

# The Dynamics of Innovative Activity and Competitive Advantage: The Case of Australian Retail Banking, 1981 to 1995

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## Abstract

This study examines the adoption of new products and processes in the Australian retail banking industry over the 1981 to 1995 period. Our analysis demonstrates that the vast majority of observed innovative activity was based on ideas sourced from outside the focal firm, and that innovations diffused very quickly across competing banks. As such, there were no periods during which any bank had proprietary possession of a major product or process innovation. We therefore ask how the banks' innovative activity could affect their relative financial performance positions. We answer this question by developing a set of hypotheses that relate specific features of their histories of innovative activity to their current financial performance. These hypotheses are tested using a detailed data set describing 1,297 modifications made to products and services, distribution technologies, and back-office processes within a sample of Australian retail banks over the sample period. Our results provide support for the general position that establishing an attractive competitive position depends on the specific history of a firm's innovative activity. Banks that undertook more innovative activity, that were more consistent in that activity, and whose composition of activity was somewhat differentiated from the industry norm tended to display superior financial performance. Rather than looking solely for internally generated, inimitable innovations to deliver competitive advantage, these results suggest that active and consistent innovative activity that is somewhat differentiated from competitors can also deliver superior financial performance.

*(Innovation; Evolution; Firm Performance; Banking)*

It is sometimes not possible to uncover the logic (or illogic) of the world around us except by understanding how it got that way... the dynamic process itself takes on an essentially historical character (David 1985, p. 332).

Considerable emphasis is placed on the relationship between innovation and competitive advantage (Henderson and Cockburn 1994). A dominant view holds that a valuable new product or process may be developed within the firm, and may be protected for

some time from imitation by competitors (Schumpeter 1934). The discovery of a new product that makes more effective use of existing assets enhances profitability. The discovery of a new production process transforms a firm's asset base and establishes or re-establishes its value and uniqueness in the face of competitor imitation. In either case, a successful act of innovation that generates a proprietary competitive position can deliver advantage and, therefore, superior profitability (Geroski et al. 1993, Roberts 1999). In this paper, we refine and extend this explanation by formally recognizing that most innovation occurs at a subfirm level of analysis (Roberts 2001). New products and processes—and not necessarily new firms—are introduced and subsequently imitated during Schumpeter's (1950) process of creative destruction. More importantly, multiple new products and processes are introduced within the same firm over time (Schumpeter 1950). Therefore, a complete examination of the relationship between innovation and firm performance must move beyond the current emphasis on the organizational processes that generate a valuable new product or process (Henderson and Cockburn 1994). It must examine a firm's overall record of innovative activity.

The approach that we offer is summarized as follows. Superior returns accrue to firms with uniquely valuable systems of strategic attributes, which include the firm's strategic assets as well as the products and services that they combine to produce for customers (Barnett et al. 1994, Levinthal 1998). The development of these systems depends critically on new strategic attributes, i.e., new products and processes. When a major innovation is developed within a firm, and when there are barriers to imitation by competing firms, a uniquely valuable system results, and superior firm performance may be traced to a particular act of innovation (Geroski et al. 1993). This said, what if the relevant new products or processes

are developed outside of the focal firm? Or, what if there are no effective barriers to the imitation of those products and processes by competing firms? When these conditions hold, it is difficult to argue for a relationship between a specific act of innovation and superior financial performance. There is simply no period during which a firm has proprietary possession of any one innovation. To address this type of scenario, we argue that a firm's system of strategic attributes *evolves over time* as it continually incorporates new strategic assets and new products.

According to standard evolutionary models, variation and selection are two processes that jointly influence the development of firms and industries over time. The source of variation (product and process innovation) may originate in the external environment. Moreover, there may not be obstacles to the subsequent selection of those innovations by competing firms. Against this backdrop, differentiated systems of strategic attributes result not from major stand-alone innovations, but from the cumulative effects of a series of more incremental changes (Aldrich 1999). In this way, a firm's current competitive position is a function of all previous changes made to its system of attributes, i.e., its total history of innovative activity. Firms create competitive advantage by creating novel combinations, which may entail adopting new products and processes that were developed by other firms and that are readily adopted by competing firms.

The perspective that emerges is a translation to the firm level of some important conclusions reached about the dynamics of technological evolution. Scholars of technological innovation have learned that novel product or process technologies are often new combinations of pre-existing fragments of knowledge. Utterback (1994, p. 2), for example, concluded that "innovation often draws from existing technologies and models for its application but uses these elements creatively in combination with new ones to form a uniquely different product." A firm-level variant of this conclusion is: "a firm's overall competitive position often draws from existing strategic attributes for its application but uses these elements creatively in combination with new ones to form a uniquely different competitive position." Henderson and Clark (1990, p. 28) support this translation by suggesting that "to the degree that other tasks performed by organizations can also be described as a series of interlinked components within a relatively stable framework, the idea of architectural innovation yields insights into problems that reach beyond product development and design."

This broader perspective on innovation and competitive advantage requires that we be clear about terminology, and about one specific assumption that we are making. Hereafter, a firm's innovative activity comprises all of the new-to-the-firm strategic attributes, and all modifications to its existing attributes. This implicitly invokes Rogers' (1995, p. 11, emphasis added) definition of an innovation as "an idea, practice, or object that is *perceived as new by an individual or other unit of adoption*." The subset of adoptions or modifications that represent industry firsts are "true innovations." This distinction allows us to conceive of a firm as being innovative in an overall sense, even if it does not produce any true innovations in its own right. What is necessary is that its overall history of innovative activity culminates in a uniquely valuable system of strategic attributes. In terms of our critical assumption, we stress that the adoption or modification of any one strategic attribute has a direct impact on firm performance, as well as a combinative effect when applied in the context of the firm's other strategic attributes. This is consistent with Teece (1987), who stresses that the strategic implications of innovation depend on the distribution of complementary assets across firms.

The balance of the paper is presented as follows. The next section describes the empirical context of the study—the Australian retail banking industry. There, we demonstrate that the majority of the innovative activity witnessed over the 1981 to 1995 period was based on ideas generated outside of the focal firm, i.e., most of the relevant variation was external. At the same time, the major new products and processes diffused rapidly across competing banks. Along with the high volume of innovative activity that was witnessed, these observations suggest that if innovative activity was to contribute to differentiated competitive positions over time, it was not due to any stand-alone act of innovation.

With this as our point of departure, the ensuing sections develop and test a set of hypotheses that relate a bank's prior innovative activity to its current financial performance. We first show that a firm's performance relates more to its history of innovative activity than to its current adoptions of new products and processes. We then link up with the literature on first-mover advantage by demonstrating that (in this context) moving early into new initiatives does not necessarily improve firm performance. The ensuing analysis of the firms' differential patterns of innovative activity speaks to whether there are returns to focus and/or consistency in the historical pattern of innovative activity. Finally, we address the dual concerns about competition and legitimacy (Hannan and Carroll 1992) by relating each firm's own pattern of

innovative activity to that which characterizes the prevailing industry norm. These different hypotheses and tests attest to the broad applicability of the framework that we are proposing. The final section concludes the paper with comments on the implications and generalizability of our findings.

### Australian Retail Banking

Prior to 1981, Australian retail banking was subject to strict regulatory controls. As a result, competing banks were quite similar in the products and services they offered, in the processes they used to develop and administer those offerings, and in the distribution techniques they used to deliver them to customers. Taylor and Hirst (1983, p. 267) described Australian banking from the 1950s through to the 1970s as an "era of gentle non-price competition in which services were virtually identical from one bank to another, charges were agreed upon and standardized, and advertising was unused." Given this description, it is not surprising that a 1982 newspaper article suggested that

[we are at] a crucial point in the history of Australian banking. The Campbell report, the mergers and two-thirds deregulation of interest rate controls have, almost overnight, cleared the way for massive changes in an industry which has seen only cosmetic alterations over several decades (*Sydney Morning Herald*, May 6, 1982, p. 17).

Indeed, things did begin to change in the early 1980s with the first of a series of regulatory reforms aimed at fostering competition within the industry.<sup>1</sup> The period of study for our analysis begins in 1981 with the first of these regulatory events. We therefore consider a period during which the industry evolved from a cohort of similarly endowed banks offering a limited range of products and services to one with considerably more heterogeneity.

Our aim is to relate a bank's history of innovative activity to its current financial performance, accounting for both major and minor innovations. This requires data that provide sufficient detail and give consistent treatment to each of the 15 years in the sample period. These requirements pose data collection challenges. Standard archival sources do not provide the detail needed for this type of analysis. And, while interview or survey techniques provide some of the missing detail, it is difficult to avoid respondent biases toward recent events or to highly salient developments (Rogers 1995). We avoid these problems by conducting a detailed search of the Australian business press, and of the various annual reports generated by each bank.<sup>2</sup> We minimized the likelihood of missing important information by searching

through publications that vary in terms of periodicity (i.e., annual, monthly, weekly and daily periodicals), regional coverage (i.e., national, regional and city publications), and perspective (i.e., "insider" annual reports and "outsider" business press articles). Table 1 provides a list of the major periodicals that were searched, as well as the banks covered by this analysis. These are virtually all banks with nontrivial retail operations in Australia at some point during the sample period.<sup>3</sup>

We began by identifying all business press articles published between 1981 and 1995 that were indexed under the heading "banking," or under the names of any of the sampled banks.<sup>4</sup> The indexing service used was the *Australasian Business Intelligence Index*, which abstracts and summarizes articles from over 120 Australian and New Zealand newspapers and journals. A review of each title and abstract allowed us to discard articles that did not report on bank-specific issues. This left 4,969 press articles spread quite evenly across the 15 years, ranging from a low of 236 articles in 1986 to a high of 459 articles in 1995. The text in these articles, and in all of the banks' annual reports over the sample period, formed the basis for data collection.

Data collection was guided by a stylized representation of a retail bank's value chain (Porter 1985). Figure 1 indicates that a firm may be described as a set of processes that access required inputs and make the requisite transformations to those inputs, and a set of distribution technologies that ensure that outputs reach the targeted set of customers. These are housed within an organization with a specific structure and administrative framework. Finally, a specific set of products and services flow through this stylized firm. Table 2 shows how a range of strategic attributes influences the activities that comprise a retail bank's value chain. Back-office capability relies on data processing centers, computer hardware and software, and related information technologies. Distribution is influenced by a range of technologies, including traditional branch networks, automatic teller machines, mobile bankers, PC banking, point-of-sale technologies, private banking centers, and telephone banking systems. Finally, a bank's overall competitive position is also a function of the price-performance characteristics of the different accounts, annuities, approved deposit funds, cash management accounts and trusts, credit cards, investments, loans, and mortgages that it offers to its customers.

We searched the full text of each press article and annual report for specific indications of discrete modifications to the banks' back-office processes, distribution systems, and product/service offerings. For each observation, we recorded the year of occurrence and a brief

**Table 1 Summary of Data Collection**

<b>Major Banks:<sup>1</sup></b>								<b>Former Building Societies:<sup>3</sup></b>							
ANZ								Adelaide							
Commonwealth								Advance							
National Australia								Melbourne							
Westpac								Challenge							
								Metway							
								St. George							
<b>Former State Banks:<sup>2</sup></b>															
<b>State, NSW</b>															
State, Victoria															
State, South Australia															
BankWest (formerly R&I Bank)															
State, Queensland															
<b>Foreign (and other) Entrants:<sup>4</sup></b>															
Barclays, Australia															
Chase AMP															
Citibank															
Australian															
<b>Main Publications:<sup>5</sup></b>															
Australian Business (national)								The Advertiser (national)							
Business Review Weekly (national)								The Age (regional)							
Money Management (national)								The Australian (national)							
Personal Investment (national)								The Australian Financial Review (national)							
Sun-Herald (regional)								The Courier-Mail (regional)							
Sydney Morning Herald (regional)								The West Australian (regional)							
<hr/>															
<b>Article Counts (by year):</b>															
'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	Total
328	338	239	399	306	236	337	349	293	330	300	278	394	383	459	4,969
<b>Innovative Acts Counts (by year):</b>															
'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	Total
33	59	32	78	116	74	96	99	128	94	58	87	101	111	131	1,297

**Note.**<sup>1</sup>The major banks are the largest and have historically operated in all states.<sup>2</sup>The former state banks were initially owned and operated by the state governments and have only recently been permitted to operate across state boundaries.<sup>3</sup>The former building societies were those that converted to bank status during the sample period.<sup>4</sup>All but one of the entrant banks are/were operated by foreign parent banks.<sup>5</sup>The periodical search also generated at least 1 article in 46 other publications.

description of the nature of the modification.<sup>5</sup> We also noted when an article indicated that the modification was a first for Australian retail banking. After deleting observations for which no year of occurrence was reported (104 instances), there were 1,297 modifications.<sup>6</sup> Table 1

shows the counts of these observations across the 15 years and indicates a slight increasing trend over time, with distinct lulls in innovative activity in 1986 and 1990. Of the modifications identified, 687 were product-related, with the remaining half split roughly evenly between process (285) and distribution (325). Figure 2 indicates no discernable trend in the relative proportions of product, process, or distribution innovations over the sample time period, although there was a reduction in the year-to-year variance of these proportions after 1990. Finally, note that 62 of the reported changes were identified as firsts for Australian retail banking.

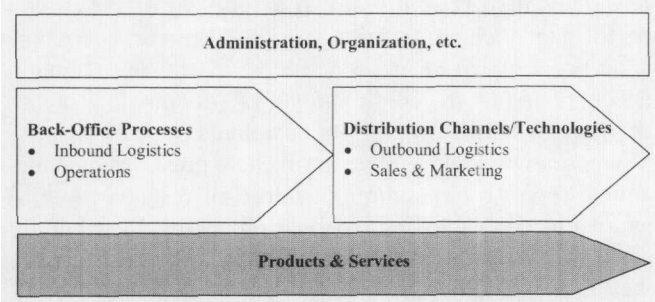
**Figure 1 A (Stylized) Value Chain****Summary of Innovative Activity**

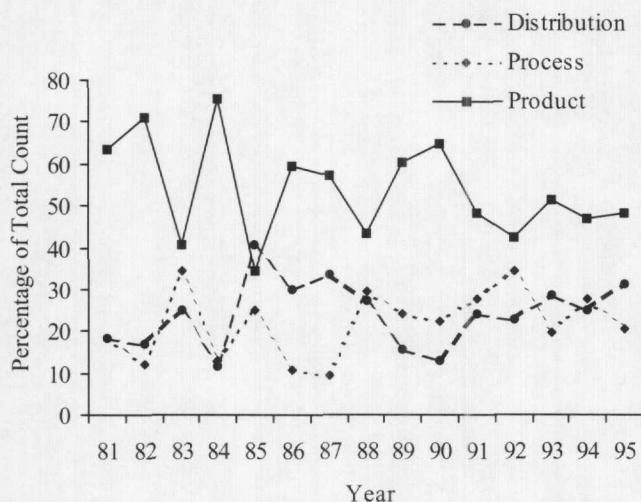
Table 2 identifies the major innovations observed within Australian retail banking between 1981 and 1995. It

**Table 2** Innovation Categories: Distribution, Process, and Product-Related Innovations

Category:	First Bank (Year)	Year of First-Follower
<b>Distribution:</b>		
Automatic Teller Machines	Westpac (1981)	1981
EFTPOS	Westpac (1983)	1984
Mobile Banking	Advance (1993)	1993
PC Banking	State, Victoria (1987)	1993
Private Banking	Citibank (1985)	1987
Telephone Banking	ANZ (1985)	1985
Other	(several)	—
<b>Process:</b>		
Centralization	ANZ (1990)	1992
Equipment	(several)	—
Information Technology	(several)	—
Other	(several)	—
<b>Product:</b>		
Accounts		
• interest on chequing account	BankWest (1981)	1983
• interest on business chequing	Queensland (1983)	1984
• youth-oriented account	Commonwealth (1984)	1984
Approved Deposit Funds	State, Victoria (1984)	1984
Annuities	ANZ (1988)	1989
Credit Cards		
• first international card	Australian (1982)	1982
• affinity card	ANZ (1988)	1988
• loyalty program	National Australia (1994)	1995
Cash Management Accounts	BankWest (1985)	1986
Cash Management Trusts	Australian (1981)	1982
Flexible Mortgages		
• mortgage offset	Queensland (1984)	1986
• access to previous overpayments	Advance & Australian (1987)	1987
Investments	(several)	—
Loans		
• cash flow	Citibank (1995)	1995
• home equity	Advance & Chase AMP (1988)	1988
• personal combined with mortgage	Commonwealth (1993)	1993
Mortgages		
• capped rate	Challenge (1987)	1989
• fixed rate	Citibank (1989)	1989
• low start	National Australia (1982)	1982
Other		
• investment advisory service	State, NSW (1984)	1985

also identifies the bank that first introduced each major innovation, as well as the year of initial introduction. Twenty-six major distribution, process, and product innovations were introduced into Australia by the sampled retail banks. Thirty-four other follow-on innovations (not reported) were also identified across the various categories. These data attest to the abundance of new strategic attributes that emerged over the sample period and confirm the dynamism characterizing this industry.

While the specific balance of internally and externally generated innovations varies across contexts, the extent to which the Australian retail banking innovations were sourced externally is surprising. Of the numerous documented major innovations, none were conceived (in whole or in part) within Australia. Rather, the ideas tended to come from banking industries in other countries. For example, ATMs and EFTPOS first appeared in the United States in 1974. Affinity and loyalty credit

**Figure 2 Breakdown of Innovation Counts by Category—1981 to 1995**

cards were launched in the United States in 1980 and 1992, respectively. Telephone banking was first observed in the United Kingdom and Japan in 1983. Finally, stored value cards went into commercial production in France in 1984, while pilots were conducted in the United States in 1988. These observations suggest that an understanding of the flow of innovations into this industry should draw on Von Hippel's (1988) work on the external sources of innovation. They also suggest that differentiated competitive positions had to be built from strategic attributes developed by other firms; in this case, banks in other countries.

Table 2 points to another important feature of the innovation dynamic within Australian retail banking. Consistent with observations by MacMillan et al. (1985) and Tufano (1989), the data reveal a high incidence of simultaneous and near simultaneous adoption. Of the 26 major innovations, 13 report a second introduction within the same year. In another seven cases, followers emerged within one year of the initial introduction. Only PC banking showed a prolonged period during which the initial adopter could claim a proprietary position—and this was during a period when PC banking technology did not represent a highly valuable distribution asset.

In summary, many new products and processes were introduced into Australian retail banking between 1981 and 1995. The adoption of each new attribute tended to occur in rapid succession by competing banks. Moreover, the competitive significance of each of these introductions must be considered in a context wherein the ideas for all major innovations were sourced from outside the industry. These observations suggest that

the conditions of externally generated variation and low impediments to selection hold in this industry. It is therefore difficult to argue for a relationship between any specific act of innovation and superior financial performance.

To better appreciate the relationship between innovative activity and the development of differentiated competitive positions, consider the case of the automatic teller machines (ATMs). Westpac Bank (one of the major banks) introduced ATMs into Australia in 1981. At the point of introduction, however, the impact of these ATMs on the bank's distribution capability could not be considered significant, as there were only a few simple machines at selected trial locations. To have an impact on customer behavior (i.e., to be considered truly valuable), the network had to be expanded, in terms of both the features of the machines and the locations at which the machines could be accessed. This is precisely what happened. Of the 101 ATM-related innovations documented between 1981 and 1995, 64 affected the accessibility of the network by providing customers with access to other banks' ATMs, expanding the types of locations at which ATMs could be accessed (both domestically and overseas), and allowing access to ATMs using credit cards. Another 20 modifications were aimed at updating the attributes of and the functions performed by the ATMs. As these modifications enhanced the value of ATM-related assets, other developments negatively affected the rarity of the offerings. While Westpac Bank was the first mover in 1981, all other major banks launched their respective ATM offerings by the end of 1982 (as did four other banks operating at the time). These early entries in advance of the realization of the full value of the ATM networks suggest that ATMs by themselves never offered a valuable proprietary position for Westpac Bank.

One way to generate and maintain a competitive advantage under these circumstances relates to each bank's specific history of ATM-related initiatives. As the above comments suggest, in the years following the introduction of the ATM, the banks undertook a series of initiatives to enhance the value of their offerings. These included several that were Australian firsts, including two launched by ANZ Bank (the first to introduce 24-hour service and the first with credit card access). In addition, ANZ Bank was involved in more ATM-related initiatives (17) than was any other bank, followed by National Australia Bank (14) and Commonwealth Bank (11). ANZ Bank also undertook its ATM-related innovations earlier, on average, than any of the other four major banks. In this respect, it is interesting to note that Westpac Bank, which introduced the ATM into

Australia, was by far the least active bank in ATM initiatives, and was among the latest major banks to undertake follow-on ATM-related initiatives.

This ATM example suggests that a firm's specific history of innovative activity may have an impact on its relative competitive position. In the next section, we further develop this point by articulating a set of hypotheses that relate specific characteristics of a firm's history of innovative activity to its current financial performance outcomes.

## Financial Performance and the History of Innovative Activity

Viewing firms as evolving systems of strategic attributes highlights the presence of numerous attributes with rich interactions among them (Rivkin 2000, Simon 1962). This is consistent with Levinthal (1995, p. 32), who states that "overall organizational effectiveness is the result of complex interactions among the various attributes of the organization." Similarly, Foss et al. (1995, p. 8) suggest that "the value of an individual resource is likely to be at least partially contingent on the presence (or absence) of other resources." If a firm's overall competitive position depends on the various attributes housed within it, and on the specific way they link together, then it must evolve over time as new strategic attributes are adopted, and as existing attributes are modified. In the following paragraphs, we hypothesize about several specific relationships between the historical level and composition of a firm's innovative activity and its current financial performance. In doing so, we draw on previous research on first-mover advantage and organizational commitment, as well as related work on competition and legitimacy.

The stand-alone impact of innovative acts, when cumulated over time, suggests a relationship between financial performance and the firm's overall level of innovative activity. Each product, process, or distribution modification updates one or more of a firm's strategic attributes. When changes are industry firsts, one expects possible short-term monopoly positions that deliver superior financial performance. Even when the changes represent later adoptions, they keep the firm in step with the latest developments. A firm's performance should therefore be positively related to the intensity of its innovative activity (Geroski et al. 1993):

**HYPOTHESIS 1A.** *Firms with greater innovative intensity experience better financial performance.*

The previous section stressed that the ideas for many innovations are sourced externally and tend to diffuse

rapidly across competitors. This being the case, we look at the cumulative impact of value-chain modifications by competitors, as well as the focal firm. If a firm's own innovative intensity makes it a stronger competitor, then similar activity by competitors should depress the financial performance of the focal firm (Barnett and Hansen 1996). Invoking symmetry, we therefore hypothesize that:

**HYPOTHESIS 1B.** *Firms whose competitors have greater innovative intensity experience lower financial performance.*

The first two hypotheses focus on the entire set of new or modified products and processes adopted by a firm and its competitors. An argument may be made for an even stronger relationship between innovative acts that are industry firsts (i.e., true innovations) and the emergence of competitive advantage. Even if the performance benefits associated with short-term monopoly positions are not evident, the propensity to move first into new initiatives may enhance a firm's overall competitive position. The issue is whether to expect first-mover advantages at the level of the specific strategic attribute (Lieberman and Montgomery 1988). First movers benefit if they can preempt the development of critical supporting assets by competitors, or if attribute-specific learning is an experience-dependent process (Argote 1999, Tushman and Anderson 1986). In either case, one would expect that:

**HYPOTHESIS 2.** *Firms whose innovative activity is comprised of more industry firsts experience better financial performance.*

Note that Hypothesis 2 is stated in its positive form as a test for first-mover advantages. However, the current context may not favor the emergence of first-mover advantages. The documented ease by which all new products and processes diffuse across competitors suggests that asset preemption is not a strong factor in this setting. And, given the proposed combinative effects of innovative acts, much of the variance in the competitive impact of any one act of adoption depends on heterogeneity in the firm's other strategic attributes, which is strongly influenced by differences in past and future innovative activity. Strong interfirm variance in this latter respect dampens any stand-alone impact associated with first-mover advantage. As such, we are sympathetic to the conclusion reached by Lieberman and Montgomery (1998, p. 1113): "First-mover advantage depends on the initial resources captured by the pioneer, plus the resources and capabilities subsequently developed."

In addition to variables that describe the historical level of innovative activity, we also examine the distribution of that activity across the product, process, and distribution categories. The combinative effects of innovative activity, when cumulated over time, suggest that the composition of a firm's prior innovative activity may have an impact on its financial performance. Given time and resource constraints, no firm can adopt the full range of potentially profitable additions and modifications to its attribute system. Therefore, they must choose either to focus their innovative activity on a particular category, or to spread that effort more thinly across categories. The main difference between these extremes relates to the extent to which a firm develops deeper, more-focused (product, process, or distribution) capabilities. In terms of the specific nature of the attribute combinations, this equates to whether the combinative effects on performance are stronger within, or across, innovation categories. If they are stronger within categories, then the performance effect of prior adoptions will be enhanced with more-focused innovative efforts. There is some reason to believe that more-focused adopters should experience better financial performance. In developing the concept of asset mass efficiencies, Dierickx and Cool (1989, p. 1507) suggest that "adding increments to an existing asset stock is facilitated by possessing high levels of that stock." In a similar vein, Cohen and Levinthal (1989, 1990) argue that a firm's ability to integrate new ideas depends in part on the level of knowledge already possessed. In the context of the modifications examined in this study, a firm's ability to access and assimilate new process or distribution assets, or new products and services, should depend on its depth of experience—and therefore the number of previous modifications—in the corresponding area. We thus test the following hypothesis:

**HYPOTHESIS 3.** *Firms with more focused innovative activity experience better financial performance.*

Note that evidence that contradicts this hypothesis does not suggest that attribute combinations are unimportant. Rather, it suggests that the combinative effects are equally strong within and across innovation categories.

The next hypothesis considers the extent to which the consistency of innovative activity over time has an impact on financial performance. At different times, different innovation categories may be associated with more profitable opportunities for improvement. This is consistent with recent examinations of variations in technological opportunities across industries (Klevorick et al. 1995). It is also consistent with the data summarized in

Figure 2, which indicate considerable longitudinal variation in the aggregate importance of the three innovation categories, especially during the first half of the sample period. Firms that are sensitive to changes in the flow of profitable new ideas will adjust the composition of their own innovative activity from year to year as different areas become more prominent innovation sources. On the other hand, there may be returns to committing to a particular area. Even when innovations are sourced externally, there are still costs associated with locating and assimilating different types of innovative ideas (Rosenberg 1994). If these switching costs are high, then firms which commit to a particular arena may outperform those whose innovative trajectory is more ad hoc. In support of this, Ghemawat (1991) and Porter (1996) stress the benefits of strategic commitment. While there are in principal returns to undertaking a wide range of strategic initiatives, the trade-offs and inconsistencies inherent in the problem space imply the need for a more consistent agenda. In light of this possibility, we test the following hypothesis:

**HYPOTHESIS 4.** *Firms with greater year-to-year consistency in the composition of their innovative activity experience better financial performance.*

Our final hypothesis looks at the pattern of a firm's innovative activity relative to the overall flow of new products and processes into the industry. Here, firms must balance the need for legitimacy with the offsetting need for competitive differentiation (Deepphouse 1999). Legitimacy concerns provide an incentive to engage in a pattern of innovative activity that tracks the overall industry norm (Hannan and Carroll 1992). If it is seen as appropriate or desirable to emphasize new products in a given year, then performance should improve for firms that follow suit. However, given the need to compete on a differentiated basis, there are also returns to innovation patterns that are somewhat different from the prevailing norm (Baum and Haveman 1997). If the returns to differentiation diminish with level of divergence, and if illegitimacy penalties increase at an increasing rate, then the optimal degree of divergence will lie at some intermediate level. These two effects imply that:

**HYPOTHESIS 5.** *As the composition of a firm's innovative activity diverges from the corresponding industry norm, its performance first improves and then declines.*

## Analysis and Results

The financial performance measure used to test these hypotheses is bank return on total assets (ROA). In support of this decision, note that accounting rates of return

are used extensively by scholars examining the dynamics of firm profitability (Mueller 1986). This is also the measure used by Barnett et al. (1994) in their evolutionary study situated in the banking industry.<sup>7</sup> Table 3 summarizes the ROA for each sampled bank over the 1986 to 1995 period, and shows considerable dynamic variability. In each of these 10 years, National Australia Bank and the Bank of Queensland earned rates of return that were above the industry average. Other notable superior performance episodes included Advance Bank (1988–1995) and Metway Bank (1989–1994). At the other extreme, the State Bank of NSW was a below-average performer in every year except 1989, while BankWest was a below-average performer in all but two years (1992 and 1994). To explain this dynamic heterogeneity in financial performance outcomes, the next section relates each ROA observation to six variables that characterize the bank's history of innovative activity.

Our innovation count data are used to generate a set of variables that reflect a bank's innovative intensity, the innovative intensity of competing banks, a bank's propensity to move first into new initiatives, the degree of focus of its innovative activity, the consistency in the composition of its innovative activity over time,

and the extent to which its composition diverges from the industry norm. In all cases, the variables are constructed based on innovative activity over the previous five years. This is the window used by Griliches (1981) and Cockburn and Griliches (1988) in their analysis relating a firm's market valuation to its recent history of annual R&D expenditures. In subsequent analysis, we estimate a model with variables calculated based on a three-year window and find that it underperforms that using these five-year variables. We also find that the five-year variables explain significantly more of the variance in financial performance than do variables constructed using only current-year innovation activity.

The innovative intensity variable is the total count of innovative acts during the previous five years divided by total bank assets. The other banks' innovative intensity variable is the same five-year count of innovations by all other banks in the sample divided by the sum of their bank assets. A bank's propensity to move first is reflected by a count of the number of reported Australian firsts during the previous five years.

The focus variable is a measure of the degree to which a bank concentrates on one of the three innovation categories.<sup>8</sup> It is calculated by first summing the five-

**Table 3 Return on Total Assets for Australian Retail Banks, 1986 to 1995 (Boldfaced entries are above average.)**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
<b>Major Banks</b>										
ANZ Banking Group	<b>0.59</b>	<b>0.59</b>	<b>0.69</b>	<b>0.42</b>	0.23	<b>0.28</b>	-0.57	0.25	0.82	0.94
Commonwealth Bank	<b>0.73</b>	<b>0.45</b>	0.54	<b>0.92</b>	<b>0.79</b>	<b>1.00</b>	<b>0.48</b>	0.50	0.76	<b>1.01</b>
National Australia Bank	<b>0.72</b>	<b>0.70</b>	<b>0.83</b>	<b>1.04</b>	<b>0.81</b>	<b>0.78</b>	<b>0.95</b>	<b>0.97</b>	<b>1.36</b>	<b>1.34</b>
Westpac Banking Corporation	<b>0.66</b>	<b>0.64</b>	<b>0.83</b>	<b>0.74</b>	<b>0.63</b>	<b>0.45</b>	-1.41	0.04	0.75	0.90
<b>Former State Banks</b>										
State Bank of NSW	0.29	0.26	0.31	<b>0.34</b>	0.02	0.08	0.14	-0.39	0.21	0.59
State Bank of Victoria	<b>0.63</b>	0.39	0.47	-0.82	<b>0.78</b>	—	—	—	—	—
Bank of SA	<b>0.42</b>	0.36	—	<b>0.60</b>	0.11	0.02	0.16	0.54	0.53	<b>1.02</b>
BankWest	0.27	0.30	0.33	-1.15	0.27	-1.38	<b>0.28</b>	0.33	<b>0.86</b>	0.95
Bank of Queensland	<b>0.91</b>	<b>1.00</b>	<b>1.00</b>	<b>1.06</b>	<b>1.09</b>	<b>1.10</b>	<b>1.16</b>	<b>1.05</b>	<b>1.06</b>	<b>1.03</b>
<b>Former Building Societies</b>										
Adelaide Bank	—	—	—	—	—	—	—	<b>0.70</b>	0.68	0.66
Advance Bank Australia	<b>0.42</b>	0.39	<b>0.58</b>	<b>0.44</b>	<b>0.55</b>	<b>0.47</b>	<b>0.56</b>	<b>0.61</b>	<b>0.97</b>	<b>0.97</b>
Challenge Bank	—	0.34	<b>0.67</b>	<b>0.55</b>	<b>0.47</b>	<b>0.19</b>	-1.28	0.51	0.80	0.93
Bank of Melbourne	—	—	—	<b>0.65</b>	<b>0.53</b>	<b>0.62</b>	0.12	<b>0.86</b>	<b>0.86</b>	<b>0.96</b>
Metway Bank	—	—	—	<b>0.80</b>	<b>0.73</b>	<b>0.52</b>	<b>0.73</b>	<b>0.66</b>	<b>0.85</b>	0.78
St. George Bank	—	—	—	—	—	—	—	<b>0.70</b>	0.65	0.77
<b>New Entrants</b>										
Australian Bank	-0.25	0.09	0.20	<b>2.19</b>	<b>2.13</b>	—	—	—	—	—
Barclays Bank Australia	0.10	0.38	0.02	-2.77	-3.26	-0.04	<b>0.47</b>	—	—	—
CHASE AMP Bank	-0.17	0.01	0.10	-0.74	—	—	—	—	—	—
Citibank	0.36	<b>0.42</b>	<b>1.39</b>	<b>1.04</b>	-0.40	-2.58	<b>0.75</b>	<b>1.19</b>	<b>1.31</b>	<b>1.33</b>
<b>Overall Average</b>	0.40	0.42	0.57	0.31	0.34	0.11	0.18	0.57	0.83	0.95

year counts of product-related ( $prod_{it}$ ), process-related ( $proc_{it}$ ), and distribution-related ( $dist_{it}$ ) innovative acts and then dividing each by the five-year count of total innovative acts ( $inn_{it}$ ). We then sum the squares of these proportions across the three innovation categories:

$$Focus_{it} = \left( \frac{\sum_{t=-5}^{t=-1} prod_{it}}{\sum_{t=-5}^{t=-1} inn_{it}} \right)^2 + \left( \frac{\sum_{t=-5}^{t=-1} proc_{it}}{\sum_{t=-5}^{t=-1} inn_{it}} \right)^2 + \left( \frac{\sum_{t=-5}^{t=-1} dist_{it}}{\sum_{t=-5}^{t=-1} inn_{it}} \right)^2$$

This variable equals 0.33 when innovative activity is evenly spread across categories, and increases toward unity as activity becomes focused on a single category.

The commitment variable reflects the year-to-year changes in each category's proportion of innovative activity. For each category, we first sum (over the previous four years) the squared year-to-year changes in that category's proportion of total innovative activity. We then compute the negative of the sum of these annual changes across the three categories:

$$Commitment_{it} = - \left[ \sum_{t=-4}^{t=-1} (\%prod_{it} - \%prod_{it-1})^2 + \sum_{t=-4}^{t=-1} (\%proc_{it} - \%proc_{it-1})^2 + \sum_{t=-4}^{t=-1} (\%dist_{it} - \%dist_{it-1})^2 \right],$$

where  $\%prod_{it}$ ,  $\%proc_{it}$ , and  $\%dist_{it}$  are the proportions of firm  $i$ 's innovation counts in year  $t$  that are accounted for by product, process, and distribution innovations. The maximum value of this variable is zero, and is realized when the distribution of innovative activity across categories is constant over the previous five years. Larger negative values indicate greater year-to-year instability in the proportion of innovative activity devoted to each category.

The divergence variable reflects the extent to which a firm's own innovative activity follows the corresponding industry norm. It is calculated based on the differences between the proportion of a firm's own innovative

activity devoted to each category and the corresponding industry averages:

$$Divergence_{it} = \sum_{t=-5}^{t=-1} (\%prod_{it} - \%PROD_t)^2 + \sum_{t=-5}^{t=-1} (\%proc_{it} - \%PROC_t)^2 + \sum_{t=-5}^{t=-1} (\%dist_{it} - \%DIST_t)^2,$$

where the uppercase  $\%PROD_t$ ,  $\%PROC_t$ , and  $\%DIST_t$  are the proportions of innovation counts for each category calculated at the industry level. This variable equals zero when a bank's composition of innovative activity moves in step with the industry average, and increases with the degree of dissimilarity between the composition of a bank's own activity and the overall industry composition. To capture the hypothesized nonmonotonic effects, we also generate a squared  $Divergence_{it}$  variable.

A number of control variables are included in the analysis. First, we control for the average annual level of profitability experienced by all firms in the sample and expect a bank's own profitability to be positively related to this average. Here, average ROA is the annual unweighted average ROA across the banks active in that year. We also include a series of dummy variables that capture the four different classes of banks operating within Australia during the sample period: major banks, former state banks, former building societies, and new entrants. Given the advantageous historical development of the four major banks, we expect that their average profitability will exceed the levels experienced by the other three types of banks, with the lowest profitability accruing to the new entrant banks. The conjecture about lower profits for entrant banks is consistent with our focus on the banks' histories of innovative activity. Because entrant banks had no Australian history prior to 1985, one would expect them to be relatively disadvantaged in this respect (Barnett et al. 1994, p. 12). In addition to reflecting differences in bank histories, the dummy variables capture most of the variance in size (total assets), distribution reach (total number of branches), and geographic spread (distribution of banking assets across Australia's seven states and territories).<sup>9</sup>

Table 4 provides the descriptive statistics and pairwise correlations for the variables used in this study. Note that the use of innovative activity variables calculated over a moving five-year period reduces the number of years in the sample period to 10, and number of the useable observations in our pooled time series to 149.

**Table 4 Descriptive Statistics (*N* = 149)**

	Mean	Std. Dev.	Correlation with:							
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Return on Assets	0.470	0.718	—	—	—	—	—	—	—	—
(2) Average ROA	0.469	0.253	0.352*	—	—	—	—	—	—	—
(3) Innovative Intensity	0.380	0.732	0.209	-0.0077	—	—	—	—	—	—
(4) Others' Innovative Intensity	0.108	0.017	-0.110	-0.455*	0.037	—	—	—	—	—
(5) Firsts	1.275	1.394	0.068	-0.048	0.251*	0.178	—	—	—	—
(6) Focus	0.460	0.134	0.183	0.041	0.177	0.004	-0.010	—	—	—
(7) Commitment	-1.188	1.054	0.339*	0.192	0.130	-0.051	0.176	0.315*	—	—
(8) Divergence	0.768	0.615	-0.231*	-0.098	-0.034	-0.120	-0.261*	0.032	-0.660*	—
(9) Divergence 2	0.966	1.445	-0.300*	-0.091	-0.073	-0.132	-0.208	0.004	-0.642*	0.961*

Note. \* $p < 0.01$ .

Table 5 presents results from two models, each estimated using least-squares regression, corrected for first-order autocorrelation with the Prais-Winsten technique. As panel data are used, we explored random effects models. However, after including the bank-type dummy variables, no significant bank-specific effects were observed. Model 1 includes only the control variables. The coefficient on average ROA confirms that industry-level forces influence each bank's financial performance systematically. The dummy variables that control for bank type are also consistent with expectations. Major banks (the omitted category) tend to have the highest financial performance, as evidenced by the negative coefficients on the three bank-type dummy variables. The new entrant banks feel the most substantial performance disadvantage.

Model 2 includes the variables that test our hypotheses. The adjusted  $R^2$  increases from 0.146 to 0.324 with the inclusion of the additional variables. An  $F$ -test ( $F = 4.760$ ;  $p = 0.000$ ) confirms that this increase is statistically significant. The coefficient on innovative intensity is positive and significant, indicating that a bank's profitability increases with the intensity of its recent innovative activity. The coefficient on competitor innovative intensity is negative, but not statistically significant. Because the innovative intensity variable has bank assets in its denominator, we ran a model (not reported) with total bank assets as an additional control variable. The coefficient on this variable was not statistically significant, and the coefficient on the innovative intensity variable was virtually unchanged. We also recalculated the innovative intensity variable using total bank branches in the denominator and obtained identical results.<sup>10</sup>

The innovative intensity effect is evident despite the insignificant coefficient on the variable reflecting a bank's propensity to move first into new initiatives.<sup>11</sup>

**Table 5 Regression Results (*N* = 149)<sup>1</sup>**

	Model 1	Model 2
Constant	0.244* (0.184)	0.248 (0.592)
Average ROA	0.917*** (0.229)	0.876*** (0.252)
Former State Bank	-0.223 (0.204)	-0.552*** (0.220)
Former Building Society	-0.186 (0.197)	-0.518*** (0.266)
New Entrant	-0.521*** (0.225)	-0.696*** (0.230)
Innovative Intensity	—	0.274*** (0.090)
Others' Innovative Intensity	—	-3.061 (4.053)
Firsts	—	-0.011 (0.049)
Focus	—	0.130 (0.449)
Commitment	—	0.133** (0.082)
Divergence	—	1.382*** (0.361)
Divergence <sup>2</sup>	—	-0.553*** (0.143)
Adjusted $R^2$	0.146	0.324

Note. <sup>1</sup> Results are from an autocorrelation-corrected model.

\* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Banks do not seem to benefit from early movement into major new initiatives. This finding is consistent with the ATM example presented earlier, wherein Westpac Bank was the first mover, but trailed the other banks in the extent of its follow-on innovative activity. Given our results, this latter observation seems more important than does the simple act of moving first.

The coefficient on the focus variable is positive, but also not significant. Although the sign is in the predicted direction, our relatively small sample size does not allow us to report statistical significance. In the case of the focus result, we may also conclude that assuming stronger combinative effects among within-category innovative acts is not supported by the data. In a context wherein the value of product-related attributes (e.g., credit cards and deposit accounts) depends critically on the quality of the process and distribution-related assets, it may be equally important to have innovative activity devoted to all areas of the value chain.

The coefficient on the commitment variable is significant and in the predicted direction. Banks that are more consistent in the composition of their innovative activity over time experience improved profitability. Finally, the coefficients on the first- and second-order divergence variables are both significant and in the predicted directions. Moreover, the model that includes the second-order divergence variable yields significantly improved fit ( $F = 15.045$ ;  $p = 0.000$ ) over that which includes only the first-order expression. As the degree of divergence between the composition of a bank's own innovative activity and the corresponding industry norm increases, financial performance first improves, and then worsens. In other words, banks tend to perform best when their composition of innovative activity is different, but not too different from the prevailing norm. The specific parameter estimates suggest that financial performance improves up to the point when the divergence variable equals 1.25, which is one standard deviation over the sample average.

Overall, there is support for the innovative intensity and consistency hypotheses, as well as for the hypothesized curvilinear relationship between pattern mapping and financial performance. To explore these findings more deeply, we ran several additional analyses. Given the high pairwise correlations reported in Table 4, there is concern about the prospect of multicollinearity. In response, we ran a series of models with each hypothesized variable included individually (along with the control variables). In all cases, the sign and significance of the reported parameter estimates were the same, as was their rough magnitude. We also estimated a model comprised of innovation variables created using a three-year lag period. This model returned an adjusted  $R^2$  of 0.255, which is considerably lower than the 0.324 value reported for Model 2. A model that replaced the lagged variables with corresponding variables capturing only current-year innovative activity returned an adjusted  $R^2$  of only 0.145. We ran a final model that included the five-year lagged variables and the current-year variables

simultaneously. An  $F$ -test ( $F = 1.080$ ;  $p = 0.380$ ) suggests that the current-year variables do not significantly improve the fit of Model 2. Consistent with expectations, a bank's current financial performance is more a function of its history of innovative activity than its current-period activity alone.

## Discussion and Conclusions

In this paper, we develop a broader account of the relationship between innovation and the emergence of differentiated competitive positions over time. In doing so, we borrow insights from research into technological evolution, which studies the processes by which novel product and process technologies emerge over time. While that research calls attention to the generation of novel component knowledge, it also stresses that existing technological components may be combined in creative ways to generate important new products and production processes. Applying this to the firm level, we suggest that competitive positions evolve as firms continuously incorporate new strategic attributes and thereby develop novel strategic combinations. In this way, firms often create competitive advantage from products and processes that were developed by other firms, and that may be readily adopted by competing firms. Extending the analogy, we argue that a firm's current competitive position (and therefore its current financial performance) is a function of its unique history of innovative activity.

The results from our empirical analysis support this general position—a firm's history of innovative activity significantly affects its current financial performance. They also contribute to a more detailed understanding of how differentiated competitive positions evolve over time. Our specific findings suggest that firms that are more active and consistent in their innovative activity tend to experience superior financial performance. There are also performance benefits associated with patterns of innovative activity that are different from, but not too different from, the prevailing industry norm. At the same time, there is no evidence that the propensity to move first into new initiatives has a significant impact on financial performance. This latter finding suggests that individual innovative acts need not be strictly novel in a competitive sense in order for performance differences to emerge across competitors. It also corroborates recent arguments by Hill and Deeds (1996), who suggest that acts of imitation can lead to differentiated competitive positions.

As suggested above, our arguments and findings are not meant to compete with the prevailing Schumpeterian explanation of the relationship between innovation

and firm profitability. If a major new product or process is developed and resists imitation by competing firms, superior firm performance may indeed be linked to a particular act of innovation. Rather, our aim is to broaden this explanation to account for the fact that "calculating the effects of innovation on profitability associated with the product of a specific innovation... considerably understates the total effects of innovation on profits" (Geroski et al. 1993, p. 208). Because most firms engage in a range of innovative activity over time, we have broadened the scope of investigation in order to explain more of the observed variance in performance across firms. At the same time, the broader approach links the study of innovation and profitability to research that addresses important issues such as first-mover advantage, organization commitment, and legitimacy and competition.

Having said this, it is important to consider the extent to which our specific findings (and therefore conclusions) generalize to other industry settings. Here, there are two issues to address. The first is whether the Australian retail banking industry is qualitatively different from those found in other industrialized countries. We are comfortable that Australian retail banking (while having its own distinctive characteristics) is in many ways similar to other national banking systems. Among G7 countries, Australia trails only Germany in terms of the number of large banks per capita (*The Banker*, July 1999). At the same time, all four of Australia's major banks were among the world's Top 150 banks in 1998. So, despite its relatively small population, Australia is home to several of the world's leading retail banks. Note also that the average ROA for Australia's four major banks in 1998 trailed the major United States and United Kingdom banks, but was better than the averages reported for the remaining G7 countries.

The second issue relates to our ability to generalize beyond retail banking. Here, the assumptions and observations that guided this analysis suggest important boundary conditions. We demonstrated that within retail banking, most of the relevant variation is generated outside the focal firm, and most novel strategic attributes diffuse rapidly across competitors. These two factors support our cumulative orientation to the relationship between innovation and competitive advantage. In other settings, these conditions may not hold, as important variation may be generated within a firm's own R&D laboratories, or by its internal learning processes. At the same time, some firms are able to keep their innovations proprietary for considerable periods of time (Levin et al. 1987). In such cases, more of the salient differences in the attribute portfolios of competing firms may be traced

to important stand-alone innovations. This is likely the case in the pharmaceutical industry, where the distribution of blockbuster drugs across firms is an important determinant of observed financial performance differentials (Henderson and Cockburn 1994, Roberts 1999). With this in mind, there is reason to believe that the salient features of the retail banking industry—i.e., external variation and unimpeded selection—are evident in other industries as well (Brown and Eisenhardt 1998, D'Aveni 1994). We therefore propose that the insights gained from this study are portable across many industrial contexts. Of course, this cannot be confirmed without more analyses offering a similar depth of coverage.

In addition to the research streams noted above, this paper dovetails with the emerging interest in evolutionary approaches to firm strategy (Nelson and Winter 1982), which share a belief that history matters in determining a firm's current actions and performance outcomes. This said, precisely how the past manifests itself in behavior and performance is complex, and not well understood. Some researchers note that conduct and performance are affected by actions and decisions taken at a firm's founding (Barnett and Burgelman 1996). Others emphasize path dependence and stress that what a firm will do in the future depends in part on strategic decisions taken in the recent past (Teece et al. 1997). Still others focus on the extent to which organizational learning is characterized by localized search behavior (Stuart and Podolny 1996). We have shown that a firm's specific history of new product and process adoption contributes to its uniqueness. Similar expressions of this point are found in Hunt and Morgan (1995, p. 9), who argue that "each firm in an industry is a unique entity in time and space as a result of its history." This position is also supported by Rumelt (1984, p. 558), who notes that "firms differ because of differing histories of strategic choice and performance."

Our research also has implications for thinking about the potential role played by firm and managerial networks in fostering competitive advantage. McEvily and Zaheer (1999) show that ties across organizations facilitate the development of strategic competences by serving as access channels for new capabilities. We add to these potential effects by suggesting that network ties of all types may impact a manager's access to newly developed strategic attributes. By emphasizing the combinative nature of firms' overall competitive positions, we focus on how differentiated positions are built by incorporating new ideas emerging from various places within the competitive system, and not only from within the firm itself. Because the sources of many important new ideas are external to the firm (i.e., competitors, upstream

and downstream firms, and firms in other industries or countries), heterogeneity in the pattern of network ties may also be associated with heterogeneity in perceptions of, and access to, valuable new strategic attributes. These ties include formal and informal ties across firms, but also the ties between a firm's management and just about anyone else.

Finally, our paper also has implications for empirical strategy research. David and Wright (1997) found in their analysis of the global mineral extractions industries that the emergence of United States dominance in many industries could not be attributed to the simple fact that the United States had "better resources." This conclusion was reached only after a detailed historical examination of all of the inputs that contributed to this success story and, more importantly, how these various inputs interacted to generate the observed success. Similar historical analyses of technological evolution allowed researchers to conclude that what emerges as a novel product or process technology is often a recombination of existing knowledge components. This same type of detailed historical analysis should be conducted more regularly within the strategy field in order to get a better feel for the types of processes that generate the dynamic patterns of performance heterogeneity that are being observed.

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### Endnotes

<sup>1</sup>A summary of major regulatory changes is as follows. Banks were permitted to borrow at call (1981); the 30-day deposit rule was abolished (1982); the Australian dollar was floated (1983); limits on short-term borrowing were eased (1984); mortgage rates were deregulated (1986); banks were allowed to wholly own brokerage firms (1987); banks were not required to hold capital on securitized assets (1991); foreign banks were allowed to operate wholesale operations as branches (1992); banks could integrate savings and trading arms (1992).

<sup>2</sup>Golder and Tellis (1993) describe the historical approach that we employ. Other research that relies on the business press for innovation data include Pennings and Harianto (1992a, 1992b).

<sup>3</sup>Five entrant banks never established serious retail operations, while one former building society changed to a retail bank only in 1995. Two other banks did not provide consistent financial performance data, leaving 19 banks in the final analysis.

<sup>4</sup>We augmented the search during the data collection process by retrieving any additional articles that were indexed under the names of the major innovations that were identified.

<sup>5</sup>Specific examples of these value chain modifications include indexed deposits (Product); fixed rate mortgages (Product); Mastercard linked with Maestro/Cirrus (Product); customer account processing systems (Process); loan event tracking systems (Process); online computer system upgrades (Process); look-ahead mortgage computers (Process); after-hours loan centres (Distribution); toll-free service lines (Distribution); and 24-hour, 7-day-a-week access to telephone banking (Distribution).

<sup>6</sup>To assess concerns about bias in the reports of innovative acts across the sampled banks, note that roughly 69% of the observed acts are reported in more than one source document. We also analyzed the total counts reported across banks and compared those to what would have been observed had we used (a) only annual reports or (b) only press articles. The correlations between the counts based on all sources and those based on the annual reports alone was 0.92, while the correlation with the counts based on the press articles alone was 0.99. These very high correlations ease concerns about systematic bias in the internal versus external reports of innovative activity. Moreover, any residual bias should be accounted for by controlling for systematic bank effects in the regression models. As we report later on, these controls do not improve the fit of our models.

<sup>7</sup>While ROA is not the only possible measure, it is an adequate measure of a firm's economic performance. Scherer and Ross (1990, p. 417) suggest three ... profitability measures: accounting rates of return (e.g., ROA), Tobin's q ratio, and the price-cost margin. The correlations between accounting rates of return and Tobin's q are typically quite high and "neither measure is innately superior to the other in detecting supra-competitive profits."

<sup>8</sup>Note that we analyze the composition of innovative activity at a fairly coarse level of analysis. Given the more-detailed innovation categories presented in Table 2, future research should consider whether focus (as well as divergence and consistency) is better modeled at a more fine-grained level of analysis.

<sup>9</sup>A series of ANOVAs reveals that these dummy variables capture 87% of the variance in bank size, 93% of the variance in the number of branches, and 73% of the variance in the geographic spread of banking assets across Australian states and territories. Moreover, an *F*-test ( $F = 0.740$ ;  $p = 0.530$ ) rejects the significance of the joint impact of size, branches, and geographic spread variables on bank ROA after including the bank-type dummy variables.

<sup>10</sup>We were also concerned about the prospect of endogeneity, or that more financially successful banks would be those engaging in more innovative activity. Our data limit our ability to handle this issue in a fully satisfactory manner. However, note that accounting for systematic bank effects does not significantly improve the performance of the model or alter the reported coefficients in any way. Note also that a bank's ROA and its innovative intensity over the subsequent five years are virtually uncorrelated ( $p = 0.04$ ).

<sup>11</sup>We obtained identical results when we substituted the raw count of industry firsts over the previous five years with (a) a variable that normalizes each bank's industry firsts to its level of banking assets and (b) a variable that measures each bank's own share of industry firsts over that same period.

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