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# Financial Statement Disclosure of Carbon Footprint Costs in the Airline Industry

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Abstract

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CPA, Institute of Chartered Professional Accountants, 2012

MBA, York University, 1998

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CMA, Society of Management Accountants, 1989

Dissertation Submitted in Partial Fulfillment

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Abstract

Unaccountable corporate polluters profit short term at the expense of global economic sustainability. The purpose of this study was to determine if carbon dioxide ($CO_2$) penalties on the airline emissions would result in financial statement disclosure and emission mitigation. Contributing to environmental accounting, the study was based in corporate social responsibility with a conceptual framework based on economically-centered $CO_2$ studies. A random sample of 69 global airlines, taken from the International Air Transport Association (IATA), and the International Civil Aviation Organization (ICAO) memberships, was stratified between EU bound and non-EU bound airlines. The research questions explored (a) the frequency mean differences in disclosed $CO_2$ costs between the strata based upon the European Union's environmental trading scheme (EU-ETS) and (b) whether international financial reporting standards (IFRS) influenced the financial statement reporting of $CO_2$ emissions costs. Financial statement data was analyzed in a 3-year longitudinal, ex-post, quasi-experimental, repeated measures factorial ANOVA and ANCOVA, pretest-posttest control group design. The results showed significant $CO_2$ disclosure differences between the experimental (EU bound) airlines and control group (non-EU) airlines and for those airlines with IFRS prepared statements, indicating that government regulation was needed for the disclosure of pollution costs. These results should convince accounting practitioners that the quantification and reporting of greenhouse gas pollutions can become the catalyst for improved operations and commercial sustainability. Positive social change to mitigate anthropogenic pollution should result and should promote normative accounting practice to hold those responsible to a higher global accountability.

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Dedication

To my mother, Mildred Jones-Tuck, for her steadfast example.

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# Chapter 1: Introduction to the Study

Anthropogenic pollution is destroying the earth's life sustaining systems and the species that currently live on the earth (Gaglemann & Hansjurgens, 2002; Hopwood, 2009; Janmaat & Braun, 2009; Kolk, Levy, & Pinkse, 2008; MacKenzie, 2009; Smale, Hartley, Hepbur, Ward, & Grubb, 2006). The European Union (EU) has taken the initiative to quantify the anthropogenic destruction caused by the greenhouse gas (GHG) carbon dioxide ($CO_2$) and to penalize the polluters. This EU action was pursued within the EU obligations under the Kyoto Accord's specific pollution reduction targets and to promote a social paradigm shift to pollution responsibility. The EU has penalized airline corporations that used any EU airspace for their $CO_2$ emissions. I analyzed an empirical research problem regarding corporate disclosure of the costs of carbon pollution on the financial statements (FS) of responsible airline corporations under this EU regulatory intervention. The background to the study provided in Chapter 1 includes the underlying problem examined and the purpose of this study. The theoretical foundations and design frameworks that I referenced, as well as the rationale for the design chosen, are discussed along with any assumptions and limitations that might have occurred within this investigation.

## Background to the Study

During the 250 years since the Industrial Revolution began, the anthropogenic destruction of the earth's natural resources and the corresponding pollution into earth's atmosphere has been increasing, with approximately 50% of that pollution produced in just the last 40 years (Ajani et al., 2013; Denman et al., 2007; Gaglemann & Hansjurgens,

2002; Janmaat & Braun, 2009; Kolk et al., 2008; Venmans, 2012). This anthropogenic destruction is anticipated to double again before 2025, during which time some scientists have determined that the weather patterns and therefore land masses, vegetation, and earth's species will change dramatically due to climate warming from atmospheric pollution (Ajani et al., 2013; Perrow, 2011; Power, 2011; Suzuki & Hanington, 2012). The airline industry currently contributes approximately 2% of the GHGs that promote anthropogenic atmospheric pollution (International Panel on Climate Change [IPCC], 1999). Across the globe many companies and their home countries are more interested in profit, short-term gain, and raising or maintaining standards of living, and they are in the process of destroying the earth's ability to sustain life (Perrow, 2011; Preston, Lee, & Hooper, 2012; Pritchard & MacPherson, 2004). Financial statements are the global vehicle upon which all economic decisions and activity depend (Graham, Harvey, & Rajgopal, 2005). For sustainable global economics, financial statement information is the engine of change.

There was little researched evidence in the literature of disclosed $CO_2$ costs on corporate income statements or balance sheets, whether voluntary or compulsory, in environmental accounting, or in the realm of corporate social responsibility (CSR) research. Several authors discussed environmental accounting from a management accounting perspective (Bagliani & Martini, 2012; Burritt, 2004; Christ & Burritt, 2013; Gray & Bebbington, 2000; Tsai et al., 2012; Vasile & Man, 2012) and others have created software packages for modeling the cost components of anthropogenic pollution (Protogeros, Vontas, Chatzikostas, & Koumpis, 2011) that may be reported on either

management accounting or financial accounting statements. Several frameworks have been put forward by accounting practitioners and researchers for what should be included in a full costing system. This costing system would include the anthropogenic pollution cost of the earth's biomass, geosphere, and oceanic water (Ajani et al., 2013; Matisoff et al., 2012; Tsai et al., 2012). Still others, such as Malina et al. (2012) and Venmans (2012), have created theoretical arguments on the validity of the EU's environmental $CO_2$ penalty trading scheme. However, there is a gap in the quantitative research literature on evidence of pollution footprint inclusion on financial statements even in the footnotes and notations (Andrew & Cortese, 2011).

While International Financial Reporting Standards (IFRS) are struggling to set out what will be acceptable to the global accounting community for pollution cost reporting, there has been little evidential research to prove compliance or the framework used in the calculations. This lack of evidence remained even when some form of regulation was put in place such as in Australia and Europe (Choi, Lee, & Psaros, 2013; Pedersen, Neergaard, Pedersen, & Gwozdz, 2013; Stubbs, Higgins, & Milne, 2012). Allowable additional costs on income statements should result in less corporate tax; however, the political stigma of disclosing pollution might have been a barrier. The EU presented an opportunity to discover if regulation and legislation can make a positive difference in a paradigm shift to disclosure of pollution costs.

## Problem Statement

A problem exists while unaccountable corporate polluters, such as those in the airline industry, profit short term at the expense of global economic sustainability, that is

threatened by escalating ecosystem destruction costs and human health costs (Brown, Dillard, & Marshall, 2009; Dillard, 2010; Henriques & Richardson, 2012; Hopwood, 2009). Although some accounting frameworks and legislations currently exist, such as the EU-ETS and IFRS, no quantitative evidence existed to show whether the members of the airline industry had incorporated those pollution costs into their formal income statements and therefore had accepted the transparent economic consequences for this pollution, such as profit or loss (O'Dwyer, Owen, & Unerman, 2011; Pedersen et al., 2013; Perrow, 2011; Stechemesser & Guenther, 2012; Uddin & Holtedahl, 2013). Despite the Kyoto and Copenhagen Accords (2005, 2009), within which many countries agreed to specific polluting GHG target reductions, researchers have shown that environmental accounting will happen only with a consistent framework and individual country legislation (Archel, Husillos, & Spence, 2011; Alrazi, de Villiers, & van Staden, 2010; Ball & Craig, 2010; Power, 2011). Authors have provided limited studies on environmental cost reporting (Apergis, Eleftheriou, & Payne, 2013; Turner, Munday, McGregor, & Swales, 2012; Vasile & Man, 2012); however, I found no current published studies on the financial statement disclosure of carbon pollution costs in the airline industry. In this study, I provided quantitative data on the incidence of carbon pollution costs in the financial statements of airline corporations to show whether the EU intervention (EU-ETS) and/or the IFRS guidelines would support corporate compliance and normative accounting practice to create pollution conscious social change.

## Purpose of the Study

The purpose of this quantitative quasi-experimental study was to analyze the intervention effectiveness of the EU-ETS carbon pollution scheme for the airline industry. This analysis was done in order to provide evidence of carbon cost disclosure and corporate accountability for anthropogenic pollution. Two strata within the airline industry were considered and compared: those airline corporations that were subject to the EU-ETS intervention legislation (EU-bound airlines), and those airline corporations who were not subject to the EU-ETS intervention legislation (non-EU bound airlines). I examined whether there was a causal relationship on the formal financial statements of the mandated airline corporations due to the EU-ETS intervention (the independent variable) by comparing EU-destined airlines' carbon pollution cost reporting (the dependent variable) on their financial statements with the non-EU destined airlines that were not under any similar mandate. IFRS, a further independent variable, might also have been a factor in the reporting treatment of carbon costs and, therefore, financial statements were also analyzed for IFRS cost reporting (a dependent variable).

The financial statements were analyzed for the various accounting treatments and the method of costing being reported by the airline industry. In the analysis, I recorded the frequency of reporting of these costs, and any inference that was apparent for changes to accounting database systems to collect and report these costs from the management discussion and analysis (MD&A) section or footnotes. Detailed information on all variables in this study is discussed in the Research Design section of Chapter 3.

## Research Questions and Hypotheses

The research questions of interest in this study were as follows.

Research Question 1: To what extent is there a difference in the frequency means for reporting carbon footprint costs between the EU bound airlines and the non-EU bound airlines?

Research Question 2: Do international financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations?

The research questions were translated into the following hypotheses:

Hypothesis 1:

$H_0$: $\mu_1 = \mu_2$. On average there is no difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

$H_1$: $\mu_1 \neq \mu_2$. On average there is a difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

Where $\mu_1$ is the average number of carbon credit or debit or penalty accounting disclosures on the financial statements of the Group 1, EU mandated airlines, and $\mu_2$ is the average number of accounting disclosures on the financial statements of the Group 2, non-EU mandated airlines.

The statistical methodology to test Hypothesis 1 was an ANCOVA that compared three independent population means, that is, a comparison of average carbon cost disclosures between EU resident airlines, EU bound airlines, and non-EU mandated

airlines. In this comparison the differences in the reporting of carbon costs on the financial statements of global corporate airlines was measured, classified by carbon credit or EU-ETS terminology.

Hypothesis 2:

$H_0$: $\mu 1 = \mu 2$. International financial reporting standards do not influence the reporting of carbon emissions costs on the financial statements of airline corporations.

$H_1$: $\mu 1 \neq \mu 2$. International financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations.

Where $\mu_1$ is the average number of IFRS allowable carbon emissions accounting references disclosed on the financial statements of IFRS country airlines and $\mu_2$ is the average number of IFRS allowable carbon emissions accounting references disclosed on the financial statements of non-IFRS country airline corporations.

The statistical methodology to test Hypothesis 2 was an ANOVA that compared two independent population means, that is, a comparison of average carbon cost disclosures between IFRS country airline corporations and non-IFRS country airline corporations, as classified by the allowable, but not environment specific, IFRS treatment sections for financial statements.

## Theoretical Foundation

Underlying the disclosure of carbon pollutants on financial statements were regulatory constraints, political priorities, and corporate behavioral actions, all of which reflect social value systems. This report included several theories that informed this

study; agency theory, the systems theories that include; complexity, political economic theory, stakeholder, and legitimacy, as well as operant behavior theory.

**Agency Theory**

Eisenhardt (1989) explained agency theory's contractual foundation as discussing two problems, the divergent goals of the principal and agent and the failure of the principal to be able to validate what the agent was doing. This goal divergence may unfortunately lead to goal congruence with some stakeholders and not others. Agents, their employer principals, stakeholders, and regulatory authorities as well as the earth's natural systems of resources are altogether part of a larger system of economics and commerce as reflected in FS and as such the general systems theory, complexity theory, and its subordinate theories are also discussed.

**Systems Theories**

According to Chan and Nunamaker (1991), a system is a set of interconnected activities that forms a whole. Accounting is a system of interrelated statements that are created out of a set of interconnected double entry transactions representing economic activity. Von Bertalanffy (1968) was credited with the general theory that any system cannot be studied as isolated component parts; inquiry must consider the influencers and environments holistically. Anderson (1999) used the term *complexity theory* to describe the complex interactions of organizational adaptation to its ever changing environment. This section presents a cascade of related system theories, focusing on one subset, political economy theory (PET), and its subordinates, legitimacy theory and stakeholder

theory. Operant behavior theory #2 from Reynolds (2007) and Skinner (1978) completes this section.

Similar to the interdependencies within the earth's biological environments are the economic operations activities, actions, and reactions of companies and their management as they strive to satisfy regulators, their shareholders, and their own personal agendas (Deegan & Unerman, 2011; Hahn, 2007). The politics within an industry as a whole may use collective strength to force beneficial economic sanctions. Adding more complexity are the politics involved in disclosing pollution costs and perhaps the technologies or strategies to meet pollution targets as these may pose a risk to proprietary information that companies decide not to take (Matisoff, Noonan, & O'Brien, 2012).

Weaver (1948) and other authors including Anderson (1999) discussed complexity theory as the need to manage multiple, diverse, and possibly interrelated forces simultaneously. In order to be flexible and adaptable to meet these changing needs and demands, a corporation should integrate algorithmic risk probability models within its strategic planning along with continuous landscape monitoring by employees or agents (Anderson, 1999). To facilitate this needed knowledge, the organization's logistic systems for product transference as well as its business information systems for data gathering and reporting must be efficient and effective. The airline industry faces complex continuing challenges in cost structure and pricing in response to fierce competition, as well as rigid safety expectations and increasing pressure from environmental concerns (Pritchard & MacPherson, 2004).

Political economy theory as a subsidiary of complexity systems theory, according to Gray et al. (1996), provides a framework for human life that is simultaneously economic, social, and political. Jevons (1871) wrote that as humans we remain politically aware and must balance the economic impacts of our actions to be perceived as acceptable to that society and its politics. Bebbington, Larrinaga, and Moneva (2008) described this perception in corporate actions as reputation risk management. The disclosures that entities choose to make on their FS may be legislated; however, other voluntary disclosures according to Gray et al., are part of their public relations strategy—their politics. I continued this complexity discussion with two subset theories, those of legitimacy theory and stakeholder theory. These theories are concerned with CSR and the public perception of behavior in adherence to an organization's economic, social, and political environment.

Following Hurst (1970) and legitimacy theory, according to Gray et al. (1996), social and ethical adherence, or that perception, of an entity to its society's expectations and value system is a social contract and creates legitimacy for that entity. According to Bebbington et al. (2008), Ebrahim and Weisband (2007), and Gray et al., accounting reporting, disclosure, and audit practice have become legitimizing tools, part of a corporate strategy to manage relationships and perceptions. Lindblom (1994) described four organizational strategies to win this perception: (a) make actual changes, (b) put forward an education or awareness information for the public, (c) associate with some recognized symbol of legitimization, or (d) adjust the public perception through public relations (PR) campaigns. Although these PR expenses, for example in the oil and gas

industry, are recorded on the FS, the costs of the underlying social and environmental damage may not be (Levy & Kolk, 2002; Ungerer, Tavitian, & Boutin, 2005; Wagenhofer, 2011; Winer, 2003).

The perception of legitimacy is a powerful organizational motivation and investors and all stakeholders have a vested interest and can be a power in a corporation's actions. In 1984, Freeman's stakeholder theory presented the many and varied details of parties who would be interested in the health of a corporation. In 1970, Hurst (as cited in Deegan & Unerman, 2011) described the power of the investing and regulatory stakeholders as a more imminent power over the organization than societal expectations. A corporation's financial reporting, their extent of disclosure, along with the audit firm which verified the corporate reporting, resulted as much from the corporate managers' personal agendas as the necessity to maintain the entity's perceived investment reputation within the larger society (Darnall, Seol, & Sarkis, 2009; Freeman, 1984; Healy & Palepu, 2001).

The stakeholders in the airline industry included many who depended upon the profitability of the airlines and also many who desired the reduction of GHG emissions. These included the UN in its global mandate to reduce anthropogenic pollution, responsive local governments, environmental groups, and individual citizens. The profit seekers were not only the shareholders who expected dividends from profit taking, but also the employees who earned salaries, the country governments who wanted tax revenues, and auditors who verified the financial reports.

**Operant Behavior Law #2**

The cost disclosure actions of corporate management to maintain government and stakeholder relations, was also the subject of operant behavior law. Operant behavior law #2 (Reynolds, 2007; Skinner, 1978) was foundational to this study as it states that companies will comply (i.e., respond positively and report carbon costs) if previous changes in regulatory demands in accounting or other disclosures actually came to be enforced by authorities consistently on a continual basis. If previous enforcement was intermittent or inconsistent, operant law #2 states that compliance will not happen or will happen haphazardly. Further information on these theories as they supported this study is discussed in Chapters 2 and 5.

## Nature of the Study

This study was a longitudinal, quasi-experimental causal process form (Reynolds, 2007) with the classic experimental design of compared groups, pretest-posttest control group design (Campbell & Stanley, 1963). Through this analysis, the frequency of reported carbon costs, across EU and non-EU bound airlines, was counted and supported the comparison of the results between these groups. A factorial mixed model repeated measures ANOVA, two tailed analysis was used as well as an ANCOVA to include for the EU-ETS and IFRS interventions. The public financial statements of airline corporations were analyzed through a modified Guttman frame to determine the number and accounting type of disclosures of this carbon emission cost data.

The contrasted groups design type model was used as I observed intact groups over two independent variables in a longitudinal study over the 3-year period beginning

September 2011 (Frankfort-Nachmias & Nachmias, 2008) and assessed whether the average cost disclosure scores had differed meaningfully over the time frame. Campbell and Stanley (1963) outlined the pretest-posttest control group design comparison model that would be appropriate for this type of study as it was expected that the EU bound and EU resident airlines would be a compliant experimental group with the EU-ETS mandate, while the non-EU bound airlines was the control group and under no requirement from the EU authority.

## Definitions

Presented are the explanations of the source of the independent variables as well as further accounting definitions of the dependent variables and their possible corresponding or referenced EU, IFRS, IAS, ISO, UN, or SEC regulatory sections and other important acronyms. Please note that IAS, the parent of IFRS standards, continues to update its IAS sections in conjunction with IFRS changes.

*European Union Environmental Trading Scheme (EU-ETS):* A threshold of carbon emissions was established in 2003 and amended to include for airlines by directive 2008/101/EC (European Commission, 2011). Directive 2009/450/EC detailed the interpretation of aviation activities to be included. These activities included the tonne-kilometer (TKm) reporting of any flight in or out of an EU airport with pollution penalties for any airline exceeding its carbon benchmark 2008-2010 averages. Allowance credits were to be issued to each airline to cover its benchmark and additional credits could be earned by companies who put in place specific pollution reducing green projects. Airlines who exceeded their initial credit allowance could acquire carbon credits

from other companies or industries (EU, 2013). Should this ETS not be activated due to IATA or non-EU country political pressure, the EU was expected to impose carbon emissions penalty costs on airline corporations using EU airspace (EU, 2013).

As context to the EU-ETS, the international community had agreed at United Nations Framework Convention on Climate Change (UNFCCC) meetings that global warming must be kept below 2 degrees C compared to the preindustrial times that meant no more than 1.2 degrees C above current temperatures. The EU stated the growth in GHG must completely stop by 2020 at the latest, and that polluters must reduce the atmospheric GHG by 50% of 1990 levels by 2050, and must continue to cut GHG thereafter (http://ec.europa.eu/clima/policies/brief/eu/index_en.htm). EU members in 2004 (15 members) agreed to reduce collective emissions to 8% below 1990 from 2008-2012. By 2020 the EU has committed to cutting emissions to 20% below 1990 levels (EU, 2013). The EU has stated that if other countries will do their fair share, the EU may be able to commit to 30% below 1990 levels by 2020 (EU, 2013).

Although the EU-ETS trading scheme was not set to commence until January 1, 2012, under the EU-ETS, aircraft operators who flew into the EU were required to monitor and report their $CO_2$ emissions from January 1, 2010. This requirement applied to all aircraft operators with connections to Europe, who were required to report their carbon emissions to the relevant authority of the EU country assigned to them. By March 31 every year, these carbon emissions must be independently verified and reported.

*International Accounting Standard (IAS) 8*: Accounting policies, changes in accounting estimates and errors (and pertains to any IFRS after 1 January 2012). IAS 8

prescribes the criteria for changing accounting policies as well as the accounting and disclosure treatment of changes in accounting estimates and the correction of previous accounting errors (IFRS, 2012).

*IAS 36*: Impairment of assets. In keeping with IFRS 9, IAS 36 prescribes the disclosure and treatment for recording the loss or gain in value of an asset such that its balance sheet carrying value is its recoverable value through use or sale of the asset (IFRS, 2012).

*IAS 37*: Provisions, contingent liabilities, and contingent assets. BDO (2013) describes IAS 37 as prescribing the measurement and treatment for:

- Provisions: recording of a liability of uncertain timing or amount,
- Contingent liability: recording of a possible obligation in the future,
- Contingent asset: recording of a possible asset that may be held in the future.

International Financial Reporting Interpretations Committee (IFRIC), (2004), Part of IFRS which stated that an allowance was an intangible asset and governed by IAS 38, while emission cap and trade schemes gave rise to liabilities and were provisions that should follow IAS 37 (IFRIC, 2004, p. 7).

Possible carbon pollution penalties may be recorded as a contingent liability or the expectation of being allowed carbon credits due to some change in operations may be recorded as a contingent asset.

*IAS 38:* Intangible assets—contingent pricing of property, plant, and equipment and other intangible assets. Defined as “an identifiable nonmonetary asset without

physical substance" (IASB, 2005, p. 2227). As previously noted in IAS37, IFRIC (2004) stated that allowances were intangible assets (IAS38) while emission cap and trade schemes may be liabilities and were provisions of IAS 37 (IFRIC, 2004). In keeping with IAS 39 for the recording of financial instruments (such as carbon credits) and IAS 16, for property, plant, and equipment (PP&E), IAS 38 recognized that any estimated timing or financial outflow changes to the value of an intangible asset such as might happen from the decommissioning, restoration, or other changes should be recorded as deducted from or added to the asset value in the current period. The adjustment would not however, exceed the carrying cost of the asset and the new value must be a fully recoverable reality amount in accordance with IAS 36 (IFRS, 2012). Referenced in Apergis et al. (2013).

*IAS 39*: Financial instruments: recognition and measurement. The standard defines a "contract that gives rise to both a financial asset of one entity and a financial liability or equity instrument of another entity" (IASB, 2005, p. 2219). In keeping with IFRS 9 for FMV asset recording, IAS32 for financial instrument presentation, IAS 38 and IAS 16 for PP&E, standards were amended July 2013 to ensure that any change in asset value was reflected in the asset valuation on the balance sheet (IFRS, 2012).

*IAS Interpretation Article 3 (IFRIC 3)*: Emission rights set policies for carbon-related transactions which dictated how carbon credits would be accounted for. An allowance received without cost by an industry company or investment bank are intangible assets. IFRIC (2004) stated that an allowance was an intangible asset and governed by IAS 38, while emission cap and trade schemes gave rise to liabilities and were provisions that should follow IAS 37 (IFRIC, 2004, p. 7). This interpretation was

widely challenged as contradictory and amended in July, 2013. See IAS 20, 37, 38, and 39.

*IAS 41*: Fair market value reporting. This provides guidance for agricultural activity accounting including the measurement of biological assets at FMV minus the costs to sell. IAS 41 gives direction for both bearer biological assets (the parent from which a crop is taken such as, a cow, a grape vine etc.) as well as consumable biological assets (the milk, the grapes etc.). Further discussions on making bearer assets part of IAS 16 (PP&E) are ongoing. See also IFRS 9. See Bolivar and Galera (2007) which reflected IAS 41 for the FMV of biological assets.

*International Financial Reporting Standard* (IFRS) *5*: Noncurrent assets held for sale and discontinued operations. Noncurrent assets that are held for sale and not being used up by the business in daily operations should be classified separately in the current asset section of the balance sheet and should not be depreciated. To be included in current assets, the *noncurrent asset held for sale* must be available for immediate sale and there must be a high probability of its being sold within the current fiscal year of this classification. EU carbon credits may fall into this category.

*IFRS 6*: Exploration for and evaluation of mineral rights. This standard provides guidance for the expense recognition on the income statement of mining and mineral exploration and evaluation activities. It also includes for the balance sheet recognition of exploration and evaluation assets which may be termed current or capital assets dependent upon the life expectancy.

*IFRS 9*: Assets are required to be recorded/updated at fair market value (FMV) and previously offsetting assets and liabilities are to be disclosed separately. See also IFRS 7, IAS 32, 39, and 41.

*International Standards Organization (ISO) 14001*: As part of the ISO 14000 standards for management of the processes to affect positive environmental change, the 14001 is a set of standards by which an organization can design and implement a rigorous environmental management system. ISO14001 sets up and is used more specifically by the EU Eco-Management and Audit Scheme (EMAS). In this, the processes detailing administrative, material and performance improvement, as well as regulatory and legal reporting compliance standards are very strict.

*ISO 14044*: As part of the ISO14000 standards for the management of the processes to affect positive environmental change, 14044 encompasses techniques to assess the UNFCCC Scope 2 and 3 environmental impacts for the life cycle of products (LCA), (i.e., from raw material extraction, transportation, manufacture, distribution, usage, maintenance, through to disposal).

*ISO 14064*: As part of the ISO14000 standards for the management of the processes to affect positive environmental change, 14064 includes GHG emission monitoring tools that organizations may use to quantify, report, and allow verification of the GHG emissions by stakeholders such as governments, geographic regions, or other organizations.

*Land use, land use change, and forestry* (LULUCF): Under the UN framework convention on climate change, the LULUCF covers anthropogenic activity regarding

GHG emission sinks of soil, trees, plants, biomass, and timber. This includes both the removal of GHGs into the sinks and the destruction of the sink that generates emissions release. Referenced in Ajani et al. (2013). Although the Kyoto Protocol (Article 3.3) had recognized the GHG effects of afforestation and deforestation in 1990, on July 8, 2013 the UNFCCC formally recognized these sinks as part of the GHG equation (EU/Climate action, 2013). Fresh and salt water sinks and their destruction have yet to be recognized.

*U.S. Securities and Exchange Commission (SEC):* The Sarbanes-Oxley Act and the 2004 Government Accountability Office (GAO) report; Environmental disclosure: GOA recommended the SEC provide greater scrutiny of environmental disclosures. The SOX (15 U.S.C & 7266(a)) requires the SEC to conduct regular reviews of disclosures by certain classes of corporations (Lidstone, Miller, & Joseph, 2013). Because undisclosed environmental risks impair investor's decision making, the SEC requires public filings to include for disclosure of environmental liabilities. According to Lidstone et al. (2013) the extent of disclosure compliance is unknown.

*Third assessment report (TAR)*: climate change 2001): Third in a series of IPCC environment assessment reports (i.e., SAR: second assessment report, 1995 and FAR: fifth assessment report, 2013). All assessment reports may be viewed at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1.

*UN Intergovernmental panel on climate change (UN—IPCC*): A committee of the UN, the IPCC includes over 600 authors from 32 countries who frequently publish assessment reports on climate change imperatives. They provide criteria and calculation

methods for GHG inventories (IPCC, 2012). Referenced in Stechemesser and Guenther (2012).

IPCC carbon stock and flow definitions and GHG annual report. Referenced in Ajani et al. (2013)

*United Nations Framework Convention on Climate Change (UNFCCC):* Scope 1, 2, and 3 emissions classifications. Referenced in Ajani et al. (2013) and Stechemesser and Guenther (2012).

**Other Important GHG and Accounting Frameworks**

*Clean Development Mechanism (CDM):* CDM are project based green schemes meant to generate carbon credits (not cap and trade schemes) from projects that will reduce emissions below the level they would have emitted without the project. Countries like China that were evolving economies could create projects in their industries that generate CDM credits, certified emission credits (CERs) and sell those to other countries or companies (Mackenzie, 2009).

*Global Warming Potential (GWP)*: A calculated metric by formula designed by the UN intergovernmental panel on climate change (IPCC) and a department of Harvard University. It is a calculation that includes the life of various gases, its molecular weight, and its infrared absorption rate (MacKenzie, 2009).

*International financial reporting interpretations committee (IFRIC*): A subsidiary body of the International Accounting Standards Board (IASB). Mackenzie (2009) stated that IFRIC (2004, p. 19) determined that emission rights "were an instrument that must be delivered in order to settle the obligation that arises from emission" and they were not

an allowance that conferred the right to emit polluting gases. Emission rights are viewed by IFRIC as an asset.

The definitions and acronyms in this study represented many political and global organizations concerned with the growing threat from GHG and loss of ecosystems and resources. With these important definitions presented, outlined in the next section was the potential for any weaknesses in the study and the mediation of those weaknesses.

## Assumptions

In this section, the details of the assumptions of truth and completeness in secondary data sources are detailed. In the study, it was assumed that the intervention of the EU in its demand for carbon emissions reporting from affected airline corporations would be continued henceforth and provided the population frame and the representative sample. The affected airlines have been reporting their emissions in order to set a benchmark since 2010, and the EU resident airlines have been reporting under the EU-ETS cap and trade scheme since January 2012. IFRS compliance was assumed for those airlines resident in IFRS adopted countries and for which formal FS were audited annually by competent professional auditors. The financial statements, which provided the raw data, were assumed to be truthful and compliant with the GAAP regimes in which they were involved.

Additionally, the membership listings of IATA in conjunction with the ICAO and EU-ETS listings were assumed to comprise a complete airline corporation frame as members of the airline industry would want to be involved and part of the powerful lobby group that speaks for the airline corporations globally. The EU listing of affected airlines

and the reported carbon emission data to the EU was assumed to be an error free listing. It would be of critical importance to the EU that they have their numbers reporting correctly both for the trading scheme metrics themselves and more importantly, to support the reputation of the EU and their reporting requirements as being complete and truthful.

## Scope and Delimitations

### Scope of the Study

A random sampling of airline corporations was considered from the airline industry population and their anticipated reporting of carbon emission costs on their corporate financial statements. In order to provide evidence of regulatory compliance and its commercial profit effect, the study was designed to continue and expand upon the research of both corporate social responsibility scholars and of the environmental accounting scholars. These research areas have been increasingly concerned with climate warming and the disclosure of GHG emission activities by polluting organizations.

### Delimitations

My environmental accounting literature review revealed no studies into the airline corporation's disclosure of carbon emissions costs. As GHG and climate warming are becoming critical issues, this study was conceived for this industry as an objective within the environmental accounting discipline. As the scope of this carbon emissions cost reporting study was limited to airline corporations, the complete population frame comprised the ICAO listing in conjunction with the IATA and EU-ETS airline corporation listings of all airline companies which had an operating code and that flew

anywhere in the world. The random sample within the population frame allowed generalizability of the results.

Using the EU-ETS airline reporting data base, this frame was initially divided between those who are required to report (Group 1) and those who are not (Group 2). From within each of these two population groups, a random sample of 64 corporations was chosen as per the G power calculation, Figure 1 in Chapter 3. Their corporate status was confirmed and the availability of formal, audited, financial statements was assured. Until a full statistical sample of corporations within the groups had been met, further randomly chosen airlines from the groups continued until a full sample complement was reached for the study which was expanded to 69 to include for possible mortality over the study time frame. The independent variables in the study had been chosen in order to investigate the effect of an ETS or emissions penalty cost and the IFRS intervention upon the actions of these groups of airline participants.

The cost reporting of these two independent variables fell under a number of sub-categories particular to the ETS or penalty scheme, the IFRS and IAS financial reporting guidelines, the SEC regulations, and the ISO environmental recording processes. The dependent variables were the frequency of the participant's reported costs under one or many of these subcategories. The study was bound by the availability of the airline corporation's publicly available yearend financial statements and the analysis of the financial statements was completed by me, a professionally designated CPA and CMA accountant, and verified by another professional accountant.

## Limitations

The design and methodology was constructed based upon an intervention by EU regulatory authorities. Should the EU have rescinded this mandated disclosure of carbon pollution costs or not enforced their demands with appropriate penalties, compliance by any of the airlines and this study might have been jeopardized. However, EU resident airline corporations remained within the regulation from January 2012 regardless of any International Civil Aviation Organization decision to refuse compliance. As stated in the instrumentation section, the potential design and/or methodological weaknesses of the study may have been internal from experimental mortality, maturation, extreme scores, and selection bias or externally from multiple treatment interference (Campbell & Stanley, 1963).

A further limitation might have been that of the time frame for the study. A time frame that included more years after the intervention date would have provided more raw data to show potential changes over time. However, the airline industry had known of the EU requirement of the reporting of carbon emissions since 2005 and had been taking the necessary steps to gather and report these data during those 7 years. The 3-year time frame of this study included the year-end financial statements from 2011, 2012, and 2013, which showed the year previous to the intervention and two subsequent years and therefore provided meaningful data.

### How the Weaknesses Will Be Addressed

There were many regulatory and industry changes that might have occurred in this evolving carbon emissions environment. It was unknown if any of the sample airlines

would have ceased to fly into the EU or ceased to exist over the 3-year time frame and therefore experimental mortality was controlled for by increasing the sample size. The increased percentage in the sample size was determined by analyzing the shrinkage of publicly traded airlines from the EU and from the world population over the previous 5 years. Selection bias was controlled for by random selection of the participants within the experimental and control groups while regression analysis in the ANCOVA and ANOVA controlled for extreme observances. Multiple treatment interference was controlled for by understanding the other independent variables and their timing effect on the participants such as IFRS or XBRL or ERP changed requirements. However, it was expected that IFRS and XBRL changes would affect all the population equally if they were introduced.

As the industry changed in response to the EU-ETS, it was expected that participant maturation would take place if the EU enforced their regulation. With regard to the EU rescinding or airlines refusing to participate, the EU resident airlines did participate from January 1, 2012 and other airlines had been preparing for this eventuality since 2008. There was no delay in the scheme start for non-EU airline corporations flying into the EU, and the sample was drawn initially as outlined with results that showed mandated compliance against nonmandated compliance over the period.

**Threats to Validity and How Potentially Addressed**

Internal validity refers to the assignment of causes to effects (Cook & Campbell, as cited in Yu & Ohlund, 2010). In this airline study, the intervention of the imposed cost reporting to the EU was outside of my control, and there were other extenuating circumstances affecting the cost of carbon pollution beyond this intervention such as the

price of oil and the financial collapse of 2008 and its aftermath effects. These threats were mitigated by providing discussion on contributing variables by analyzing the notes to the financials for all sample participants for indications of these and other common complicating factors. As well, current news, websites, and periodicals were analyzed for the airline industry and for the EU reporting authority.

Random assignment of the sample participants within each of the EU and non-EU airlines also helped to minimize the threat to internal validity. Experimental mortality was minimized by including for more participants in the sample than were statistically required. Selection maturation was expected to occur as a reality of the airlines involved being required to report to the EU and installing better cost gathering database programs. This was the sophisticated database and accounting competence, or lack thereof that the study looked for.

Experimenter bias might have been present in the rationale for the inferences of the collected numbers. Additional readers/experts were consulted for their views. Other measurement errors resulting in risks to validity might have been from different analysts looking at the financial statements and recording incorrectly or not finding the data which was there within those statements (Frankfort-Nachmias & Nachmias, 2008). Repeated testing was not a problem as there was no risk of sensitization of participants.

Generalized results of this study may or may not have been valid for the airline industry as a whole, which would have added risk to external validity. A statistically significant sample size of 64 calculated through G power software was initially drawn and then increased for mortality. Statistical analysis and random sampling through the

entire IATA/ICAO/EU frame ensured that a proper statistical sample was employed to represent the underlying population and further mitigate external validity risk.

## Significance of the Study

### Significance to Theory

One small aspect of the costs of the carbon emissions pollution was highlighted in this study and demonstrated support for both prior theory and future practice. This study was affected by a complexity of political, economic, and social pressures that drove a change within the design itself. Two groups of participants were transitioned into three groups. The additional group (Group 2) lobbied for and received a postponement midstudy and the Group 1 participants complied until they too won postponement in April 2014. Data analysis shown in Chapter 4 evidenced a decline in disclosures from the Group 2 in 2013 once they were no longer under the EU-ETS mandate. Until those postponements and to maintain their legitimacy perception, the groups were compliant to legislation which supported prior research that the government intervention was required.

Many representations of agency theory were present throughout the study. The EU government intervened in the airline industry as agents of the people of the EU to attempt to reduce the pollution in their sovereign states. The UN Kyoto accord was the catalyst the EU agreed to as representatives of their people. IATA as agents of the airline industry lobbied successfully with ICAO on the airline's behalf to postpone the penalty EU-ETS. As discussed in Chapter 5, operant behavior theory was also significant as airlines from China and the United States took behavior stances of wait and see when

faced with alternative orders from home country legislation that conflicted with the EU-ETS.

**Significance to Practice**

The evidence from this quantitative study added to the work of environmental accounting and social researchers worldwide who have pointed theoretically to why the pollution of the earth must stop. Much more quantitative literature from the accounting academics was needed to convince and prove to accounting practitioners that these costs can be calculated and that there is an economic benefit to disclosure of these costs on the financial statements. Research may also help to highlight the obstacles that must be addressed in becoming compliant and to show that other organizations were complying and making a difference. It is only with a combination of accounting academic researchers and practitioners that there will be a change to the current financial reporting standards.

The accounting pollution dialogue must be normalized. With increased evidence and attention to these pollution costs as well as highlighting the ability or desire of companies and citizens to calculate and report these costs, other people may be moved to change their attitudes and their actions. This transformation would reflect an adjustment in the current approach to the generation of profit at the expense of the destruction of natural resources, and therefore promote further positive social change.

**Significance to Social Change**

Economic considerations as portrayed on financial statements move the holders of wealth in the world to make decisions and perhaps to change operating behavior. Until an

economic argument is made or accountability is mandated for the costs of pollution, all the impassioned concern for the health of the environment and around the real costs of pollution will not create a change for finding better methods of energy. If these real and growing pollution costs are not disclosed on financial statements, polluting will continue to grow and destroy the interdependent ecosystems, which support the earth and all life.

## Summary and Transition

Chapter 1 included the outline of the basic problem facing the continuance of life on earth as a result of anthropogenic pollution, the accounting profession's role in pollution cost reporting, and therefore the purpose of this study. Until there is an economic effect on the polluters for their pollution of the earth, there will be little mitigation of the destruction of the life-sustaining systems that are presently under threat of collapse (Gaglemann & Hansjurgens, 2002; Hopwood, 2009; Janmaat & Braun, 2009; Kolk et al., 2008; MacKenzie, 2009; Smale et al., 2006). Chapter 1 also included this study's background where due to worldwide concern over rapidly changing climates caused by anthropogenic pollution, the UN has been encouraging and supporting pollution mitigation schemes for the past 2 decades. In its accountability for the earth's survival, the EU, in accordance with its self-imposed Kyoto Accord obligations, had created a cap-and-trade carbon emission trading scheme as well as an alternative carbon emissions penalty plan for the airline corporations that fly into EU airspace to calculate and disclose their carbon emissions.

In Chapter 1, the international financial reporting standards were introduced which have given accounting practitioners some guidance for the recording of these

carbon emission credits on the formal financial statements of organizations. Although there had been limited quantitative studies to this time, the major underlying theories were introduced and some previous studies methods were highlighted that supported the design of this study. As the purpose of this study was to investigate the carbon emissions cost disclosure on the financial statements of the mandated airline corporations compared with the nonmandated airlines, the internal and external validity considerations were also introduced along with the limitations that may have been present and their mitigation.

In Chapter 2, I expand on both the underlying theories of this study and the previous important literature that had been produced over the most recent 5 years. Chapter 3 follows with details of the research design that was used, as well as the details of the methods to secure a representative population sample, the data sources, and the data collection instrument. Also in Chapter 3, the plan for data analysis is discussed in detail along with any potential threats to reliability and validity. In Chapter 4, the results of the analysis are displayed and explained. In Chapter 5, the results are discussed in relation to the literature review and the theoretical base and describe how this research expands environmental accounting practice and contributes to positive social change. My recommendations for further research opportunities conclude Chapter 5.

# Chapter 2: Literature Review

Short-term commercial profit and the life sustaining systems of the planet are in conflict, and the earth's ability to endure further anthropogenic pollution is now compromised (Brown et al., 2009; Dillard, 2010; Henriques & Richardson, 2012; Hopwood, 2009). In Chapter 1, I discussed some of the real costs of pollution in terms of biospheric, hydrospheric, and atmospheric destruction that are not being calculated, recorded, or reported on the drivers of all economic decisions, the financial statements of the offending organizations. The EU initiated carbon dioxide pollution penalties in the airline industry in order to promote reduction from this source of pollution and the IFRS accounting standards have been improved to record these pollution penalties. It has also been shown that without economic consequence for this pollution such as expenses on financial statements, the responsible organizations would have no impetus to change their destructive behavior (O'Dwyer, Owen, & Unerman, 2011; Pedersen et al., 2013; Perrow, 2011; Stechemesser & Guenther, 2012; Uddin & Holtedahl, 2013).

To date there have been limited studies that provided evidence of pollution cost reporting on financial statements (Apergis et al., 2013; Turner et al., 2012; Vasile & Man, 2012) while published articles decry the need for quantitative studies on environmental accounting and the information systems to gather and report these data (Ajani, Keith, Blakers, Mackey, & King, 2013; Di Giacomo, Guthrie, & Farneti, 2012; Frias-Aceituno, Rodríguez-Ariza, & Garcia-Sánchez, 2012; Milne, Ball, & Gray, 2008; Stechemesser & Guenther, 2012). The EU-ETS intervention for airline emission disclosure, which was described in Chapter 1, provided a new research opportunity to determine whether there

was a causal relationship for carbon costs being recorded and reported on the corporation's financial statements. Therefore, in Chapter 2, I review some of the current literature in carbon accounting, in carbon pollution, and in other industries that are relevant to this study. The supportive theories introduced in Chapter 1 are expanded and the design methods are outlined from other recent studies that I used in this investigation.

## Literature Search Strategy

The search was conducted on the following key words: *carbon, pollution, accounting, financial statements, environmental, green, management accounting, carbon trading, EU-ETS, airlines,* and *triple bottom line* in various combinations and sequences using the Science Direct database, SAGE Premier, and Google Scholar. The search was limited to peer-reviewed articles published within the last 5 years; however, some older yet relevant and informative articles to the topic were also used. Some examples of research journal databases that were searched included the following: *Accounting, Business Strategy and the Environment; Accounting, Organizations and Society; Critical Perspectives on Accounting; Ecological Economics; Environmental Development; Environmental Policy and Law; European Accounting Review; European Environment; International Journal of Business and Management; International Journal of Comparative Sociology; Journal of Cleaner Production; Journal of Theoretical Accounting Research; Organizations and Society; Long Range Planning; Oxford Review of Economic Policy; Journal of Air Transport Management;* and *Sustainability Accounting and Accountability.*

This field of pollution investigation in the airline industry was very innovative and dynamic. Countries and industries were politically involved on a daily basis in mitigating or maneuvering to improve their financial positions and public image within their complex environments. Those environments included sustained profit with traditionally narrow margins versus pollution destruction of their raw material resources, management of all stakeholders, and legislation to reduce pollution (Porter, 1980; Wensveen, 2010). Therefore, several EU and airline industry websites such as Airwise.com, ICAO.int/environmental.com, Tranportenvironment.org, ec.europa.eu/clima, the National Business Aviation Association (NBAA.org), World Green Aviation Council (WorldGAC.org), and Cembureau.eu for EU-ETS information provided additional insights and current news updates to the published studies.

## Theoretical Foundation

The political or public relations stigma to an organization of disclosing the future costs to the planet of its polluting behavior may have been an imposing barrier (Hillary, 1999). In the context of the earth's ability to sustain life, the complexity of the stakeholders affected by an organization expands to include all species of the earth. The theories that supported this study were therefore complex and considered the organizations and their management decisions, their public image to attract investment, their operational responses to environmental mandates, and the general interwoven and interdependency of all systems, including commerce, of this earth. Continued from the Chapter 1 introduction and historical basis of these theories, in this following section, the theories of agency, complexity, political economy theory, stakeholder, legitimacy,

operant behavior, and general systems are discussed as they related to this particular study.

**Agency Theory**

According to agency theory, a person (the agent) acting for or on behalf of another (the principal) should be in complete goal congruence with the principal. However, Eisenhardt (1989) explained that in a complex political environment the two may have divergent goals, and further that the principal may not be in a position to monitor or validate the agent's actions (Archel et al., 2011; Funnel & Wade, 2012; Humphrey et al., 2011; Power, 2009). Managers of organizations make decisions based upon many complex marketing factors, and rely upon financial statements (both past performance and pro forma) to determine the most profitable course for their organization. As such, these managers act as agents for their organization's stakeholders. These managers may also act in accordance with their own personal agenda, morals, and attitudes, as well taking their own personal reputation and livelihood into consideration (Power, 2011). Government employees, elected bodies, global organizations, and employees of every organization may be considered agents not only of their own organizations or constituents, but could in a larger sense be considered agents of the earth itself.

The decisions made by management in gathering pollution cost data may be considered risk management on behalf of their organization. The disclosure of those costs publicly is a consideration that has political and profit ramifications. The role of an agent can therefore be a conflicted one; corporate versus personal versus the common good.

According to a former chairman of General Electric, Owen D. Young (as cited in Vasudev, 2013) on Young's personal conflict:

> It makes a great difference in my attitude toward my job as an executive officer of the General Electric Company whether I am a trustee of the institution or an attorney for the investor. If I am a trustee, who are the beneficiaries of the trust? To whom do I owe my obligations? (p. 1)

Financial auditors of the airline corporations will also find themselves as agents of many stakeholders. These auditors may be government or regulatory auditors owing congruence with the laws and regulations of both their own geographic jurisdictions and of the EU. They may be employed by the corporations themselves and owe congruence with not only their own professional code of ethics and practice, but to the corporate management who hired them and who may continue to employ them in the future. In all cases, agents may be the simultaneous agents of different stakeholders and also part of the global commerce system.

**Systems Theories**

Agency theory describes an interconnected system between two people but in a larger sense, these two people are part of many personal and professional interconnecting systems. Von Bertalanffy (1968) theorized that all systems interconnect and are interdependent with each other. One organization's financial statements may appear as a system within themself and yet their receivable and payable accounts as well as their shareholder accounts reflect concrete ties to a much broader system of interactions and interdependencies. As such, the financial statements of one organization represent the

interconnected balance between the organization and its commercial environment. The information within an organization's financial statements affects the operational decisions made within the organization and the external decisions made by investors, clients, suppliers, and government auditors on behalf of the country's population, all interconnected in a flow of goods, services, and monetary valuation.

All of the ecosystems of the earth are also interconnected with each other in a balance of give and take. The life sustaining ecosystems of the earth not only provide the natural resources that are exploited for profit, but also the natural resources to provide food, water, and oxygen to the human power exploited for profit. Financial statements have, to this point, not considered the full extent of the costs to the interconnected systems of the planet in their reporting or decision making (Brown et al., 2009; Dillard, 2010; Henriques & Richardson, 2012; Hopwood, 2009; O'Dwyer, Owen, & Unerman, 2011; Pedersen et al., 2013; Perrow, 2011; Stechemesser & Guenther, 2012; Uddin & Holtedahl, 2013). However, in the complexity of the interconnected systems of commerce and the resources of the earth, the disclosure of these costs may be considered critical so that decision making organization management may reduce these costs and mitigate the destruction of the resource. The disclosure of the costs and the burden of the ecosystem destruction expense of airline carbon emissions was the topic of this study.

According to Weaver's (1948) complexity theory, the complexity of the pressures facing an organization to perform profitably, to appear as a good corporate citizen, and to appear as a respected employer may also be a conflicted role (Anderson, 1999; Weaver, 1948). To become and remain successful, the organization must be adaptable to its

complexity of interacting dynamic pressures and uncertainty. To do this an organization applies risk management techniques that include forecasted analysis of what-if scenarios by empowered employees who engage in collaborative information sharing and strategy fulfillment as a team. Within an adaptive organization, there may be an ordered or a chaotic response to perceived risk. The ordered response is dependent upon a set of governing rules within which each employee knows their part and limitations. In the chaotic adaptive organization, there is formal tracking of results through analysis of the adaptive actions taken.

To remain successful in such a complexity of forces requires technology that allows human interaction in asynchronous or synchronous mode, which will depend upon the corporate structure and the risk management strategy taken. Airline's information systems need to provide instant operational data on issues of mechanical fitness, airplane availability, communications systems, personnel, weather, passenger and freight loading, fuel and food provisioning, destination slot and baggage handling availability, as well as air traffic control (ATC) restrictions. These are in addition to strategic considerations within the profit or loss equation, and existing or evolving regulations such as the EU-ETS. There is also a complexity of dynamic forces that affect the economics of climate warming and all of the global stakeholders.

As society gains knowledge of the earth's vulnerability from pollution generated by the practices of corporate profit taking, pressure from investors beyond the making of profit is becoming a critical issue. In today's business environment organizations are faced with the five forces of competition as described by Porter (1979), that is, the threat

of new competitors or substitute products, the power of supplier and customers, and the competition within an industry. They also now face rapidly changing technology enhancements and the destruction of their raw materials. Information on polluted and diminishing water resources, loss of carbon sinks and oxygen producing forests, loss of species, the takeover by invasive species with no natural predators, and the depletion of corporate material resources, should be considered in the risk management of organizations which depend upon earth's natural resources.

Adding further complexity to the organizational climate and pressure to respond is seen in the power of investor's demands for environmental information. Large institutional investors with trillions of dollars to invest are seeking stable, viable companies to support. Pollution penalty legislation that may reduce a company's profit or the loss of future raw material availability is a looming threat that investment houses must consider. The SEC's SOX legislation introduced in Chapter 1 and in the SEC 2010 and 2011 risk factor disclosure requirements are further operational factors that are regulated to be calculated, compiled, and disclosed to maintain investor and regulatory compliance.

IFRS guidelines as well as country specific accounting GAAP such as FASB (FAS topic 450, formerly FAS 5) in the United States are changing to include for environmental cost disclosure. The large institutional investment houses looking for corporations with long term environmental strategies have made demands on previously documented polluting industry members, such as Exxon, and on the SEC to ensure compliant disclosure and to validate the information (Davis Polk, 2011; McCarthy,

2013). With the EU-ETS intervention, the SEC disclosure requirements, along with IFRS guidance on how to account for these environmental risks, the disclosure of many airlines' carbon emissions on financial statements should have been assured. However, studies had shown that proof of compliance remained an issue (Archel, Husillos, & Spence, 2011; Alrazi, de Villiers, & van Staden, 2010; Ball & Craig, 2010; Lidstone, Miller, & Joseph, 2013; Power, 2011). This study was intended to provide quantitative proof of whether there was compliance in the airline industry to the EU-ETS mandate and IFRS guidelines.

Political economy theory, a subsidiary of complexity theory, includes human life as a combination of economic, social, and political pressures (Bebbington, et al., 2008; Gray et al., 1996; Jevons, 1871). For corporations, Gray et al. (1996) suggested that financial disclosures like everything else in corporate action, was part of their public relations strategy. For airline corporations, this carbon pollution disclosure may bring unwanted negative political attention. Disclosure may also push future costs onto their income statements and their balance sheets as contingent liabilities that may present the company as unviable, not a going concern given airline's traditionally small profit margins (Porter, 1980; Wensveen, 2010).

In an example of overt political action in 2012 that defied the EU's pollution monitoring, China, India, and the United States forbade their country's airlines to participate in the EU-ETS. China in fact threatened to cancel its order of French manufactured Airbus airplanes if the EU-ETS went forward (EU, 2013). This political action that affected French manufacturing jobs and therefore the commercial profit of a

related industry had the effect of temporarily rescinding the EU-ETS scheme for non-EU airlines at the end of 2012.

Further in 2012, IATA formally submitted a refusal to participate in the EU-ETS on behalf of the non-EU resident airline IATA members, citing each airline corporation's own economic viability if forced to incur further costs. In November 2012, the United States had independently passed the EU emissions trading scheme prohibition act (S. 1956). The EU agreed to a postponement of the EU bound airlines in the hope of a collective airline agreement and waited for subsequent discussions in 2012 and the triennial ICAO meeting in September 2013 in Montreal. At that meeting the IATA membership agreed only to begin EU-ETS in 2020. The EU rejected that proposal and declared they would recommence the cap-and-trade scheme or the alternative carbon emissions penalty charging on January 1, 2014 for airline corporations that were non-EU resident collecting emissions on only portion of the flight journey through and in EU airspace (EU, 2013). This penalty charge did not take place and in April 2014, the EU parliament further amended the timing for EU bound airlines, as well as the EU resident airlines, to begin in 2016. Nevertheless, the EU resident airlines and any airline that travels from one point to another point inside the EU have continued to be required to submit their carbon emissions to the EU.

The politics and economics of carbon pollution and GHG in general, as well as the EU-ETS emission penalties specifically, have generated many concerns. These concern elements have come from the differing value systems within world cultures, from countries attempting to maintain or improve living standards, and from commercial

viability concerns. Those cultural norms may include corporate social responsibility for a corporation's identity in keeping with its stakeholder's perceptions. The stakeholder's perceptions would also include political economic theory's subordinate theories of stakeholder and legitimacy theories.

Stakeholder theory, a subsidiary of complexity theory, was described by Freeman (1984) as a description of the roles of the many stakeholders of an organization, along with their interests, and suggestions on the type of management attention that should be given to each of these stakeholders. This attention may include the many perceptions and politics that should be considered. While corporate management is charged with decision making on behalf of the organization, the politics of their position may appear to be of profit making. However, underlying that profit taking lie layers of productive behaviors of employees, of suppliers, of customers, of the society norms within which the organization operates, the various regulatory authorities of safety, security, industry regulations, and income tax laws, as well as the direct investors into the organization. Stakeholders as a collective may also exist in lobbying associations within an industry. Those stakeholders in the airline industry may be for example, the IATA group lobbying for fewer regulations, or institutional investors lobbying both the SEC and the industry membership for environmental cost disclosure on their financial statements (McCarthy, 2013). Institutional investors have become one of the most powerful stakeholder voices in corporate governance with their control of trillions of investment dollars (Vasudev, 2013).

Legitimacy theory, another subsidiary of complexity theory, is part of the corporate politics of being or appearing legitimate in the eyes of all of the organization's stakeholders. This includes its public relations and the appearance of compliance with its stakeholder's values and regulations (Bebbington et al., 2008; Ebrahim & Weisband, 2007; Gray et al., 1996; Hurst, 1970; Lindblom, 1994). In the complex and rapidly changing imperative to stop anthropogenic destruction, airline management must consider their own commercial survival as well as the directives of investors, regulators, and customers, and to manage those relationships. The EU-ETS has confronted the airlines with a challenge to each airline's legitimacy in the perception of investors and customers. The legitimizing power of the public relations of the EU labels the airlines as a polluter and has given the airline industry an opportunity to legitimize itself through carbon emission mitigation or public penalties for misbehavior.

In response, the airline industry may choose to use any or all of Lindblom's (1994) strategies to manage their legitimacy perceptions by (a) make the changes required to mitigate carbon emissions and disclose their carbon emission costs, (b) put forward an education or awareness campaign for the public or (c) associate their stance against disclosure and penalty by associating with another symbol of legitimacy, or (d) adjust the public perception through a PR campaign, none of which the airline industry had appeared to have initiated. The strategy appeared at this time to be one of compliance, but at a future date, thus giving themselves more time to adjust. The knowledge of what was to come has been in place since 2005 yet the time horizon for replacing airplane assets with more fuel efficient and less polluting aircraft is a long one.

Perhaps as Skinner (1978) and Reynolds (2007) show in operant behavior theory, the airlines may also have been waiting to understand whether enforcement would actually occur.

**Operant Behavior Theory #2**

In Chapter 1, Skinner's (1978) operant behavior theory #2 was described as corporate management's willingness to comply with any stakeholder pressure or regulation as long as the management perceived that enforcement would be consistent and continual. In the political battle of carbon emission disclosure, the airlines had not appeared to refute their polluting or to minimize their GHG participation in climate warming. As a collective within their own industry, under IATA and within some specific governments, such as China, India, the United States, and Russia, the airlines were pushing back the timeline for disclosure but not resisting that this carbon reduction must happen or that they would comply eventually.

At the time of this study and according to operant behavior theory #2, the airlines may also have been waiting to see what would change in the energy sector's EU-ETS which was the first industry scheme put in place in 2005 in the ETS pilot. This pilot was eventually completed in 2007 with the start of phase 2. The focus on its reporting and robust monitoring/audit may appear to have been tolerant. Since 2008 and the global financial crisis, the financial well-being of the EU's collective economies had taken priority over additional penalty costs to its industries. Additional considerations had been implemented in the ensuring years since 2008. As an example, in April, 2013, the EU undermined the value of its carbon allowances that had been allocated to affected energy

producers, by the auction of emission permits. A wait and see attitude by the airline operators may have been judicious and apparent in this dynamic environment.

The unfolding chronicle has just begun on this emerging fight to mitigate GHG emissions and assign economic penalties to profit taking by the disclosure of those costs on financial statements. As parties try to reach agreement on how to stop the anthropogenic pollution which threatens to destroy the earth and the resources of sustainable commerce, accountants may find that the carbon cost financial statement disclosure through IFRS, and the resulting economic effect, may provide a consistent platform for reform that investor's power will force. The literature review that follows described some of the very recent approaches to deal with the economics of this anthropogenic destruction.

## Literature Review

The Kyoto Protocol, (1997, 2005), the Chicago Accord (2002), the Copenhagen Accord (2009), the Cancun Agreements (2010), and potentially the 20th conference of the parties (COP) in Peru in December 2014 for GHG emissions have given signatories, such as the EU, the obligation to control their GHG emissions, concentrating on $CO_2$ in the first instance. The EU has capped $CO_2$ emissions from heavy industry (Grubb & Neuhoff, 2006) as part of their emissions trading scheme (EU-ETS) and is now demanding this reporting from the airline industry (original date January 1, 2012). The EU expected an airline consensus agreement to occur in Montreal, Canada in September 2013. The consensus that was reached at that meeting agreed only to participate in the EU-ETS from 2020. As this was unacceptable to the EU, the EU announced in November 2013 that

they would impose carbon dioxide penalties immediately to the offending airlines rather than allow the more lenient cap and trade scheme of the EU-ETS. In April 2014, the EU suspended the entire EU-ETS for airlines until 2016. A great deal of controversy continues to surround the extent of this carbon dioxide pollution, its economic costs, the parties responsible, and the financial reporting and disclosure of those costs (Frais-Aceitano et al., 2012; Helm, Hepburn, & Ruta, 2012; Matisoff et al., 2012; Milne, Ball, & Gray, 2008; Pedersen et al., 2013; Stechemesser & Guenther, 2012; Uddin & Holtdeahl, 2013).

Much qualitative, management, and theorized literature about GHG has been produced since 1992 when the United Nations Framework Convention on Climate Change (UNFCCC) began work on a process and costing framework for the control and reporting of GHG emissions. Researchers have been discussing the requirements and the economic effects of the European Union's carbon emission schemes, the EU-ETS, since 2001 (Grubb & Neuhoff, 2006), while consulting firms have created mathematical formulae to calculate these carbon costs. The EU has demanded this reporting on the basis of all airline carbon emissions within their collective sovereignty airspace. However, while it was not a demand in most other jurisdictions at the time of this study it might have been included in data collection in airline corporate ERP systems and in the footnotes to the financial statements (Smale et al., 2006).

Specific reporting requirements and guidelines which were currently broad definitions of these costs, have been included in general language terms by the International Accounting Standards (IAS) organization, the parent of IFRS, the ISO

standards for documentation, the EU, and the SEC in the United States. These organizations have described the relevant sections which might be used for pollution disclosure and certificates, which include: IFRS section 38 for recording of intangible assets (carbon credits/allowances could be considered here), IFRS 5 (noncurrent assets held for sale, that is, carbon credits), IAS 37 (liability funds), IAS 41 (FMV of biological assets), IAS 8 (estimates and errors), IFRS 6 (exploration and evaluation expenses for income statement), and ISO 14001 and 14064 (organizational documentation processes). However, the extent to which voluntary disclosure on financial reports was made or the readiness of industry for this eventuality was unknown (Kolk et al., 2008; Lidstone et al., 2013; Power, 2011). In addition, the new extended business reporting language (XBRL), a new format of disclosure reporting that is being adopted in developing countries, may soon be the standard requirement under IFRS. In January 2014, the IASB continued to recruit members to its IFRS Taxonomy Consultative Group to assist the IASB in its XBRL development.

**Consistent Language and Costing Approaches**

Beyond these reporting requirements and guidelines, what remains problematic are the issues of readiness to collect and report data, use of consistent language, reliable interpretations of financial accounting guidelines and regulations, and audit of reported data. As examples of scholastic efforts to aid consistent language, Pedersen et al. (2013) conducted a mixed methods review of the literature to synthesize a common definition to help academics and practitioners in monetary and nonmonetary calculations for carbon dioxide pollution accounting. Uddin and Holtedahl (2013) also conducted a study of the

emission trading scheme language and compared the many different GHG accounting programs in another attempt to synthesize some standard language amongst the regulatory agencies. They found that there was so much variation in the regulations of these agencies that it would be very difficult for any third party auditor or organization to be competent in all regulations. At the time of this study it remains unclear whose regulation model will survive or be effective.

The models of airline carbon footprint costs can be a simple cost of the fuel while over the EU airspace or a complex engineered cost accounting exercise (Uddin & Holtedahl, 2013). There is a direct relationship between an aircraft's base weight and engine type (together designated as 'the base') to the fuel burn on specific routes flown. There is a further direct relationship between that base plus the additional weight in the fuel loaded on the plane, passengers and freight carried, the altitudes reached, wind and temperature variations, and maintenance schedules of the planes on specific routes flown (Grubb & Neuhoff, 2006). These direct relationships will vary widely with the age of the aircraft, its engine age and efficiency, how well the aircraft and its engines are maintained, and the weather that the aircraft encounters on its flight path. Unfortunately daily wind and weather are not recorded for individual routes by the airlines. Due to the EU regulations and IFRS, a significant increase in the carbon costs reporting of any EU resident airline, including specific reporting on their financial statements, should have been clearly apparent to readers of their annual reports. However, it was possible that no increase in carbon pollution cost would have been seen on a non-EU resident airline's

current financial statements even though those same airlines must have disclosed those carbon costs to the EU authority.

As IFRS was also mandated in the EU, several authors have sought to quantify the commercial costs and benefits to organizations of carbon pollution accounting and ETS schemes rather than simply appeal to human logic regarding the destruction of their own life systems. One foundational suggestion from Ajani et al. (2013) for a starting point to calculate the progress of environmental destruction was to inventory and benchmark of all current water, land, and forest resources. In another study, Apergis, Eleftheriou, and Payne (2013) used the formal financial statements of 1230 United Kingdom, French, and German manufacturing firms to track a cost/benefit scenario. Apergis et al. performed an econometric linear regression to analyze whether accounting and tax changes to deductions for research and development (R&D) expenses would affect $CO_2$ emissions for the years 1998 to 2011. This time horizon surrounded the 2005 mandatory adoption of IFRS in EU countries. Apergis et al. found that $CO_2$ emissions declined with increased R&D spending. Tax allowances for increased R&D spending gave the organizations in EU countries some needed capital investment into pollution reduction technologies.

To attempt further proof of economic benefit of calculating and disclosing carbon dioxide costs, Turner et al. (2012) analyzed the metal/steel industry in Wales (also an EU country) and used a pretest-posttest repeated measures factorial ANOVA CGE input-output model. They concluded that under the EU-ETS, assigning the costs of pollution under the country of production (PAP) accounting rather than the country of consumption

(CAP) accounting would prove economically beneficial to Wales. They also pointed out that it was likely that the steel production would move offshore and thereby make the ETS, and possibly their study, moot. Others such as Tsai et al. (2012) chose to create a mixed activity based costing (ABC) econometric model to assist airlines in their choice of airplanes to fly based on available cost and carbon minimization attributes. In these few examples, economics, profit, and shareholder equity metrics were the basis of persuasive quantitative studies.

In another study to provide common language and a common costing approach for pollution accounting, Pedersen et al. (2013) using 2008-2009 data, analyzed 142 Danish corporate annual reports with 16 follow-up interviews. This was a mixed methods literature review and logistical regression to synthesize a common definition and approach for monetary as well as nonmonetary costs for carbon pollution accounting. These Danish organizations were all under both a Danish government and EU mandate to disclose environmental costs. In that study they looked for those company's responses to institutional pressures for CSR reporting and concluded that while environmental reporting appeared to improve over the 2-year period, most first time reporting companies mimicked other previous reporters and perceived little or no value in the reporting exercise. Others who admitted not reporting even under the Danish and EU mandate excused themselves with reasons of misunderstanding, lack of expertise, lack of technical equipment to gather the data, or lack of computerized reporting systems.

**Carbon Studies**

How carbon emissions can be assigned or allocated to countries and industries was also a contentious issue. Within the EU, carbon emission quotas were allocated based upon the country that produces those emissions. A study mentioned previously, Turner et al. (2012) conducted a repeated measures factorial ANOVA to analyze the metal/steel manufacturing in Wales. In their quantitative analysis of assigning and accounting for the carbon emissions to the country or industry of production (PAP) versus the country of consumption (CAP), their results showed a complexity of trade issues as well. In Wales, which exports much of its domestically produced metal, steel, energy production, oil refining, and chemicals, Turner et al. demonstrated that as exports rose there was a corresponding rise in $CO_2$ emissions but not a parallel rise in GDP or wage driven domestic consumption. Turner et al. further concluded that Wales, with a carbon trade surplus, under the EU rules would benefit from PAP accounting only because the rise in $CO_2$ penalty costs was outweighed by the increase in export trade profit. Should the EU transition to a carbon penalty system on the importing country, CAP, Turner et al. concluded that exports from Wales (and profits from those exports) to other EU countries might lessen as those importing countries bore the $CO_2$ penalties. The politics of the carbon emissions allocations remains dynamic.

Politics for and against pollution penalties have been vigorous in the currently identified polluting industries. In addition to the steel industry with its heavy pollution emissions, other industries such as the energy industry, oil and gas in particular, cement, and now airlines and transportation have received the earliest carbon pollution attention

by Australia and the EU. Realizing that industry lobbies and their member commercial organizations might wage industrial war if outright penalties for carbon pollution were legislated, the airline industry ETS legislation was created by the EU officials in 2008. This legislation required that all airlines flying in the EU collective airspace and airports first use their allocated 2010 threshold carbon credit allowances and subsequently buy any additional credits or permits needed for each ton of $CO_2$ the airplanes emitted (Reuters June 8, 2011; MacKenzie, 2009). This penalty for airline carbon emissions was originally scheduled to begin on January 1, 2012; however, political threats of retaliatory actions from countries such as Russia, China, and the United States prevailed temporarily to derogate the ETS for EU bound airlines in November 2012 until January 1, 2014 and then subsequently this was moved to 2016. The EU resident airline's compliance benchmarked in 2010 was required continuously from the original date January 1, 2012 but it too was postponed in April 2014 until 2016.

The 2010 airline's carbon emissions benchmarking data for all EU resident and EU bound airlines was public record (Ellerman & Joskow, 2008). The disclosure requirements demanded that airlines flying to and from EU airports collect emissions cost data based on an acceptable formula approved by the EU. These reported cost data were audited by the EU or by approved agencies or auditors. Through a grandfathering process, airlines received free credits amounting to 85% of their 2010 market share (European Commission, 2011). Subsequently, the airlines had to buy credits from other organizations or regimes that did not use their free allowances or from another industry

also under the EU-ETS mandate and who may be producing emission credits through EU approved global green carbon projects (GCP) (Malina et al., 2012).

There were many economic as well as political implications of the EU-ETS. The implications of the EU-ETS pollution costing scheme for the airline companies that are included in this cap and trade, were analyzed by Preston, Lee, and Hooper (2012). The United States, which currently contributes 10% of the total airline industry GHG emissions, had taken both unilateral action and group leadership of the refusal to participate in the EU-ETS for airlines (*Reuters*, 2013). According to IATA (2013) airlines argued their position to resist another cost by citing the economic traditionally low profit margins of the airline industry as well as the economic adversities of the next few years. The 2008 global financial crisis that reduced air travel, the 2010 volcanic ash preventing flying in Europe for 2 months, and the new 2011 European air tax were hardships that caused the bankruptcy of many major airlines and the consolidation of other carriers to remain solvent (Wensveen, 2010). From an environmental perspective, the importance of the airlines inclusion in the ETS was pointed out by Preston et al. who stated that airlines represented nearly 5% of the carbon pollution emissions which are anticipated to grow at an average of 4.8% year on year for the foreseeable future.

Preston et al. (2012) were not hopeful that the politics that surrounded the airline industry and the lack of good accounting models would see a cohesive conformance in the near term. Airlines were not included in the actual Kyoto Accord but referenced in article 2.2 to be the responsibility of the UN under the ICAO. In fact, ICAO has been trying to achieve global agreement from the airlines on a pollution reduction and cost

system but at September 2013 they had yet to succeed and could only gather agreement in principle for some action in 2020. The main topic of this study was to show the reporting readiness and compliance of EU versus non-EU destined airlines to collect this ETS data. This readiness was analyzed through the extent of carbon emissions data tracked and reported on their formal financial statements in the EU reporting periods of 2012 and 2013.

**Management Accounting**

Academic researchers have explored management accounting techniques for the reporting of $CO_2$ emissions. Management accounting reports use a data collection process and computer software to calculate their costs of the pollution, but these are internal reports and may not be divulged to the public at large (Christ & Burritt, 2013; Vasile & Man, 2012). Vasile and Man reported that employee competence in constructing carbon emission costing models and information computing abilities has been seen as one of the operational obstructions in the reporting of the real costs of pollution. The use of management accounting cost models and available costing software was seen as an innovation to assist financial accountants in addressing this operational barrier to pollution cost reporting on financial statements (Vasile & Man).

Several costing models have been put forward by researchers for environmental management accounting (EMA). In defining what EMA included, Vasile and Man (2012) used two views, one of environment protection and the other, the costs of the flow of materials and energy usage. They created a table (Appendix A) of how environmental costs, those associated with routine charges for water, energy, and power, and those that

estimate the costs of environmental effect, could be incorporated into both financial (past focused) accounting and into management (future focused) accounting. The authors pointed out that a variety of EMA models has been developed by researchers. Those models included Tsai et al (2012) with an activity-based costing decision model for airplanes, Ajani et al.'s (2013) inventory of carbon flows and reservoirs, as well as Apergis, Eleftheriou, and Payne's (2013) study of IFRS accounting guidelines that may offer costing incentives for ETS compliance. According to Vasile and Man, the multiple emerging EMA costing models have constituted an ongoing controversy and a defacto limitation to practical adoption.

Vasile and Man (2012) identified other economic benefits complementary to an organization's increasing ability to gather and report acceptable EMA data. Those benefits consisted of improved pollution information for decision making in pricing policies, in acquiring pollution reducing technologies, lower operating costs, and improved competitive advantages to the enterprise. Vasile and Man's work was an overview on the topic of management accounting's role in pollution cost calculations. Follow-up specific company and industry studies may prove beneficial to EMA.

The use of EMA may not be accepted in accounting practice. Although management accounting researchers have created some airline industry and object specific quantitative management accounting models as discussed above, others have investigated the willingness to actually use any of the environmental management accounting techniques in their firms. Wilmshurst and Frost (2001) surveyed 500 Australian CEOs and CFOs to determine the importance of accountants in the climate

change discussion. Wilmshurst and Frost, from their survey, concluded that while industry leaders saw a business need to address environmental issues, for those surveyed there appeared to be no important role for the accountants. Christ and Burritt (2013) conducted a survey of 1585 Australian accountants to determine their attitudes toward environmental management accounting (EMA). Australia, like the EU, has been mandating pollution and environmental policies, actions, and reporting since the late 1980s. Christ and Burritt used a Likert scale survey questions and multiple regressions to analyze the results on a dichotomous dependent of present use and future use of EMA techniques. Christ and Burritt found that the company's own environmental strategy, the industry norms, and the organization's size (to have the people and means to gather data) were good predictors of EMA usage, but that organization structure was not.

The value of waste product and operations emissions as reported by accountants has also been studied. Gale (2005) in his study performed under the UN Division for Sustainable Development (UNDSD) attempted to trace the material purchase value of wastes and emissions. Gale concluded that companies had either hidden these costs within overhead accounts or not recorded them at all within the traditional, conventional accounting systems. The implications from these research studies would suggest either a lack of understanding of what information EMA can provide, or what benefits there may be in business decisions that are predicated on complete, detailed costing information. With complete costing information models, future profits may be forecasted from sage investments in new technologies for both reporting detailed costs and for illuminating where operational efficiencies could be gained (Ratnatunga & Balachandran, 2009).

EMA uniform practice remains an enigma to be solved so that EMA procedures, calculations, and reporting can be more easily implemented to promote universal consistency. Academic researchers have shown that academics, UN and accounting organizations, and some governments have given general explanations of what should be reported. Unfortunately, the plethora of voices in this ongoing discussion, have created several costing models that are without regulatory specifics or detailed mandates on financial statement reporting.

**Corporate Social Responsibility and Pressures to Disclose**

Many researchers since the late 1970s have dealt with the stimuli of economic and environmental disclosure. These economic and environmental issues are inextricably linked as economic success depends upon the resources of the earth and also upon the manpower that the earth sustains. Global economic and business sustainability decisions are made based upon the financial reports of organizations and of countries. Di Giacomo et al. (2012) and Pedersen et al. (2013) have shown that pollution or environmental cost disclosure may reflect CSR to its stakeholders and its society but other researchers have also shown that government or regulatory intervention is necessary for a sustained and consistent approach to pollution disclosures (Apergis et al., 2013; Ball & Craig, 2010; Frias-Aceituno et al., 2012; Matisoff, et al., 2012; Turner et al., 2012). Nevertheless, without senior management's conviction and direction, there is evidence that many firms simply feign environmental concern and display a public relations façade in both voluntary and mandated disclosure schemes (Matisoff et al., 2012; Milne et al., 2008; Pedersen et al., 2013).

The motivators for environmental pollution disclosure are varied. Frais-Aceituno et al. (2013) and Matisoff et al. (2012) investigated the motivators of disclosure for companies which had already begun to disclose carbon and environmental cost information or which were thinking about disclosure. Frias-Aceituno et al. used the Forbes 2000 global corporation list to analyze the motivators of financial and environmental integrated financial reporting. Frias-Aceituno et al.'s 2008–2010 logistic regression used a sample of 1590 international companies and found that monopolies were unlikely to publish integrated financial reports and that the proposed predictors of business growth opportunities and industry segment did not predict integrated reporting. However, company size and profitability were predictors that indicated organizations may produce and disclose this environmental information. There was no inference suggested as to why this difference in predictors might have been true.

The quality of environmental reporting has been an issue. Quality was the focus of a 2003-2010 longitudinal survey study by Matisoff et al. (2012) of 2900 world-wide firms. While the perceived quality and the quantity of reporting improved over the years due to government intervention, their results also showed that the United States actually declined in environmental reporting despite the fact that the SEC (17 CFR parts 211, 231, and 241) and the EPA have rules and penalties to support this reporting. The authors speculated that companies might be waiting to see what consequence power the U.S. regulations had.

CSR is the topic under which environmental disclosure often resides. The quality and management CSR motivators, oftentimes called triple bottom line accounting (TBL)

or corporate sustainability accounting, were critiqued in a literature exposé by Milne et al. (2008). These authors who had been writing in this discipline from the early 1990s analyzed the carrying capacity of the earth, its growing population, and the ecological risks that reliance upon voluntary or even mandated ecology reporting would have. Milne et al. strongly suggested that TBL and the global reporting initiative (GRI) as forms of CSR were simply a form of deception and were in fact detrimental to the actual need for GHG reporting. These sentiments have also been strongly stated by other renowned scholars in this discipline such as Brown et al. (2009), Elkington (2004), Ebrahim and Weisband (2007), Giddens (2009), Gray and Bebbington (2000), Henriques and Richardson (2012), Hopwood (2009), O'Dwyer, Owen, and Unerman (2011), and Pedersen et al. (2013). Di Giacomo et al. (2012) had also supported the notion that companies make the appearance of success in addressing and reducing their environmental impact by manipulating their results.

Manipulation of results remains a problem in the credibility of company reports. In the case study of a U.K. based international management and technology consulting firm with over 250,000 employees and revenues of US$25 billion, Di Giacomo et al. (2012) found that a lack of management commitment failed to produce carbon footprint reductions. This U.K. company fell under the EU carbon reduction mandate and had been awarded the environmental ISO 14001 classification. This company set its carbon reduction goals in part based on a commitment to reduce corporate travel. The company did not give the training or the technology tools to the employees in time to offset their previous travel practices and the company in fact had a larger carbon emissions footprint

during the study. The company's response to this outcome was to increase its carbon emission measurement goals in order to be perceived as successfully striving to be an ecologically responsible organization.

In the CSR and disclosure section of this airline industry report, the early reporting response evidence from companies in the emerging field of GHG reduction was not encouraging. Companies may have been struggling to economically justify changing operations or accounting methods in order to actually reduce their carbon footprint. However, companies were thinking about their image as good corporate citizens and putting some thought into their practices, even if sometimes it may have been only public relations words. With time and experience, as other members and other industries find the economic benefit in pollution mitigation, specific pollution operations and reporting practice may become more widespread.

**Industry Polluting Emissions**

Despite the EU regulation, the struggle to assign pollution responsibility and reporting continues as several countries have not adopted IFRS or accepted the EU-ETS scheme that would affect their countries airlines. Countries such as China, India, and the United States objected on economic bases indicating that additional costs would damage their airlines' ability to continue operations (Malina et al., 2012; Stechemesser & Guenther, 2012). To evaluate this stance, specific country studies have been done. Malina et al. (2012) analyzed the effect of the EU-ETS on U.S. airlines that would be involved through their North Atlantic flight routes to Europe. Through a CGE model regression they used the EU-ETS projected costs and allowances to forecast fuel prices and GDP

from 2012 through 2020. They found that no matter whether costs were put through or not to passengers, the U.S. airlines would reap profit windfalls and would be better off to accept the EU-ETS scheme.

There is controversy as to whether the EU-ETS would be more profitable or more costly to the airline industry. Contrary to the more profitable scenario presented by Malina et al. (2012), Tsai et al. (2012) reported that a Reuters' aviation study forecasted that the EU-ETS would cost the airline industry 1.4 billion Euros ($1.95bn) in the first year. In the Matisoff et al. (2012) already mentioned on the quality of environmental reporting, curiously the U.S. corporations (not just airlines) involved were actually seen to be reducing their environmental disclosure during 2003 to 2010 despite SEC and EPA policies and penalties for nondisclosure. The United States has put in place environmental protection committees, agencies, and acts at the direction of President Obama, but it is not yet clear how successful these will be.

Pollution created by industry and the billions of people living around the globe were starting to be given attention by governments and other stakeholders for the real environmental costs. These pollution costs were being analyzed in terms of current and future health care costs, ecosystem remediation costs, and the resulting changes in climate and therefore loss of economic stability (Gagelmann & Hansjurgens, 2002; Smale et al., 2006). These future costs and the potential change in energy sources away from carbon based in order to mitigate costs, has received attention from the investing community as well. The devaluation of carbon based assets on a balance sheet and the increasing costs of pollution penalties have caused a coalition of institutional investors to

communicate with fossil fuel producers and the SEC to bring pressure to bear on disclosing the future risks and costs on their financial statements (McCarthy, 2013). This coalition included Goldman Sachs and Citigroup as well as the membership of the nonprofit sustainability advocate Ceres, whose membership includes the California Public Employees Retirement System (Calpers) and the New York State retirement fund. Investors look to the future of a corporation and need to be informed of the fiscal risks. Because of the trillions of investment dollars they control, the demands of this investment coalition was being listened to by publicly listed corporations.

The costs of pollution, similar to the costs of quality, are subjects of future accounting research and practical application (Ellerman & Joskow, 2008). There is a need to build these pollution costs into generally accepted accounting procedures in a similar manner to the importance and the rules surrounding asset values and amortization. To ensure that the future costs of pollution will be borne by the polluting organization, financial statements as well as forecasts must be affected with real data. If accounting is to measure the depletion costs of the carrying capacity of the earth there must be a starting point for quantification of the earth's resources.

A standardized methodology for calculating the cost of pollution and the depletion of natural resources and carbon sink reservoir continues to be a complex and debated issue. A description of the earth's carbon stock reservoirs and flow was provided by Ajani et al. (2013) who also suggested an accounting methodology to inventory and benchmark the land, forest, and water reservoirs. A tracking and costing of maintenance, restoration, and destruction could be done with that benchmark foundation. There are

many risks to human's inability to stop the ecological destruction, three of which are (a) if these costs are not being gathered and made apparent, they will not be minimized, and (b) if the remediation costs are not being accrued for and appropriate expense funds built the risk is no remediation in the future. The third and more important risk is (c) that the calculation methods of the real costs must be incorporated into IFRS and GAAP so that these can be accurately reported on financial statements. The EU's demand for airline $CO_2$ reporting presented an opportunity to compare one industry's ability to cost and report pollution costs.

**Gaps and/or Deficiencies in Prior Research**

The costs of carbon pollution, as well as accounting's ability to calculate, record, and report those costs were a new area of research. The prior research showed limited studies into environmental reporting of costs, none on airlines, and published studies continue to highlight the need for technical information systems to gather and report data. Just one element of carbon pollution costs was analyzed in this study, that of the airline industry and the EU-ETS or the alternative of $Co_2$ emission penalties.

A complete cost of the historical manufactured costs as well as the cost of lost future resources remains critical if humans are to place the real value on their purchases and actions. The limited academic research and corporate carbon cost disclosures on financial statements to date have focused on the costs of securing energy sources such as fuel costs (scope 1 emissions) and providing the costs of dumping locations for pollution laden water, soil, garbage, and other wastes of all types. Matisoff et al. (2012) reported that almost no disclosure or focus had been placed on the costs of the Scope 2 emission's

value to society of the devastated water, land, and air resources that are destroyed in the pursuit of gaining profits. Further, that little focus had been placed on the Scope 3 complete supply chain costs of GHG pollution within the product or service costing and pricing.

The highest polluting industries and their environmental impacts had been targeted by scientists and environmentally concerned societies but disclosure of the costs of the impacts remains inconsistent and most often, elusive. Transportation energy users in addition to the oil and gas producers were the largest contributors to GHG. Grubb and Neuhoff (2006) pointed out the progress that was being made for GHG calculations as each new country or industry regulation was being formulated; however, a consistent calculation method had not been agreed globally. Smale et al. (2006), as well as Gagelmann and Hansjurgens (2002), reported on the need to also calculate the costs of health and economic effects of pollution from carbon burning. Both researchers pointed to consulting firms as providing the formula for at least the EU-ETS purposes and the data gathered by these sample airlines has had their calculation process vetted and approved by the EU emission administration. However, a lack of understanding of requirements and unpreparedness to collect the data were some of the excuses given by mandated companies in other industries who had not reported beyond the historically reported scope 1 fuel used. This study did not look specifically for delineated scope costs but for emissions costs in the airline industry. Kolk et al. (2008) reported that it was unknown if any industry was ready to record the Scope 2 and 3 data either because of

computer software issues or the competent employees needed to calculate the costs for this reporting eventuality.

The real financial costs of Scope 1, 2, and 3 emissions are complex and multifaceted; difficult to collect, record, and report for the pollution effects. The UNFCCC mandate for reduction of GHG reflected the willingness of 196 countries to agree to reduce all three emission scopes in an effort to return to within 2 degrees centigrade of preindustrial levels under the UN directed inventory metrics of those GHG levels. Country GHG emissions were begun by the UN in 1990 and are updated annually.

IFRS may be the solution for consistent disclosure. To assist in the financial statement disclosure of GHG emissions IFRS included some global accounting guidelines that could be used for recording the EU-ETS emission penalties and for remediation liabilities for the restoration of land, water, and atmosphere degradation. These IFRS guidelines were used generally for all accounting valuations and were not specific to environmental accounting. The United States SEC filing requirements did include some sustainability accounting standards (SASB) but most environmental pollution costs for the ecosystem destruction were not recorded in any financial way. Researchers had covered some aspects of the models, motivators, and predictors of environmental cost disclosure in some industries; however, no research was found with evidence of airline adherence to the EU-ETS or EU emission penalties for airlines which fail to reduce emissions. This gap may be a topic of future study as the ETS scheme continues and other countries adopt similar legislation.

**Previous Environmental Research Designs and Frames**

In this study, I used the pretest-posttest repeated measure factorial ANOVA design that was utilized by Turner et al. (2012) in their study of the carbon emission costs of manufacturing of steel in Wales. Turner et al. used an economics CGE model to forecast the carbon emissions and concurrent GDP. Their model was based upon the Kyoto (2005) and Copenhagen (2009) accords on climate change mitigation, input-output accounting, and the attribution of penalties to the carbon emitting company/country, Their study was completed over a 25 year span, based on a 2003 base year data regression which used a statistical comparison with real data for 2007 and 2008. Turner et al. compared the carbon emissions attributable to either the country of production (PAP) versus the country of consumption (CAP) over the period. In my study, this pretest-posttest method allowed for testing before and after the intervention of the EU-ETS and the changing IFRS standards during the 3-year period of this study. The repeated measuring showed any disclosure changes in the financial statements over the time frame that surrounded the intervention and permitted the ANOVA as well as an ANCOVA comparison between the EU resident and other mandated airlines with the non-EU or nonmandated airlines.

The data collection framework presented in Chapter 3 was constructed drawing upon two previous studies. These are, the Stechemesser and Guenther (2012) criteria frame for carbon dioxide allowances and financial statement inclusion recording as well as the Uddin and Holtedahl (2013) scope and emission criteria frame. Stechemesser and Guenther researched over 2000 publications and carbon collection criteria which included

for all monetary and nonmonetary evaluations and monitoring costs. Their analysis included the entire value chain with all Scope 1, 2, and 3 emissions. Uddin and Holtedahl's study concluded a common language and treatment through a review of publications and public practice literature inclusive of 2011 listings in both regulatory and voluntary schemes of carbon emission reporting. Uddin and Holtedahl also commented that "all standards and programs have a more-or-less uniform approach in accounting for greenhouse gases from projects or organizations"; however, the audit assurance rigor was much less consistent (p. 6). With the foundational information from these studies, in this study I included data gathering criteria for all current sections of regulatory and reporting standards of the IAS, IFRS, EU-ETS, SEC, and ISO. Together these standards comprise the possible recording and reporting opportunities for airline corporations to disclose present and future carbon pollution costs.

## Summary

The regulatory and social responsibility for carbon emissions reporting to provide business sustainability information appeared inconclusive in the literature; however, many scholars have tried to identify the issues to be addressed. Regulatory frameworks for the reporting of GHG emissions were presented in the literature review as well as the current problems associated with the calculation and disclosure of those costs on the financial statements of corporations. Corporate governance for financial accounting, social responsibility, and corporate legitimacy toward the environment remain inconsistent in the perception of stakeholders. Consistent accounting language, guideline interpretations, and audit remain elusive, and compounding these reporting issues,

corporate management's role also appeared to be conflicted as they responded to diverse stakeholder demands for profit and GHG disclosure, as well as to regulatory mandates.

Researchers showed that even when these pollution costs are disclosed, there are diverse calculation models. Disparate geographic regulations and GAAPs used different cost calculations and not surprisingly, the verification of those costs and the audit of specifics were troublesome for the audit agents to be considered competent. In addition, the ability of corporations to actually gather and report these costs may not be economically available to some industry members due to the need for trained personnel and sophisticated information software. For this airline industry study, while all of these issues were emerging, this study looked to quantify the number of costs being disclosed at this particular juncture given the regulatory intervention imperative of the EU-ETS, carbon cost penalties, and the use of evolving IFRS accounting guidelines for the environment.

**Importance of the Study**

**Why the study should be pursued.** The survival of the earth and the politics of profit are in conflict. The reviewed literature has called for more quantitative research to convince economic decision makers to support the disclosure of pollution costs in order to prevent the destruction of the earth's natural resources needed for life and commercial use. A consistent global accounting framework that included the many environmental costs of operations would support the fair and equal treatment of all commercial entities and therefore support the availability of life and commerce supporting resources.

Disclosure of pollution costs on financial statements, the engine of financial decisions, is imperative.

The airline industry has a global reach and according to the UN Intergovernmental Panel on Climate Change (UNIPCC), aviation in 1990 contributed 330 billion Metric tons (Mt) of $CO_2$ which rose to 480 billion Mt by 2000 or 1.5 times in 1 decade. To put the airline emissions into perspective as part of the much larger crisis, in the UNIPCC fifth assessment report of 2014, scientists have forecasted that regression analysis put the anthropogenic atmospheric $CO_2$ at 450 parts per million (ppm) by 2030 and 770 ppm by 2100. Further, cumulative anthropogenic $CO_2$ emissions since 2010 are forecasted to exceed 700 Gigatons (Gt) the equivalent of 700 billion tons of $CO_2$ by 2030 and exceed 1500 Gt by 2050, and over 4000 Gt by 2100 (UNIPCC, 2014). The earth's ecosystem flows are even now unable to handle the increasing pollutants and concurrent destruction of its natural reservoirs and ecosystem processing systems that are being destroyed through anthropogenic activity (Ajani et al., 2013).

If there is no disclosure of the pollution costs on financial statements and therefore no economic impetus to reduce these emissions through different energy sources, better engines, better engineered airplane bodies, more efficient loading, more efficient flying and landing, and better maintenance, it is estimated that by the year 2020 airline carbon emissions will have grown at 3 – 4% per year (Tsai et al., 2012). Tsai et al. reported that these emissions will rise to over 954 Mt per year of $CO_2$ GHG by the year 2020 that will be dumped into the air and thence to the land and the water. These are just the airline industry projections. Other industries such as oil and gas, cement, agriculture,

and other transportation modes will also be growing their GHG emissions during that same period.

The focus in this study was the airline industry's carbon emissions and the disclosure of the costs of those emissions in financial statements. The EU-ETS intervention provided an opportunity for a comparative study to discern whether carbon costs are being disclosed on financial statements. Concurrent with this EU intervention, the international accounting standards committee (IASC) continued to update the IFRS standards to include for asset devaluation (S. 8) and rehabilitation (S. 6) as well as pollution control costs (S. 8), market value of intangibles such as emission allowances (S.38), and (S. 41) contingent liabilities (Firoz & Ansari, 2010; Frias-Aceituno et al., 2012; Stechemesser & Guenther, 2012). These accounting treatment sections could have been or may have been used to record environment assets, liabilities, or expense items, but were not forced upon companies and most IFRS guidelines were not specific to environmental wording and may not have been used. As IFRS is currently in over 140 global countries and not well audited in some of those; this research study did include the current state of IFRS reporting and adoption by specific country in the airline random sample used.

Scholarly authors pointed out why the issue of pollution costs is becoming so important. This importance stems not only from the remediation costs of pollution to future generations, but the cost to any future economic development and to life on earth. An understanding was needed of how these costs were being captured, how reported under GAAP, how international regimes were handling this emerging issue, and how

these might have indicated a method to gain consistency across the globe. All of these understandings were in an attempt to try to bring some equity in terms of pollution generation and its affects to all peoples, animals, and vegetation which live on earth now and in the future. This study was a first step to determine the degree of compliance and the effect of this new regulation intervention on the airline industry.

**For whom is it important?** This study should be important to the governments of the world as it showed the extent of disclosure and willingness of one industry to be accountable for the pollution costs of their economic profits. It should be important to the airline industry, health authorities, accounting professionals, and consulting firms (accounting, database systems, and remediation specialists). A former UN Director of Emissions, Frank Joshua, felt that this study was important to the UNFCCC as it was the first accounting study to try to analyze the impacts of two global interventions, EU-ETS and IFRS, on climate change.

## Conclusion

My literature review revealed no studies in the airline industry on the disclosure of carbon emissions costs on their financial statements. In order to provide further quantitative data on the incidence of the recording of the costs of anthropogenic carbon pollution, as well as the impact of IFRS on these same airline corporations, this study may help to close this gap in the literature. In this analysis, I built upon previous research in the environmental accounting discipline and used airline corporations from the global industry population. In Chapter 3, I expand on Chapter 1 material to provide the specific attributes of the chosen ANOVA and ANCOVA research designs, and my rationale for

those designs as well as the methodology for sampling from within the population frame. In Chapter 3, I discuss the design details of the data being analyzed from the formal financial statements of the sample as well as the collection instrument and analysis procedures. The weaknesses or threats to validity in the study introduced in Chapter 1 are further described in Chapter 3 along with their mitigation so that the study's results may be generalizable within the airline industry. In Chapter 4, the results of the analysis are displayed and explained. In Chapter 5, the results are discussed in relation to the literature review and the theoretical base and how this research expands environmental accounting practice and contributes to positive social change. Chapter 5 concludes with my recommendations for further research opportunities beyond this study.

# Chapter 3: Research Method

In this study, I examined whether the EU-ETS intervention for airlines (the primary independent variable) and the evolving IFRS guideline sections (the secondary independent variable) that deal with environmental reporting were influencing carbon pollution disclosure on the financial statements of airline corporations. Three groups were compared; those airlines mandated by the EU-ETS (Groups 1 and 2), and those that were not (Group 3). Additionally, the airlines resident in the EU countries (Group 1) have IFRS as their GAAP; however, there were other airlines in the population whose countries have also adopted IFRS. As a control in this study there were airlines in the population frame (Group 3) that were not flying into an EU airport but may or may not be from a country that has adopted IFRS guidelines. To accomplish this examination purpose, in Chapter 3 I discuss the research design, the sampling strategy used with the specific population data sources, the data collection instrument, and the analysis methods. The threats, weaknesses, or any ethical issues that might have been present in the study along with my plan to mitigate those are also detailed to ensure reliability and validity.

## Research Design and Rationale

The research questions from Chapter 1 are as follows.

Research Question 1: To what extent is there a difference in the frequency means for reporting carbon footprint costs between the EU bound airlines and the non-EU bound airlines?

Research Question 2: Do international financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations?

These research questions were then translated into the following hypotheses:

Hypothesis 1:

$H_0$: $\mu_1 = \mu_2$**.** On average there is no difference between EU bound and non-EU bound airlines in tracking the carbon costs of carbon emissions and reporting on financial statements.

$H_1$: $\mu_1 \neq \mu_2$. On average there is a difference between EU bound and non-EU bound airlines in tracking the carbon costs of carbon emissions and reporting on financial statements.

Where $\mu_1$ is the average number of carbon credit or debit or penalty accounting disclosures on the financial statements of the Group 1, EU mandated airlines and $\mu_2$ is the average number of accounting disclosures on the financial statements of the Group 2, non-EU mandated airlines.

The statistical methodology to test Hypothesis 1 was an ANCOVA that compared three independent population means, that is, a comparison of average carbon cost disclosures between EU resident airlines, EU bound airlines, and non-EU mandated airlines. This comparison measured the differences in the reporting of carbon costs on the financial statements of corporate airlines, classified by carbon credit or EU-ETS terminology.

Hypothesis 2:

$H_0$: $\mu 1 = \mu 2$. International financial reporting standards do not influence the reporting of carbon emissions costs on the financial statements of airline corporations.

$H_1$: $\mu 1 \neq \mu 2$. International financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations.

Where $\mu_1$ is the average number of IFRS allowable carbon emissions accounting references disclosed on the financial statements of IFRS country airlines and $\mu_2$ is the average number of IFRS allowable carbon emissions accounting references disclosed on the financial statements of non-IFRS country airlines.

The statistical methodology to test Hypothesis 2 was an ANOVA that compared two independent population means, that is, a comparison of average carbon cost disclosures between IFRS country airline corporations and non-IFRS country airline corporations, as classified by the allowable, but not environment specific, IFRS treatment sections for financial statements.

**Variables**

The main independent variable, the intervention, was the carbon cost trading scheme of the EU-ETS or carbon emission penalties that required airline corporations landing in EU sovereign territories to disclose the carbon burn of their flights. Through this information, carbon credits or debits were generated by the EU for trading or penalty beyond an allowance benchmark. A secondary independent variable was the IFRS requirements at the time of the study. Confounding variables that were considered were the eXtensible Business Reporting Language (XBRL) interactive data reporting requirements and the sophisticated computerized environments that would have been required in order to report on EU-ETS, IFRS, and XBRL (i.e., the technological readiness to report these costs).

The population of interest was the EU resident airlines, the EU bound airlines, and the non-EU bound airlines as the nominal variables and the dependent variable was the demonstrated compliance by EU destined airlines or noncompliance compared with non-EU destined airlines. This dependent variable was included as the reporting of carbon costs on one or more of different financial statement presentations either on the income statement as expenses, the balance sheet as accumulating funds for remediation, carbon debits as a liability, or as a destruction of some asset value, carbon credits or allowances held. These may have been held as an intangible asset, a current asset available for immediate sale, a nondepreciable noncurrent asset not immediately to be sold, or reported as a note to the annual, formal financial statements. Further, should the management discussion and analysis (MD&A) section of the financial statements have reflected a discussion of EU-ETS, IFRS, or a software installation, these were also counted. The definition section of Chapter 1 described the relevant accounting sections of IFRS, IAS, and SEC that outline the appropriate accounting treatments. Table 1 indicates the variables of interest and their levels within which responses were gathered: Counting the carbon emission disclosures on formal financial statements across airline industry corporations.

Table 1

*Carbon Emission Costs Disclosed on Financial Statements*

| | ←----------Independent variables ----------→ |
|---|---|
| Demonstration of disclosure | |
| Presence of depletion account for a remediation/green fund? | |
| Presence of liability accounts? | |
| Presence of intangible asset? | |
| Presence of current asset? | |
| Presence of pollution costs expense line on income statement? | |
| Presence of EU-ETS penalty costs? | |
| Presence of EU-ETS carbon credits or revenue? | |
| Presence of pollution costs dialogue or information system in (MD&A)? | |

*Note.* Each demonstration of disclosure was sought within the samples's individual financial statements under the independent variables of: Pre-EU-ETS; Post EU-ETS; the disclosure frames or guidelines of IFRS, IAS, and ISO; the formally recognized auditing frame or organization of the SEC or UN; and the software or ERP system used by the corporation. The frame is based upon the work of C. A. Tuck-Riggs, RSCH8250Z, April 11, 2013.

**Paradigm and Design**

The design that was used for this study was a straightforward comparison of the frequency means of three independent groups in a classic quasi-experimental design, longitudinal 3-year pretest-posttest control group design. The design took into account the most recent studies, their intention, and design as a foundation. Previous quantitative literature in this specific carbon cost area was extremely limited and no studies on airlines were found. The strategies to calculate the costs of pollution and remediation and to disclose those on formal financial statements are in their infancy. As seen in the literature review in Chapter 2, quantitative researchers have begun very recently to quantify some of the emerging issues as the UN, the EU, and IFRS-interested countries become aware of their responsibilities for global warming.

A number of research designs had been used previously for commercial and environmental studies. Some of the current literature in studies that are in this environmental area were completed with survey designs with multiple regression (Christ & Burritt, 2013), logistic regressions to find predictors of disclosure (Frias-Aceitano et al., 2012), and mixed methods to synthesize common definitions of $CO_2$ costs (Pedersen et al., 2013). Researchers have used ABC models to compare airline strategies that might be used in order to lower costs (Tsai et al., 2012), CGE models in pretest-posttest repeated measures factorial ANOVA to compare the costs of production using carbon based energy (Turner et al., 2012) and to project the effect of $CO_2$ penalty costs (Malina et al., 2012). Although there is much literature regarding the carbon disclosure project

(CDP) and global reporting initiative (GRI), at the time of this study there was a gap in airline emissions disclosure.

The design of this study comprised elements of previous carbon studies. The design was constructed to include for the European Union's initializing airline polluter's penalties within the collective EU sovereignty. In this study the incidence of carbon pollution costs being reported by the airline industry and the frequency of reporting of these costs was investigated in a global context. Within the analysis, the computer systems each airline was using was recorded but not in enough technical or operating detail to make an inference for changes to accounting database systems to collect and report these costs. The protocol and attribute frameworks used were based upon both the Stechemesser and Guenther (2012) criteria frame for carbon dioxide allowances and financial statement inclusion recording as well as the Uddin and Holtedahl (2013) scope and emission criteria frame. The design followed the pretest-posttest repeated measures factorial ANOVA design of Turner et al. (2012).

This analysis was a longitudinal, quasi-experimental causal process form (Reynolds, 2007) with the classic experimental design of three compared groups, pretest-posttest control group design (Campbell & Stanley, 1963). The frequency of reported carbon costs were counted across EU and non-EU bound airlines and then compared. This analysis to answer Research Question 1 used a repeated measures factorial ANCOVA, two tailed.

Secondary data were examined. The public financial statements of airline corporations were analyzed to ascertain the number and accounting type of disclosures of

this carbon emission cost data in a modified Guttman frame. The contrasted groups design type model was used as the study observed three intact groups over two independent variables in a longitudinal study over the 3-year period beginning January 2011 (Frankfort-Nachmias & Nachmias, 2008). According to the research methodology studies described in Campbell and Stanley (1963), the pretest-posttest control group design comparison model was appropriate for this type of study. It was expected that the EU airport bound airlines would be compliant experimental groups with the EU-ETS mandate, while the non-EU bound airlines would be the control group and under no requirement from the EU authority.

The study had a 3-year series; a pretest of financial statement analysis before the EU-ETS intervention and 2-years financial analysis posttests, one immediately following the EU-ETS, with annual separations for delayed effects. This was a multiple measures design which included a within subjects design of each of the participants and the three levels of the independent nominal groups. It was also a between subjects design which measured the means of the participants taking each of the independent nominal groups as a whole. The factorial multiple model repeated measures ANCOVA, two tailed, assessed whether the average scores had differed meaningfully over the time frame. Additionally, the public record of reported emission costs to the EU authority was sought as a comparison to reported data on financial statements. As the number of world and EU specific airlines formed the population, the individualistic fallacy was minimized as data was gathered by each company. Ecological fallacy was minimized as not only was this

investigation done by individual airline corporation but there was also a sufficient population of data gathered from multiple airline carriers.

**Rationale for the Quasi-experimental Design Chosen**

The quasi-experimental design was appropriate for this study as I had no control over the intervention itself. The treatment or intervention was the EU-ETS regulation effective January 2012, then postponed for the 2013 reporting to 2016 for the Group 2 airlines from non-EU countries which fly into the EU. The EU-ETS was the only regulatory mandate at that time for carbon emissions cost tracking in the airline industry. The EU resident airlines remained mandated from the original January 1, 2012 date along with any airline that traveled from one point to another point within Europe. The quasi-experimental design using contrasted groups was appropriate for the research questions which were (a) to find out if there is a direct causal relationship between the EU-ETS demand for EU formatted carbon cost reporting and carbon costs reporting on financial statements and (b) whether IFRS guidelines were having a direct causal relationship on carbon cost reporting on financial statements.

The study had three comparison groups, the EU resident airlines, the EU destined airlines, and the non-EU destined airlines. Airline corporations were assigned to any of the population comparison groups by virtue of their planned or nonplanned routes to EU airports. The sample airline corporations were then randomly assigned specifically from within those three strata. The contrasted groups design allowed for a second or possibly a third intervention cause which was either or both of the IFRS and also XBRL requirements had XBRL become mandated. IFRS was assessed for its covariate effect.

The study made use of metric and discussion information from the annual reports and financial statements. Footnotes containing any changes to the financial statements in accordance with GAAP and/or IFRS (2009) were scrutinized for additional information from all participants, from all stratum. This contrasted groups design type included some elements of the control-series design type that uses longitudinal studies in order help control for "history, maturation and test-retest effects" (Frankfort-Nachmias & Nachmias, 2008, p. 128, para.1). As the public financial data from previous years of these three sample groups was available as well as potential macro data from the EU and other jurisdictions, past and present trends over time allowed inferences to be made.

**Approaches Not Chosen**

A mixed methods study was not considered at this time due to time and resource constraints. A qualitative study may be appropriate as a subsequent study in order to attempt to understand management's motivations and actions regarding their financial statement carbon cost accounting disclosure seen in this study. Therefore, in this initial airline study no attitudinal questions through survey or interview were administered.

Data was gathered to support or refute the research questions and hypotheses that the EU mandate for carbon cost reporting was causing additional financial statement reporting in advance of any GAAP or IFRS mandate. This research question called for a quantitative approach. The nonexperimental design would not be appropriate as the study is not simply an observation of behavior over time; there is a defined intervention and a regulatory change in the circumstance of the participants which might have driven the effects shown on the financial statements. The preexperimental design with a one shot

case strategy was not appropriate as there were three comparison groups with reported data gathered for statistical causal inference.

The experimental design could not be used for this study as I was not in control of the intervention and participants could not be randomly assigned to the comparison groups from the entire ICAO/IATA population (Frankfort-Nachmias & Nachmias, 2008). The comparison groups were already intact and it was within the EU bound groups and non-EU bound group of airlines that random sampling was done. The cross-sectional design was also not appropriate as it usually requires a survey or interview wherein the participants answer questions about their attributes and attitudes—the variables—with researchers using the data collected to attempt some "pattern of relationship amongst [those] variables" (Frankfort-Nachmias & Nachmias, 2008, pp. 116-117).

This study was quasi-experimental due to the defined intervention; however, there were also design type models under quasi-experimental that I did not recommend for this study. The planned variation design would have been appropriate only if the stimuli (the EU mandate) could be varied systematically to observe any effect on the reporting, which could not be done in this study. There could be no researcher control on the treatment therefore the research question sought to quantify if there was a direct causal relationship between the EU-ETS and any reporting on the financial statements of the affected airline corporations. This was observed over a 3-year period beginning in the year previous to the proposed enforcement date. Even with the delay in enforcement, airline corporations had been preparing for this eventuality since 2008.

The quasi-experimental panel is a design type used when there is no comparison group and the research is simply testing one group at different times; again, this was not the case here. Although the statements and reports of the comparison groups were analyzed over time, the time series design type would have been appropriate for testing just one group, not comparison groups over time, which was not the case in this study and the same rationale was true of the extended time-series design. As three comparison groups were present in this study, neither of these designs was appropriate.

## Population and Sample

**Population.** The population was the airline industry companies. At the time of the study there were over 5,500 airlines listed with an ICAO and/or IATA code. According to the EU, there were 4,000 airline companies affected as of April 2011and required to report under their EU-ETS beginning on January 1, 2012.

**Sampling.** The population of EU bound airlines at the time of this study constituted 72.7% of the entire airline industry population (4,000/5,500) therefore this sampling was a stratified probability sample, with random sampling from within the stratified sampling using three strata, EU bound (Groups 1 and 2) and non-EU bound airlines (Group 3). Figure 1 shows the G power statistically calculated sample size of 64. From within the three strata 64 experimental and control participants were gathered from companies whose financial statements were published. This sample stratification ensured proportional representation from all groups by analyzing the annual reports and financial statements of the sample for disclosure of carbon costs.

The stratification began with the population from the listing of the ICAO of the airline industry companies. This list was verified by a comparison to the IATA membership list to ensure a complete population frame. This resulting list was then cross-referenced to that of the EU regulatory authority mandate listing thereby creating the three groups, two experimental and one control which also minimized the ecological risk (Frankfort-Nachmias & Nachmias, 2008). Each member of the ICAO/IATA and EU-ETS population was compared through an Excel spreadsheet using the sort application in Excel to compare and confirm the absence or inclusion of each air carrier to minimize an incomplete frame.

The resulting three strata listed in Excel allowed the random sampling within each group (i.e., EU bound Groups 1 and 2 and non-EU bound Group 3) drawing out units until the appropriate sample size was reached (Frankfort-Nachmias & Nachmias, 2008). The random sample was compared with public corporation listings as these corporations had accessible data available for quantitative study. Random sampling continued until the required number (64 participants spread approximately evenly across the three stratum) of airline corporations with published financial statements had been reached.

Through a classic quasi-experimental test design the three randomly chosen approximately similarly sized groups, from both the treatment (Groups 1 and 2) and control (Group 3) groups, formed $R_1$ and $R_4$. For Group 1, pretest observations labeled $O_1$ were followed by immediate intervention posttests $O_2$ and delayed posttest $O_3$. For Group 2, pretest observations labeled $O_4$ were followed by immediate intervention posttests $O_5$ and delayed posttest $O_6$. For Group 3, pretest observations labeled $O_7$ were followed by

immediate intervention posttests $O_8$ and delayed posttest $O_9$. The amount and nature of disclosure of pollution carbon costs on their financial statements pre and post intervention was analyzed using a modified Guttman framework that had been created by Tuck-Riggs (April 2013) shown as Table 1 in Chapter 3. No blank foreign elements were included in the sample as each of the sample units had published financial statements that were analyzed for disclosure of carbon costs (Frankfort-Nachmias & Nachmias, 2008).

***Sampling strategies not used.*** As the entire population was known and after several comparison and culling passes as previously noted, neither a convenience sample, a purposive sample, nor a quota sample would have been appropriate as they would have limited the randomness and therefore the validity of the study (Frankfort-Nachmias & Nachmias, 2008). The stratification of the experimental and control groups was done through the comparison culling process of ICAO/IATA versus EU-ETS listings. A systematic sample (Frankfort-Nachmias & Nachmias, 2008) rather than a random sample within the three groups would have been an alternative.

***Sample size and why this was chosen in relation to the population size.*** The sample size had to be large enough to be representative of the underlying population within an acceptable level of error (Frankfort-Nachmias & Nachmias, 2008) but statistically small enough to be practical and economical. Even with large enough numbers in the sample, if the sample was not representative, the study's results might have been unreliable and invalid (Trochim, 2006). The confidence level that was used in the study was 95% or within two standard deviations of the estimated mean. According to Burkholder (2010) the sample size could have been calculated using the Cohen d formula

with *t* test for two independent samples based upon the gathering of data to compare the groups EU bound (1 and 2) and non-EU bound (3).

G*power (Faul, Erdfelder, Buchner, & Lang, 2009), a sample size calculator, was used to confirm the valid sample size as shown in Figure 1. A statistical *F* test ANCOVA for fixed effects, main effects, and interactions between three independent means (three groups) .05 alpha reject region that is, only 5% chance of the wrong hypothesis conclusion (Burkholder, 2010), effect size .4 (large) and with 80% power, was run; 80% was the chance of finding a mean difference between the groups if one existed (Sherperis, 2010). The parameters of that test are displayed below in Figure 1 where a total sample size of 64 was required. From the EU-ETS resident airline list of public corporations a sample was drawn of 15 companies for which formal financial statements over the study period were available. From the EU bound group of airlines a sample of 27 airlines was drawn and a similar 27 from the non-mandated remaining list of public corporations was drawn for which formal financial statements over the study period could be gained for a total of 69 airlines analyzed. To control for maturation and mortality, a further five participants, from the 64 required, was chosen from the beginning of the test period (Frankfort-Nachmias & Nachmias, 2008).

To confirm the sample size required for Hypothesis 2 for IFRS effect, a further G*Power was run for *t* test, means: difference between two independent groups as well as *F* test ANOVA for repeated measures, within-between interaction. The *t* test used two tailed, effect size .5, .05 alpha reject region with 80% power and confirmed a total sample size required of 52. The G*Power calculation *F* test ANOVA, effect size .4, .05 alpha

reject region, with 80% power, 2 groups and 9 measures confirmed a required sample of 12. As shown in Figure 1, the ANCOVA sample of 64 plus an additional five for maturation and mortality was sufficient for all statistical tests performed.

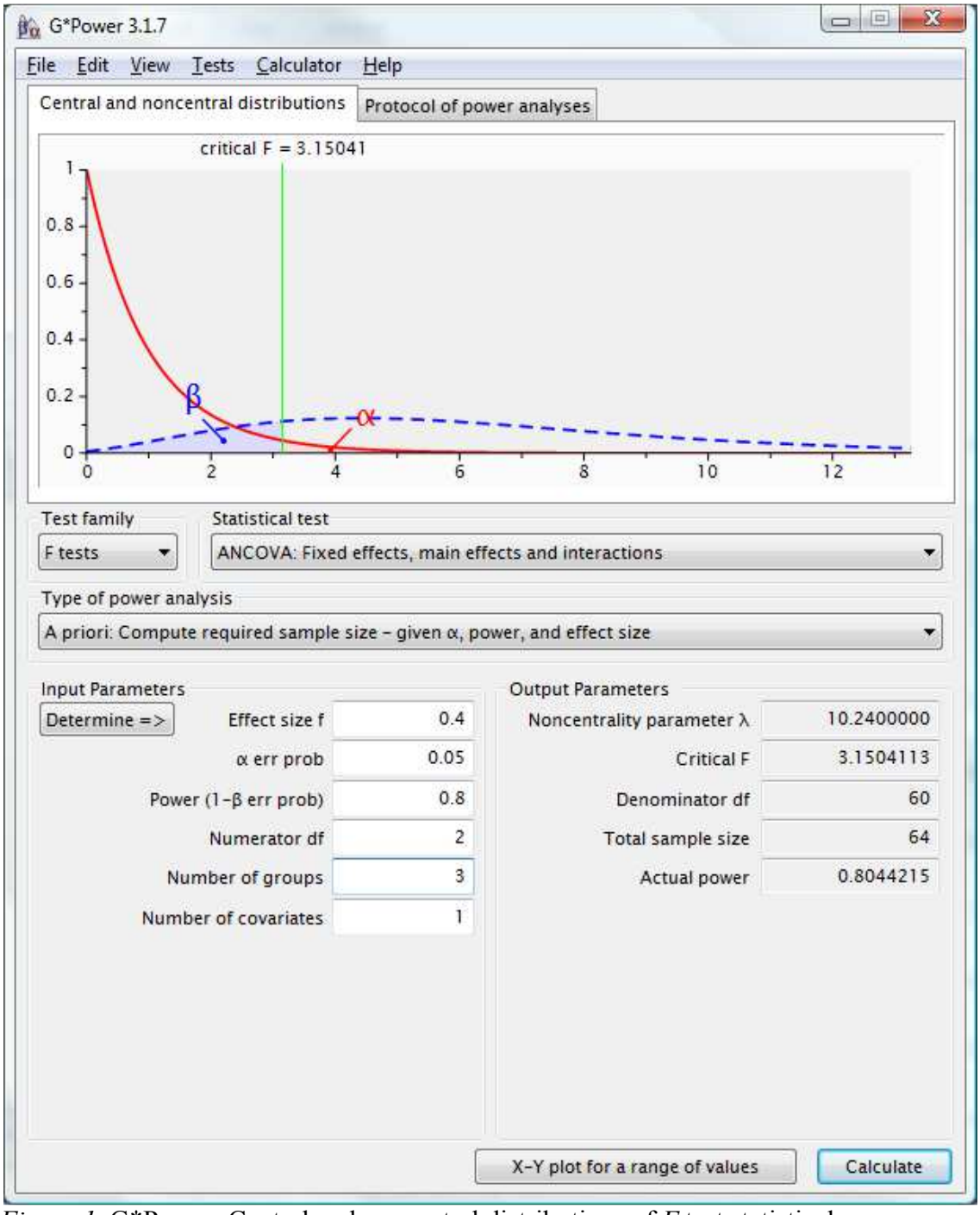


*Figure 1*. G*Power: Central and noncentral distributions of *F* test statistical ANCOVA: Fixed effects, main effects, and interactions, three independent groups. Software retrieved from the Institute for Experimental Psychology, http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3

## Data Collection

**Procedures.** To create a comparison in the study, a sample of public airline companies was required; two independent groups under EU-ETS intervention mandate and one group which was not involved in this carbon emissions disclosure scheme. The population comprised the airline industry corporations beginning with the IATA/ICAO airline listings of approximately 5,500 corporations. A secondary list from the EU-ETS listings 2012 to 2014 was secured through its public website, which allowed a stratification to be done within the IATA/ICAO listing to identify airlines for the intervention groups (Groups 1 and 2) and those for the control (Group 3). The EU-ETS airline listing was cross-referenced for the actual assigned EU-ETS numbering system for each airline. Bloomberg's airline listing was consulted for public corporations as well as regional airlines. This cross referencing was done through an MS Excel spreadsheet.

Subsequently from these four large listings of those involved in the EU-ETS scheme (Groups 1 and 2) and those not involved (Group 3), a random selection was completed within each of the three strata. These randomly sampled airline corporations were investigated for their public financial statement availability and further random sampling was done within the three strata until the statistically significant number of corporations was achieved. A larger than required sample was drawn to ensure a statistical sample size was maintained through the study period. The Sample section above in Chapter 3 described the details.

The public financial statements of the randomly chosen sample airlines were analyzed for their reporting disclosure according to the data collection instrument shown

in Table 1. Publicly available financial statements were found or solicited from company websites. The names of individual airline corporations were protected from publication by the use of aggregate reporting. Excepting where positive examples were needed in the results discussion, the results of individual airline corporations will be held in confidence by the principal investigator (PI) in password protected files on the PI's main computer and in locked backup in the PI's residence. The names of individual airline corporations will be protected by the assigning of numeric codes in the aggregate data. Original data will be destroyed within 10 years of initial publication. While no contact with company employees was expected during the study, the Walden University IRB was solicited for their approval of this study. The IRB approval number for this study is 02-20-14-0077664.

**Appropriateness of survey or Internet research methods.** The Internet provided the major source for the data collection. The ICAO and IATA provided the population. The EU regulator's Internet site provided the participants for the experimental stratum. From both sites, participants in experimental and control strata were chosen at random and the public financial records of the participants on each corporation's website provided the resulting dependent information. Other IFRS and XBRL influences as well as computer competency for providing of this information were analyzed from specific corporate documents available online. Where financial data for listed public corporations were missing or incomplete, four airlines were contacted by e-mail and one provided the missing public documents for that airline. There was no need for a survey of corporate employees or regulator employees in this quantitative study as

the data was provided by the compilation from publicly available information websites as described.

**Instrumentation and Materials**

**Instrument.** In measuring the carbon costs disclosure of the EU resident and EU bound (Groups 1 and 2) compared with the non-EU bound airlines (Group 3) there were elements of content, empirical, and construct validity to ensure. The instrument used a matrix record of observed line items or footnotes within the financial statements of the sample as evidence of disclosure items (Jang, 2005). As the instrument was a developed structured filter based upon a modified Guttman scale as exampled in Table 2, no pilot testing was done.

Table 2

*Coding of Carbon Cost Disclosures*

| Participant Group 1,2, or 3 | Reported on Income Statement | Reported on Balance Sheet | Reported in Footnotes or MD&A | Reported to EU-ETS | Guttman cumulative total |
|---|---|---|---|---|---|
| 1, 2, or 3 | Yes-Y, No-N | Yes-Y, No-N | Yes-Y, No-N | Yes-Y, No-N | Range:0->∞ |

*Note.* Adapted from "A basis for scaling qualitative data," by L. Guttman, 1944, *American sociological review*, *9*(2), pp. 139-150. doi:10.1177/001316444700700204

The Guttman scale was appropriate to use for this study as it is a unidimensional and cumulative scale (Frankfort-Nachmias & Nachmias, 2008) which supported the data collection. Across each of the Groups 1, 2, and 3, data was gathered with either an affirmative or negative response (Janmaat & Braun, 2009). The cumulative total score gained through the eight dependent disclosure options as shown in Table 1, allowed my manipulation and statistical inferences using SPSS, to be apparent both initially and at

each subsequent testing time (Bolivar & Galera, 2007). The constructed data collection instrument is shown in Table 1 in the Variables section of Chapter 3**.**

**Reliability.** The measurement instrument gathered the needed specific reporting data at several various intervals across the time frame to ensure that the results were consistent and therefore reliably gathered by this instrument. Reliability was ensured by using the test-retest method (Frankfort-Nachmias & Nachmias, 2008) in this longitudinal, time series delayed design model (Frankfort-Nachmias & Nachmias, 2008). As the airline's personnel were not interviewed, there was no risk of the participants being sensitized by repeated testing. This repetition risk could be problematic in future attitudinal studies using survey instruments. Another risk to the reliability of the instrument was that something not yet identified, other than the EU-ETS regulation, might have caused a change in the carbon cost behavior of the groups (Frankfort-Nachmias & Nachmias, 2008).

At the time of the study IFRS were not mandated for participants for the financial statement reporting of carbon costs (Abeyratne, 2010). IFRS guidelines included sections on accounting treatments that could be applied to environmental costs should organizations choose to use them for that purpose. Hesford and Potter (2010) pointed out that companies were reluctant to invest in the technology or reporting systems to gather and report this data voluntarily. It was expected that this initial study would be early enough and just ahead of any ecology changes, and that this study's results might set a benchmark in place that would serve as a foundation for any subsequent changes that may come forward (Hesford & Potter, 2010).

As previously discussed, there could have been a weakness in reliability in the test-retest model due to sensitization or another new phenomenon that was actually causing the results to change over the time period (Frankfort-Nachmias & Nachmias, 2008). In this case, the test-retest itself did not sensitize the participants as corporate employees were not contacted. However, it was expected that the corporate reporting would improve not only due to the regulatory instructions but also, as was seen in Fauré, Brummans, Giroux, and Taylor (2010), improvement was caused in accounting reporting by the effects of social actions demanding accuracy and risk disclosure on accounting reports. Therefore, as social action evolved in the years of the study, a positive effect on additional disclosure accounting was expected (i.e., a maturation threat).

## Data Analysis Plan

A data analysis plan is described in order to satisfy the Chapter 1 research questions and hypotheses.

Research Question 1: To what extent is there a difference in the frequency means for reporting carbon footprint costs between the EU bound airlines and the non-EU bound airlines?

Research Question 2: Do international financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations?

Hypothesis 1:

$H_0$: $\mu_1 = \mu_2$. On average there is no difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

$H_1$: $\mu_1 \neq \mu_2$. On average there is a difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

Hypothesis 2:

$H_0$: $\mu 1 = \mu 2$. International financial reporting standards do not influence the reporting of carbon emissions costs on the financial statements of airline corporations.

$H_1$: $\mu 1 \neq \mu 2$. International financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations.

There were two independent and multiple dependent variables in this study. The disclosure of carbon costs data was gathered from the public financial statements and annual reports of the sample through a Guttman style scale (Bebbington et al., 2008). The main independent variable, the intervention, was the EU-ETS carbon trading scheme that mandated airlines flying into their territories to disclose the carbon burn of their airplanes. A further secondary independent variable was the IFRS financial reporting regulations that might or might not have had an effect within the country of the airlines analyzed or even be in effect during the study time frame. The ability to gather and report costs through some technology computing might also have been a confounding variable in this study. The dependent variable with eight levels was the carbon cost disclosure on the formal financial statements and annual reports of the corporations as described in the Sample and Instrumentation sections of this Chapter 3.

The analysis of the data was completed using SPSS. A norm referenced test compared the nominal disclosure incidence of each airline company across the five

reporting areas that were under consideration (Criterion and Standards Tests, 2007). Those were (a) income statement, (b) balance sheet, (c) footnotes to the financials, (d) annual reports, and (e) EU-ETS reporting. Further subcategories were described in the collection instrument of Table 1. Aggregate data from the EU-ETS public documents for EU destination airline's reporting was compared in SPSS with individual airline corporation's data to derive correlation between the reported data (Jang, 2005).

Further delineation of the variables for this plan was described in levels of detail. This plan used a multivariate quantitative test and considered three independent nominal groups which were assessed against several nominal reported outcomes over a repeated measures longitudinal study. In the study, a pretest and two posttests (i.e., three different reporting time intervals) was used. This was a multiple measures design including within subjects design of each of the participants within the levels of the independent nominal groups. It was also a between subjects design which measured the means of the participants taking each of the independent nominal groups as a whole. A factorial mixed model repeated measures ANCOVA though SPSS was used to assess whether the average scores had differed meaningfully over the time frame.

## Threats to Validity and Reliability

### External Validity

Generalizability was a strength of this study's results as the entire airline industry population from ICAO was used as the frame and verified against the IATA membership listing. Ecological fallacy was also minimized by the use of the airline industry population frame. This resulting complete airline industry population frame was first

stratified into two comparison groups and subsequently into three groups when the EU bound airlines reporting requirement was postponed after their 2012 reporting. This further stratification of Group 1 was done by analysis against the EU-ETS data which showed the airline corporations that were required to report under the EU-ETS mandate. Those airline corporations that were not mandated originally comprised the original Group 2 control population strata. In 2012, with the Group 1stratification into Groups 1 and 2, the non EU bound airlines control group became Group 3. From within these three strata a random sample of 72 was initially chosen and 69 participants were analyzed. Their formal financial statements and annual reports were reviewed for raw data. Also the raw cost data were gathered by individual airline corporation thereby eliminating the individualistic fallacy.

**Internal Validity (Content, Empirical, Predictive, Construct)**

Validity was a strength of this measurement instrument. A modified Guttman scale instrument assured the face and sample validity within the content validity. The collection instrument recorded all possible options within the reporting of the carbon costs (face validity) and used a randomly chosen, statistically significant calculated sample size. There was also empirical validity in the modified Guttman scoring instrument as it allowed a relationship to be seen between the alternatives and the nominal groups and a further comparison between those nominal groups. Group 3 (non EU bound) was the control group. Empirical with predictive validity was present and by comparison to the known-group data collection by the EU-ETS itself (Kolk et al., 2008), the strength of the construct validity was in this measurement instrument (Frankfort-

Nachmias & Nachmias, 2008). Based upon the results of each of the pretest, first posttest, and second posttest, the coefficient of reproducibility (CR) was calculated representing the "extent to which the total response pattern on a set of items can be reproduced even if the total score alone [was] known" (Frankfort-Nachmias & Nachmias, 2008, pp. 426-427).

$$CR = 1 - \frac{\sum e}{N_r}$$

Where $\sum e$ = the number of inconsistencies in the data collected

and $N_r$ = the total number of responses (number of cases x number of items [variables])

Although Jang (2005) pointed out that each nationality had slightly different reporting requirements and GAAP, the EU gathered and reported carbon cost reports from all group's airlines from January 2012 and forward, and therefore some measure of predictability was assured when the EU publicly reported Groups 1, 2, and 3 carbon costs were compared within this study's measurement instrument. Construct validity came from the known groups technique using the EU publicly reported data on all Groups 1, 2 and 3 airlines (Chan & Lam, 2001).

**Reliability**

Further reliability elements were assured in the study. As discussed in the Design section and in the Instrument Reliability section of Chapter 3, the contrasted groups design type was applied in this longitudinal study in order help control for "history, maturation and test-retest effects" (Frankfort-Nachmias & Nachmias, 2008, p. 128, para.1). The records that provided the random sample came from the regulatory bodies of

the ICAO under the UN as well as the EU-ETS and the raw cost data came from public published audited financial statements. An additional five airline corporations were drawn beyond the statistically significant requirement in the random sample to minimize the maturation concern over the time frame. To the extent that these data sources could be relied upon as valid data, there was a good basis for inference from the results.

## Summary

The reliability of the research design, the methodology, the data collection, and the instruments for data analysis have been described in Chapter 3 in detail along with a discussion of the threats and mitigation to internal and external validity. The independent and dependent variables for this study were discussed and then presented as the axes of the data gathering instrument in Table 1. Chapter 3 included the intervention in this study which was provided by new regulatory mandates of the primary independent variable, the EU-ETS, and also the secondary independent variable, the IFRS guidelines. Therefore, the design was ex-post, quasi-experimental.

The data was collected through a pretest-posttest longitudinal frame across 3-years of data. The dependent variables were the disclosure of carbon emissions on the formal financial statements of the randomly sampled airline corporations. As the airline corporations must have sophisticated data information systems in order to collect this flight data on a per flight basis, there might have been confounding variables of inadequate computer programs, and incompetent employees to set up this data gathering. No requirement for XBRL language submission to the EU was found. In Chapter 4, the

results of this data collection and analysis are discussed followed in Chapter 5 with the results discussed relative to the literature, accounting practice, and positive social change.

# Chapter 4: Results

The results of this study indicated that regulatory intervention was required to ensure that the full costs of conducting business within a sustainable environment, including the costs of environmental destruction, were disclosed. The study was a 3-year longitudinal ex-post analysis of financial statements and annual reports of airlines under the EU-ETS carbon emission intervention encompassing pretest 2011 through the intervention period, 2012 and 2013. The initially planned striated sample of an experimental group, airlines subject to EU-ETS and a control group not subject to EU-ETS, were further stratified into three groups; (a) EU resident, (b) EU bound, and (c) non EU bound as global politics forced an EU-ETS postponement for the EU bound airlines at the end of 2012. The 2012 EU-ETS reporting data were available for all mandated airlines.

Both ANOVA and ANCOVA were performed on the data. A one-way repeated measure factorial ANCOVA considered the differences in the number of pollution disclosures across 3-years, 2011 to 2013, made by each airline using one independent variable, the EU-ETS, and the dependent carbon emissions variable. The dependent variable comprised the number of disclosures in European Union certificates of exchange (CER) from green projects plus a number of IFRS allowable accounting methods as shown in Table 1. The mark scored range was 0 to 8 possible outcomes in any one year. A further test used the particular group, either EU resident, EU bound, or non EU bound, to which each airline belonged, as a covariate in the analysis. In addition, an ANOVA of

the number of users of IFRS and the frequency of their disclosures by group was compared with the non-IFRS prepared financial statements.

The main ANCOVA to answer Research Question 1 was conducted to compare the carbon disclosures of the airline groups. The independent variable, the ETS for airlines, included three levels; EU resident airlines, EU bound airlines, and non-EU bound airlines. The dependent variable was the financial statement and annual reports carbon disclosures by each of the sample airlines during 2012 and 2013 during the EU-ETS intervention. The covariate was the 2011 carbon disclosures on the financial statements before the EU-ETS. The data were collected through a pretest-posttest longitudinal frame across 3-years of data. The emissions certificates and allowances reported were cross-referenced to the EU airline carbon emissions repository.

## Purpose, Research Question, and Hypotheses

### Purpose

The purpose of this research study was to determine if involved EU-ETS airlines were disclosing carbon emissions costs on financial statements and annual reports and whether the evolving international reporting standards (IFRS) were having a disclosure affect in conformity with the European Union's carbon emissions trading scheme (EU-ETS) for airlines.

**Research Questions.** The research questions were (a) to what extent there was a difference in the frequency means for reporting carbon footprint costs between the EU bound airlines and the non-EU bound airlines and (b) whether IFRS influence the reporting of carbon emissions costs on the airline's financial statements?

**Hypotheses.**

Hypothesis 1:

$H_0$: $\mu_1 = \mu_2$**.** On average there is no difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

$H_1$: $\mu_1 \neq \mu_2$. On average there is a difference between EU bound and non-EU bound airline corporations in tracking the carbon costs of carbon emissions and reporting on financial statements.

Hypothesis 2:

$H_0$: $\mu 1 = \mu 2$. International financial reporting standards do not influence the reporting of carbon emissions costs on the financial statements of airline corporations.

$H_1$: $\mu 1 \neq \mu 2$. International financial reporting standards influence the reporting of carbon emissions costs on the financial statements of airline corporations.

**Chapter Organization**

Chapter 4 is organized to have a logical information flow following the review of the study purpose, questions to be answered, and hypotheses through to the actual methodology and design used. The flow continues with the quantitative analyses performed and the results of those analyses along with any conclusions that could be drawn. Chapter 4 includes the details of the data collection time frame, the random sampling design, the collection method, and any discrepancies from the original plan described in Chapter 3. The results of the data analyses are discussed including the intervention univariate effects and the covariate effects of both the EU-ETS carbon

trading scheme and IFRS guidelines mandates; a summary of the findings as well as figure and tables for display are included.

## Data Collection

### Time Frame, Recruitment, and Response Rates

**Time frame.** The study encompassed the 2011, 2012, and 2013 annual reports and financial statements of the sample of 71 airlines. Two airlines were removed for lack of available English reports. IFRS had been adopted by many countries over the past decade while the EU-ETS carbon dioxide emissions for airlines was benchmarked in 2008-2010 with formal carbon disclosure reporting mandated from January 1, 2012. Although this date was postponed in late November 2012 for EU-bound airlines, they were required to report to the EU-ETS for 2012. The EU-ETS for EU resident airlines continued to report throughout 2012 and 2013 but like the suspension for the EU bound airlines, the EU resident formal reporting mandate was suspended in April 2014. Annual reports with financial statements during the study period did present data for analysis for the three stratified groups. EU resident airlines (Group 1) reported to the EU-ETS throughout the study, EU bound airlines (Group 2) reported to the EU-ETS until the end of 2012, and non EU bound airlines (Group 3, the control) which were not required to report to the EU at any time.

**Recruitment.** The stratified probability sample with random sampling of publicly traded airlines used three strata within which random sampling was completed until a full complement of 64 airlines was reached. A sample of 71 airlines was chosen to adjust for mortality. The complete population was taken from the ICAO airline listing cross-

referenced to both the EU airline and IATA listings of the then 5,787 airlines in the airline industry. The full listing was subdivided into three strata, the airlines that were EU residents, EU bound airlines, or non EU bound airlines. These constituted Groups 1, 2, and 3 respectively. Group 1 airlines were under the EU-ETS mandate during the study period and were also using IFRS as their GAAP. Group 2 airlines flew into one or more EU airports; some of the airlines used IFRS as their reporting GAAP in their own countries. Group 3 airlines did not fly into any EU airport and might or might not have been using IFRS in their own country for financial reporting. Each selected airline had to have publicly available annual reports. Shown in Figure 1, G power (Faul, Erdfelder, Buchner, & Lang, 2009) .05 alpha reject region, effect size .40 (large) and with 80% power, *F* test ANCOVA sample size calculator confirmed the valid sample size of 64; however, 71 airlines were selected across all three comparison groups to allow for mortality across the study years. Two airlines were eventually removed for lack of complete, available data leaving 69 airlines in the analysis set.

An additional *t* test for the means differences between the airlines that prepared their financial statements using IFRS and those that did not, made use of the same random sample within the three strata. The required statistical sample for this *t* test was 42; therefore, the main sample for the main ANCOVA provided sufficient data. In addition, a further ANOVA *F* test was performed to consider the effects of IFRS financial reporting on carbon emission disclosures. The required statistical sample number was 12 and this too was satisfied by the main ANCOVA sample data.

**Response rates.** A sample of 69 airlines remained in the study throughout the study period. Within the 69 airlines, 15 were from the EU resident group, and 27 were represented from the EU bound group, and 27 from the non EU bound groups. As the data was ex-post secondary data taken from public records, the response was as expected; 97% response data of the 71 airlines originally randomly chosen. Two airlines were removed as no English data could be gathered from their public websites or from e-mail contact to the shareholder relations departments.

**Discrepancies From Chapter 3 Plan**

The study design was conceived to include for multiple measures within and between two sample groups which was subsequently increased to three groups. This study included a within subjects design of each of the participants and the three levels of the independent nominal groups. It was also intended as a between subjects design measuring the means of the participants taking each of the independent nominal groups as a whole. As described in the time frame section, the original design of two stratified groups, EU-ETS mandated, and those which were not, transmuted into the three stratified groups of EU resident, EU-Bound, and non-EU bound due to the postponement of the EU-ETS for the EU bound group at the end of the first mandated reporting year, 2012.

The plan for a *t* test or ANOVA was modified to conduct an analysis of covariance (ANCOVA) for the EU-ETS using the airline groups (three levels) as representing the ETS effect, the independent variable, holding the reported data from 2011 as the covariate constant. The dependent variable was constructed as the repeated measures disclosures in 2012 and 2013. A further ANCOVA was performed holding

IFRS as the covariate with 2011, 2012, and 2013 being the repeated measures. An ANOVA test was performed to analyze the effect of the IFRS mandate on the airline disclosures by having the identified IFRS user airlines as the independent variable and the disclosures across the 3-years of the study as the dependent variable.

The conceived contrasted groups design allowed for a second or possibly a third intervention cause which may have included the airlines being compelled to report to the EU-ETS in XBRL language. Although XBRL language was present in all companies that reported data to the SEC, no XBRL language reporting was required for the EU-ETS during this study's time frame. A measure of the complex computer systems to gather and report data that may have been present was considered in the design; however, due to a lack of reporting within the annual statements, the extent of the ERP systems was limited in this secondary data study.

**Sample Baseline Descriptive and Demographic Characteristics and Representation**

The study used only publicly traded airline corporations for which annual reports were available. These airlines were from countries around the world. The airline industry is comprised of very large or medium sized international passenger and freight companies, medium sized regional passenger carrying or freight forwarding companies, with over 95% of the industry as small privately held or military airlines for which no data could be obtained. This was according to my comparison of the Bloomberg (2013) publicly listed airline index with the IATA/ICAO listings, wherein publicly traded corporations comprised approximately 3.5% of the industry. To verify the EU-ETS reporting as shown on the annual reports, the EU official repository record of ETS airline

environmental reporting was scrutinized for corroborating evidence of carbon certificate allowances, purchases, and green offsetting credits.

Large public companies were most represented in the sample due to their publicly traded shares. These public companies were most prevalent in the industrialized, western cultures with sophisticated and long standing corporate legislation, income tax regulations, and audit. In the randomly achieved sample from within the three strata, not segregated by EU-ETS mandate, 22% were resident in the EU (including 1 Denmark, 1 Finland, 1 France, 2 Germany, 1 Greek, 1 Iceland, 2 Ireland, 1 Netherland, 1 Spain, 1 Turkey, 5 UK), 7.25% Australia, 7.25% Canada, 1.5% Columbia, 17.4% United States, 4.35% China/Hong Kong, 4.35% Taiwan, 1.5% Egypt, 5.8% India, 1.5% Israel, 1.5% Japan, 1.5% Kenya, 2.9% Malaysia, 1.5% Mexico, 1.5% New Zealand, 1.5% Pakistan, 1.5% Panama, 1.5% Philippines, 4.35% Russia, 1.5% South Korea, 1.5% Singapore, 1.5% South Africa, 1.5% Sri Lanka, 1.5% Tanzania, 1.5% Thailand, and 2.9% UAE for a 100% total of the sample (rounding in individual percentages caused slight excess in totaling).

**Results of Basic Univariate Analysis and Further Inclusion of Covariates**

A univariate analysis of airline penalty disclosures for EU-ETS carbon fuel burn and a univariate analysis conducted on the IFRS prepared annual reports versus the non-IFRS prepared reports did not take into consideration the covariate affect that may have been present. A subsequent multivariate analysis was required. As a result, several analyses were conducted as repeated measures ANCOVA holding 2011 and/or IFRS as one or two covariates concurrently in response to Research Question 1 regarding the EU-

ETS effect on reporting. In addition, an ANOVA to determine the effect of IFRS on the reported carbon emissions was also done in response to Research Question 2.

In order to set the context to answer the Research Question 2 which referred to the use of IFRS for standardized financial reporting, a univariate base comparison was run between the IFRS user and non-IFRS users. Within the 69 sample airlines, the EU resident Group 1, which comprised 22% of the sample and within which all airlines were mandated to use IFRS, had 100% IFRS compliance in their annual reporting. Of the EU bound airlines which comprised 39% of the sample, just 19 of the 27, or 70.4% were reporting compliance with IFRS. Of the non-EU bound airline group, which comprised 39.1% of the sample, 15 of the 27 airlines or 55.6% were IFRS compliant. These comparisons are shown in Figure 2. Therefore, while just 34 of the 69 airlines (50.7%) were from IFRS mandated countries and were required to report in IFRS, there were actually 49 airlines, or 71% of the sample, that did report in IFRS. Of the 50.7% of the sample which were from IFRS mandated countries, just one airline from Hong Kong failed to indicate that they had reported in IFRS or HKFRS which is the Hong Kong replication of the IFRS.

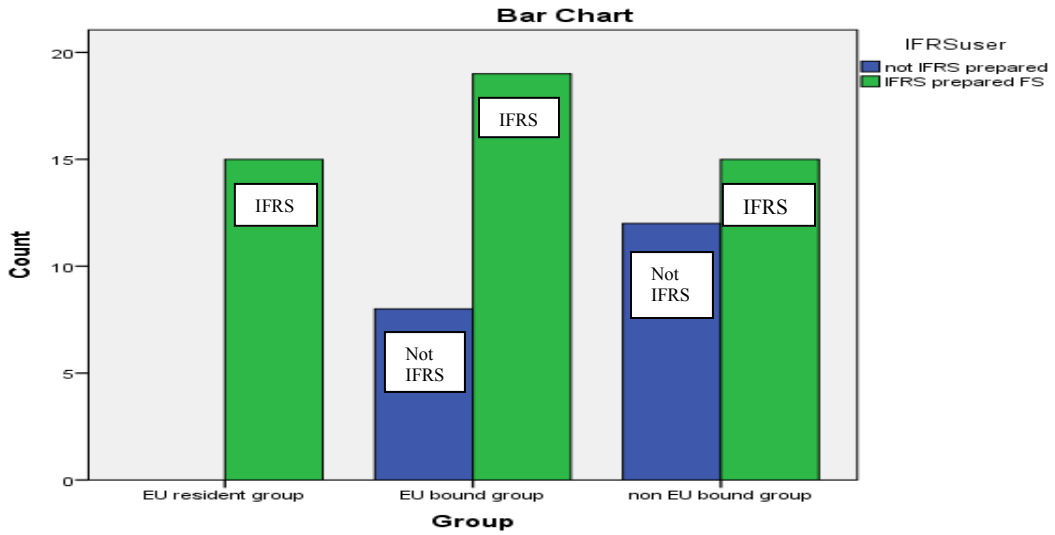


*Figure 2*. Bar graph of the frequency of IFRS reported prepared annual reports across the three represented groups of airlines.

The results of this ANOVA of IFRS based reporting through the study period and based in each group is shown in Table 3; the chi-square test of this reporting data with $X^{(!)}$ (2, $N$ = 69)= 9.263, $p$ = .010.

Table 3

*IFRS Users Compared With Non IFRS Users: Chi-Square Test*

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 9.263 | 2 | .010 |
| Likelihood Ratio | 13.168 | 2 | .001 |
| Linear-by-Linear Association | 8.711 | 1 | .003 |
| N of Valid Cases | 69 | | |

*Note.* $N$ = 69, $p$<.05

## Treatment and/or Intervention Fidelity

### Plan

The ANOVA design was enhanced to also provide an ANCOVA to investigate the covariate relationships within the interventions and the repeated measures of carbon

disclosures across the 3-years of the study. The ANCOVA was performed to include for the IFRS covariate and used 2011 as the benchmark year against which the repeated measures in 2012 and 2013 were compared. The two group plan was modified to three groups due to a postponement of the EU-ETS intervention for the EU bound airlines in 2012. The data collection instrument was expanded to provide information on additional categories of CSR dialogue categories and green project offset credits. The data collection instrument was also broadened to include any evidence of derivative hedging contracts for forward Certified Emissions Reduction (CER) contracts taken on by the airlines to hedge exposure to carbon emissions allowance trading volatility.

**Intervention Limitations**

The EU-ETS mandate for the proposed groups, all airlines under the EU-ETS mandate, was not universally enforced. The EU-ETS intervention applied only to the EU resident airlines during the full period of the study. Other airlines using EU airports (EU bound Group 2 in the study) were given a moratorium in late November 2012 on the assigned penalties until the ICAO could establish a globally acceptable scheme. The EU bound airlines were required to report to the EU-ETS for the whole of 2012 and were not required to report for the year 2013, the final year of the study. The EU bound airlines, which had prepared for the EU-ETS since 2008 like the EU resident airlines, became a separate Group 2 for this study. This moratorium was based in the airline industry (through IATA) and United States/China country lobbies which claimed low profit margins and a continuing poor economic climate remaining from the 2008 financial crisis. That economic crisis affected the airline industry with bankruptcies and losses that

continued into the study period. During this study period, the continuing poor profits of the airlines was exacerbated by the need for the airlines to invest in upgrades to their airplane assets and IT infrastructure in order to reduce their carbon emissions.

The secondary intervention of IFRS was evident in those airlines whose countries had accepted the IFRS guidelines. IFRS adoption was mandated by the EU for all EU members' financial reporting but remained voluntary for all other world regimes. On a country by country basis, the airlines were analyzed for their IFRS use as GAAP. Figure 2 depicted the IFRS reporting by the three groups and while 50.7% of airlines belonged to IFRS GAAP mandated countries, 71% of the sampled airlines were reporting in IFRS.

## Results

To satisfy Research Question 1, whether the EU-ETS $CO_2$ penalty scheme had an effect on the financial reports of the airline industry, a one way analysis of covariance (ANCOVA) was conducted. The *F* test ANCOVA using a statistically significant sample of 69 airlines was performed for fixed effects, main effects, and interactions between three independent means (three groups) .05 alpha reject region, effect size .4 (large) and with 80% power. The results indicated that the EU resident airline participants, 100% of which were IFRS mandated and who remained under the EU-ETS mandate throughout 2012 and 2013, did disclose and report carbon penalty costs in significantly more IFRS adapted methods or green project credits, which continued to increase over the time frame. The EU-bound airline group under the EU-ETS mandate for 2012 which were 70.3% from IFRS mandated countries, had mean disclosures that were 76% fewer carbon emission costs in 2012 than the EU residents and subsequently showed a within group

46.5% mean decrease in their disclosure from 2012 to 2013 when they were no longer required to report to the EU-ETS. The non EU bound group, never under the EU-ETS mandate, in 2012 disclosed 87.5% less mean carbon costs than the EU resident group and 47.7% less than the EU-bound group.

For the ANCOVA, the independent variable, the airline groups, included three levels; EU resident airlines, EU bound airlines, and non-EU bound airlines. The dependent variable was the financial statement carbon disclosures on each of the airlines in the sample throughout 2012 and 2013 during the EU-ETS intervention, and the covariate was the 2011 carbon disclosures on the financial statements before the EU-ETS. A preliminary analysis evaluating the homogeneity of slopes assumption indicated that the relationship between the covariate and the dependent variables did not differ significantly as a function of the independent variable; for 2012, $F(2, 63) = .125$, $MSE = .635$, $p = .883$, and partial $\eta^2 = .004$, small effect, and the interaction was non-significant; for 2013, $F(2, 63) = 1.445$, $MSE = .337$, $p = .224$, and partial $\eta^2 = .044$ and again, the interaction was non-significant. Based upon the results of the partial $\eta^2$ and verified homogeneity of slopes, an ANCOVA could have been conducted; however, an ANCOVA with a main effects test was conducted that allowed for the homogeneity of slopes in order to obviate the assumption.

The one way ANCOVA tests for the main effects with the covariate. The results of the analysis indicated that the null hypothesis, that the adjusted population means are equal, should be rejected as the ANCOVA was significant. In comparing the groups in 2012, $F(2, 65) = 55.51$, $p = .00$, and the partial $\eta^2$ of .631, a strong relationship was

suggested between the different groups and their 2012 carbon disclosures controlling for the disclosures in 2011. The strength of the relationship between the EU resident group and the carbon disclosure, as assessed by the partial $\eta^2$ with the EU resident group, accounted for 63.1% of the variance of the dependent variable, the carbon disclosures, in 2012, and 79% of the variance in the dependent variable, the carbon disclosures, in 2013, holding constant the 2011 carbon disclosures. The comparison of the groups with 2013 disclosures, $F(2, 65) = 122.49$, $p = .00$, and the partial $\eta^2$ of .790 again suggests a strong relationship between the different groups in the 2013 carbon disclosures controlling for the disclosures in 2011.

The relationship between the 2011 carbon disclosures, the covariate, and the 2012 and 2013 dependent variables within the three groups is significant; for 2011 with 2012, $F(1, 65) = 57.08$, $p = .00$, with the 2011 disclosures accounting for about 46.8% of the variance in the 2012 carbon disclosures. For the 2011 comparison with 2013, $F(1, 65)$, $p = .00$, with 2011 disclosures accounting for 51.1% of the variance in the 2013 disclosures.

The means of the number of carbon disclosures adjusted for the initial differences in 2011 were ordered as expected across the three airline groups. Appendix B depicts the estimated marginal means of each group's reporting wherein the EU resident group had the largest adjusted mean of $M = 3.141$ (2012) and $M = 3.240$ (2013), the EU bound group with $M = 0.751$ (2012) and $M = 0.402$ (2013), and the non EU bound group with the smallest means at $M = 0.393$ (2012) and $M = 0.354$ (2013). The results of the pair-wise comparisons in Table 4 showed the differences in the adjusted means of the three groups

in 2012 and 2013. The differences in the EU resident group with the other two groups is significant in both 2012 ($p$ = .00) and 2013 ($p$ = .00) and non-significant between the EU bound and non EU bound groups in both 2012 ($p$ = .10) and 2013 ($p$ = .76).

Table 4

*Pair-wise Comparisons Main ANCOVA*

| Dependent Variable | (I) Group | (J) Group | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| TtlYes12 | EU resident group | EU bound group | 2.390* | .266 | .000 | 1.860 | 2.921 |
| | | non EU bound group | 2.749* | .271 | .000 | 2.207 | 3.290 |
| | EU bound group | EU resident group | -2.390* | .266 | .000 | -2.921 | -1.860 |
| | | non EU bound group | .358 | .215 | .100 | -.070 | .787 |
| | non EU bound group | EU resident group | -2.749* | .271 | .000 | -3.290 | -2.207 |
| | | EU bound group | -.358 | .215 | .100 | -.787 | .070 |
| TtlYes13 | EU resident group | EU bound group | 2.839* | .198 | .000 | 2.444 | 3.233 |
| | | non EU bound group | 2.887* | .202 | .000 | 2.484 | 3.289 |
| | EU bound group | EU resident group | -2.839* | .198 | .000 | -3.233 | -2.444 |
| | | non EU bound group | .048 | .160 | .763 | -.270 | .367 |
| | non EU bound group | EU resident group | -2.887* | .202 | .000 | -3.289 | -2.484 |
| | | EU bound group | -.048 | .160 | .763 | -.367 | .270 |

Based on estimated marginal means

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

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Regression plots of the ANCOVA depicted by airline, 2013 disclosures compared with 2011 constant covariate and 2012 disclosures compared with the 2011 constant covariate, are shown in Figures 3 and 4.

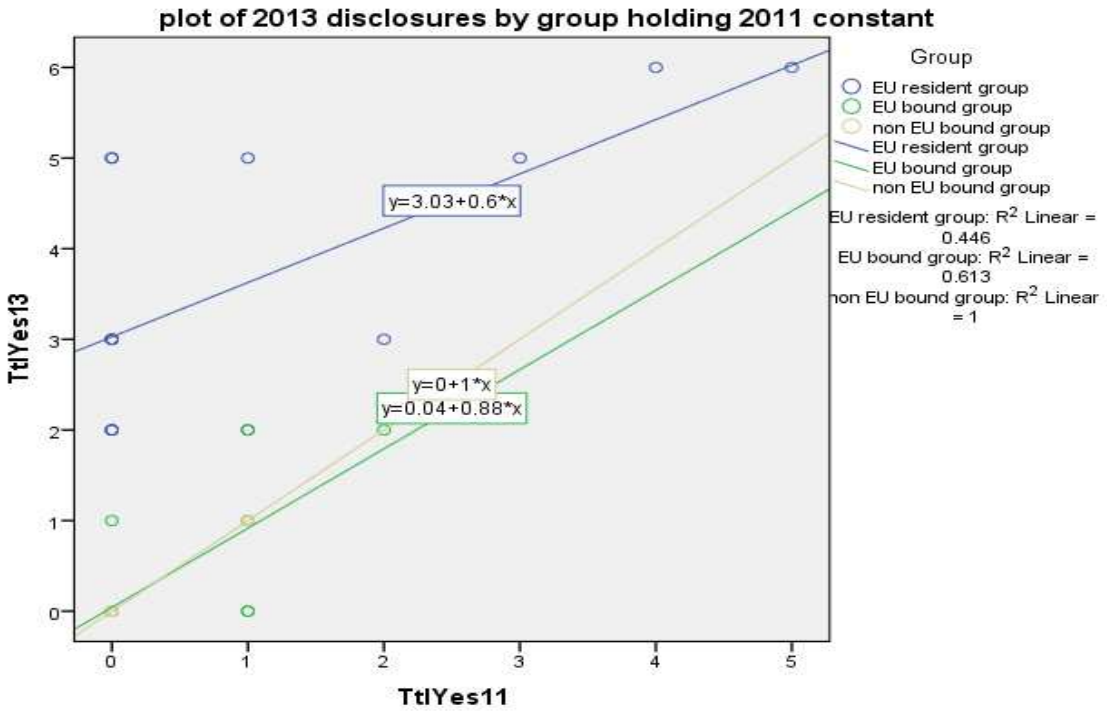


*Figure 3.* Scatterplot of main ANCOVA 2013 confirming carbon disclosure frequencies of three airline groups. In the regressions, the fixed means and variable slope components indicated a positive trajectory of reporting carbon pollution costs with the continuation of the interventions.

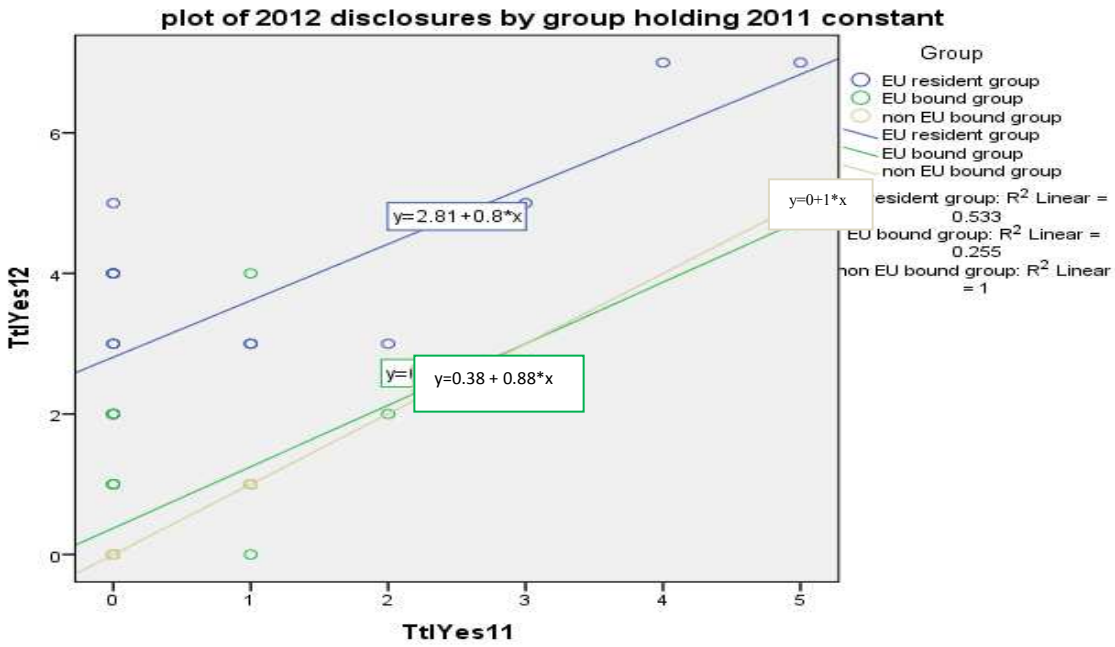

*Figure 4*. Scatterplot of main ANCOVA 2012 confirming carbon disclosure frequencies of three airline groups. In the regressions, the fixed means and variable slope components indicated a positive trajectory of reporting carbon pollution costs with the continuation of the interventions.

The scatterplots and regression lines of best fit in 2012 and 2013 showed a positive trajectory for increasing carbon emissions cost disclosure. For the EU resident airline sample, the carbon disclosure regression line in 2012 of y =2.81 + .8x increased to y =3.03 +.6x in 2013 reporting. This increase was significant as there were just eight IFRS or carbon related categories that might have been used and once an airline had chosen its disclosure guideline, consistency principle in GAAP would have had them remain constant from year to year. For the EU bound airline sample, the carbon disclosure regression line in 2012 of y =.38 + .88x decreased to y =.04 + .88x. This was also significant as this result indicated a decline in the airline's own annual formal reporting of carbon emission costs once the regulatory EU-ETS mandate had been removed for 2013.

To investigate Research Question 2, the effect of IFRS on carbon reporting, a one way ANOVA was conducted to evaluate the relationship between IFRS prepared financial statements and the disclosure of carbon cost penalties on the financial statements of the airline industry for the 3-years of the study. An ANOVA, for mean differences between the independent group means, .05 alpha reject region (i.e., only 5% chance of the wrong hypothesis conclusion [Burkholder, 2010]), effect size .8 (large) and with 80% power, was run; 80% is the chance of finding a mean difference between the groups if one exists (Sherperis, 2010). The independent variable, the IFRS prepared

financial statement airlines and the dependent variable was the carbon disclosures on their financial statements in the study years, 2011, 2012, and 2013.

The ANOVA showed significant differences in disclosures amongst the groups in years 2012 and 2013; (2012) $F(1, 67) = 9.206$, $p = .003$ and (2013) $F(1, 67) = 8.434$ (2013), $p = .005$, but non-significant differences in 2011, $F(1, 67) = 2.70$, $p = .105$. The strength of the relationship between the IFRS user airlines and the number of carbon disclosures, as assessed by $\eta^2$, was of medium strength in the 2012 and 2013 years with IFRS representing 12.1% of the variance in the dependent variable, carbon disclosures, in 2012, and 11.2% of the variance in 2013. The strength of the relationship was very small in 2011 with IFRS users representing just 3.9% of the carbon disclosures dependent variable.

The *F* tests for 2012 and 2013 were significant and follow-up tests were conducted to evaluate the pair-wise differences amongst the means. The mean variances across the 3-years varied from 0.239 to 3.587, the lower end applicable to all 3-years of not IFRS prepared, and the upper end approximately applicable to all 3-years of IFRS prepared, indicated that the variances were somewhat different from each other. The test of homogeneity of variance was significant at $p = .013$ (2011), $p = .000$ (2012), and $p = .000$ (2013) which implied that there are differences in the population variances. Post hoc tests of Tukey and Dunnett C were not possible as there were less than three levels in the independent variable. In the pair-wise comparison the 2011 results showed non-significant differences at $p = .105$ between the IFRS users and non-IFRS users in their carbon disclosure. In 2012, $p = .003$ and in 2013, $p = .005$, there were significant

differences between the IFRS and non-IFRS user's carbon disclosures. The 95% confidence intervals for the pair-wise differences, as well as the means and standard deviations for the two IFRS groups are reported in Table 5. With *p* values in the intervention years of less than .05, the difference is significant and the null hypothesis for Research Question 2 is rejected. The alternate hypothesis is accepted and it is inferred that IFRS makes a difference in the reporting on the airline annual statements. Graphic illustration of the comparative carbon reporting across the study is shown in Figure 5.

Table 5

*95% Confidence Intervals – Pair-wise Differences: Mean Changes in $CO_2$ Disclosures*

| Disclosure Year | IFRS user/not user | M | SD | IFRS User | Not IFRS user |
|---|---|---|---|---|---|
| 2011 | IFRS user | .55 | 1.042 | | [-.086, .888] |
| | Not-IFRS user | .15 | .489 | [-.888, .086] | |
| 2012 | IFRS user | 1.51 | 1.894 | | [.448, 2.172] |
| | Not-IFRS user | .20 | .523 | [-2.172, -.448] | |
| 2013 | IFRS user | 1.35 | 1.809 | | [.374, 2.020] |
| . | Not-IFRS user | .15 | .489 | [-2.020, -.374] | |

*Note*. *M* = Mean, *SD* = standard deviation.

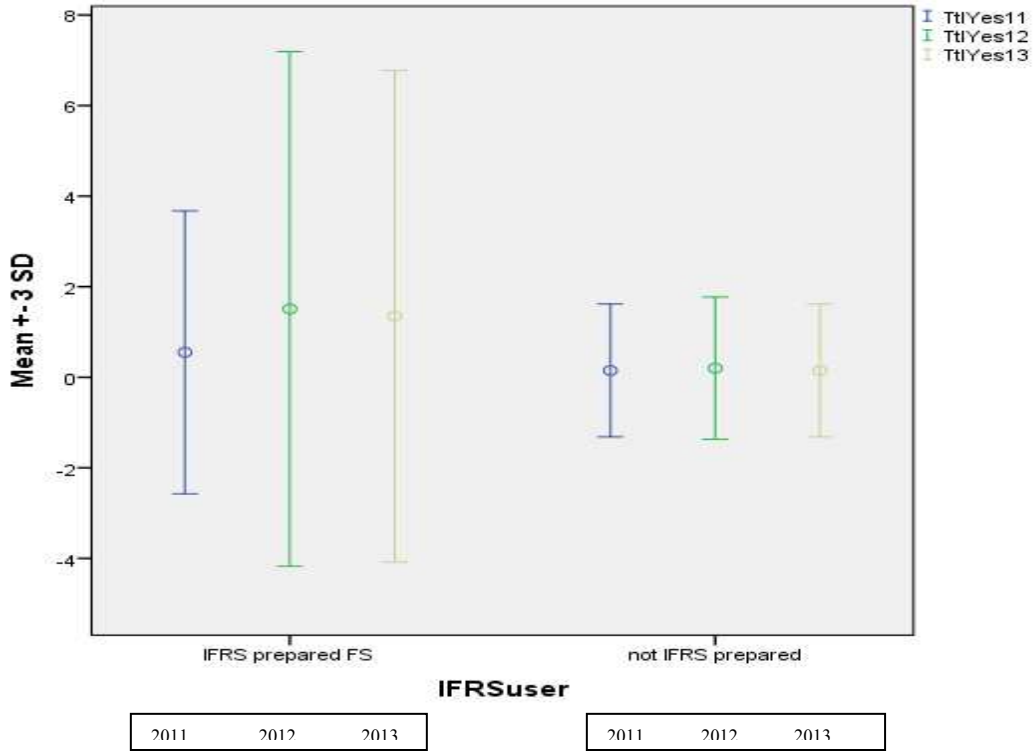


*Figure 5*. ANOVA. IFRS user generated financial statement carbon disclosure. Graphic confirmation of the variation in carbon pollution reporting between those airlines whose countries had adopted IFRS and those who had not. Note: Consideration in these results is mitigated by the knowledge that all EU resident airlines were mandated to both EU-ETS and IFRS GAAP reporting.

## Summary

The analysis completed led to the acceptance of the alternative hypotheses for both research questions. The analysis implied that the EU-ETS demand for airline carbon reporting had made a difference in the airline's carbon pollution reporting and so too had the IFRS financial reporting standards mandate that has been adopted by many countries. The results supported previous research (Apergis et al., 2013; Ball & Craig, 2010; Frias-Aceituno et al., 2012; Matisoff, et al., 2012; Turner et al., 2012) that indicated government intervention was needed to garner compliance to any environmental issue. Without the economic ramifications of pollution and environmental damage costs

imposed and then included on the financial statements of the offending corporations, there will be little incentive to mitigate and reduce current GHG emissions. These findings indicated that previous research (i.e., size of company, senior management of company, profitability, industry norms, and sophisticated computerized systems) appeared to be present in the airlines that produced more disclosure and enabled compliance as indicated by the ANCOVA results (Christ and Burritt, 2013; Frias-Aceituno et al., 2012). This study's results did not support any one of the academic researchers' compiled or suggested pollution costing models (Ajani et al., 2013; Apergis et al, 2012; Vasile & Man, 2012).

The regressions in Figures 3 and 4 indicated that the trajectory was positive for carbon reporting and carbon minimization initiatives as a result of government/regulatory intervention. The disclosure results showed that the EU resident airlines, under the mandate throughout the study, continued to increase their reporting and carbon minimization initiatives, while the EU bound airlines, though increasing their disclosure during their mandated 2012 year from the foundational 2011 year, decreased their reporting in 2013 when they were no longer mandated. The non EU bound airline's reporting remained relatively constant throughout the study period and in some cases, such as Australian regional airlines, had home country mandates for environmental protection. The results revealed that government/regulatory action was indicated if responsible companies were to disclose carbon pollution on financial statements and thereby begin to include the full costs of conducting business. As a result of both the attention being given to carbon pollution and the airlines' increased operating costs of

penalties, the annual report evidence indicated that both operating efficiencies and technical changes were initiated by EU-ETS airlines to lower fuel consumption. The lower fuel consumption indicated increased profits, and a CSR appearance for the responsibility for the sustainability of global ecosystems. In Chapter 5, the results are discussed in relation to the literature review and the theoretical base, as well as how this research expands environmental accounting practice and contributes to positive social change. Chapter 5 is concluded with my recommendations for further research opportunities beyond this study.

# Chapter 5: Discussion, Conclusions, and Recommendations

This study was conducted to discover whether corporations required regulatory imperatives to reduce anthropogenic $CO_2$ and would disclose the economic effects of that pollution on their financial statements. The airlines represented in the experiment and control groups in this study were publicly traded airlines for which annual reports were available and that may have been disclosing carbon or GHG emission costs due to the EU mandate and/or IFRS guidelines adopted as GAAP in their home countries. The EU and IFRS provided an environmental accounting analysis opportunity through the EU environmental trading scheme for $CO_2$ penalties (EU-ETS). This EU-ETS opportunity concerned airlines using the EU airspace along with the evolving IFRS international accounting guidelines, which provided the reporting framework. Annual statements of a statistical airline industry sample provided 3-years of reporting data for a quasi-experimental repeated measure ANCOVA. The study results confirmed the positive effect of regulation on the airline industry's compliance and on their ability to gather and report their $CO_2$ pollution data in increasingly formal disclosure over the period. Through the study, a review of annual statements also revealed the details of operating adjustments made by airlines to minimize their carbon pollution that concurrently resulted in reductions of their operating costs through fuel savings and operational efficiencies.

## Key Findings Summary

The study results indicated that both the EU-ETS airline mandate as well as IFRS accounting guidelines made a significant difference in the carbon emissions reporting of the industry. The ANOVA and ANCOVA analyses with accompanying regression

figures inferred that the trajectory was positive for carbon reporting and carbon minimization initiatives as a result of government/regulatory intervention. Significant differences in carbon pollution reporting were identified between the airline groups that flew into EU airports and those that did not.

In response to Research Question 1, the regulatory legislation that created the EU-ETS mandate for airlines flying into and within the EU sovereign space did affect the carbon emissions disclosure on the annual reports of the sample airlines. As this sample was both statistically significant and randomly chosen from within the three groups represented in the industry frame, the sample is representative of the entire industry. As discussed in the Chapter 4 results and shown in Appendix B, the carbon disclosures for the EU resident Group 1, which remained under the government regulation throughout the study, were significantly higher than the disclosures of both of the other two groups with Group 1 at $M = 3.141$ (2012) and $M = 3.240$ (2013). The refusal of some large countries to allow their airlines in Group 2 to participate in the ETS scheme such as the United States and China, as well as the EU postponement for 2013 for Group 2, did reduce the EU bound group disclosure results. However, the within group analysis of disclosure did indicate that EU bound Group 2 with $M = 0.751$ (2012) and $M = 0.402$ (2013) were in those respective years significantly higher disclosures than in the control Group 3 non EU bound airlines. The reduction in disclosure in the 2013 results of Group 2 appeared to be a direct result of the postponement until 2016 for that group. The control Group 3 results of carbon disclosure as shown in Appendix B were $M = 0.393$ (2012) and $M = 0.354$ (2013). The EU-ETS was forced by geopolitical lobbying by IATA through

ICAO, into postponing the pollution penalty ETS in late 2012 for the EU bound group and resulted in the study's three group delineation of EU resident, EU bound, and non EU. As reporting data was available for the 2012 period for the two ETS mandated groups, I was able to analyze the effect through the 3-years on the groups flying into the EU. This analysis indicated, as shown in Figure 4, a decline in disclosure reporting due to the EU postponement for the EU bound group. This was further confirmed in Table 4 which showed the mean difference widening between the EU resident group and the EU bound group in 2013 which moved from 2.390 in 2012 to 2.839 in 2013 while the mean difference gap between the EU resident group and the non EU bound group remained more stable at mean difference 2.749 in 2012 and 2.887 in 2013.

The widening gap in 2013 disclosures between the first two EU user groups, shown in Figures 3 and 4 as well as Table 4, indicated both an increasing disclosure from the EU resident airlines and a decreasing disclosure from the EU bound airlines in 2013 when no longer under the EU-ETS mandate. The small increase in the mean differences between the EU residents and the non EU bound group in 2013, were indicative of the increasing disclosure from the EU resident airlines in 2013.

Positive economic effects in operating savings in many of the sample airlines were evident in their annual reports. Within the mandated Groups 1 and 2, as their number of flights and therefore fuel burn increased over the study period, their EU-ETS disclosed penalties did not rise in corresponding percentages. Although several major airlines forecasted ETS expense for 2012, which were subsequently revalued by those airlines for 2012 and 2013, the nonescalating carbon penalties were a result of reduced

operational fuel burn per flight or increased green project offsets. Some examples of this were; Air Berlin, Air Lingus, and British Airways. While conducting this research, other private airlines whose annual reports were not available, were nevertheless found to have environmental protection policies, such as in South Africa, Kenya, and Australia as a few examples.

In response to Research Question 2 and as discussed in Chapter 4, the study results indicated a high correlation between those airlines using IFRS and their carbon disclosure. The analysis of IFRS mandated airlines compared against their country of origin GAAP mandate, as well as their disclosed IFRS reporting during the study, was compared with the ETS reporting. This comparison, discussed in Chapter 4 and depicted in Table 5 as well as Figure 5, indicated a high correlation between IFRS reporting and carbon emissions disclosure with 2012 disclosure mean of 1.51 (IFRS users) compared with 0.20 mean (non-IFRS users). The same disparity was seen in the 2013 results with disclosure mean of 1.35 (IFRS users) compared with a mean of 0.15 (non-IFRS users).

Significant differences, as shown in Table 5 and Figure 5, were found in the IFRS based reporting of $CO_2$ between the 2011 previous year to the regulation and the ensuing 2012 and 2013 disclosures. The carbon reporting remained flat for the non IFRS prepared statements throughout the study as shown in Figures 3 and 4 with regression lines of $y = 0 + 1x$ in both 2012 and 2013. A significant disclosure increase was seen in the IFRS prepared statements in the 2012 EU-ETS mandated year with regression line of disclosures of the EU resident airlines moving from $y = 2.81 + .8X$ in 2012 to $y = 3.03 + .6X$ in 2013. EU Bound airlines disclosure regression line declined from the 2012, y =

0.38 + .88x to y = .04 + .88X in 2013 due to the EU bound group no longer being required to report carbon burn metrics to the EU for 2013.

An example of a global conglomerate airline's carbon footprint disclosure, publicly traded, is Virgin Australia Holdings. Headquartered in an IFRS mirrored GAAP country and that has just one corporate segment that flies into the EU. Virgin Australia Holdings will begin to use Australian Accounting Standards Board (AASB), AASB 9 and AASB 13 in 2014 which is mandatory for the classification and measurement of financial and nonfinancial assets and liabilities on the fair market value rather than historical cost. AASB is a reflection of IFRS guidelines. Their notes to the financials including their future risks do not mention specifically carbon credits or debits that may be assigned to them by Australia or the EU. On page 162 of their 2013 annual report they stated that since 2011 they have been following the GRI or triple bottom line disclosure guidelines, displayed separately from Virgin's FS. They present their GRI metrics under the environment section which rose due to their increasing consumption of energy, aviation fuel, and ground fuel. Virgin further showed their carbon dioxide emissions from Scope 1 and 2 emissions as rising but Virgin has had passengers donate money as offset carbon pollution credits. Virgin then used the donations to purchase green credits (CERs) from the green project originating country. Virgin's GRI efficiency measures both in carbon and fuel have consistently increased as a percentage of revenue ton kilometers (RTK) for fuel and revenue passenger per kilometer (RPK) for carbon emissions. In the 2011 GRI report, Virgin began showing the categories of *number of fines, value of fines, and non-monetary sanctions*. In all 3-years of annual reports, nothing has been entered in these

categories. Clearly while public pressure has Virgin participating in GRI disclosure and they anticipated the evolution of airline emissions penalties in 2011, by 2013 they had not been penalized. Pollution penalties or costs were not dealt with on Virgin's financial statements or with any negative costs attached.

## Interpretation of the Findings

### Confirm, Disconfirm, or Extend Previous Research

The theories and previous carbon literature that I discussed in Chapter 2 were positively supported and extended by the results of this study. In Chapter 2, I discussed previous research findings that indicated that government intervention was required in order to have companies change their operating paradigm and reduce their pollution of the earth (Apergis et al., 2013; Ball & Craig, 2010; Frias-Aceituno et al., 2012; Matisoff, et al., 2012; Turner et al., 2012). Also discussed from the literature was the value of consistent language and consistent costing approaches and penalties to provide a homogeneous, fair economic operating environment for all industry participants (Grubb & Neuhoff, 2006; Uddin & Holtedahl, 2013). The commercial costs and benefits of carbon accounting and ETS schemes reported in Chapter 2 based upon European multi-country studies by Apergis et al. (2013) and a Welsh study by Turner et al. (2012) were confirmed in apparent economic benefits that were discussed by some of the participants in this study and demonstrated in their write down of previously accrued for ETS pollution credits (i.e., Aer Lingus, Ireland and Atlantic Air, Denmark). In Chapter 2, the literature was discussed that described the corporate attributes that would enable compliance to regulation. The financial ability to make operating changes as well as a

philosophical change in senior management's thinking was required if the previous polluting business models were to change (Christ & Burritt, 2013; Frias-Aceituno et al., 2012).

This study confirmed previous research that indicated government intervention was needed to force mitigation of anthropogenic pollution (Apergis et al., 2013; Ball & Craig, 2010; Frias-Aceituno et al., 2012; Matisoff et al., 2012; Turner et al., 2012). The EU resident airlines in Group 1, forced into compliance with EU-ETS and IFRS, not only demonstrated explicit compliance in reporting and paying penalties but found additional profit in their innovative strategies to reduce fuel consumption. Tactics were employed such as new aircraft, maintained engines, lighter weight seating, and cargo containers. Finnair produced an 88 page sustainability report in 2012 that detailed their fuel reducing strategies, their increased profits from those strategies, and their reduced carbon emissions for the year. Finnair reduced fuel consumption to 785,000 kilos (-2%) and $CO_2$ emissions to 2.5million kilos (-2%) in 2012 and a further 5.5% less in 2013. In addition, each airline in Group 1, the EU residents, over the study period dedicated increasing space to discuss other aspects of their changing business model. These operational changes regarding anthropogenic pollution were reduction initiatives such as their use and handling of mechanical chemicals, their employees' participation, and other societal environmental projects such as reforestation.

Airlines in Group 2, EU bound, did not show on-going compliance in 2013 to the EU-ETS as they had been given a postponement. Although the EU bound airlines had been part of the initial mandate since 2008 and had sent in their benchmarking data for

2010 this group of EU bound airlines were given a reprieve for 2013. This reprieve was due to the political lobby environment of IATA member countries which through ICAO confirmed their compliance willingness for 2020. EU-ETS intends to begin again in 2016 after the next ICAO global meeting. In these EU bound airlines there was evidence of carbon reduction innovations, dialogue, and readiness in the annual reports of 2011 and 2012. After the ETS postponement in late November 2012 for the year 2013 there was a noticeable decrease in carbon emission disclosure in MD&A or sustainability reports in some Group 2 airlines (e.g., El Al Airlines). Many airlines from Group 2 such as those from China, India, and Pakistan had little or no discussion or awareness of mitigating their $CO_2$ emissions or climate change responsibility across all 3-years of the study (e.g., China Airlines, Kingfisher, and Pakistan. Aeroflot, another Group 2 airline from Russia noted the EU-ETS regulation, but described only the Russian environmental requirements and penalties.

Group 3 airlines were under no EU mandate to comply with carbon emissions penalties; however, some showed compliance to their own countries mandates such as Australia, Kenya, South Africa, and Malaysia. Their compliance was in the metrics of their own geographic regulation. For example, Group 3 Australian airlines reported according to Australia's regulations, some African airlines in accordance with GHG Protocol or GRI G3/G4, and still others were more anecdotal in their emissions/environment discussion (i.e., Comair, Kenya Airlines, and EVA). Comair from South Africa, as an example, which operates regionally with international flight agreements through British Airways (BA), was not part of the EU-ETS. However, they

adhered to the GHG protocol for accounting and protocol standards and disclosed Scope 1, 2, and 3 emissions because of their relationship with BA. Comair identified climate change as the most urgent and significant sustainability issue on their 2013 annual report. From Australia, other Group 3 airlines such as Alliance Airlines had posted their energy efficiency opportunities (EEO) reports and Regional Express Airline had posted both EEO and GHG reports on their website.

Australia has had an EEO reporting requirement as well as a National Greenhouse and Energy Reporting (NGER) requirement since 2005 and 2008 respectively. In the aftermath of the EU rescinding its ETS airline mandate for EU bound airlines for 2013 and for all airlines in April 2014, Australia also changed their carbon penalties. Due to a political party change in the 2013 Australian government elections, the Australian carbon tax law for airlines and all industries was repealed in July 2014. Economic hardship was the rationale for the law's repeal.

Previous research regarding the company attributes that would enable compliance to regulations, such as the size of company, senior management of company, profitability, industry norms, and sophisticated computerized systems (Christ & Burritt, 2013; Frias-Aceituno et al., 2012) were not statistically confirmed. In Chapter 2, I discussed the previous research findings on the characteristics of corporations which chose to disclose their pollution emission. Frais-Aceituno et al. concluded that the predictors that may support a company's pollution disclosure were company size and profitability. Both of these attributes may potentially be linked to a larger pool of cash flow, employee and asset resources needed to gather data and produce meaningful information. Large

international airlines resident in regulatory sophisticated, highly computerized, and accounting regulated countries such as Canada, the United States, Australia, and Europe prepared the most detailed disclosures and detailed financial statement notes. These attributes included company size, senior management's supportive dialogue, available asset and operational investment funds, and competitor's compliance. Air Canada, as an example, created an additional operations analysis department, trained in six sigma techniques, specifically in response to the EU-ETS and an increasing regulatory environment. On the IS and BS of many participants, sophisticated enterprise resource planning systems (ERP) coupled with additional extensive application software appeared as assets purchased and upgraded for support of the required compliance.

Sophisticated computerized environments needed for carbon emissions data gathering are available but not universally used. Most airlines in the sample of Group 1 (EU residents) did not specifically detail ETS allowance costs as a separate line item on the IS or BS. It is unknown if this was due to a lack of computer system or employee sophistication in report writing or whether the cost was immaterial and therefore not worth disclosing alone. I also gathered data on ETS allowances (EUA) and green project credits (CER) by airline from the EU climate action transaction log (EU, 2014). The EU-ETS repository data was used to verify the IS and BS disclosures as well as add valuable underlying detail for each sample airline.

Some airlines did create sophisticated pollution reporting systems. One airline, Finnair Cargo (Group 1), in partnership with CGI Group (Logica), an IT consultancy firm, had developed an emissions reporting tool that provided $CO_2$, $SO_2$, $NO_x$ emissions

on every shipment through the entire delivery chain, air, road, and sea. Finnair had shared this software with their forwarding agents. Finnair had been tracking against the GRI G3 calculation guidelines and encompassing not only their airline fuel emissions but their used technical services chemicals, as reported through the their own company extensive regulated environmental performance indicators.

The public airline corporations were analyzed through their annual reports. The larger global airlines, many of which had 2013 revenues of several billion dollars, were apparent in their pollution reporting and public relations publications. Unlike the detailed economic analysis of Apergis et al. (2013) or Turner et al. (2002) for regulatory effect, this study was focused on pollution disclosure compliance. Data was gathered on revenue and employee numbers as well as references to their ERP systems within MD&A or on financial statements; however, the statistical analysis to determine mean reporting differences by size and profitability were not performed. Also, as the data was gathered from published annual reports the detailed metrics of comparing operating profits before and after EU-ETS upgrades and process changes was not done in this study. Even though there was anecdotal evidence in the MD&A as well as increasing operating profits for some airlines, the underlying details of the costs and benefits was unavailable in this study design.

The analysis completed did not support any of the academic researcher's compiled or suggested pollution costing models shown in Chapter 2 (Ajani et al., 2013; Apergis et al., 2013; Tsai et al., 2012; Vasile & Man, 2012). Where pollution was calculated, it was to the EU mandate and/or a specific government mandated formula in

whichever jurisdiction the airline resided or operated. Specific calculation and reporting requirements were set out for the EU-ETS. The EU-ETS emission factors used in the 2010 benchmark and ensuring years were 3.15 t $CO_2$ per ton of jet kerosene and/or 3.10 t $CO_2$ per ton of aviation/jet gasoline (Price Waterhouse Coopers, 2011). The Group 1, EU resident airlines, were also required to report annual financial statements in IFRS and some IFRS asset and liability categories were used in the financial statements in the 2011 reports and to a lesser degree in 2012. Group 2 airlines resident in an IFRS user country followed the same pattern of disclosure as the Group 1 airlines in the analysis. This curious anomaly of less financial statement and more MD&A disclosure in 2012 occurred as airlines discovered the passenger offset green project credits which became a flow through to that airline's EU account. The green project credits became highlighted in the MD&A and separate environmental reports and fewer detailed economic disclosures were made on the actual financial statements.

As disclosed in Ellerman and Joskow (2008), anticipated EU-ETS penalty costs were substantially reduced. This resulted from the application of generous free benchmark credits assigned by the EU, airline technical and operational improvements, plus the passenger paid for offset green credits. As examples of this, China's green offset credits were purchased by Aer Lingus (216,537 or 15% of their required carbon unit), Air Berlin (344,340 or 14% of their carbon units), and British Airways (381,531or 15% of their carbon units) in 2012.

The free benchmark allocation, harmonized, EU-wide transitional rules were constructed in an EU-wide consultative process and passed into law in the 2011

Benchmarking Decision. This provided the benchmark calculation from 2010 submitted emissions data from each airline from which the airlines were given approximately 80% of their 2010 emissions in free emission certificates in 2012. This free allocation was to gradually diminish by 6.25% annually to 30% by 2020. It is also worth noting that for some airlines who continued to increase their flying miles post 2010, due to operationally reduced airline emissions, the EU benchmark allowances resulted in Aer Lingus having EUAs that represented 80.4% of their required 2012 units, Air Berlin had a benchmark allocation of 137.7% of their 2012 requirement, and British Air's benchmark free allocation was 406.7% of their 2012 penalty.

The reporting and costing of EU carbon allowances on financial statements was performed using different accounting treatments and did not adhere to the research recommendations for consistency such as those discussed in Chapter 2 of Uddin and Holtedahl (2013) or Grubb and Neuhoff (2006). For EU resident airlines as well as other countries in the sample, IFRS was regulated as early as 2006. For the EU resident companies three of the sample used hedging contracts and provisional liabilities in accruing for their EU allowance payments (IFRS 19). Those companies included gains and losses on the hedge in an equity reserve account. Other EU resident companies in the sample recorded the EUA on the IS in the year of disclosure as well as a current liability until paid the following year. Saleable assets in the short term were not evident in any of the EU resident companies. Three of the EU resident airlines considered the emission certificates as noncurrent assets.

Other airlines flying into the EU disclosed further different accounting treatments in recording their EU-ETS obligation beyond the IFRS usage results for Research Question 2. Several airlines opened an EU-ETS registry account wherein the EUAs were deposited along with any further CERs purchased or green project CERs generated, (i.e., Thai Airways). Passenger offset donations were used to invest in green project CERs. For Thai, the registry account debits and credits were not included on either the IS or BS of the company. SriLankan Airlines, another EU bound airline with a registry account, disclosed only a carbon unit expense on the IS and a liability on their BS in the following year when they needed to purchase any further CERs.

In this airline industry sample of 69 airlines, 44 airlines publicly acknowledged their responsibility for their carbon footprint in their annual reports. These 44 provided varying lengths of detailed environmental discussion along with their on-going individual efforts. Although the industry had been aware of the EU-ETS airline mandate since 2007-2008 and reporting their fuel burns to the EU during the benchmarking period, strong political pressures remained throughout the study time frame. The start up evidence of EU-ETS compliance behavior within this airline sample appeared consistent with several of the underlying management theories in Chapter 2.

**Analysis and Interpretation**

Complexity theory along with its subordinate theories of political economy, stakeholder, and legitimacy, was discussed in Chapter 2 for its relationship to this study wherein the airline EU-ETS was mired in sovereignty and economic issues throughout the study's time frame. Involved in the on-going discussion were all the large global

economies including the United States, China, Japan, India, and Europe. The impacts of the global recession of 2008 lingered on and were discussed in most airlines MD&A sections in 2011. The costs to gather and disclose the metrics, to begin to reduce the operating carbon burn, and the costs to pay for penalties or offsetting credits, was stated as a hardship. Stakeholders and shareholders around the globe were engaged. There were political issues of the EU's sovereign right to penalize non EU airlines, the EU tourist and trade industry's fear of retribution, and the lobby effects of IATA and of other non EU nations to protect their airlines and their own tax based economies. Although the 2013 revenue data from each airline was gathered in this investigation the covariate analysis of the effect on net income by comparing the decreased fuel burn, reduced carbon emissions reported to the EU (Research Question 1 results of this study), and increased flying miles, was beyond the scope of this study and may be the subject of future research.

The airline investors and the travelling public were also involved as airlines felt the pressure to appear good global citizens or legitimize public perception. The strategy of asking passengers to donate towards their carbon footprint appeared successful as many of the airlines were able to buy into green projects put in place by countries such as China, India, Brazil, Argentina, Africa, Mexico, and Russia . These green passenger donations were used as offset credits to benefit the airlines as payment within the EU-ETS, but were a strategic win for the countries who received the foreign dollar donations to build positive non-polluting or pollution reduction projects in their countries. The benefits of employee and passenger engagement in new operational paradigms, new technologies, and greater efficiency demands across the entire organization in order to cut

fuel costs and therefore carbon emission penalties, was noticeable in the MD&As. Across the Groups 1 and 2 MD&A spectrum this appeared as excellent public relations, CSR, as well as strategic management.

In keeping with the Chapter 2 discussion of legitimacy and stakeholder theories, companies such as Air Canada, from Group 2, created a mission critical strategic analyses department with Six Sigma training to address operational issues across the Air Canada value chain (P. Torell, Air Canada Dispatch, personal communication, 2013). Adapting to its complexity of stakeholder perceptions and in response to the EU regulatory mandate, Air Canada showed itself as an adaptive organization. Air Canada's response appeared to be an organized response as described in Chapter 2. Calculated and specifically ordered changes were put into operation to gain specific monetary benefits. This operational response was demonstrated within the ANCOVA analysis of Chapter 4 that indicated that the EU resident airlines and the EU bound airlines increased their financial and annual report carbon disclosures in 2012. While large airlines, like Air Canada, would have had the capacity and technology for an ordered response, there might also have been some additional chaotic response to the EU regulatory intervention with the effects tracked after the fact through their ERP systems.

Throughout the years of this study, the politics of agency theory conflicts were apparent. Several airlines acted unilaterally to disclose $CO_2$ costs to the EU-ETS acting as agents for their shareholders and employees despite their government's opposition to the scheme. Cathay Pacific, a Group 2 airline, chose to disclose green projects, hedging contracts, and pollution discussions in compliance with the EU-ETS while concurrently

their government threatened to cancel a major purchase of French manufactured Airbuses if the EU-ETS continued. In the United States, the federal government acting as agents for the U.S. airline industry and the U.S. economy overall, passed legislation in November 2012 to forbid their airlines from participating in the EU-ETS. Federal Express, a Group 2 airline and U.S. resident, as agents of their many stakeholders disclosed their fuel burns to the EU, were audited by the French authority under the EU, and created a large pollution discussion in the MD&A with an extensive environmental report. Although Federal Express did not report in IFRS GAAP, the Group 2 collective results for Research Question 1 carbon reporting, increased in 2012 over 2011 by a means difference of 0.321 (.751 - .43). This disclosure may also have been a component of legitimacy theory, disclosure as a part of the marketing strategy of the complying airlines to appear good global citizens to their stakeholders.

The conflicting behavior in these previous examples that was seen between the airlines acting as agents for their many stakeholders, was also indicative of Skinner's (1978) operant behavior theory #2 discussed in Chapter 2. The airline management might or might not have disclosed based upon their perception of whether the EU-ETS would prevail and whether their landing rights would be rescinded in the EU. While some of the participant airlines, such as Cathay Pacific and Federal Express, chose to mitigate their operating risks and began disclosure, other Group 2 airlines from China, such as Hainan and Air China chose to disregard the EU-ETS requirements on their annual reports although both flew into the EU. Others such as Thai Airways International and SriLankan Airlines, without a strong central government voice to oppose the EU-ETS on their

behalf, appeared politically expedient and disclosed and complied with the EU-ETS and mitigated their future or potential risk.

It might have been expected that like the successful energy sector EU-ETS moving into phase 2, the airline industry EU-ETS would likewise be successful and therefore most of the airlines complied. The energy industry affected was more geographically contained within the EU and more easily EU controlled. Similarly, one hundred percent of the EU resident airlines in the sample, under EU legislation and aware of the successful energy sector EU-ETS, were fully compliant in reporting. These Group 1 participants' incidence of carbon reporting moved to a means of 3.141 in 2012 and to 3.240 in 2013 from the pre-ETS 2011 means of 0.43 as shown in Appendix B.

The operant behavior theory, wait and see, strategy of some Group 2 sampled airlines was indeed gratified with the postponement of the EU bound mandate at the end of 2012 and the further EU resident mandate postponement in 2014. According to operant behavior #2, the EU may face a credibility gap with future pollution reduction strategies. A future qualitative study to understand the management motivation of the airline industry during the time of this study may clarify the disclosure behavior.

## Limitations of the Study

Data was gathered based upon each airline's visible recording of the carbon trading scheme effects on the year-end annual reports and financial statements. A limitation to the findings in the study was the lack of specifically named line item detailed disclosure of carbon emission allowances within the EU resident airlines in Group 1. In the design of this study it was anticipated and subsequently verified in this

study that footnotes or MD&A would provide further disclosure should specific line items not be apparent. Group 1 airlines were buying additional emission allowances or creating carbon offset credits beyond their free benchmarks. IFRS 9 does not require underlying offset debit and credit disclosure until January 1, 2018 (originally 2013, then 2015) and therefore any carbon item details that netted to zero during the time of this study would not have been disclosed. Based upon other disclosures in the IS, for instance for a future provision on the balance sheet, the data collection instrument was labeled with the assumed double entry corresponding dependent IS cost categories with a '3' collection instrument category indicating a cost assumption in the IS rather than a simple yes or no (1 or 2).

Evolving limitations were created within the research design of the study as carbon pollution in the airline industry remained a very dynamic political environment. This study was conceived to analyze the carbon cost disclosures on the financial statements of the airline industry given the EU-ETS intervention. The study was conceived to have a quasi-experimental group and a control group. Data was gathered from years 2011, 2012, and 2013, the year before the inception, as well as the 2-years following. During that period, in addition to the United States and China actively denying the airline EU-ETS, in late 2012 IATA successfully lobbied for a postponement of the EU-ETS from 2013 until 2016 for all EU bound airlines. The EU bound sample airlines were required to report for 2012 but not for 2013 and it was therefore necessary to split the original intervention group of airlines into two groups, thus making the study into a three group study, Group 3, non EU airlines became the control. The carbon disclosure

effect of this 2013 EU bound postponement was demonstrated in the ANCOVA Research Question 1 results. In Appendix B, the reported EU bound Group 2 disclosure mean dropped from .751 in 2012 down to .402 in 2013, while the EU resident group disclosures increased from a mean of 3.141 in 2012 to 3.240 in 2013.

The potential for politics to cancel the airline EU-ETS, and this study, remained apparent. Despite global politics surrounding the airline industry, all EU resident airlines (Group 1) remained mandated during the study period but they too received a postponement eventually. In April 2014, the EU parliament voted to suspend the EU-ETS for resident airlines until 2016, but this postponement did not change the reporting of the EU resident airlines during the study period. Given the potential economic consequences of this additional tax as forecasted by IATA members, it was anticipated that the EU resident airlines would clearly disclose that cost for its public relations value and reduction of corporate income tax on the lower profit. In this study's data, the EU-ETS repository record was cross referenced to the annual report data collected from the airlines to confirm the penalties assigned and both EU allowances given and green project credits applied.

Several airlines in the study expressed dismay at the accounting confusion perpetrated by the constantly volatile ETS environment. Luftansa, from the EU resident group, stated that the EU's refusal to negotiate the airlines concerns throughout 2008 to 2012 and then to suspend the ETS in November 2012 for just the non-EU airlines had caused abstruse changes to liabilities. In addition, German air traffic tax liabilities on the statements of EU resident airlines were systematically reduced approaching 2012

anticipating the EU-ETS implementation. Due to the ETS confusion, the German air traffic taxes were not rescinded causing airlines to recalculate and restate. Several other Group 1 airlines discussed, in their MD&A, the economic unfairness at EU resident airlines bearing a further expense than those of all other non-EU airlines.

A major challenge to the airlines economic stability and to this study was the length and depth of the global financial crisis of 2008 as well as natural disasters in 2010 and 2011. The lingering recessive economic effects of those crises negatively affected the acceptance and the enforcement of the EU-ETS intervention in the airline industry from its inception year, 2012. From the 2008 financial crisis, in Euro zone insolvent countries such Greece, Portugal, Italy, Belgium, Cyprus, Slovenia, France, and Spain airline traffic was affected resulting in losses and bankruptcies. The 2010 Iceland volcanic eruption stopped all airline traffic in western and northern Europe for 6 days in 2010 and a subsequent 4 days in 2011. The 2011 Japanese earthquake with nuclear station collapse provided still further economic imperatives for IATA members to refuse participation in the EU-ETS. Many EU resident airlines provided for the additional emissions burden in 2011 and 2012; however, some airlines from other countries, such as those from the United States, refused to burden their organizations financial reports with these additional EU taxes. This reaction in some of the U.S. airlines was expected given the U.S. economy's value to Europe and the U.S. legislation passed to prevent U.S. airlines from EU-ETS participation.

The delimitations to external validity, generalizability, and trustworthiness to this study's results were controlled by the design, population frame, sampling technique, and

EU-ETS participant external formal audit. The entire industry listing from ICAO was cross referenced with the IATA membership listings, Bloomberg's corporation listing, and the EU-ETS airline industry repository to ensure a complete data frame. From that frame, the airlines were divided into the three study groups with random sampling within those groups until the requisite statistically significant sample size was reached, as depicted in Figure 1. A further five airlines were included to ensure requisite sample numbers from mortality. The data was considered trustworthy as each corporation's financial statements were formally audited by licensed professional accounting firms before their publication. The data submitted to the EU by each airline was audited by professional auditors within the EU country to which that airline had been assigned.

The delimitation to the internal, content, and construct validity that were present in this study as well as instrument validity and reliability were controlled by the extensive data collection instrument. The instrument assured the face and sample internal validity. A modified Guttman scale was used as the collection instrument which recorded all possible reporting options under IFRS guidelines as well as other EU-ETS allowances and green project offsets. This collection allowed comparisons within the assigned groups and between the groups. Empirical and predictive validity was confirmed in the Figures 4 and 5. In these regressions of the carbon data disclosures during years 2012 and 2013, a positive trajectory of carbon disclosures was seen when airlines were under the regulatory mandate. The construct and content validity were assured from the comparison with the EU-ETS publicly reported data for Groups 1 and 2.

## Recommendations

Future years, beginning with the 2014 annual statements of the airlines, should be analyzed following the methodology of this study to continue to monitor the airline industry for the evolution of observable disclosure of carbon emission costs on the financial statements. Despite the periodic postponements of the airline EU-ETS, consistent annual monitoring of annual financial statement carbon disclosure to see the effects of regulatory and non-regulatory intervention phases would be important information for governments to have as they plan their intervention strategies. It is expected that with the passage of time, anthropogenic pollution may be fully recognized by humans as the cause of climate change and the death of species and ecosystems.

Going forward, it is expected that financial reports will show more completely the costs of pollution as technologies evolve and are purchased to minimize pollution production. Based upon the changing accounting reporting, from both the rules and software support already accomplished, it is hoped that IFRS guidelines and jurisdictional tax regulations and GAAP will evolve more fully to be very specific on what Scope 1, 2 and 3 emissions must be reported on financial reports. This should include the categories of the GRI-G4 and the GHG Protocol. None of these expectations can be assumed and it is critical that research attention remain focused on the full costs of anthropogenic pollution and its residual economic effects.

# Implications

## Positive Social Change

The fight to reduce anthropogenic pollution's destruction of the earth, given the growing numbers of humans who inhabit the earth, is the major social issue for this millennium. For positive social change to occur, research such as this study on the airline industry must show what efforts are being successful in addressing and reducing anthropogenic pollution. Technologies and strategies to help humans reduce their waste and destruction can be studied in every discipline.

The impetus for the accounting discipline to participate in this fight is two-fold. One is the sustainability of the biological world. Without accounting showing the economic effects of this pollution on financial statements there will be little economic incentive to mitigation and therefore few efforts to stop the destruction of the earth. The second is the sustainability of commerce. Strategies and operational changes that show on financial statements to be both a cost and provide savings or benefits will be the foundation and the engine of change to our societal norms in living behavior and its responsibility to sustain life. The annual report analysis conducted in this study found that those in the airline industry that had been mandated to reduce their carbon impact, found cost saving and efficient operational methods to reduce their footprint and to engage both their employees and their citizens in their efforts (Atlantic Airlines, 2011, p. 40). Data gathered in this study from financial statements and the EU-ETS repository, but not analyzed as part of the core design, indicated increased margins and reduced penalties per

mile flown. This appeared as a direct result of the airline's efforts to reduce their carbon footprint stimulated by the catalyst of reporting under the EU-ETS.

**Recommendations for Practice**

The financial accounting for the costs of carbon emissions can be financially and biologically beneficial (i.e., commercial and ecosystem sustainability). It was indicated by many airlines' annual reports that by applying carbon emissions reduction strategies that eventually display on accounting records, innovative operating efficiencies were promoted. These commercial sustainability efforts should reduce costs on financial statements and concurrently mitigate the destruction of the earth's ecosystems. The individual airline's 2010 benchmark carbon emissions were close to or higher in some cases than the emission penalties imposed by the EU during the penalty periods, 2012 and 2013. Although the EU allocated a significant portion of the benchmarks, airlines among the mandated EU residents took steps to reduce their emissions and worked to obtain carbon offsets.

There were economic benefits to airlines to reduce fuel weight and operating costs to be operationally efficient and environmentally friendly, that along with green CERs offset much of the carbon emission penalties imposed by the EU-ETS. While few airlines followed possible IFRS classifications for carbon credit asset or liability accounts, the operating costs of not carrying duty free on board, of less water in the plane, of reduced excess fuel carried and sometimes dumped, all related to significant cost reduction of those items and of the weight they once contributed to. In addition, less fuel was required with more efficient newer airplane fuselage designs, added winglets, and more efficient

takeoff, landing, flight routes, and cruising strategies. All of these innovative strategies to reduce carbon emissions reduced operational process costs and also reduced the largest cost of airlines, the cost of fuel.

The accounting effects on the income statement and balance sheet may be multiple. The reduced operating costs may lower expenses on the IS. The increased asset value of the airplanes will be shown on the BS as is the increased amortization expense on the income statement. Any remaining EU-ETS penalties would show as a cost on the IS and the offset initially would show as a noncurrent or intangible asset which is reduced as the CERs or EUAs are submitted to the EU.

Consistency in the treatment and use of IFRS or IAS guidelines would enable equitable industry comparisons and transparency for investors. Airlines in the EU resident Group 1 were EU reporting compliant but not all recorded every aspect of the debits and credits of the emission certificates. On January 1, 2018 (originally 2013, then 2015), IFRS 9 will come into effect wherein companies will disclose both the debit and credit transactions underlying a swap arrangement for carbon debits and credits. During the period of this study, IAS 39 was in force which demanded the net effect only of any carbon debits (charges) or credits.

This net effect was seen to be immaterial by most airlines in the experimental sample and therefore often included within the other operating expense line items. Six of the Group 1 EU resident airlines showed emissions certificates as individual line items. Three showed noncurrent assets in 2011 and 2012 that they had purchased, and also showed the EU benchmarked granted certificates as other receivables. EU resident

Lufthansa also showed a provision to return the benchmarked granted certificates should the ETS be disbanded. The other three of six showed emissions certificates as liabilities. Fourteen airlines across the sample groups, such as Air Nippon, spoke extensively about their carbon reduction efforts and in particular their carbon offset projects such as reforestation. EU resident airlines (Group 1) appeared compliant to the legislation and made some disclosures on their financial statements, but although all airlines in Group 2 were EU compliant in their 2010 benchmarking exercise, the resistance to the actual program in 2012 continued.

Consistency in treatment and use might assist in eliminating purposeful or inadvertent manipulation of data. The political and public relations pushback to the ETS legislation was evident in a Russian airline from Group 2 flying into the EU and a user of IFRS. This airline appeared to misinterpret IFRIC 21 of 2013 to avoid financial statement presentation of the EU-ETS related penalties. IFRIC 21 specifically excludes emission trading schemes from the new liability disclosure timing guidelines for government levies. This same airline appeared misinformed within their 2011 disclosure of all pollution penalties of their home country. Their 2011 report partially blamed the EU-ETS in the overarching accountability wording for their 2011 penalty cost of 1.2 M USD equivalent. This accusation occurred despite the fact that no EU penalties would have been assigned at that time. Specific disclosure and consistent practice of these costs may become more important as other political regimes mandate further pollution penalties.

**Recommendations for Further Study**

The legislative interventions have been shown to make a difference in this study. Continued analyses of airline financial statements will provide data to indicate what carbon disclosure reporting will be done in the ensuing years between this study and the next 2016 implementation date. With so much legislative and media attention on GHG and climate change, the airlines, whether for legislative compliance or public relations, were pollution aware both as economic enterprises and as humans making efforts to reduce their carbon footprint. One South African airline stated that "while slowing down aviation growth is not an option, not doing anything about the emission issue is not the solution either as the current growth in emissions will not be environmentally and economically sustainable" (Comair, 2012, p. 39). One postal freight airline in Group 2 summarized the situation as they described the regulations they are now under within the United States and the European Union. This airline stated that regardless of the legislations, without constructive GHG mitigation, they were vulnerable to economic loss as their customers may stop using their service due to perceptions of the airline's GHG pollution, and further vulnerable "to the physical risks of climate change that could affect all of mankind—such as shifts in ecosystems" (Federal Express, 2011, p. 38).

Airline management's willingness to disclose $CO_2$ costs on financial statements is another important area of future research. Qualitative studies to understand the reasons for airline management's willingness to disclose $CO_2$ is important for successful public relations rhetoric surrounding change management techniques for compliance in the future. The importance of air travel to economies is growing and so too is the pollution

from airline emissions. The airline industry in 2013 contributed just over 2% of the GHG emissions worldwide and 3% within the EU mainly due to carbon based fuel emissions in Scope 1 category. Some included the Scope 2 such as electricity use and Scope 3 in the full supply chain of their operations (EU climate action, 2014).

It has become imperative to understand management's motivation to disclose all scope emissions. In 2013, the airline industry enabled tourism, trade, investment, and global integration which provided a direct contribution to global economic profit and business sustainability. The airline industry contributed directly or indirectly one in every 12 global jobs and approximately 9% of global GDP (UNWTO, 2013). However, the airline industry emissions by 2020 are projected to be approximately 70% higher than in 2005 with a further 300 to700% emissions growth by 2050. Growing GHG and atmospheric deterioration are expected to continue to destroy the life supporting environmental systems as well as the industrial raw materials for sustainable business economics (Perrow, 2011; Stechemesser et al., 2012). An understanding of the motivators to disclose is critical to gain positive action.

The results of this study indicated positive disclosure results under both regulatory ETS and IFRS but did not analyze the profitability of the sample during the time frame. Data on revenue was collected but remained anecdotal for the analysis conducted. A further study of operating profit (EBIT) compared with disclosure frequencies may prove beneficial to encourage the airline industry and others to promote and action pollution reduction strategies.

Additional in depth studies should be conducted that consider the effects on net income of an increasing number of operational changes. Technology design, maintenance schedules, employee processes, and the costs and savings of other tactics should be quantified while flight traffic and flying miles increase. These may be juxtaposed against decreased fuel burn and lower operating costs. In addition to the IATA tactics workshops being given world-wide to the airline industry, scholarly research and statistical evidence is critical to legitimize the costs and benefits of the changes.

Further mixed studies of the install and use frequencies of a variety of ERP systems for reporting would be important. They IS product along with what modules or enhancements that may have been employed by the airline industry may give insights into the limitations that some industry participants may face in future industry or regulatory reporting expectations. In this study ERP data was gathered that was available through the annual reports; however, an in-depth survey or detailed study of participant's IT abilities may provide both quantitative and qualitative information. A detailed information systems study may provide the basic infrastructure attributes that would support extensive data gathering and reporting on a variety of metrics.

## Conclusion

Environmental scientists have determined that GHG global warming, at the current escalation rates, will undermine the global economic GDP by 3% per year unless the atmospheric temperature is kept to within 2% of the 1990 rate (Tsai et al., 2012). ICAO under the UN environmental mandate has negotiated agreement through IATA with the airline industry for EU emissions penalties by 2020. At a forecasted airline

traffic growth rate of approximately 4% per year, extrapolation of 700 million tons of $CO_2$ (2013) yearly airline emissions would result in approximately ($1.04^8$ x 700) 958 million tons of $CO_2$ annually by 2020 (Tsai et al., 2012). Those figures come from one industry that contributes just 2% of the current anthropogenic industrial and transportation atmospheric pollution.

The results of this study indicated that government/regulatory intervention is necessary if we are to disclose carbon pollution on financial statements and thereby begin to include the real costs of business and to take responsibility for the destruction of our ecosystems. This study also showed that a consistent accounting framework (i.e., IFRS) is necessary for consistency and fairness in economic reporting. This study also showed that most airlines were willing to do their part based upon legitimate CSR behavior and regulatory leadership to treat the entire industry fairly. Investment into efficient technologies and processes appeared to be economically beneficial from this sample's annual reports.

A standardized, regulatory supported and legislated mandate, understanding, and calculation for GHG must be adopted in a global context. The accounting for these must be written specifically into IFRS so that both the calculation and the reporting become globally consistent. Both of these issues has been politically charged by ego posturing countries wanting the lead and the economics of dwindling and scarce economic resources to carve further expenses out of airline's declining profit margins.

It is a catch 22 for the earth and for the airlines. Economies are declining due to dwindling earth resources for an increasing global population. This declining profit

margin is cited as the economic argument against including further costs to mitigate, if not reverse, the earth's declining carrying capacity. When governments embark courageously on a valuable scheme like the EU-ETS toward global sustainability, they cannot falter as their weakness sends a distrust message from which they may never recover.

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# Appendix A: Accounting for Carbon Costs Example (Management Accounting)

***ENVIRONMENTAL MANAGEMENT ACCOUNTING - Types of employed measuring units***

| **Environmental management accounting in monetary units** | | | Environmental management accounting in physical units |
|---|---|---|---|
| **Past oriented** Yearly costs and expenditures; Costs accounting. | **Future oriented** Budget in monetary units for environment protection and investment plan. Costs' estimation and project benefits. | **Past oriented** Balance for energy, water, and materials. Environment performances evaluated by indicators. External report of environment activity. | **Future oriented** Budget in physical units for environment protection and investments. Settling each action's performances. Planning and implementing the environmental management systems, pollution prevention, and clean manufacturing. |
| **Accounting in monetary units / Accounting in physical units** | | | |
| Conventional accounting | Accounting of monetary environmental management | Accounting of physical environmental management | Other instruments of evaluation |
| **Data at the level of the corporation** | | | |
| Conventional accounting | Transition to environmental costs as part of conventionally registered costs. | Balance of flows at the level of the corporation for materials, energy, and water. | Systems of production planning; system of stocks accounting. |
| **Data regarding processes, the costs of manufacturing centers and of products; accounting level** | | | |
| Costs accounting | Activities relying upon the flows of materials costs (cost accounting) | Balance of material flows,processes, and products. | o Other evaluations at the f level of the environment; measures and tools of evaluation. |
| **Applications: business interest** | | | |
| Statistic indicators for internal use, calculation of savings; budget and investment plan drawing. | Statistic indices of internal use; budget and investment plan after environment costs. | Management accounting of environment systems; performances' evaluation, etc. | Other internal uses for internal production; eco-projects. |
| External financial report. | External data regarding environment expenditures; investments, responsibilities. | External report; durability report. | Other external reports towards statistics agencies, local authorities, etc. |
| **Applications at national level** | | | |
| National income accounting at the level of statistics agency. | Investments national accounting, yearly environment costs; externalities costs. | Accounting of national resources; balance of materials flows according to countries, regions, and fields. | |

*Note.* From Current dimension of environmental management accounting by E. Vasile and M. Man, 2012, *Procedia-Social and Behavioral Sciences, 62,* p. 568. Copyright 2012 by Elsevier. Reprinted with permission. Elsevier License 3540330314834.

Appendix B: Estimated Marginal Means Between Groups

Estimated Marginal Means Between Groups In 2012 and 2013 Airline Carbon Reporting Data

Estimates

| Dependent Variable | Group | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| TtlYes12 | EU resident group | 3.141[a] | .215 | 2.713 | 3.570 |
| | EU bound group | .751[a] | .152 | .448 | 1.054 |
| | non EU bound group | .393[a] | .154 | .086 | .700 |
| TtlYes13 | EU resident group | 3.240[a] | .159 | 2.922 | 3.559 |
| | EU bound group | .402[a] | .113 | .177 | .627 |
| | non EU bound group | .354[a] | .114 | .125 | .582 |

a. Covariates appearing in the model are evaluated at the following values: TtlYes11 = .43.

# Curriculum Vitae

CAROL A. TUCK-RIGGS, BAS, CMA, CPA, MBA, Ph.D.(c)
carol.riggs@waldenu.edu

VOCATIONAL HISTORY:

2004–present **Sheridan College**; Professor and Program Coordinator: in degree and graduate programs; courses in management and financial accounting, strategic management, business administration, and leadership

- Research Ethics Board of Sheridan committee; Research Committee
- Curriculum, Faculty, Pedagogy and Technologies Development Specialist
- Collaborative Project manager for baccalaureate, diploma and certificates; new and revised curriculum designs and approval processes—Internal and regulatory.
- Leader: develop/deliver; interactive teaching methods, learning objects, curriculum design
- Designer: on-line curriculum and teaching methods
- Liaise; provincial government, industry, other institutions
- Participated in upgrade of ERP backbone and documentation of processes college-wide

**PEQAB**: Senior Policy Analyst secondment (2009); Provincial Distance Education policy, degree review policy, multiple degree proposals management

**York University**; professor and interactive curriculum design; management accounting, strategic management, comprehensive case analysis, financial accounting

2002-2004 **Seneca College**; Chair, Accounting and Finance. Ensure Academic Quality and Delivery for programs.

-Leader: Significantly improved team collegiality, trust through constant, consistent, fair and equitable treatment and active support of all positive/economic initiatives for student success.
- Successfully revamped all systems and accounting courses to support student needs.
- Manage change and implementation of discipline technologies and on-line curriculum - Set a new tone for on-going change. Changed culture to positive, participating.
- Upgraded student generic skills education to support retention, success, employability.
- Participated on Presidents task force resulting in implementation: e-enrollment software student service and student tracking.
- Successful ministerial proposal and implementation of: post diploma: Accounting and Information Technology with transfer credits and articulation to professional designation and SAIT Bachelor degree, plus Forensic Accounting and college baccalaureate.

**York University**; professor; management and financial accounting, comprehensive case analysis

1994 - 2002 SELF-EMPLOYED Contractor with major Multi-National corporations

1999 - 2002 **Sheridan College**, Trafalgar and Davis Campuses, School of Business
*Instructor* in Mobile Computing Software to 1st Year students, Instructing in Business, Accounting, Finance and Cost Accounting to Business and Human Resource students 2nd and 3rd year.
-Standard and Mobile teaching techniques; curriculum and lesson creation on Blackboard

1998 - 2002 **Investors Group Financial***, Financial and Investment Analyst*
Theoretical, practical, tax planning, Financial Management, Investments and Corporate Analysis
Accounting and Planning issues for corporate investment.

1998 – 2000 **Cogency Semiconductor Technology Inc**., *CFO* for high tech startup with venture capital backers of VenGrowth, Working Ventures, and Celtic House; including Business Plans and Risk Management

1995 - 1998 **DeVRY University - Institute of Technology (Toronto 3 campuses**)
*Dean; Finance, IT, Administration and Facilities; Professor,* Business and Accounting; reengineering/establishment of all business processes; IT management, accounting systems, budgeting/forecasting, Risk Analysis

1994 – 1995 **York University - for Vaughan Technologies** Professor, for Adult education, Business Planning, Marketing, Accounting, Finance and Computer applications.
Clients; Teaching Assignments: IT, Change Management, Strategic Planning, Finance

1994 – 1995 **IBM Canada., Celestica Inc**. BPCS and SAP: Financial Analyst for Devolution of Celestica Manufacturing: Complete restructure and integrity of Balance Sheet and system processes, policies and procedures for North American Intercompany Transfers and Purchasing, Corporate Tax Audit

1989 - 1994 **FISONS CORPORATION LTD**.
*VICE-PRESIDENT OF FINANCE and MIS* (1991 - 1994) Pharmaceutical

-Strategic planning, Budgeting, Special Projects;
-Participation on Commercial Management Team;
-Cost Analysis, Accounting and MIS Departments, Treasury and Tax, Financial Statements;
-Strategic alliances, acquisition and disposition accounting;
-Liaison with legal counsel, international offices, auditors, government bodies and other organizations;

*Additional Accomplishments Included:*

-Won international marketing and business competition 1992;
-Analysis and successful alliance with competitor for co-marketing;
-Successful transition in competitor acquisition; negotiation, due diligence, divestment of affiliates;
-Comprehensive on-line sales force system efficiencies and EDI;

*VICE-PRESIDENT OF FINANCE and MIS* (continued)

-Management of National Research Projects and International Asthma Council;
-Facilitated North American commercial paper, cash pooling, forward contracts;
-Created international reputation with financial and information systems, (incl. Federal transfer price audit).

*CONTROLLER* (1989 - 1991)

-All company operating and control systems including sales desk;
-Liaison with international subsidiaries; cash pooling, tax strategy, consolidation, acquisitions;
-Term investments analysis, financial statements - Cdn., U.K., U.S. GAAP, corporate taxes, audit, Management Information Systems;
-Financial analysis, costing, budgets, forecasts;
-Implementation of BPCS Software on AS400 and PC spreadsheet innovations, computer conversion.

*Additional Accomplishments Included:*

-Revised job descriptions and functions to logical lines of responsibility and authority;
-Revised management systems to accurate, critical time, continuous reporting;
-Instituted education and training programs for quality customer-oriented company with a satisfied, competent, cross-trained employee base;
-AS400 computer conversion

1984 to 1989 **MONARCH MARKING SYSTEMS LTD**. **Part of PITNEY BOWES**

*ACCOUNTING MANAGER and Interim Director of Finance*

-All Finance, Cost, and Accounting functions and personnel for manufacturing;
-Investment portfolio, timely financials, corporate taxes, audit, budget and Management Information Systems;
-Internal controls and implementation of computerized costing, manufacturing and financial systems, including PC innovations and IBM 40.

*Accomplishments Included:*

-Revised reporting formats and reports to facilitate management decisions;
-Instituted internal controls to stop inventory shrinkage;
-Reorganized Finance Department for more efficient use of personnel; Data Entry, A/P and Payroll.
-New controls and efficient administrative systems to create a minimum of effective paperwork and production flow.
-Established controls and procedures for credit management and procedures for information gathering for company use and compliance with government regulations;
-Established cost centers and manufacturing reports to management in addition to accurate and timely financial information.
-IBM 40 conversion, J.D. Edwards, BPCS

1980 to 1984 **CONSTRUCTION SPECIALTIES LTD.**
*PRODUCTION CONTROLLER/CUSTOMER SERVICE SUPERVISOR*
- Responsible for production scheduling, inventory control, delivery scheduling, material ordering, job records, co-ordination between production and sales;
- Administering all customer orders, receiving and rectifying all customer complaints and initiating all service action.

*Accomplishments Included:*
-Established a control system for incoming goods co-related to specific customer orders and plant productivity. A smooth, informed and efficient operation resulted and cost saving effected.
-Sales Co-ordination/Estimator

EARLY EXPERIENCE:

Held responsible supervisory positions with the Ontario Road Builders Association, S.B. McLaughlin and Associates Ltd. and with Great-West and Canada Life Insurance Companies. In addition to accounting and office management experience, gained skill in organizing and administering seminars, costing, and actuarial work.

EDUCATION:

PhD. (expected 2014), Management Science–Accounting, Walden University.
MBA, Finance, York University, April 1998, Dean's List
Plus Organizational Behavior concentration. 1998
MBA, Marketing (double major) – York University, 1997
BAS, York University, 1993
CPA, 2012
C.M.A. Designation, 1989
Honors Graduation Diploma - Grade 13 Ontario - Maths and Sciences

C.B. Cragg Award of Excellence in Natural Science, York University

University of Western Ontario, Case Method Teaching Certificate 2008

AFFILIATIONS:

Former Director, International Asthma Council

PMAC Executive Finance Council
-Toronto and Area Meetings Coordinator
-Healthcare Economics Committee of Ontario

Women in Technology Council, Mississauga

Society of Management Accountants of Canada

Town of Oakville, Former Advisory Chair, Tree Committee
Town of Oakville, Advisory Chair, Parks and Recreation Committee

ASAC 2013 Accounting – Mount Royal University, Calgary
ASAC 2005 Organizing Chair of Critical Accounting – Ryerson U., Toronto
ASAC 2004 Session Chair, Critical Accounting – U. Laval, Quebec City
ASAC 2003 Session Chair, Accounting – St. Mary's U., Halifax

Provincial Curriculum Developers Group– Special Projects
Provincial Degree Operating Group – CDOG – Sheridan representative

STHLE: Society for Teaching and Learning in Higher Education: Member
EDC: Education Developers Caucas: Member
SWAAC: Senior Women's Academic Association of Canada: Member

CanMapp, Canadian Management Accountants in Public Practice Incorporated, Director

REFERENCES: Available on request

Carol A. Tuck-Riggs

**Research: Areas of Interest**

Environmental Accounting
Sustainability management accounting
IFRS reporting for consistency and transparency
OBR/Operational MGMT: Effective Management: Delegating your power with accountability
Strategic MGMT: Setting the Flexible Plan for the Long Term
ACCTG: Accounting is a Behavioral Science
MGMT ACCTG: Without accurate and timely internal reports, there are no decisions
ERP Systems: Satisfying the corporation Needs
The number coding is the Key
Higher Education, Teaching and Learning theory and strategies; Curriculum Design

**Academic: Textbooks, Presentations, Seminars and On-Line Learning Objects**

***Seminars, Workshops****:*
Collaborative Baccalaureate Design; Cross Institution Development; CDOG Conference, 2009

Teaching and Learning with Cases; Case Study Method Teaching and Report Methodology; Sheridan, 2009, 2010, 2011, 2012

Traditional to Transformative Learning; Curriculum praxis – the music and the dance. Feb. 2009 Educational Developers Caucus (EDC) Conference, STHLE (Society for Teaching and Learning in Higher Education).

Writing Curriculum begins with a Critical Performance Sheridan College: 2004, 2005, 2006, 2007, 2008, 2009

Learning Objects–A Teachers Tool. " This is IT" conference, Sheridan: February 2007

Fundamentals of Teaching and Learning – Active learning, Active teaching - 2004, 2005, 2006, 2007, 2008, 2011

Re-engaging Senior Faculty. Professional Development Workshops – 2006, 2007, 2008

Each sales territory-a complete business. Lake Louise, Alberta. Fisons Pharma Jan 1992

Research Opportunities for Baccalaureate education. May 2009. Degree Operating Committee Conference.

Branding and Marketing Baccalaureate programs through Sharing. May 2009. Degree Operating Committee Conference "Working Together for Better Degrees". (also Conference organizer)

***Editing:***

Edit of Managerial Accounting Text Book: Raiburn, Mallouk, Spraakman, Barfield and Kinney Fall 2005

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***Editing and Learning Object creation***,

Financial Accounting: M. Gibbins: April to August 2006

**Financial Accounting: An Integrated Approach : Fifth Edition** (ISBN: 0176223509)
University of Alberta Michael Gibbins

IMM learning object project on Teaching and Learning–Sheridan College October 2006

***Baccalaureate and Post-Graduate Programs Created*:**

| | | |
|---|---|---|
| BAB, Intn'l Accounting and Finance Baccalaureate | Seneca | 2005 |
| Post-graduate with Baccalaureate Accounting and Information Technology | Seneca College | 2003-4, SAIT, CGA |
| Forensic Accounting Post graduate | Seneca | 2004 |
| | | |
| BAHSc Athletic Therapy | Sheridan | 2005, 2006 |
| BAHSc Exercise Science and Health Promotion | Sheridan | 2005, 2006-7 |
| BAA Global Business Management | Sheridan | 2006–2008 |
| BAISc – Security Systems | Sheridan | 2006-2006 |
| BA – Early Childhood Leadership | Sheridan | 2006-2007 |
| BA – Music Theatre Performance | Sheridan | 2007-2009 |

Business Administration course developer – Baccalaureate 4th year. Sheridan – 2006
Management Accounting course developer – Baccalaureate 2nd year. Sheridan –2006

***Process and Operational Design***
On-line delivery criteria (collaborative writing)
Program and Course Evaluation Criteria and Grid
Course Outline Development: on-line, interactive learning object (Flash)
Curriculum approval process: Guidelines & Operational templates (collaborative writing)
Bloom's and other Taxonomies – An operational approach.
Re-engaging Senior Faculty: workshops for Professional Development
Fundamentals of Teaching and Learning: workshops for Part-time faculty Professional Development

**Academic Associations:**
ASAC member (2001-2005, 2013 to present) Chair of Critical Accounting 2005
Administration Sciences Association of Canada
STHLE (2005 - present) Society for Teaching and Learning in Higher Education
SWAAC (2002 - present) Senior Women's Academic Association of Canada
CDOG (2002 to present) College Degree Operating Group; Ontario steering committee

Teaching:

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|---|---|
| DeVry University | 1994-1998 |
| Sheridan College | 1999- present |
| Seneca College | 2002- 2004 |
| Marketing -York University | 1994, 1995 |
| Finance, Accounting, and Management- York University | 2002 – present |

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|---|---|
| ADMS 2510 Accounting York U | 2002 through 2005, 2011 |
| ADMS 3510 Management Accounting York U | 2005 through 2008, 2012 |
| ADMS 4570 Advanced Management-Cases, York U | 2004, 2005, 2013 |

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|---|---|
| Managerial Accounting | Sheridan College 2000 – 2002; 2009 through 2014 |
| Mobile Applications for IT | Sheridan College 1999 |
| Financial Accounting | Sheridan College 2002, 2007 through 2013 |
| Organizational Behavior | Sheridan College, 2003, 2004, 2006, 2010 to 2012 |
| Taxation | Sheridan College, 2008 |
| | CanMAPP seminars, 2006, 2008, 2011, 2012 |
| Leadership and Management | Sheridan College, 2006, 2007, 2008, 2010, 2012, 2013 |
| Business Administration | Sheridan College 2008, 2009, 2011 through 2014 |

Investment Planning Seminars: Investors Group 1999, 2000, 2001

Community Service:

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|---|---|---|
| Committee Member; Parks, Recreation and Culture Committee | Oakville | 2001 - 2004 |
| Chair, Tree Committee | Oakville | 2003 - 2005 |
| Chair, Parks and Recreation Committee | Oakville | 2004 - 2005 |
| CanMAPP Inc.; Director (Accounting Practitioners Association) | Toronto | 2007 - 2012 |