ABSTRACT
The importance of innovation to small firms has been much debated, but conflicting results from existing research identify more questions than answers. Yet, a better understanding of how innovation can improve performance may hold much benefit to small firms. This quantitative study uses a large scale longitudinal dataset on Australian small firm innovation to shed light on the directionality, temporality and contextual nature of this relationship. We find that the innovation – performance relationship is a mutually beneficial, reciprocal relationship which is context dependent. Innovation breadth exhibits characteristics of diminishing returns.

INTRODUCTION
Hephaestus, the Greek god of fire and innovation was cast down from Olympus, only to be restored because his technical and artistic skills made him indispensible (Berbekar 1988). Today we, like the ancient Greek gods, do not fully comprehend the nature of innovation, but embrace its importance in improving firm performance, advancing living standards and creating wealth. Drucker (1985) regards innovation as the key function of entrepreneurship; one which creates new resources or utilise existing resources to maximise wealth creation in firms. Schumpeter (1950) agrees and states that profit is the measure of entrepreneurial success - a consequence of the introduction of economically superior innovation. Firm performance is, however, multifarious in that a myriad of endogenous and exogenous factors interplay that ultimately lead to the success or failure of business ventures (Subramanian & Nilakanta 1996). Innovation is only one such factor, and the exact manner in which it affects performance remains unclear.

Small firms, here defined as firms employing fewer than 200 full time equivalent staff, play a vital role in the economies worldwide, and contribute 46 per cent of Australia’s gross domestic product (Australian Bureau of Statistics 2010). Due to their importance, more conclusive evidence regarding the nature of the innovation – performance relationship, could improve practice as well as public policy responses towards small firm development. In large firms the relationship between innovation and performance has received much scholarly attention since Schumpeter (1950) advanced his theory of creative destruction, postulating that large firms in concentrated markets are more likely to innovate. However, the role of innovation in the performance of small firms is only starting to draw attention (Rosenbusch, Brinckmann & Bausch 2010). In this regard issues such as the directionality and nature of the innovation – performance relationship remains unclear (Mansury & Love 2008). Furthermore, this relationship has been found to be highly contextual and hence diverse in nature due to the complex array of factors that interplay and shape the innovation process at (Rosenbusch et al. 2010).

Thus, neither economic theories nor empirical studies have reached definitive conclusions about the relationship between innovation and firm performance in small firms (Rosenbusch et al. 2010). The interplay with endogenous variables also has not been satisfactorily clarified. This paper therefore explores the longitudinal relationship between innovation and small firm performance, and the contextual factors moderate this relationship. Specifically, the direction and linearity of the relationship are investigated. This is done by applying correlation and regression analyses, using longitudinal data collected by the Australian Bureau of Statistics (ABS). Next, a theoretical background is provided.
INNOVATION

The term innovation originates from the Latin word *innovare* meaning to make something new (Tidd & Bessant 2007). Innovation encompasses invention, but it is only when an invention or creative idea is institutionalised, implemented or commercially exploited that it becomes innovation (van de Ven 1986). Numerous definitions for innovation can be found in the literature, ranging from broad to more narrow definitions (e.g. Damanpour & Evan 1984; Salavou & Lioukas 2003). This hampers convergence, makes comparison of empirical data difficult and adds to already conflicting results. The Oslo Manual aims to address this by outlining guidelines for collection and interpretation of innovation data (OECD 2005). This has provided guidance and became the reference for various large scale surveys since 1992 when the first edition was published. The Oslo Manual’s definition (OECD 2005, p. 46), used by the ABS’s (2009a, 2009b) large scale business longitudinal data (BLD) employed in this study, has been adopted to define innovation:

“*Innovation is the implementation of any new or significantly improved product (goods or services), operational processes (methods of production and service delivery), any new marketing methods (packaging, sales and distribution methods), or new organisational or managerial methods or processes in business practices, workplace organisation or external relations.*”

Innovation in the contexts of this study therefore relates to innovation breadth not depth. Innovation breadth refers to the implementation of different types of innovation across a range of business functions or areas. It does not relate to the intensity or frequency of the specific type of innovation but range of types of innovation implemented by the small firm.

THE INNOVATION – PERFORMANCE RELATIONSHIP

Schumpeter (1950) argued that at the heart of capitalism rests its internal dynamics of revolutionary change based on intense technological and organisational innovation. He believed that entrepreneurs bring the radically new into the capitalist system through their innovation efforts. The process of creative destruction is a constant search by entrepreneurs to create something new which simultaneously destroys the old rules and establishes new ones with the object of deriving monopolistic profits (Agarwal, Audretsch & Sarkar 2007). These profits or entrepreneurial income are derived as a consequence of departing from the existing equilibrium, forming the basis for the competitive edge. Schumpeterian monopoly profits derived in this manner are diminishing over time as a consequence of increased competition, which create impetus for a new creative destruction process to emerge, accentuating that capitalism consists of change and cannot be analysed as static. Firms reinvent themselves in their quest to remain competitive, wiping out the quasi rents of existing competitor innovations, and ensuring sustainable firm performance.

Examining the nature and impact of innovation on firm performance has been the focus of numerous studies over the past decades (Damanpour & Evan 1984; Gopalakrishnan 2000; Kleinenschmidt & Cooper 1991; Lööf & Heshmati 2006; Wong et al. 2007). Uncertainties and contradictions exist on the nature and role of innovation as complex and varied phenomena, calling for clarity on inconclusive empirical findings (Baldwin & Gellatly 2003; Cho & Pucik 2005). As Dodgson, Gann and Salter (2005, p. 3) state: “Innovation is, and will remain, a socially determined and hence unpredictable process.” Adding to the uncertainty is the fact that the innovation – performance relationship is context dependent, implying different relationships depending on the firm specific and environmental circumstances (Rosenbusch et al. 2010).

Schumpeter (1950) does not regard the role of small firms as important and see large monopolistic firms as the drivers of innovation and economic progress. Small firms have thus long been burdened by the Schumpeterian size handicap, having a deficit of resources required to generate and commercialise innovations, leading to small firms being kept outside the domain of innovation research for a long time (Audretsch & Lehmann 2005). That is until recently, when a wave of new studies recognised the role entrepreneurial small firms play in contributing to innovation (Caloghirou, et al. 2004; Lee et al. 2010; Mohannak 2007; O’Regan, Ghobadian & Sims 2006; Raymond & St-Pierre 2010; van de Vrande et al. 2009).

Theoretically, the link between innovation and performance can be explained from the resource based perspective. The resource based theory draws from the earlier work of Schumpeter (1934), Penrose (1959) and Wernerfelt (1984) in assuming that strategic resources or distinctive competencies are relatively stable over time and heterogeneously distributed across firms. This perspective emphasises firm specific capabilities or competencies and resources in strategy formulation, implementation and as the fundamental determinants of firm performance (Parnell 2007; Teece 1984; Teece, Pisano & Shuen 1997). The firm’s valuable, rare, inimitable and sustainable resources are the source of competitive advantage (Barney 1991). Competitive advantage is thus a result of a firm
utilising these rent-generating resources and matching them with the external environment in order to generate above average profits (Wernerfelt 1984). Argued from the resource based view, firm innovativeness and the outputs of the innovation process are regarded to be valuable resources and sources of sustainable competitive advantage in the market and hence commercial success (Harmancioglu, Droge & Calantone 2009).

Dynamic capabilities represent an extension in the resource based view thinking (Caloghirou et al. 2004) and explain why some firms sustain competitive advantage amid rapidly changing environments (Eisenhardt & Martin 2000). According to Teece et al. (1997, p. 517) dynamic capabilities reflect the “…firm’s ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments. Dynamic capabilities thus reflect an organisation’s ability to achieve new and innovative forms of competitive advantage…” Seen from this perspective, not only does the innovation itself enhance firm performance because of increased competitiveness, but the innovation process also transforms the firm’s internal capabilities, making it more adaptive to change (Love, Roper & Du 2009). Geroski and Machin (1993, p. 35) states that “…the process of innovation … transform firms in some way that give rise to what look like generic differences between innovators and non-innovators [in that] innovating firms seem to be much less sensitive to cyclical shocks …”

Firm innovativeness could therefore be regarded as a dynamic capability. The performance robustness of innovating firms is related to their innovative capability, which is a result of among others, their architectural competence. Architectural competence refers to the firm’s ability to access and integrate a variety of knowledge and expertise (Henderson & Clark 1990). Henderson and Cockburn (1994, p. 65) use the term architectural competence to include, what others have called; “capabilities, integrative capabilities, dynamic capabilities, implicit/social or collective knowledge, organizational architecture, combinative capabilities, managerial systems and values and norms, and invisible assets.”

In summary, small firm strategy impacts on configuration of internal resources and firm structures, making the firm more responsive to its external environment and in purposefully stimulating innovation activity. Resulting innovation is a source for competitive advantage which in turn leads to above average firm performance. The process of innovation utilises and strengthens dynamic capabilities of the firm, making firm performance more robust in its dynamic competitive environment. It is thus postulated that innovative small firms will be more successful than non-innovators. The theoretical argument, which is supported by empirical findings and discussed in the next section, postulates a positive link between innovation and firm performance. Very few empirical research studies on the innovation – performance relationship of Australian small firms could be found in peer reviewed journals which lead to the main objective of this study; to provide clarity on this relationship within an Australian small firm context.

Hypothesis 1: Innovation is positively correlated with Australian small firm performance.

While this is hardly groundbreaking, the directionality of this relationship remains arguable. As evident from the ensuing paragraphs, the reciprocal innovation – performance relationship has been liberally debated among scholars (e.g. Geroski & Machin 1993; Harmancioglu et al. 2009). Emanating from this debate, it seems that this seemingly complementary relationship requires further clarification.

This paper argues that the innovation – performance relationship may be viewed as a cycle in that firm performance influence innovation which in turn influence future performance. Previous experience dictates future behaviour and past success conditions future behaviour (Laursen & Salter 2006). Returning to the resource based perspective, resources, developed as a consequence of the innovation process and the inventions itself, are used to create competitive advantage, which in turn may lead to superior performance. Completing the cycle, firms that exhibit superior performance have been found to reinvest in innovation to sustain their competitive advantage (Bowen, Rostami & Steel 2009). The innovation – performance relationship are characterised by different feedback loops or reversed causalties. Clarity on the exact nature of this relationship can only be found within a longitudinal study design (Bowen et al. 2009).

However, the innovation – performance relationship seems to be erratic and non-continuous in nature. Geroski, Van Reenen, and Walters (1997, p. 33) answer the question; “How persistently do firms innovate?” by concluding that very few innovative firms innovate persistently. Love et al. (2009) agree that innovators differ from non-innovators and disagree with Roberts (1999) in finding that agreed high profitability results when firms repeatedly introduce innovations. Roberts argues that the introduction of valuable innovations led to temporary monopoly positions in the market which is sustained only when innovation is repeated in line with Schumpeterian thought (Schumpeter 1934). In rejecting this hypothesis Love et al. (2009, p. 432) refers to this argument as the “conveyor belt” hypothesis. In general, it is expected that innovative small firms would not be innovating on a
continuous basis but would rather follow the erratic or non-continuous pattern as suggested by Geroski et al. (1997). Innovation causes disequilibrium, followed by subsequent equilibrium initiated by imitative market forces (Chanaron & Metcalfe 2007). The erratic nature of the innovation – performance relationship further emphasises the importance of a longitudinal research design.

Substantial research evidence exists that innovation activities are important correlates or determinants of firm performance (Baldwin & Gellatly 2003; Hoffman et al. 1998; Goudis, Skuras & Tsegenidi 2003; Klomp & van Leeuwen 2001; Mansury & Love 2008; Prajogo 2006; Roper et al. 2002). More specifically, research on the link between past innovation and subsequent profitability suggests that innovators are persistently more profitable than non-innovators (Love et al. 2009). As evident, a high degree of consensuses exist among research on the strong positive relation between innovation outputs and different measures of firm performance (Baldwin & Gellatly 2003; Crepon, Duguet & Mairesse 1998). Controversy about the impact of past firm performance on subsequent innovation still remains.

Past success alone, is not the only predictor of future innovative activity. In an Australian small firm study, Bhattacharya and Bloch (2004) find that neither lagged firm growth nor profitability of firms in high-technology industries have a significant influence on successive innovation activity. They did, however, find a weak positive effect of profitability on subsequent innovative activity in the low technology industries and a negative non significant result for the effect of firm growth. Their study indicates that prior Australian small firm performance measured in terms of growth and profitability does not influence innovation behaviour of small firms. This is contrary to the findings of Audretsch (1995) who finds that both increased profitability and growth were conducive to subsequent innovation in high-tech U.S. industries. The feedback from overall firm performance to innovation is found to be significant by Klomp and van Leeuwen (2001) in their innovation study, but not so when the joint endogeneity of innovation output and sales performance are not accounted for. In their model, firm performance and its level of innovativeness is represented by feedback links running from a firm’s sales performance, either to the input stage or to the output stage of the innovation process. The feedback effect from a firm’s sales performance to its innovation endeavour is found to be more pronounced when employing a simultaneous equation approach, allowing for the joint endogeneity of the innovation process and the overall firm performance.

As evident from the above, innovation studies are clearly divided on the link between prior firm performance and subsequent innovation. Greve (2003, p. 96), provides a different explanation for this anomaly by stating that “the decision process theory of innovation leads to the proposition that organisations launch innovations following performance below the aspiration level.” Accordingly, firms facing some problem (including lower than expected performance) trigger the initiation of innovation activities in search of a solution, taking account of the substantial financial risks associated with innovation. The saying that “necessity is the mother of invention” seems to apply (Wiklund & Shepherd 2005, p. 72). Firm success, on the other hand, may impact negatively on innovation propensity leading to organisational complacency and inertia. This does not imply that firm success is negatively correlated with innovation, on the contrary, it rather suggests that: “success suppresses innovation more effectively than failure spurs innovation” (Greve 2003, p. 103). This means that both higher and lower than expected firm performance may lead to innovation although the propensity to innovate may be different due to the possibility of complacency associated with high firm performance. The BLD (ABS 2009a) does not make provision for testing performance against expressed performance aspiration levels. The self reported performance measures in the BLD compare current performance against that of the previous year and do not take account of the aspiration levels of the respondent making it impossible to determine ‘satisfactory’ performance.

In summary, innovation enhances business performance due to an increase in firm competitiveness as a result of the product of innovation. The process of innovation or innovation activities transforms the firm’s internal capabilities making it more adaptive to its dynamic environment and further contributes to firm performance. Both prior firm performance above aspiration levels and firm failure below aspiration levels, could lead to increased innovation. Prior firm performance may not always have the desired effect of increasing innovation propensity as a consequence of complacency. The link and associated mechanisms between prior firm performance and subsequent innovation are still not understood.

Building on the arguments provided above, it is argued that cross-sectional survey research cannot prove causality, in clarifying if “… innovators were more likely to grow, or if growing firms were more likely to innovate” (Freel & Robson 2004, p. 562). In a meta-analysis, Bowen et al. (2009) find that the temporal sequence of previous empirical research designs has often been flawed. After correcting for this flaw they find a positive relationship between innovation and future performance but did not find a significant relationship between past performance and innovation. Researchers who
correctly conceptualised a past performance framework generated negative effect sizes for the past performance – innovation relationships. They contend that past performance may either “breed further innovation or simply complacency” (Bowen et al. 2009, p. 1184). The data used to test the innovation – performance relationship in this study will be timed appropriately to capture the temporal aspect. Therefore, it is hypothesised that:

Hypothesis 1a: Small firm performance improvement leads to innovation.

Hypothesis 1b: Innovation leads to improvement in small firm performance.

Another aspect of the relationship between innovation and performance that warrants attention is its linearity. The research discussed above, essentially implies that more innovation will infinitely be better for small firm performance, that is, if small firms innovate across a wider range of business activities that they would be more successful. It is doubtful that this would be the case. Innovating is risky business, especially for resource strapped small firms. Small firms take proportionately larger risk in innovating than larger businesses. In their quest to establish a foothold in the market and to generate growth, younger small firms may be inclined to apply innovations across a broader range of business activities than would be the case with larger more established firms. As Rosenbusch et al. (2010, p. 5) states “If SMEs devote a significant proportion of their resources to the innovation task, yet, are unable to generate a return on their resource investments, their existence and development can be threatened.” It is therefore argued that the innovation – performance relationship may not be linear in nature. Small firms exhibiting larger innovation breadth may not necessarily exhibit higher performance. Due to resource constraints, coupled with the potential disastrous effect of innovation failure, small firms may be better off to focus on one or two types of innovations rather than endeavouring to innovate across a broad range of business activities at any given time. The payoff of successful innovations may also not be immediately apparent over the short term. It is therefore hypothesised that:

Hypothesis 1c: The innovation – performance relationship is curvilinear and is represented by an inverted U-shape; implying that beyond an optimum point greater innovation breadth would be detrimental to small firm performance.

CONTEXTUALIZING THE INNOVATION – PERFORMANCE RELATIONSHIP

The previous section investigated the linear versus nonlinear relationship between innovation and performance. In this section, it is argued that both these relationships are context dependent. Rosenbusch et al. (2010, p. 4) conclude that “the overall impact of innovation on performance of a small firm is an aggregate effect resulting from both positive and negative mediating effects which are additionally moderated by contextual factors.” The innovation – performance relationship is thus context dependent in that it is influenced by variables such as firm age, firm size and the industry factors. In this study, such contextual factors are used as controls for both the linear and curvilinear innovation – performance relationships, namely age, size, market concentration and relative market share as well as internationalisation. These contextual factors are explained next.

Business age

It is important to control for the impact of firm age on the innovation – performance relationship (Lööf & Heshmati 2006). Firms tend to accumulate more knowledge and experience necessary to innovate over time (Cohen & Levinthal 1990). In this process younger firms tend to devote relatively more resources to innovation than large and older firms in their quest to build more innovative capacity (Klomp & van Leeuwen 2001). Older firms may also have acquired more resources and tend to be larger than their newer rivals thus leading to greater economies of scale in innovation activities. Therefore, older firms are more likely to reap an immediate benefit from innovation. Rosenbusch et al. (2010) postulate a second argument, that the nature of the firm’s resources are more important that the quantity. They state that the nature of the firm’s resources changes over time from less specialized, more flexible in new organisations to more specialised, less flexible in older established small firms. They also point to the fact that older firms are less adaptable due to engrained routines and core rigidities. It is therefore argued that newly established small firms are more nimble, flexible and adaptable than more established firms, and therefore more likely to innovate. Therefore, it can be argued that:

Hypothesis 2a: The innovation – performance relationship is influenced by the business age in that younger small firms tend to gain more performance benefits from innovation.
Business size
Schumpeter started an argument about the effect of firm size on the effectiveness of innovation which is still ongoing (Iversen 2007; Lee et al. 2010). Schumpeter (1950, p. 106) referred to the “large-scale establishment” as being a “necessary evil inseparable from economic progress.” He argued that large businesses are greater innovators than small businesses largely due to a lack of resources on the part of small firms. As a result of these types of statements, size as a determinant of innovation has become one of the most studied variables (Becheikh, Landry & Amara 2006; Raymond & St-Pierre 2010). Meta-analytical studies have supported Schumpeter’s arguments (e.g. Camison-Zornoza et al. 2004), even though there are a number of studies that have found “negative, not significant, bell-shaped or U-shaped relationships” (Becheikh et al. 2006, p. 652). These studies argue that large firms have the benefit of economies of scale, smaller risks associated with R&D expenditure, greater market and better appropriation possibilities (Galende & de la Fuente 2003). Noting the positive potential relation between R&D expenditure and innovation output, small firms have been found needing to commit a much larger proportion of their resources when undertaking R&D than larger firms, making it a risky investment for small firms (Audretsch 1995; Klomp & van Leeuwen 2001). The greater innovation propensity of large firms has also been confirmed in an Australian context (Bhattacharya & Bloch 2004). Although authors such as Audretsch (1995) have found firm size to be negatively related to innovation, the majority view supports Schumpeter’s assertion that larger firms tend to not only innovate more, but also benefit more from innovation, leading to the next hypothesis.

Hypothesis 2b: The innovation – performance relationship is influenced by the relative size of small firms in that larger small firms benefit more from innovation.

Market concentration and relative market share
Schumpeter (1950, p. 106) holds that “perfect competition is not only impossible but inferior.” He believes that monopolistic competition would lead to more innovative activity and economic progress over the long run. Market concentration influences the speed with which transient quasi rents are eroded away by imitators (Nelson & Winter 1982). The absence of competition and associated high rates of return in the industry shelters firms that do innovate from competitive imitators that do not carry costs and risks associated with innovative activities. As such, innovation creates barriers to entry which in turn increases market concentration (Malerba & Orsenigo 1996). As mentioned, critics of Schumpeter argue that the lack of competition may reduce the innovation propensity of firms due to complacency setting in (Bowen et al. 2009; Greve 2003). Similarly, Acs and Audretsch (1988) find that innovation tends to decrease as the level of concentration rises. As a result of these incompatible views, the effect of market concentration on the relationship between innovation and firm performance is not clear and the results of empirical findings are mixed (Bhattacharya & Bloch 2004; Becheikh et al. 2006; Tingvall & Poldahl 2006). Market concentration at the industry level measures the number and size distribution of firms in each industry and is most commonly expressed as the market share held by the three or four largest firms in an industry (Caloghirou et al. 2004). Market concentration in this study is measured at the small firm’s competitive environment level and is defined to refer to the relative strength of competition within the specific market segment/s or immediate competitive environment/s of the small firm. It therefore differs from overall industry concentration. This approach is followed, because it is argued here that, due to their size, small firms normally do not compete industry-wide, tending to focus on a niche within the industry. Porter (1980) argues that small firms introduce innovative products, services, processes, or business models tailored to attractive niches in order to stand out from competition. Small firms may operate in highly concentrated industries but at the same time shield themselves from intense monopolistic competitive pressure as a consequence of their geographic position or niche strategy. Caloghirou et al. (2004) confirm this and find a small but significant effect of industry concentration on small firm profitability. This means that small firms occupy isolated niches and maintained profitability despite the monopoly power of market leaders. Market concentration at the firm level will be measured in this study as a function of the number of competitors a small firm compete with and the small firm’s relative market share within its immediate competitive environment. Two hypotheses are presented, reflecting the impact of level of competition and relative market share on the innovation – performance relationship.

Hypothesis 2c: The innovation – performance relationship is influenced by the level of market concentration of the small firm niche in that a higher level of competition will mean more performance benefits from innovation.

Hypothesis 2d: The innovation – performance relationship is influenced by the relative market share of the small firm in its niche market in that higher relative market share will mean more performance benefits from innovation.
**Internationalisation**

Internationalisation is a major driver of more open innovation processes, not only because it means more intense and global competition, but also because it creates a global market for innovation outputs (OECD, 2008). Internationalisation has been defined as “the process by which firms both increase their awareness of the direct and indirect influence of international transactions on their future, as well as establish and conduct transactions with firms in other countries” (Beamish 1990, p. 77). Increased internationalisation has encouraged some small firms to operate in more competitive global markets, where continuous innovation is a prerequisite (Gunasekaran et al. 1996). It is argued that internationalisation leads to increased global exposure of small firms which will expand the firm’s knowledge network, the basis of ideas and technologies. A meta-analysis conducted by Becheikh et al. (2006) indicates a positive significant effect of export orientation on innovation. In a similar vein, Baldwin and Gellatly (2003) state that exporters emphasised innovation strategies more than non-innovator small firms. Internationalisation is also associated with increased firm competitiveness and market size (Galende & de la Fuente 2003). The degree of internationalisation, measured as the proportion of foreign sales to total sales, has been found to impact positively on firm performance by Pangarkar (2008). Relating to the link between foreign ownership and innovation, Love et al. (2009) find that externally owned firms are more likely to innovate than locally owned firms. The Australian innovation survey (ABS 2005) also indicated foreign ownership to have an influence on the innovation propensity. This indicates that:

**Hypothesis 2**: The innovation – performance relationship is influenced by the level of internationalisation of the small firm in that higher levels of internationalisation would stimulate innovative activity which would impact positively on small firm performance.

**METHOD**

**The Business Longitudinal Database – Population, sample and survey**

The ABS’s BLD, released through a Confidentialised Unit Record File (CURF), comprises two independent samples (referred to as panels) drawn from the Australian business population (ABS 2009a). The statistical analysis included in this paper was done on Panel 1 due to its longer timeframe at time of analysis, being 2004-05, 2005-06 and 2006-07. This sample contains responses from 2,732 firms, which was selected from a frame containing 1,563,857 Australian businesses as at June 2005. This panel sample was stratified by industry division and business size. The BLD excludes firms classified as financial corporations, general government, not-for-profit institutions, and firms with income tax instalment payer role only as well as non-employing businesses which report less than $50,000 turnover. Small and medium enterprises (in this paper small firms) are classified as firms employing less than 200 employees. This classification is comparable to the majority of studies undertaken in the US and Europe, which ranges between 250 and 500 employees for small and medium enterprises (Verreyne 2005). In addition, the BLD excludes firms from industries such as electricity, gas and water supply, finance and insurance, government, education, health and community services, libraries, museums as well as parks and gardens.

To ensure that the data were suitable for the study, the following restrictions were imposed on the sample. First, the non-employing firms were removed due to the overrepresentation of personal service providers and missing data on a number of variables for these subjects. Second, firms without sales data recorded on Business Activity Statements (BAS) were removed. BAS are submitted by businesses to the Australian Tax Authority on a regular basis in respect of their General Sales Tax obligations. Third, firms that did not participate in the complete panel were also removed. The sample used in the analysis of this study from Panel 1 contained 1,580 subjects after these restrictions were imposed.

**Data analyses**

Data were analysed with the SPSS analysis package. The internal consistency reliability of summated variables was measured using Cronbach alphas, as indicated in Table 1. Two types of statistic analyses were performed to test the hypotheses. Spearman’s correlations were used to test two-way relationships between all of the variables included in the hypotheses. This technique was used because several of the variables were dichotomous. Bivariate regression was used for simple prediction of the innovation – performance relationship. Multiple stepwise regressions were used to test the remaining hypotheses. While the debate rages on about the significance of statistical significance (Chow 1998; Johnson 1999; Ziliak & McCloskey 2008) the arbitrary baseline error level for this research is set at below a $p$-value of 0.01 for highly statistical significance and below 0.05 for marginal statistical significance, corresponding to the Two-Sigma Rule.

**VARIABLES**
Small firm performance measurement

Performance has been used extensively in strategic management and entrepreneurship literature (Goudis et al. 2003; Hoffman et al. 1998; Prajogo 2006; Wolff & Pet 2006). Multiple measures of firm performance have been relied on including, sales growth, profitability (ROA, ROE, and ROI), employment growth, productivity, wage rates, market share, value added per employee and export orientation (Baldwin & Gellatly 2003; Cho & Pucik 2005; Klomp & van Leeuwen 2001). Of these measures, growth and profitability seems to be the most widely used. The results in empirical research on the innovation – performance relationship have provided mixed evidence in that innovation relates differently to various measures of performance (Freel and Robson 2004; Lööf & Heshmati 2006; Mansury & Love 2008; Roper et al. 2002). The differences in relational outcomes between innovation and different measures of performance highlight the fact that there seems to be no single measure of performance which account for all aspects of small firm performance (Ramaswamy, Flynn & Nilakanta 1993). Subramanian and Nilakanta (1996) address the problem faced by researchers in selecting performance measures, by viewing the measures of performance as a dichotomy. They suggest that performance measures can be categorised as measures of efficiency and/or effectiveness. Efficiency measures relate to cost-benefit measures in that a ratio measuring inputs and outputs are used (financial ratios such as return on assets etc.). Efficiency measures have a revenue generation focus using sales growth, market share growth, etc. as measures. Subramanian and Nilakanta (1996) find that the different types of innovation affect different aspects of performance. They therefore propose that a multidimensional measure of innovativeness (administrative and technological innovations) is used in conjunction with both efficiency and effectiveness performance measures.

Performance measures could also be differentiated as being objective data and/or subjective measures (Verreyenne 2005). Financial data or financial statements would constitute an objective measure while perceptions of small firm owners expressed in surveys would constitute subjective measures. Self reported measures have been found to highly correlate with objective measures of performance (Dess & Robinson 1984). For this reason, and in line with the view that performance is multidimensional, this paper used subjective measures of effectiveness (sales and range of product growth) as well as efficiency (profitability and productivity growth) as performance indicators. Such a composite self reported measure of performance would assist in accounting for most aspects of small firm performance (Pangarkar 2008; Wiklund & Shepherd 2005). Similar composite measures of reported performance are used in research by Caloghirou et al.(2004) as well as Mansury and Love (2008).

Innovation measurement

Small firm innovation in the BLD is measured by conforming to the Oslo Manual (OECD 2005) definition of innovation which is also adopted in this study as the operational definition. This definition includes product, process, organisational and marketing innovations. Therefore the BLD employs a direct subjective measure of innovation by asking respondents if they have introduced any new or significantly improved goods and/or services, operational processes, organisational and/or managerial processes as well as marketing methods. To conform to the operational definition of innovation, the statistical analysis of the innovation – performance relationship use a single measure for innovation. Thus, the different types of innovation are conflated into a single composite measure of innovation (Bhattacharya & Bloch 2004; Laursen & Salter 2006). Such a composite index provides an indication of innovation breadth assuming that small firms who innovate across a broader spectrum of business activities thus introducing a greater variety of innovations will be regarded as being more innovative. Furthermore, if different types of innovation affect different aspects of performance (Subramanian & Nilakanta 1996) the use of composite indexes for both innovation and performance is a better indication of the overall relational effects in the reciprocal innovation – performance relationship of small firms. The operational definition employed does not make provision for discriminating between the degrees of novelty of innovation (Becheikh et al. 2006, p. 652). Therefore, all new or significantly improved innovations were included in the measurement.

Control variables

Age is measured by the number of years the business has been in operation regardless of changes in ownership. Size refers to the number of persons employed. Relative market share was measured on a categorical scale of less than 10 per cent, between 10 and 50 per cent and more than 50 per cent. Number of competitor scale included; no competition, one or two competitors and more than three competitors. This study measured the degree of internationalisation using a composite index comprising of export and import activity, foreign ownership as well as an indication if the SME operates overseas.
RESULTS AND DISCUSSION

Hypotheses 1a and b: SME innovation and performance

The study results suggested that innovation matter for Australian small firms. Hypothesis 1 was confirmed as evident from Table 1. Positive, statistical significant correlations were found between innovation and performance, cross sectional as well as longitudinally. Bivariate ordinary least squares regression analysis confirmed the causal relationship in both directions. Small firm innovation is found to be positively linked to perceptual performance in that prior performance positively impact on future innovation (Audretsch 1995). In turn, past innovation is also found to impact positively on performance. There exists a mutually beneficial, reciprocal relationship between innovation and performance. This confirms Laursen and Salter’s (2006) belief, namely that previous experience dictates future behaviour and past success conditions future behaviour. Bowen et al., (2009) provide an explanation for this in stating that, superior performance leads to small firms reinvesting in innovation to sustain their competitive advantage. No evidence was found in this study for the argument that firm success may impact negatively on innovation due to organisational complacency and inertia (Greve 2003). The positive reciprocal relationship was confirmed within the limits of this study’s one-year longitudinal design. Hypothesis 1a and 1b is therefore confirmed. It has to be noted though that the effect sizes was low. The adjusted R² for the relationship between past innovation and performance was 0.052. Although statistical significant the small explanatory power of this result imply that innovation breadth explains only about five per cent of subsequent firm performance. This result has to be viewed in context. Firstly, the large sample represented both innovating and non-innovating small firms across all sectors. Secondly, as stated supra a very large number of factors impact on and determine firm performance. Even a small effect size would therefore be deemed substantively significant.

Table 1: Descriptive statistics, Cronbach Alphas of composite scales and Spearman’s coefficients

<table>
<thead>
<tr>
<th>Variables in scale</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.16</td>
<td>0.86</td>
<td>7.79</td>
<td>7.73</td>
<td>1.85</td>
<td>2.74</td>
<td>0.53</td>
<td>2.58</td>
<td>1.54</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.76</td>
<td>1.51</td>
<td>3.08</td>
<td>3.01</td>
<td>0.78</td>
<td>1.15</td>
<td>0.97</td>
<td>0.75</td>
<td>0.68</td>
</tr>
<tr>
<td>N</td>
<td>1508</td>
<td>1562</td>
<td>1675</td>
<td>1565</td>
<td>1532</td>
<td>1532</td>
<td>1524</td>
<td>1508</td>
<td>1449</td>
</tr>
<tr>
<td>Variables</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cronbach’s Alpha</td>
<td>0.73</td>
<td>0.73</td>
<td>0.8</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
</tr>
</tbody>
</table>

Variables:

1. Innovation '06
2. Innovation '07
3. Performance '06
4. Performance '07
5. Size
6. Age
7. Internationalisation '06
8. Number of competitors '06
9. Market share '06

Notes: The apostrophe 06 and 07 after the constructs denotes the survey years 2005/2006 and 2006/2007 respectively.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Although a significant positive linear relationship between innovation and performance was found, this relationship seemed to exhibit characteristics of curvilinearity. Further investigation provided insights into the nature of this relationship, evident from the results obtained from quadratic regression analysis, discussed next.

Hypothesis 1c: Inverted U-shape relationship between innovation and performance

To determine if a curvilinear inverted U-shape relationship does exist, quadratic regression analysis was applied. The results of this quadratic regression was found to be significant (adjusted $R^2 = 0.06$, F
= 46.6, p < 0.001) indicating existence of an inverted U-shape relationship. The resultant regression is plotted in Figure 1, and can be expressed as:

\[ \text{Performance}'07 = 7.23 + 0.68 \text{ Innovation}'06 - 0.05 \text{ Innovation}^2'06 \]

**Figure 1: Quadratic function of the innovation-performance relationship**

The finding that an inverted U-shape relationship exists between innovation and performance, has to be interpreted within the context of this study design. Innovation was measured by aggregating the categories of innovations in a composite index. Four innovation categories were measured (products, operational processes, organisational or managerial processes as well as marketing methods) by asking subjects eleven questions pertaining to the introduction of new or significant improvements made in these areas. Due to the measure applied, innovation in this research refers to the number of areas within which small firms have implemented innovations or types of innovations. Innovation intensity or number of innovations made within each of the categories was not examined. The breadth of innovation was therefore tested not the depth.

Seen against this background, the inverted U-shape relationship illustrated in Figure 1 could be interpreted as follows. Small firms that do not implement any innovations exhibited high levels of performance after one year. Small firms that introduced innovations in one or two areas of the business outperform non-innovators one year after introduction. Small firm performance tends to become exponentially lower after one year as they introduce innovations in more areas of the business. This implies that irrespective of the number of innovations (depth – which is not accounted for), an increase in the number of categories of innovation (breadth) beyond an optimal point would be associated with lower performance. Extensive innovation breadth seems to impact negatively on small firms one year after such introduction. This inverted U-shape phenomenon could be explained by considering three issues impacting on the innovation – performance relationship.

First, existence of a lagged payback cycle of innovation has been established in extant literature. The duration of such a cycle ranges from two (Audretsch 1995) to ten years (Freel & Robson 2004) before returns on innovation investment would materialise. The one year duration of this study may not account for the lagged payback cycle.

Second, an investigation into the contextual factors impacting on the innovation – performance relationship found that age played an important role. Younger firms tend to innovate across a broader spectrum in the process of establishing their new businesses, learning and adapting as they venture on. Most activities undertaken by a new firm would be deemed as ‘new or significant’ improvements to that business. Hence, younger firms were found to be more representative of innovating firms (implementing more types of innovation). It is argued here that older small firms have consolidated their business models and can implement more focussed and concentrated innovations in one or two business areas at a time leading to improved performance.

Third, it seems that Wiklund and Shepherd (2005, p. 72) are correct in remarking that, “necessity is the mother of invention.” Small firm founders, initiating new ventures by bootstrapping and/or those that face adversity in the face of high competition, may be inclined to innovate across a broader range of business areas to address their predicament. Greve (2003) agrees and proposes that innovations are launched following performance below the aspiration level. The impact of these innovations may not be evident in the short and medium term. The potential risks associated with innovation imply that innovation across a broad spectrum may increase such risks. Uncoordinated and unsuccessful innovations across such a broad spectrum will negatively impact on small firm performance. This may explain the inverted U-shape as to why small firms who implement less types of innovation
outperform, over one year, those who implement a larger variety of innovations. As Freel and Robson (2004, p. 570) state, firms failing in their innovative effort “are more likely to perform poorly than those that make no attempt to innovate.”

The relationship between innovation and performance, as measured in this study, is therefore found to be curvilinear. The inverted U-shape challenges conceptions of a simplistic, positive linear relationship between innovation and performance. The relationship seems to be more complex, further confirming the impact of various endogenous and exogenous factors. Some of these factors were investigated in this study and is reflected on next.

**Hypothesis 2: Small firm innovation and performance with controls**

The results indicate that the overall impact of innovation on performance of small firms is clearly moderated by contextual factors (Rosenbusch et al. 2010). The impact of the context variables were analysed by applying two statistical techniques. Spearman’s correlations were conducted to explore relationships and multiple regression was used to test the hypotheses. The results of the linear and curvilinear models are presented in Table 2.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Standardised Regression Coefficients – Linear regression</th>
<th>Standardised Regression Coefficients – Quadratic regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation’06</td>
<td>0.14**</td>
<td>0.18* (Sig. = 0.01)</td>
</tr>
<tr>
<td>Innovation’06</td>
<td>-0.04</td>
<td>-0.07**</td>
</tr>
<tr>
<td>H2a Age</td>
<td>-0.07**</td>
<td>-0.07**</td>
</tr>
<tr>
<td>H2b Size</td>
<td>0.17**</td>
<td>0.17**</td>
</tr>
<tr>
<td>H2c Competition</td>
<td>0.09**</td>
<td>0.09**</td>
</tr>
<tr>
<td>H2d Market share</td>
<td>0.11**</td>
<td>0.11**</td>
</tr>
<tr>
<td>H2e Internationalisation</td>
<td>0.06*</td>
<td>0.06 (Sig. = 0.051)</td>
</tr>
<tr>
<td>F-value =</td>
<td>23.59**</td>
<td>20.26**</td>
</tr>
<tr>
<td>Adjusted R square =</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Notes:** The apostrophe 06 and 07 after the constructs denotes the survey years 2005/2006 and 2006/2007 respectively. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

All Spearman’s rho correlations (Table 1) between performance’07 and innovation’06 as well as the moderators were found to be highly significant at p < 0.01 except for age which were only marginally significant at p < 0.05. The full model in both the linear and quadratic regressions have doubled the substantive explanatory power of the original bivariate regression model between innovation and performance to R² = 0.1. The relative contribution of the variables to the explanatory power of the linear model is represented by the standardised regression coefficients, similarly reflected by Spearman’s rho. Size had the largest effect on the linear innovation – performance relationship followed by market share, number of competitors, age and internationalisation. Hypotheses 2a-e were accepted for the linear model and Hypotheses 2a-d for the curvilinear model in that these moderators affected the direction and strength of the innovation – performance relationships as expected.

Age had a negative impact on the innovation – performance relationship in this study. This is contradictory to the reasoning, which suggests that older firms will be more innovative as they have accumulated more knowledge and experience over time (Cohen & Levinthal 1990). This study however, supports Rosenbusch et al. (2010) that newly established small firms are more flexible, adaptable and possess less specialised resources, making them more likely to innovate. The negative impact of age on innovation may also be due to the measure employed to test innovation as denoting innovation breadth. Younger firms would innovate across a wider range of business activities and functions as they develop and adapt business models during the early phases of venturing.

Regarding the impact of size, this study found that small firms do innovate and that innovation increased with size. This finding supports Schumpeter’s argument that size does matter, but dispute his conjecture that innovation is primarily driven by monolithic enterprises. This finding is in line with the majority of previous studies who favour Schumpeter (Becheikh et al. 2006; Camison-Zornoza et al. 2004). Larger small firms are regarded as more innovative due to the fact that they control more resources, spend more on R&D and generally have a larger market share (Galende & de la Fuente 2003). This study also supports the finding made in a similar study undertaken by Bhattacharya and Bloch (2004). They find that innovative activity among Australian small firms increase significantly with firm size, measured as a function of sales.
Competition seems to stimulate small firm innovation rather than inhibit it as suggested by Schumpeter (1950). The measure for ‘number of competitors’ employed in the BLD has interval ranges of none, one to three, and more than three competitors. It has to be noted that the use of these intervals to indicate the number of competitors could be very restrictive. It is evident from the unweighted frequencies on the full BLD sample that that most of the small firms have more than three competitors (47 per cent in full sample and 69 per cent in the study sample) leading to an overestimation of the competitiveness in the market segment when this interval scale is used. This potential overestimation in the number of competitors must be taken into consideration when interpreting this data. Partially supporting Schumpeterian thought on market concentration, was the finding that small firms’ relative market share impact positively on the innovation performance relationship. This imply that firms, having larger market shares and operating in more competitive environments are better able to unlock the performance advantages of innovation.

Internationalisation also positively impacted on the linear innovation – performance relationship, although this was only significant at the 0.05 level. A number of scholars argue the importance of internationalisation to innovation (Gunasekaran et al. 1996; van de Vrande et al. 2009). Internationalised small firms tend to be larger than their non internationalised counterparts. This factor may impact more positively on profitability than innovation. Exposure to the global market expands a firm’s knowledge network and sources of ideas providing more exposure to new innovations. Such small firms may be exposed to higher levels of competition in the global market. Internationalisation was found to fall just short of moderate statistical significance in the curvilinear model.

When the controls were added to the curvilinear relationship Innovation’06 became non-significant and the relative contribution of Innovation’06 increased. The existence of mediation by any of the independent variables should be further investigated as the strong curvilinear relationship established in Hypothesis 1c is not evident when controls are added. These conflicting findings may also be explained from the perspective of diminishing returns of innovation breadth. Geroski, Machin and Van Reenen (1993) argue that effective management requires constraints on the amount of strategic variety implying that breadth of innovation objectives may be subject to diminishing returns. They find the marginal effects on large firms’ corporate profitability generally continue to increase as the number of innovation objectives rises, in that in their study, the marginal effects peak at eight objectives but are still nearly as high at the maximum possible 10 objectives providing support for the benefits of innovation breadth. Their finding implies that innovation breadth is positive to firm performance but that excessive breadth may be detrimental. Our findings confirm this conjecture as it applies to small firms. The optimal point at which the marginal effects on performance derived from innovation breadth become negative may, however, be smaller or narrower for small firms given their resource constraints.

CONCLUSIONS

The contribution of businesses to innovation in the economy is unmistakable (Judd & McNeil 2008). Public expenditure and policies aimed at stimulating innovation underlines the commitment of bureaucrats to unlocking the innovative potential of enterprises. Small firms are by far the majority of business entities in Australia (ABS 2010). Yet, not much is known about their contribution to innovation in the economy and/or the impact that innovation has on the survival and growth of these small firms. Small firm owners or managers are bombarded with often contradictory claims as to the value of innovation to their bottom-line. This is as a consequence of the wide range of factors that potentially impact on firm performance. Innovation is but one of these factors. Innovation can therefore not merely be equated with small firm performance, but should rather be studied as a potential contributor to overall performance. This study set out to assess and clarify the dynamics associated with the innovation – performance relationship, a quest that can be equated to a search for the Holy Grail.

The first limitation to this study relates to the dichotomous and polytomous nature of the data used in this study. Dichotomous questions do not capture much of the depth of the phenomena investigated. While the benefits of yes/no measures are clear in terms of low bias and efficiency, these measures miss some of the complexity involved in the innovation – performance determinants (de Jong & Vermeulen, 2006). The restrictive nature of categorical survey data becomes evident when considering the potential impact of misspecifying the predetermined intervals. This may be evident with the categories used in the BLD survey to indicate ‘number of competitors’ as discussed. Second, innovation was measured by applying a composite index of categories of innovation. This measure captures the breadth of innovation but not the depth thereof. The degree of novelty is not tested nor does it measure the relative contribution of these innovations. Third, the longitudinal study design
captured only two periods with one year interval, not fully allowing for the lagged payback cycle of innovation. Longitudinal evidence on the existence of a positive, reciprocal innovation – performance relationship on a large sample of Australian small firms was presented. This study, or aspects thereof, could be replicated in future research, having the benefit of employing the same data over a longer period of time. This is made possible due to the composition of the BLD panels, providing opportunity for longitudinal analysis of up to five years. A period of five years is suggested by Freal and Robson (2004) to be adequate in accounting for the lagged payback period of innovation. This as well as mediation analysis would provide more clarity on the curvilinear innovation – performance relationship that was found. Longer time periods may also provide opportunity for differentiating between the lagged payback periods of different types of innovation. It may also provide a clearer indication of the time it takes innovating firms to reinvest in innovation to sustain their competitive advantage.

Several findings emerge, for example, the existence of a mutually beneficial, reciprocal relationship between small firm innovation and performance was confirmed. This relationship is complex and exhibited characteristics of nonlinearity. The inverted U-shape depicting this relationship, suggests the existence of an optimal point in the number of innovation types that small firms should implement to derive maximum performance benefit from such innovations. Endogenous and exogenous moderating variables impact on this relationship, making the innovation – performance relationship highly contextual. Size matters. Larger small firms tend to innovate more and exhibit higher levels of performance. Increased competition and higher relative market share (within the niche or market segment occupied) stimulate innovative activity among small firms and unlock the performance potential of innovation. Younger small firms innovate across a wider range of business activities as they grow and consolidate their business models. Internationalisation has been found to positively correlate with innovation and performance.

The finding of a positive relation between innovation and firm performance in Australian small firms confirm past research findings in other regional contexts (Baldwin & Gellatly 2003; Crepon et al. 1998). This study leads to enhanced understanding of the innovation – performance relationship by not only confirming existing research but also by shedding more light on the nature of this relationship. The finding that the innovation – performance relationship is curvilinear opens the door for further research into this phenomenon. It postulates the existence of diminishing returns when increasing innovation breadth. Wider innovation breadth, if not correctly applied, may be detrimental to the performance of small firms. Replicating this study over a longer time period will provide more clarity on the optimal point at which further introduction of innovation across more business functions would become counterproductive.

Does innovation matter? This is the question that has to be answered to small firm owners as they contemplate the practical costs and risks associated with innovation in the face of competitive pressure and daily management tasks. The answer is yes. However, proprietors should be informed as to the nature of the innovation – performance relationship. The threat exists that innovation may be seen as the ultimate solution for ensuring firm performance. This assumption may give rise to the belief that "more innovation is better" for small firms. This research has shown such an assumption to be flawed, in that the small firm innovation – performance relationship exhibit characteristics of curvilinearity. Overextending the range of activities in which innovations are applied may prove to be counterproductive. Small firms are hampered by limited resources and capabilities. They would derive maximum performance benefit from innovation if they focus their innovative efforts on one or two areas of application at a time. The research results suggest that it may be more beneficial not to innovate rather than endeavouring to innovate in a large number of business areas at the same time within a short period. The main advice to small firm owners/managers is therefore to focus their innovative efforts on a few core business activities, and to refrain from being tempted into innovating within a short period. The main advice to small firm owners/managers is therefore to focus their innovative efforts on one or two areas of application at a time. The research results suggest that it may be more beneficial not to innovate rather than endeavouring to innovate in a large number of business areas at the same time within a short period. The main advice to small firm owners/managers is therefore to focus their innovative efforts on a few core business activities, and to refrain from being tempted into innovating within a short period.

REFERENCES


