* = 0.861; *Sig.* < 0.05

4.3 Factor analysis

This section will empirically address the following question: to what extent the percentage change in total port throughput, revenue, operating income and profit measure port performance under difficult economic condition? The aim of this test is to determine whether any of the port performance indicators does badly correlate with the others resulting in its elimination from the analysis.

A principal component analysis (PCA) with orthogonal rotation was conducted on four performance indicators. The main results of this analysis are presented in Table 4-9 and Table 4-10.

Table 4-9. Factor analysis correlation matrix

Correlation Matrix[a]

		Throughput	Operating_ income	Revenue	Profit
Correlation	Throughput	1.000	.095	.386	.249
	Operating_income	.095	1.000	.072	.355
	Revenue	.386	.072	1.000	.234
	Profit	.249	.355	.234	1.000
Sig. (1-tailed)	Throughput		.174	.000	.006
	Operating_income	.174		.238	.000
	Revenue	.000	.238		.010
	Profit	.006	.000	.010	

a. Determinant = .681

Table 4-10. Main results of factor analysis

Variable	KMO	Communalities	Factor loadings	
			1	2
Revenue	.592	.684	.825	
Throughput	.599	.668	.810	.112
Operating_income	.544	.775		.878
Profit	.594	.653	.311	.746

First thing to look into when performing a factor analysis is to check whether the sample is adequate for the analysis. The Kaiser – Mayer – Olkin (KMO) measure verifies whether the sample is satisfactory to perform the factor analysis. The results

show that the sample is not big enough since KMO = 0.586 ("mediocre" according to Field, 2009) and all the KMO values for individual indicators are > 0.50 which are above the acceptable frontier of 0.5. Bartlett's test for sphericity χ^2 = 37.221, *Sig.* = 0.000 points out that the associations between performance indicators are significantly large for PCA. Eigenvalues for each component have been obtained after running the analysis. Two components met the Keiser's condition of eigenvalues above 1 and in combination they explained 69.51 % of the variance. Another important result is the determinant that offers information about variables that are highly correlated. If determinant is lower than 0.00001 then multicollinearity exists between certain variables and the unique contribution to a factor of those variables is impossible to determine. In this case the determinant takes the value of 0.681 and multicollinearity is not a problem.

According to Table 4-9, there are two groups of variables that significantly and positively correlate with each other: first consisting of throughout that correlates with revenue (*Correlation coefficient* = 0.386; *Sig.* < 0.05) and the second made up of operating income that correlates with profit (*Correlation coefficient* = 0.355; *Sig.* < 0.05). In other words, if percentage changes in throughput increases (decreases) then the percentage change in revenues increases (decreases) as well by a proportionate amount. Similar reasoning applies to the second pair of variables. Although this might suggest a promising outcome, the correlation coefficients values suggest a medium effect[3]. The results show also a small, though positive and significant, effect between throughput and profit (*Correlation coefficient* = 0.249; *Sig.* < 0.05). As for operating income, there exist no correlation with throughput and revenue.

The factor loadings after rotation are presented in Table 4-10. There is two clusters of interrelated variable that are suspected to measure common factors (as expected after analysing the correlations). First, the percentage change in total cargo traffic at ports clusters with the variation in their gross income generated from sales of goods and services. Second, the growth rate of operating income clusters with changes in profit. It is therefore useful to identify common themes of items that load onto the same factor. Since revenue represents the financial throughput of port authorities and the

[3] According to Field (2009) "values of ± 1 represent small effect, ± 3 is a medium effect and ± 5 is a large effect".

term throughput refers in general to the level of productivity of a business it may be implied that first factor suggests the *productivity* of a port authority. However, the Cronbach's α reliability coefficient equals 0.525, which implies that the reliability of the data is 52.5% and the two items poorly measure the same construct. In other words, 52.5% of the variance of the sum of two items is attributed to the "true score". Thus, the remaining 47.5% of variability is explained by the error term. The items that load highly on second factor are operating income and profit and this factor may be labelled *growth*. Though, the reliability of test's scores is very poor (Cronbach's α = 0.505) thus the two entries poorly measure the growth.

Although it may be generally assumed that port performance under economic crisis depends not only on the efficiency of its production (expressed in either monetary or non-monetary terms) but also on their ability to raise the rates of accumulation of their financial capital, low reliability shows low consistency of scores that poorly contribute some unique information. Thus, it is inconclusive whether all port performance indicators measure the ports' performance (or, put another way, unclear whether the data needs to be reduced) since there is a complex interrelationship between the four variables. Analysing the 'Communalities'[4] column in Table 4-9, though, it can be observed that although only the percent of variance within operating income variable explained by the factors jointly is above 0.7 (77.5%), the average communality is 0.695 (2.78/4), which allows keeping all four variables for further analysis[5].

4.4 Factorial ANOVA analysis

The results of factorial ANOVA identify the factors that significantly contributed to the declining growth rates in total cargo traffic handled at ports. Not only provides information about the main effect of each independent variable on the outcome but also estimate the impact of interaction effect between the variables on the output. Because the interaction term consisting of three or more components is difficult to interpret, several analyses with two factors have been performed.

[4] Communality may be interpreted as the reliability of the indicator.
[5] According to Field (2009), p. 662, the Kaiser's rule suggests that the communalities after extraction should be greater than 0.7 and the average communality should exceed 0.6.

Autonomy corrected for Region

The first analysis is to determine whether there are significant main and joint effects of the geographical location of port authorities and their autonomy level on the percentage change in their operational performance. To make this possible, first step was to perform an analysis with *Autonomy* and *Region* as independent variable followed by second step using correction for region to break down the effect of autonomy level. The main results of first step of analysis are presented in Table 4-11.

Table 4-11. Main and interaction effects of autonomy and region

Independent Variable	**Effects**	
	F-statistic	Sig.
Autonomy	.579	.630
Region	6.079	.001
Autonomy*Region	1.472	.196

Dependent variable: Throughput (R^2 = 0.261)

The empirical results show a significant main effect of *Region* on the percentage change of total tonnage handled at ports (*Sig.* < 0.05). Thus, as expected, regions has suffered differently from the economic crisis. In order to provide a clear picture on the difference in operational performance across regions the Helmert contrast[6] (Appendix B) was applied to break down the effect of geographical location on throughput variation. When comparing Europe to all other three regions combined it can be concluded that the difference in percentage change in throughput is not significant (*Difference* = - 2.643, *Sig.* > 0.05). However, this result is misleading because the mean for USA is far lower than the means for Canada and Oceania (Table 4-12), which makes the *Difference* slightly inaccurate.

[6] Helmert contrast is one of the contrasts used the most in SPSS analyses. It means that "each category's (except the last) mean is compared to the mean effect of all subsequent categories combined" (Field 2009, p. 371).

Table 4-12. Average means within autonomy and region

Autonomy		Region	
Category	**Mean***	**Category**	**Mean***
Low	-9.0261	Europe	-9.4064
Moderate	-8.5354	USA	-12.1081
High	-5.9031	Canada	-7.3357
Full	-7.6482	Oceania	1.8974

*Dependent variable: Throughput

This means the percentage changes in throughput were negatively higher in USA than in all other three regions. Put another way, the economic crisis affected the most the total cargo traffic handled at American ports. The Helmert contrast confirms that indeed there is a very significant difference between USA and Canada and Oceania combined (*Difference* = -14.916; *Sig.* < 0.05). Although there is a difference in percentage change in throughput between Canada and Oceania (*Difference* = -6.364; *Sig.* > 0.5), according to Helmert contrast this is not significant. The ports located in Oceania registered, on average, positive percentage changes in their operational performance compared to all other three regions. The Bonferroni *post hoc*[7] test (Appendix B, Table B2-3) strengthens this effect and shows that the differences in percentage changed in throughput between ports located in Oceania and those in all other three continents are positively higher (*Sig.* < 0.05). It can be implied that, although they experienced a challenging year, ports in Oceania kept on delivering pleasant results. Port authorities in Europe and Canada did not significantly differ (*Sig.* > 0.05) and therefore can be concluded that the crisis hit somewhat equally the activity of ports in those two continents.

All in all, the crisis affected the cargo traffic at ports in USA the most followed by Europe, Canada and Oceania. One explanation may be that all the links in trade between the Europe, USA and Canada are more influential than those with Oceania. As mentioned previously, Oceania relies heavily on mining trade that, to their advantage, has been less affected by the crisis. Port of Gladstone, for example,

[7] Post hoc tests "consist of pair-wise comparisons that are designed to compare all different combinations" of the variable' groups. They are part of the output for ANOVA tests and they are similar to the *t*-test performed on each pair of groups (Field 2009, p. 372).

managed to achieve record coal exports for the financial year 2008-2009 with an increase of 5.1% from precedent year, despite the global economic downturn (Port of Gladstone, 2009).

If *Region* significantly influenced the growth rates in total cargo, the autonomy level of port authorities has an opposite main effect. With F test statistics = 0.579 and Sig. > 0.05, the autonomy level of port authorities has no influence on percentage change in total throughput. A correction for region was applied and the effect of autonomy remains a non-influential factor for the percentage change in total throughput handled at ports in all four regions (Table 4-13). It seems that, for the sampled port authorities, the decision-making autonomy did not influence the increase/decrease in amount of cargo passed through their ports in 2009 compared to 2008. This may explain the existence of other external factors such as the negative development in international trade during 2009 that severely reduced the cargo volumes moved through the ports.

Table 4-13. Autonomy main effect by region

	Europe		**USA**		**Canada**		**Oceania**	
	F-stat	*Sig.*	*F-stat*	*Sig.*	*F-stat*	*Sig.*	*F-stat*	*Sig.*
Autonomy	.207	.891	.864	.462	.184	.907	.507	.678

Dependent variable: Throughput

Autonomy corrected for Size

The most important results of this analysis are summarized in Table 4-14 which shows that the port authorities' autonomy and size have no significant main effect on percentage change in throughput (*Sig.* > 0.05 in both cases). Also, there is no significant interaction effect which means that the effect of ports' size on the percentage change in throughput does not depend on the port authorities autonomy level.

When breaking down the effect of size (Appendix B, Table B2-9) interesting result was obtained for small ports. Although not significant (*Sig.* > 0.05) the *Difference* between small ports and all other three categories combined is 4.526.

Table 4-14. Main and interaction effects of autonomy and size

Independent Variable	Effects	
	F-statistic	*Sig.*
Autonomy	.357	.784
Size	.673	.571
Autonomy*Size	1.205	.302

Dependent variable: Throughput (R^2= 0.123)

This is mainly attributable to the small ports with low autonomy levels whose mean is 12.6550, the highest and only positive mean across *Size* categories. Thus, the results show that small ports with state government as their administrative body were the least affected by the crisis implying, to some extent, that the government does play role in limiting the crisis' impacts. It might be also worth mentioning that the majority of small ports with low autonomy levels, within the sample used for this study, are located in Oceania that reported, on average, positive operational performance. For example, Port of Darwin reported an increase with 38% in their throughput due to increase in dry bulk, petroleum and chemicals trade through the port for the fiscal year of 2009 comparing to 2008. Such appealing results led to a correction for size and the test results show a significant interaction effect between autonomy levels and small sized ports (*F-statistic* = 2.733; *Sig.* < 0.05). So, indeed, the effect of port authorities' autonomy level on their throughput performance does significantly depend on whether the port is small sized. For all other three categories, there is not significant main or interaction effect.

With the main results presented above and the information from Table 4-15, which shows that the average means are almost evenly distributed across categories within variables, it can be already concluded that, on average, the level of freedom of ports authorities to make independent decisions does not relate to ports' size. A slightly distinction makes the small sized ports, however the difference is not significant as showed by the Helmert contrast.

Table 4-15. Average means for categories within autonomy and size

Autonomy		Size	
Category	**Mean***	**Category**	**Mean***
Low	-9.0261	Small	-7.1709
Moderate	-8.5354	Medium	-7.2881
High	-5.9031	Large	-8.3387
Full	-7.6482	Very large	-6.3169

*Dependent variable: Throughput

Ownership corrected for Region and Size

It is also motivating to analyze whether the ownership structure had any influence on port operational performance during the crisis. A correction for region will offer a better understanding on whether the public, private and mixed ports responded differently to the economic shocks in terms on their location. The main results of the analysis show a significant main effect of region. There is no main effect of ownership and no interaction effect of the two variables on the throughput's growth rates.

Table 4-14. Main and interaction effects of ownership and region

Independent Variable	Effects	
	F-statistic	*Sig.*
Ownership	.949	.391
Region	5.742	.001
Ownership*Region	1.669	.179

Dependent variable: Throughput (R^2= 0.223)

However, when breaking down the effect of ownership using Helmert contrast the *Difference* in throughput between public and private and mixed port authorities combined equals +3.275. Although not significant (*Sig.* > 0.05), this difference indicates that public ports were performing poorer than private and mixed ports combined. The *Difference* between private and mixed equals – 3.794 and is not significant (*Sig.* > 0.05) however it gives an indication that mixed port authorities performed better than the private ones. A correction for region was applied and the

tests results show no significant differences between public, private and mixed port authorities in terms of cargo traffic performance among regions. However they offer a clue on how ports responded to crisis in terms of their ownership.

Table 4-15. Comparison between port authorities' ownership types among regions in terms of throughput performance

	Europe		**USA**		**Canada**		**Oceania**	
	Diff.	*Sig.*	*Diff.*	*Sig.*	*Diff.*	*Sig.*	*Diff.*	*Sig.*
Public vs Later[8]	-1.765	.526	0.569	.886	1.245	.658	4.659	.113
Private vs Mixed	-1.334	.762	-2.972	.492	1.527	.721	3.316	.413

Dependent variable: Throughput

According to Table 4-15 the public ports, on average, suffered considerable loses in their cargo traffic especially if they were located in USA, Europe and Canada. Oceania's public ports performed much better but this may also be an influence from an overall better performance of ports in Oceania. Ports with a mixed ownership structure come second in the ascending ranking for operational performance with private ports in USA suffering the most followed by European mixed ports. Again, these ports performed quite well in Oceania. Private ports have been hit as well but not as hard as ports with public and mixed administration body. As concluding remark it can be argued that the declining figures in throughput were not in reality affected by the type of the supervisory board of port authorities but varied more with the geographical location of ports.

A correction for size was also applied and no significant differences (Table 4-16) between port authorities' ownership categories were obtained. Although medium sized ports that adopted full privatization seem to be suffering the most (*Mean* = -13.2800) alongside large ports that decided to go public (*Mean* = - 11.7613) the influence of ownership structure on throughput performance remains not significant.

[8] Later refers to the mean of the sequent categories combined ((Mean Private + Mean Mixed)/2).

Table 4-16. Comparison between port authorities' ownership types among size levels in terms of throughput performance

	Small		**Medium**		**Large**		**Very large**	
	Diff.	*Sig.*	*Diff.*	*Sig.*	*Diff.*	*Sig.*	*Diff.*	*Sig.*
Public vs Later	-0.578	.857	0.185	.955	2.923	.326	.016	.996
Private vs Mixed	-1.566	.763	-3.777	.484	1.201	.800	-.063	.990

Dependent variable: Throughput

The highest mean of scores, though still negative, is obtained for large port authorities (*Mean* = - 4.2573) that adopted a mixed ownership structure. Wrapping up, there is not significance evidence that the ownership structure adopted by port authorities plays a role in the variation in throughput performance reported by ports in 2009.

4.5 Kruskal –Wallis analysis

The Kruskal – Wallis non-parametric test results will offer information on how port authorities' financial performance was influenced by the variables already mentioned before.

When analysing the effect of *Region* on the percentage change in financial performance indicators the Kruskal-Wallis test results show that operating income and revenue were, on average, significantly affected by the location of ports ($H(3)_{OI}$ = 11.65, $H(3)_R$ = 9.130, Sig. < 0.05) while profit did not suffer significant changes in its growth rates ($H(3)_{PR}$ = 4.173; *Sig.* > 0.05). Mann-Whitney tests were used to follow up these findings. A Bonferroni correction was applied in order to avoid the occurrence of Type I error more than 5%. This means that the new significance level was obtained dividing 0.05 by the same number as of tests conducted. For *Region* three comparison tests were conducted and the effect size was calculated for each comparison and all the effects have been reported at a 0.05/3 = 0.0167 level of significance. It appeared that percentage changes in revenue (U = 288; r = - 0.297), operating income (U = 297, r = - 0.25) and profit (U = 383, r = - 0.083) were not significantly different between port located in Europe comparing to those in Oceania

(*Sig.* > 0.0167). Moving on, American ports registered significantly lower percentage changes in operating income (U = 137; r = -0.46) and revenue (U = 158; r = -0.40) while percentage changes in profit (U = 192; r = - 0.31) did not significantly differ compared to ports in Oceania. Furthermore, the variation on financial performance for port authorities in Canada did not significantly differ compared to those located in Oceania (Sig. > 0.0167). It can be concluded that if port authorities are located in USA the crisis affected their financial status to a greater extent than ports in all other three regions. The Jonckheere-Terpstra (J-T) test looks for an ordered pattern to the medians of the compared groups. Positive values greater than 1.65 indicate a trend of ascending medians which means that the median get bigger as the value of coding variable gets bigger. If this is applied to *Region*, the J-T's test revealed a significant ascending trend in percentage changes in operating income and revenues: as a port authority was located in Europe, USA, Canada and Oceania the median operating income (J =2131; z = 2.01; r = 0.20) and revenue (J =2234; z = 2.20; r = 0.22) growth rates increased, respectively. The test also revealed no significant trend in profit's variation amongst regions.

As for ownership structure's effect, the financial performance of ports authorities was not, on average, significantly affected by the authorities' decision to go public, private or mix their administrative composition (Sig. > 0.05 in all three cases). Although Mann – Whitney tests were used and a Bonferroni correction has been applied (0.05/2 = 0.025 significance level), none of the comparisons between public, private and mixed port authorities indicated a significant effect on variation of financial figures (Sig. > 0.025). In other words, the percentage changes in operating income, revenue and profit were no different for public and private port authorities compared to those that adopted a public private partnership as governance structure. Even though the J-T test points out a trend of descending medians (the medians of percentage changes in financial indicators get smaller as we go from public to mixed port authorities) it does not represent a significant outcome.

Similar results have been obtained when analysing the effect of *Size, Autonomy* and *Diversification* variables on financial performance of port authorities under difficult economic conditions. Contrasting the theory, the test results showed no significant evidence (*Sig.* > 0.05 in all cases) on the influence of autonomy and diversification

levels on variance of ports' financial performance. Even after applying a correction for region and size the results still showed a non-significant effect of the two variables on financial performance' indicators. Several striking figures in growth rates for all three financial performance indicators among port authorities might have played a role in obtaining such results. For example, Port of Hamburg reported a decrease in their operating income and profit by 1248.92% and 4524.57%, respectively. This huge loss was explained by the changing in the port's financing system that is the elimination of the grants and subsidies for the general infrastructure investments and operational costs at the beginning of 2009. Thus, in the financial year of 2009 these subsidies and grants were not reported as earnings anymore causing the immense loss in their profit and loss accounts. Conversely, Port of Prince Rupert in Canada reported an increase in their operating income and profit by 397.8% and 3089.92%, respectively. Although their revenues increased by 27.5%, the port managed to trim the expenses by 4.6% and their interest in long term debt by 8.1% in 2009 which caused the enormous increase in operating income and profit. Such extreme cases, termed outliers, usually cause the data points to greatly deviate from the mean influencing the accuracy of the statistical test's output. However, even after eliminating such outliers from the data set the relationships between *Diversification*, *Autonomy* and *Size* and the financial performance indicators remained not significant.

4.6 Comparing means analysis

Since the Kruskal-Wallis non-parametric test's output does not include a comparison[9] between levels within variables (in contrast to factorial ANOVA), the results do not offer a clear picture of the variation in financial ports' performance in terms of *Diversification*, *Autonomy*, *Size* and *Ownership*. Keeping in mind that none of the tests performed in previous section produced significant results with respect to above mentioned variables, the 'comparing means' method has been applied in order to gain, at least, an impression on how port authorities differentiated in their financial performance.

[9] In case of significant results (*Region* example) the comparison is preformed separately using Mann-Whitney test and a Bonferroni correction for avoiding the occurrence of Type I error more than 5%.

Diversification

Although all the means are (on average) negative, the statistical output shows that regardless of their diversification level ports performed well in terms of revenues with low diversified ports being least affected and medium diversified ports being the most affected. Ports with medium and high diversification level reported, on average, almost similar declining figures in terms of operating income and profit. Ports with medium diversification level registered the lowest growth rates in profit. Highly diversified ports reported the lowest declining figures in terms of operating income. Overall, financial performance of low diversified ports was the least affected (Appendix B4, Table B4-1).

Autonomy

As for autonomy, all port 'categories performed better in terms of their revenue with lowest performance for port authorities with full autonomy and the highest, though still negative, performance for port authorities with moderate autonomy level. The most affected were port authorities with low decision making autonomy while the least affected were port authorities with high levels of autonomy in terms of both operating income and revenue (Appendix B4, Table B4-2).

Size

All categories of port authorities within *Size* variable managed to achieve higher (positive for small and very large ports) percentage changes in their revenues with very large ports leading followed by small, large and medium ports respectively. The worst performance was observed among small ports in terms of their profit. Large and very large ports registered quite equally high losses in their operating income (Appendix B4, Table B4-3).

Ownership

In context of ownership structure an interesting result has been obtained for public ports. They registered the highest declining figures in terms of operating income and profit but they also performed the best in terms of revenue. Private ports reported the lowest percentage changes in terms of revenues. Mixed ports were least affected, however the financial figures remain negative on average, especially in terms of their revenues (Appendix B4, Table B4-4).

5. CONCLUSIONS, LIMITATIONS & RECOMMENDATIONS

The main challenge throughout this study was to answer the research question searching for specific variables that are held accountable for port authorities' performance under the recent economic crisis circumstances. In the practical setting of port authorities, the general theories on organisations' strategic ability to adapt to difficult economic conditions have been partly contradicted. This statement is based on the results obtained after testing the hypotheses expressed as follows:

Hypothesis	Result
H1: The port authorities' response to economic crisis varies with their geographical location.	Not rejected
H2: There is a strong association between ports' diversification level and their size: the bigger the port the higher the diversification level.	Not rejected
$H2_a$: There is a positive relationship between diversification level of ports and port authorities' financial performance.	Rejected
H3: There is a strong association between port authorities' ownership type and their decision-making autonomy.	Not rejected
$H3_a$: There is a positive relationship between decision making autonomy of port authorities and their both operational and financial performance.	Rejected

Derived from the main findings of this study, the concluding remarks can be divided into two categories: confirmatory and contradictory conclusions.

5.1 Confirmatory conclusions

One of the valuable outcomes of the empirical analysis is that for both port authorities that managed to remain resilient in the face of a challenging global economic environment and those that did not succeed in this respect, the geographical location

turns out to have a significant influence on port authorities' operational and financial performance. This fact was mainly explained by the disparities between regional (expressed in 'continent' terms) economies in terms of concentration of particular industries, amount and direction of exports and availability of land areas. Ports located in regions with exports accounting as large proportion of their output benefit from competitive advantage. However, the links in exports with other regions sensitive to external shocks may put ports in jeopardy. It was empirically demonstrated in chapter 4 that ports located in USA, also considered the "host" of the 2008's financial crisis, suffered the peak loses regarding their operational performance. Since the European Union has the largest bilateral trade with USA it comes as no surprise that European ports scored second at declining operational figures.

A second confirmatory conclusion relates to the strong and positive associations between the two group of variable namely ports diversification level that highly correlated with their and the decision making autonomy being contingent on port authorities' ownership structure.

5.2 Contradictory conclusions

Surprising results have been obtained when analysing whether high diversification levels of ports' activity and high levels of decision making autonomy related to high ability of port authorities to handle the economic crisis. Since both diversification and autonomy levels have been theoretically recognized to constitute two fundamental dimensions that offer port authorities a stable position in times of economic crisis, the practical analysis of sampled port authorities contradicted this theory. Such results bring up questions as it is still difficult to believe that the two factors did not influence the ports' performance at all, in reality, since comprehensive literature elaborated on the positive relationships between the diversification strategy and decision making autonomy and performance.

5.3 Shortcomings of the analysis and recommendations

Although extensive research has been performed in order to answer the research question, there still exist shortcomings to this study. These limitations may explain the

failure in reaching the expected outcome and may be considered as recommendations for further research.

First set of limitations refers to the *measurement* of both dependent and independent variables. When measuring port's performance, choosing a variety of indicators would ease the analysis and help in determining the exact factors that highly correlated with each, hence measure the same construct. This will also lead to more accurate results. Alongside the number of indicators, the figures collected from a larger time spam would better explain the variation in ports' performance indicators. For this study, figures from 2008 and 2009 have been used however port authorities are still in course of recovery after the hit of the economic crisis. Adding figures from 2010 and even 2011 and computing the compounded annual growth rates would improve the understanding on how, in fact, the performance varied across port authorities. Still in conjunction with the measurement of ports' performance indicators it might be worth mentioning that the rearrangement of the financial figures, converting from fiscal year to calendar year due to differences in international financial reporting, created sort of a "hassle" with respect to the comparability of scores within dependent variables. Besides, the rearrangement of data may be the cause of failing the assumption of normality for dependent variables since the variance between scores did not show a homogeneous pattern.

As for independent variables, since they were all categorical, difficulties in determining the exact measurement were encountered. This happened especially when determining the levels of *Diversification* and *Autonomy* variables that are opened to subjectivism if no obvious information is provided.

The second set of limitations relates to the *sample size.* Although 105 port authorities created a satisfactory sample, the Kaiser – Mayer – Olkin (KMO) measure proved that the data was not satisfactory. Expanding the sample would lead to higher KMO values, hence more accurate results. Based on a larger sample, one may be also able to draw conclusions that can induce to creating new assumptions regarding port authorities performance under crisis conditions.

Thus, overall, further research shall give high importance to the measurement of both dependent and independent variables. Alongside measurement, constructing numerical independent variables would unquestionably improve the empirical outcome. For example *Size* variable can also be constructed based on land area under port authorities' jurisdiction. By adding continuous independent variables will facilitate the use of more parametric tests that are believed to have higher power than the non-parametric tests, however this has been never demonstrated (Field, 2009). Further research shall also take into consideration collecting statistics from similar time spam (expressed in terms of either months, quarters or years) to eliminate both the necessity of rearrangement of data and the issue on comparability between scores. The last but not the least, further research shall be oriented towards adding more port authorities to the data.

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Ports Australia: http://www.portsaustralia.com.au/

APPENDICES

APPENDIX A: Sampled port authorities

Europe	USA	Oceania	Canada
ABP	Alabama (Mobile)	Albany	Belledune
Amsterdam	Albany	Auckland	Halifax
Antwerp	Corpus Christi	Brisbane	Hamilton
Barcelona	Duluth	Bunbury	Montreal
Belfast	Galveston	Dampier	Nanaimo
Bergen	Georgia PA (Savannah & Brunswick)	Darwin	Port Alberni
Bilbao	Houston	Fremantle Ports	Prince Rupert
Constanta	Hueneme	Gladstone	Quebec
Copenhagen & Malmo	Jacksonville	Hedland	Saint John N.B.
Cork	Lake Charles	Kembla	Sept Iles
Cyprus	Long Beach	Lyttelton	Thunder Bay
Dublin	Los Angeles	Melbourne	Toronto
Duisburg	Massachusetts (Boston)	Napier	Trois Rivieres
Forth Ports	Miami	Nelson	Vancouver Fraser
Gdansk	New York & New Jersey	Newcastle	
Ghent	Palm Beach	Otago (Dunedin)	
Gijon	Port Everglades	Ports North (Cairns)	
Groningen	Portland	South Port (Bluff)	
Hamburg	San Diego	Sydney	
Harwich	San Francisco	Taranaki	
Helsinki	Seattle	Tasports	
Koper	South Carolina (Charleston)	Tauranga	
Le Havre	Stockton	Townsville	
Lisbon	Tacoma		
London	Tampa		
Milford	Virginia		
Naples			
Oslo			
Piraeus			
Riga			
Rotterdam			
Shoreham			
Sines			
Tallinn			
Tarragona			
Thessaloniki			
Turku			
Tyne			
Valencia			
Venice			
Zeebrugge			
Zeeland Seaports			

APPENDIX B: SPSS tests outputs

B1: Cross tabulations

Table B1-1. Measures for relationship's strength: Region & Diversification

Symmetric Measures

		Value	Asymp. Std. Error[b]	Approx. T[c]	Approx. Sig.	Monte Carlo Sig. Sig.	Monte Carlo Sig. 99% Confidence Interval Lower Bound	Monte Carlo Sig. 99% Confidence Interval Upper Bound
Nominal by Nominal	Phi	.286			.197	.197[a]	.186	.207
	Cramer's V	.202			.197	.197[a]	.186	.207
	Contingency Coefficient	.275			.197	.197[a]	.186	.207
Interval by Interval	Pearson's R	-.264	.092	-2.779	.006[d]	.007[a]	.005	.009
Ordinal by Ordinal	Spearman Correlation	-.271	.092	-2.855	.005[d]	.006[a]	.004	.008
N of Valid Cases		105						

a. Based on 10000 sampled tables with starting seed 2000000.

b. Not assuming the null hypothesis.

c. Using the asymptotic standard error assuming the null hypothesis.

d. Based on normal approximation.

Table B1-2. Measures for relationship's strength: Ownership & Diversification

Symmetric Measures

		Value	Approx. Sig.	Monte Carlo Sig. Sig.	Monte Carlo Sig. 99% Confidence Interval Lower Bound	Monte Carlo Sig. 99% Confidence Interval Upper Bound
Nominal by Nominal	Phi	.109	.870	.862[a]	.853	.870
	Cramer's V	.077	.870	.862[a]	.853	.870
	Contingency Coefficient	.109	.870	.862[a]	.853	.870
N of Valid Cases		105				

a. Based on 10000 sampled tables with starting seed 1149983241.

Table B1-3. Measures for relationship's strength: Size & Diversification

Symmetric Measures

		Value	Asymp. Std. Error[b]	Approx. T[c]	Approx. Sig.	Monte Carlo Sig. Sig.	Monte Carlo Sig. 99% Confidence Interval Lower Bound	Monte Carlo Sig. 99% Confidence Interval Upper Bound
Nominal by Nominal	Phi	.621			.000	.000[a]	.000	.000
	Cramer's V	.439			.000	.000[a]	.000	.000
	Contingency Coefficient	.527			.000	.000[a]	.000	.000
Interval by Interval	Pearson's R	.600	.057	7.610	.000[d]	.000[a]	.000	.000
Ordinal by Ordinal	Spearman Correlation	.597	.059	7.557	.000[d]	.000[a]	.000	.000
N of Valid Cases		105						

a. Based on 10000 sampled tables with starting seed 2000000.

b. Not assuming the null hypothesis.

c. Using the asymptotic standard error assuming the null hypothesis.

d. Based on normal approximation.

Table B1-4. Measures for relationship's strength: Autonomy & Region

Symmetric Measures

				Monte Carlo Sig.		
					99% Confidence Interval	
		Value	Approx. Sig.	Sig.	Lower Bound	Upper Bound
Nominal by Nominal	Phi	.532	.000	.000[a]	.000	.001
	Cramer's V	.307	.000	.000[a]	.000	.001
	Contingency Coefficient	.470	.000	.000[a]	.000	.001
N of Valid Cases		105				

a. Based on 10000 sampled tables with starting seed 1149983241.

Table B1-5. Measures for relationship's strength: Autonomy & Size

Symmetric Measures

				Monte Carlo Sig.		
					99% Confidence Interval	
		Value	Approx. Sig.	Sig.	Lower Bound	Upper Bound
Nominal by Nominal	Phi	.220	.826	.837[a]	.828	.847
	Cramer's V	.127	.826	.837[a]	.828	.847
	Contingency Coefficient	.215	.826	.837[a]	.828	.847
N of Valid Cases		105				

a. Based on 10000 sampled tables with starting seed 1149983241.

Table B1-6. Measures for relationship's strength: Autonomy & Ownership

Symmetric Measures

				Monte Carlo Sig.		
					99% Confidence Interval	
		Value	Approx. Sig.	Sig.	Lower Bound	Upper Bound
Nominal by Nominal	Phi	1.217	.000	.000[a]	.000	.000
	Cramer's V	.861	.000	.000[a]	.000	.000
	Contingency Coefficient	.773	.000	.000[a]	.000	.000
N of Valid Cases		105				

a. Based on 10000 sampled tables with starting seed 1149983241.

B2: Factor analysis

Anti-image Matrices

		Throughput	Operating_ income	Revenue	Profit
Anti-image Covariance	Throughput	.824	-.010	-.288	-.132
	Operating_income	-.010	.874	.013	-.287
	Revenue	-.288	.013	.831	-.123
	Profit	-.132	-.287	-.123	.808
Anti-image Correlation	Throughput	.599[a]	-.012	-.348	-.162
	Operating_income	-.012	.544[a]	.015	-.342
	Revenue	-.348	.015	.592[a]	-.150
	Profit	-.162	-.342	-.150	.594[a]

a. Measures of Sampling Adequacy(MSA)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.709	42.716	42.716	1.709	42.716	42.716	1.437	35.930	35.930
2	1.072	26.797	69.513	1.072	26.797	69.513	1.343	33.583	69.513
3	.614	15.347	84.860						
4	.606	15.140	100.000						

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.586
Bartlett's Test of Sphericity	Approx. Chi-Square	37.221
	df	6
	Sig.	.000

B2: Factorial ANOVA

Autonomy & Region

Table B2-1. Helmert contrast for Region

Contrast Results (K Matrix)

Region Helmert Contrast			Depende…
			Throughput
Level 1 vs. Later	Contrast Estimate		-2.643
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-2.643
	Std. Error		2.835
	Sig.		.354
	95% Confidence Interval for Difference	Lower Bound	-8.274
		Upper Bound	2.988
Level 2 vs. Later	Contrast Estimate		-14.916
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-14.916
	Std. Error		3.677
	Sig.		.000
	95% Confidence Interval for Difference	Lower Bound	-22.219
		Upper Bound	-7.614
Level 3 vs. Level 4	Contrast Estimate		-6.364
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-6.364
	Std. Error		5.563
	Sig.		.256
	95% Confidence Interval for Difference	Lower Bound	-17.412
		Upper Bound	4.684

Table B2-2. Helmert Contrast for Autonomy

Contrast Results (K Matrix)

Autonomy Helmert Contrast			Depende…
			Throughput
Level 1 vs. Later	Contrast Estimate		3.998
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		3.998
	Std. Error		3.844
	Sig.		.301
	95% Confidence Interval for Difference	Lower Bound	-3.638
		Upper Bound	11.633
Level 2 vs. Later	Contrast Estimate		1.250
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		1.250
	Std. Error		4.837
	Sig.		.797
	95% Confidence Interval for Difference	Lower Bound	-8.358
		Upper Bound	10.857
Level 3 vs. Level 4	Contrast Estimate		4.411
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		4.411
	Std. Error		4.042
	Sig.		.278
	95% Confidence Interval for Difference	Lower Bound	-3.617
		Upper Bound	12.438

Table B2-3. Multiple Comparisons between levels within Region

Multiple Comparisons

Dependent Variable:Throughput

	(I) Region	(J) Region	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Europe	USA	2.7016	2.77454	1.000	-4.7799	10.1832
		Canada	-2.0707	3.43126	1.000	-11.3231	7.1817
		Oceania	-11.3038*	2.88414	.001	-19.0809	-3.5267
	USA	Europe	-2.7016	2.77454	1.000	-10.1832	4.7799
		Canada	-4.7724	3.68577	1.000	-14.7110	5.1663
		Oceania	-14.0055*	3.18270	.000	-22.5876	-5.4233
	Canada	Europe	2.0707	3.43126	1.000	-7.1817	11.3231
		USA	4.7724	3.68577	1.000	-5.1663	14.7110
		Oceania	-9.2331	3.76896	.097	-19.3961	.9299
	Oceania	Europe	11.3038*	2.88414	.001	3.5267	19.0809
		USA	14.0055*	3.18270	.000	5.4233	22.5876
		Canada	9.2331	3.76896	.097	-.9299	19.3961

Based on observed means.
The error term is Mean Square(Error) = 123.622.

*. The mean difference is significant at the .05 level.

Table B2-4. Multiple Comparisons between levels within Autonomy

Multiple Comparisons

Dependent Variable:Throughput

	(I) Autonomy	(J) Autonomy	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Low	Moderate	-.4908	3.35902	1.000	-9.5484	8.5668
		High	-3.1230	3.07301	1.000	-11.4094	5.1634
		Full	-1.3779	4.25515	1.000	-12.8520	10.0961
	Moderate	Low	.4908	3.35902	1.000	-8.5668	9.5484
		High	-2.6322	2.64396	1.000	-9.7617	4.4972
		Full	-.8872	3.95645	1.000	-11.5557	9.7814
	High	Low	3.1230	3.07301	1.000	-5.1634	11.4094
		Moderate	2.6322	2.64396	1.000	-4.4972	9.7617
		Full	1.7451	3.71670	1.000	-8.2770	11.7671
	Full	Low	1.3779	4.25515	1.000	-10.0961	12.8520
		Moderate	.8872	3.95645	1.000	-9.7814	11.5557
		High	-1.7451	3.71670	1.000	-11.7671	8.2770

Based on observed means.
The error term is Mean Square(Error) = 123.622.

Table B2-5. Test for Autonomy *Europe

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	593.041[a]	7	84.720	.556	.790
Intercept	4496.814	1	4496.814	29.496	.000
Autonomy	94.714	3	31.571	.207	.891
Europe	159.992	1	159.992	1.049	.308
Autonomy * Europe	113.411	3	37.804	.248	.863
Error	14788.044	97	152.454		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .039 (Adjusted R Squared = -.031)

Table B2-6. Test for Autonomy *USA

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1232.981[a]	6	205.497	1.423	.213
Intercept	5676.317	1	5676.317	39.318	.000
Autonomy	374.418	3	124.806	.864	.462
USA	967.462	1	967.462	6.701	.011
Autonomy * USA	296.838	2	148.419	1.028	.362
Error	14148.104	98	144.368		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .080 (Adjusted R Squared = .024)

Table B2-7. Test for Autonomy *Canada

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	587.923[a]	5	117.585	.787	.562
Intercept	1654.016	1	1654.016	11.069	.001
Autonomy	82.701	3	27.567	.184	.907
Canada	49.976	1	49.976	.334	.564
Autonomy * Canada	383.373	1	383.373	2.566	.112
Error	14793.162	99	149.426		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .038 (Adjusted R Squared = -.010)

Table B2-8. Test for Autonomy *Oceania

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3462.688[a]	7	494.670	4.026	.001
Intercept	890.107	1	890.107	7.244	.008
Autonomy	186.824	3	62.275	.507	.678
Oceania	1571.971	1	1571.971	12.794	.001
Autonomy * Oceania	818.796	3	272.932	2.221	.091
Error	11918.397	97	122.870		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .225 (Adjusted R Squared = .169)

Autonomy & Size

Table B2-9. Helmert Contrast between levels within Size

Contrast Results (K Matrix)

Size Helmert Contrast			Depende…
			Throughput
Level 1 vs. Later	Contrast Estimate		4.526
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		4.526
	Std. Error		3.567
	Sig.		.208
	95% Confidence Interval for Difference	Lower Bound	-2.561
		Upper Bound	11.612
Level 2 vs. Later	Contrast Estimate		-.895
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-.895
	Std. Error		3.535
	Sig.		.801
	95% Confidence Interval for Difference	Lower Bound	-7.919
		Upper Bound	6.128
Level 3 vs. Level 4	Contrast Estimate		-2.224
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-2.224
	Std. Error		3.799
	Sig.		.560
	95% Confidence Interval for Difference	Lower Bound	-9.773
		Upper Bound	5.324

Table B2-10. Multiple Comparisons between levels within Size

Multiple Comparisons

Dependent Variable:Throughput

	(I) Size	(J) Size	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Small	Medium	.1172	3.53578	1.000	-9.4241	9.6586
		Large	1.1678	3.45549	1.000	-8.1569	10.4924
		Very_large	-.8540	3.56617	1.000	-10.4773	8.7694
	Medium	Small	-.1172	3.53578	1.000	-9.6586	9.4241
		Large	1.0505	3.26569	1.000	-7.7620	9.8630
		Very_large	-.9712	3.38259	1.000	-10.0992	8.1567
	Large	Small	-1.1678	3.45549	1.000	-10.4924	8.1569
		Medium	-1.0505	3.26569	1.000	-9.8630	7.7620
		Very_large	-2.0217	3.29858	1.000	-10.9230	6.8795
	Very_large	Small	.8540	3.56617	1.000	-8.7694	10.4773
		Medium	.9712	3.38259	1.000	-8.1567	10.0992
		Large	2.0217	3.29858	1.000	-6.8795	10.9230

Based on observed means.
The error term is Mean Square(Error) = 151.551.

Ownership & Region

Table B2-11. Helmert contrast between levels within Ownership

Contrast Results (K Matrix)

Ownership Helmert Contrast			Depende…
			Throughput
Level 1 vs. Later	Contrast Estimate		3.275
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		3.275
	Std. Error		2.889
	Sig.		.260
	95% Confidence Interval for Difference	Lower Bound	-2.461
		Upper Bound	9.010
Level 2 vs. Level 3	Contrast Estimate		-3.794
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-3.794
	Std. Error		4.123
	Sig.		.360
	95% Confidence Interval for Difference	Lower Bound	-11.978
		Upper Bound	4.390

Table B2-12. Multiple Comparisons between levels within Ownership

Multiple Comparisons

Dependent Variable:Throughput

	(I) Ownership	(J) Ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Public	Private	-.2965	3.65925	1.000	-9.2128	8.6198
		Mixed	-1.8232	2.39488	1.000	-7.6587	4.0123
	Private	Public	.2965	3.65925	1.000	-8.6198	9.2128
		Mixed	-1.5267	3.86994	1.000	-10.9564	7.9030
	Mixed	Public	1.8232	2.39488	1.000	-4.0123	7.6587
		Private	1.5267	3.86994	1.000	-7.9030	10.9564

Based on observed means.
The error term is Mean Square(Error) = 124.471.

Table B2-13. Helmert contrast between levels within Region (Ownership)

Contrast Results (K Matrix)

Region Helmert Contrast			Depende…
			Throughput
Level 1 vs. Later	Contrast Estimate		1.017
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		1.017
	Std. Error		3.072
	Sig.		.741
	95% Confidence Interval for Difference	Lower Bound	-5.080
		Upper Bound	7.115
Level 2 vs. Later	Contrast Estimate		-8.789
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-8.789
	Std. Error		3.337
	Sig.		.010
	95% Confidence Interval for Difference	Lower Bound	-15.413
		Upper Bound	-2.165
Level 3 vs. Level 4	Contrast Estimate		-15.161
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-15.161
	Std. Error		4.945
	Sig.		.003
	95% Confidence Interval for Difference	Lower Bound	-24.976
		Upper Bound	-5.346

Table B2-14. Tests for Ownership*Europe

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	466.084[a]	5	93.217	.619	.686
Intercept	3455.046	1	3455.046	22.933	.000
Ownership	121.462	2	60.731	.403	.669
Europe	140.001	1	140.001	.929	.337
Ownership * Europe	35.044	2	17.522	.116	.890
Error	14915.001	99	150.657		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .030 (Adjusted R Squared = -.019)

Table B2-15. Tests for Ownership*USA

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	865.103[a]	4	216.276	1.490	.211
Intercept	4592.659	1	4592.659	31.639	.000
Ownership	62.619	2	31.310	.216	.806
USA	691.987	1	691.987	4.767	.031
Ownership * USA	1.917	1	1.917	.013	.909
Error	14515.982	100	145.160		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .056 (Adjusted R Squared = .018)

Table B2-16. Tests for Ownership*Canada

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	80.208[a]	3	26.736	.176	.912
Intercept	2761.566	1	2761.566	18.229	.000
Ownership	80.205	2	40.103	.265	.768
Canada	6.772	1	6.772	.045	.833
Ownership * Canada	.000	0	.	.	.
Error	15300.877	101	151.494		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .005 (Adjusted R Squared = -.024)

Table B2-17. Tests for Ownership*Oceania

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3184.655[a]	5	636.931	5.170	.000
Intercept	1028.137	1	1028.137	8.346	.005
Ownership	325.617	2	162.809	1.322	.271
Oceania	1260.083	1	1260.083	10.228	.002
Ownership * Oceania	624.406	2	312.203	2.534	.084
Error	12196.430	99	123.196		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .207 (Adjusted R Squared = .167)

Ownership & Size

Table B2-18. Tests between Ownership and Size

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	622.706[a]	11	56.610	.357	.969
Intercept	3495.884	1	3495.884	22.029	.000
Size	44.238	3	14.746	.093	.964
Ownership	52.678	2	26.339	.166	.847
Size * Ownership	483.182	6	80.530	.507	.801
Error	14758.380	93	158.692		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .040 (Adjusted R Squared = -.073)

Table B2-19. Ownership corrected for small ports

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	88.533[a]	5	17.707	.115	.989
Intercept	2426.165	1	2426.165	15.706	.000
Ownership	25.299	2	12.650	.082	.921
Small	.232	1	.232	.002	.969
Ownership * Small	12.231	2	6.115	.040	.961
Error	15292.552	99	154.470		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .006 (Adjusted R Squared = -.044)

Table B2-20. Ownership corrected for medium ports

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	157.412[a]	5	31.482	.205	.960
Intercept	2661.386	1	2661.386	17.307	.000
Ownership	95.106	2	47.553	.309	.735
Medium	40.958	1	40.958	.266	.607
Ownership * Medium	83.915	2	41.958	.273	.762
Error	15223.673	99	153.774		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .010 (Adjusted R Squared = -.040)

Table B2-21. Ownership corrected for large ports

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	475.603[a]	5	95.121	.632	.676
Intercept	2760.542	1	2760.542	18.335	.000
Ownership	233.323	2	116.661	.775	.464
Large	1.863	1	1.863	.012	.912
Ownership * Large	351.900	2	175.950	1.169	.315
Error	14905.482	99	150.560		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .031 (Adjusted R Squared = -.018)

Table B2-22. Ownership corrected for very large ports

Tests of Between-Subjects Effects

Dependent Variable:Throughput

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	309.735[a]	5	61.947	.407	.843
Intercept	2503.203	1	2503.203	16.443	.000
Ownership	.026	2	.013	.000	1.000
Very_Large	12.079	1	12.079	.079	.779
Ownership * Very_Large	199.432	2	99.716	.655	.522
Error	15071.350	99	152.236		
Total	21012.216	105			
Corrected Total	15381.085	104			

a. R Squared = .020 (Adjusted R Squared = -.029)

B3: Kruskal – Wallis test

Region

Test Statistics[b,c]

			Operating_ income	Revenue	Profit
Chi-square			11.653	9.130	4.173
df			3	3	3
Asymp. Sig.			.009	.028	.243
Monte Carlo Sig.	Sig.		.007[a]	.027[a]	.253[a]
	99% Confidence Interval	Lower Bound	.005	.023	.242
		Upper Bound	.009	.031	.264

a. Based on 10000 sampled tables with starting seed 2000000.

b. Kruskal Wallis Test

c. Grouping Variable: Region

Jonckheere-Terpstra Test[b]

			Operating_ income	Revenue	Profit
Number of Levels in Region			4	4	4
N			100	102	100
Observed J-T Statistic			2131.000	2234.000	1945.000
Mean J-T Statistic			1807.500	1870.500	1807.500
Std. Deviation of J-T Statistic			160.529	165.044	160.529
Std. J-T Statistic			2.015	2.202	.857
Asymp. Sig. (2-tailed)			.044	.028	.392
Monte Carlo Sig. (2-tailed)	Sig.		.043[a]	.028[a]	.386[a]
	99% Confidence Interval	Lower Bound	.038	.023	.374
		Upper Bound	.049	.032	.399
Monte Carlo Sig. (1-tailed)	Sig.		.022[a]	.013[a]	.193[a]
	99% Confidence Interval	Lower Bound	.018	.010	.183
		Upper Bound	.025	.016	.203

a. Based on 10000 sampled tables with starting seed 2000000.

b. Grouping Variable: Region

Diversification

Test Statistics[b,c]

			Operating_ income	Revenue	Profit
Chi-square			2.660	1.281	1.593
df			2	2	2
Asymp. Sig.			.265	.527	.451
Monte Carlo Sig.	Sig.		.271[a]	.532[a]	.454[a]
	99% Confidence Interval	Lower Bound	.259	.519	.442
		Upper Bound	.282	.545	.467

a. Based on 10000 sampled tables with starting seed 562334227.

b. Kruskal Wallis Test

c. Grouping Variable: Diversification

Jonckheere-Terpstra Test[b]

			Operating_ income	Revenue	Profit
Number of Levels in Diversification			3	3	3
N			100	102	100
Observed J-T Statistic			1507.000	1581.000	1581.500
Mean J-T Statistic			1662.500	1727.500	1662.500
Std. Deviation of J-T Statistic			157.870	162.536	157.869
Std. J-T Statistic			-.985	-.901	-.513
Asymp. Sig. (2-tailed)			.325	.367	.608
Monte Carlo Sig. (2-tailed)	Sig.		.336[a]	.369[a]	.614[a]
	99% Confidence Interval	Lower Bound	.323	.357	.601
		Upper Bound	.348	.382	.626
Monte Carlo Sig. (1-tailed)	Sig.		.168[a]	.184[a]	.306[a]
	99% Confidence Interval	Lower Bound	.158	.174	.294
		Upper Bound	.177	.193	.318

a. Based on 10000 sampled tables with starting seed 562334227.

b. Grouping Variable: Diversification

Autonomy

Test Statistics[b,c]

			Operating_ income	Revenue	Profit
Chi-square			1.022	4.156	1.852
df			3	3	3
Asymp. Sig.			.796	.245	.604
Monte Carlo Sig.	Sig.		.801[a]	.255[a]	.610[a]
	99% Confidence Interval	Lower Bound	.791	.243	.597
		Upper Bound	.811	.266	.622

a. Based on 10000 sampled tables with starting seed 2000000.

b. Kruskal Wallis Test

c. Grouping Variable: Autonomy

Jonckheere-Terpstra Test[b]

			Operating_ income	Revenue	Profit
Number of Levels in Autonomy			4	4	4
N			100	102	100
Observed J-T Statistic			1749.000	1754.000	1773.500
Mean J-T Statistic			1672.500	1758.500	1672.500
Std. Deviation of J-T Statistic			156.364	161.637	156.363
Std. J-T Statistic			.489	-.028	.646
Asymp. Sig. (2-tailed)			.625	.978	.518
Monte Carlo Sig. (2-tailed)	Sig.		.640[a]	.983[a]	.522[a]
	99% Confidence Interval	Lower Bound	.627	.980	.509
		Upper Bound	.652	.987	.535
Monte Carlo Sig. (1-tailed)	Sig.		.323[a]	.497[a]	.266[a]
	99% Confidence Interval	Lower Bound	.310	.484	.254
		Upper Bound	.335	.510	.277

a. Based on 10000 sampled tables with starting seed 2000000.

b. Grouping Variable: Autonomy

Size

Test Statistics[b,c]

			Operating_ income	Revenue	Profit
Chi-square			2.286	3.540	.679
df			3	3	3
Asymp. Sig.			.515	.316	.878
Monte Carlo Sig.	Sig.		.519[a]	.317[a]	.882[a]
	99% Confidence Interval	Lower Bound	.506	.305	.874
		Upper Bound	.532	.329	.890

a. Based on 10000 sampled tables with starting seed 92208573.

b. Kruskal Wallis Test

c. Grouping Variable: Size

Jonckheere-Terpstra Test[b]

			Operating_ income	Revenue	Profit
Number of Levels in Size			4	4	4
N			100	102	100
Observed J-T Statistic			1872.000	2032.000	1987.500
Mean J-T Statistic			1870.000	1944.500	1870.000
Std. Deviation of J-T Statistic			162.209	167.053	162.208
Std. J-T Statistic			.012	.524	.724
Asymp. Sig. (2-tailed)			.990	.600	.469
Monte Carlo Sig. (2-tailed)	Sig.		.993[a]	.606[a]	.467[a]
	99% Confidence Interval	Lower Bound	.991	.593	.455
		Upper Bound	.995	.618	.480
Monte Carlo Sig. (1-tailed)	Sig.		.496[a]	.307[a]	.231[a]
	99% Confidence Interval	Lower Bound	.483	.295	.220
		Upper Bound	.509	.319	.242

a. Based on 10000 sampled tables with starting seed 92208573.

b. Grouping Variable: Size

Ownership

Test Statistics[b,c]

			Operating_ income	Revenue	Profit
Chi-square			.212	2.398	.204
df			2	2	2
Asymp. Sig.			.899	.302	.903
Monte Carlo Sig.	Sig.		.901[a]	.303[a]	.900[a]
	99% Confidence Interval	Lower Bound	.894	.291	.893
		Upper Bound	.909	.314	.908

a. Based on 10000 sampled tables with starting seed 215962969.

b. Kruskal Wallis Test

c. Grouping Variable: Ownership

Jonckheere-Terpstra Test[b]

			Operating_ income	Revenue	Profit
Number of Levels in Ownership			3	3	3
N			95	102	94
Observed J-T Statistic			1260.000	1330.000	1286.000
Mean J-T Statistic			1250.000	1457.500	1230.000
Std. Deviation of J-T Statistic			136.473	152.532	134.629
Std. J-T Statistic			.073	-.836	.416
Asymp. Sig. (2-tailed)			.942	.403	.677
Monte Carlo Sig. (2-tailed)	Sig.		.947[a]	.404[a]	.674[a]
	99% Confidence Interval	Lower Bound	.941	.391	.662
		Upper Bound	.952	.417	.686
Monte Carlo Sig. (1-tailed)	Sig.		.476[a]	.206[a]	.339[a]
	99% Confidence Interval	Lower Bound	.463	.195	.327
		Upper Bound	.489	.216	.351

a. Based on 10000 sampled tables with starting seed 215962969.

b. Grouping Variable: Ownership

B4: Comparing means

Table B4-1. Comparing means between Diversification and financial performance indicators

Operating_income Revenue Profit * Diversification

Diversification		Operating_ income	Revenue	Profit
Low	Mean	-25.8341	-1.1683	-27.6353
	N	34	35	34
	Std. Deviation	165.47041	22.83963	169.18034
Medium	Mean	-34.9175	-5.1653	-42.6854
	N	28	30	28
	Std. Deviation	97.25378	20.87568	113.87722
High	Mean	-33.9494	-3.6146	-42.5719
	N	33	37	32
	Std. Deviation	80.89800	8.50761	109.60870
Total	Mean	-31.3303	-3.2313	-37.2031
	N	95	102	94
	Std. Deviation	120.72329	18.14309	134.08289

Table B4-2. Comparing means between Size and financial performance indicators

Operating_income Revenue Profit * Size

Size		Operating_ income	Revenue	Profit
Small	Mean	-30.0314	.3714	-56.8623
	N	22	22	22
	Std. Deviation	106.35692	20.83398	150.47783
Medium	Mean	-24.3825	-10.0419	-15.3457
	N	24	26	23
	Std. Deviation	84.65415	23.91863	121.14819
Large	Mean	-35.7504	-2.7945	-48.9152
	N	26	29	27
	Std. Deviation	188.81234	12.54796	163.03925
Very_large	Mean	-34.8261	.1748	-26.0209
	N	23	25	22
	Std. Deviation	58.13625	12.30334	86.32603
Total	Mean	-31.3303	-3.2313	-37.2031
	N	95	102	94
	Std. Deviation	120.72329	18.14309	134.08289

Table B4-3. Comparing means between Autonomy and financial performance indicators

Operating_income Revenue Profit * Autonomy

Autonomy		Operating_ income	Revenue	Profit
Low	Mean	-53.6807	-4.7700	-53.8479
	N	14	16	14
	Std. Deviation	101.87563	17.77533	157.41452
Moderate	Mean	-29.5450	-1.3939	-48.5578
	N	28	28	27
	Std. Deviation	101.28055	11.66108	124.59726
High	Mean	-26.2398	-1.9926	-24.5298
	N	43	47	43
	Std. Deviation	148.66084	20.29736	138.66186
Full	Mean	-26.9280	-10.9627	-37.7380
	N	10	11	10
	Std. Deviation	48.86729	22.41020	117.56760
Total	Mean	-31.3303	-3.2313	-37.2031
	N	95	102	94
	Std. Deviation	120.72329	18.14309	134.08289

Table B4-4. Comparing means between Ownership and financial performance indicators

Operating_income Revenue Profit * Ownership

Ownership		Operating_ income	Revenue	Profit
Public	Mean	-41.8413	-.4798	-46.9567
	N	55	58	54
	Std. Deviation	143.74182	15.91079	133.93468
Private	Mean	-26.9280	-10.9627	-37.7380
	N	10	11	10
	Std. Deviation	48.86729	22.41020	117.56760
Mixed	Mean	-13.5277	-5.4900	-19.4683
	N	30	33	30
	Std. Deviation	86.49571	19.78752	141.69653
Total	Mean	-31.3303	-3.2313	-37.2031
	N	95	102	94
	Std. Deviation	120.72329	18.14309	134.08289