

# **Foreign Ownership, Foreign Competition and Innovation in Australian Enterprises\***

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### **Abstract**

This paper empirically investigates the relationship between innovative effort, measured by R&D intensity, and foreign shareholding and competition. The data set used is a sample of large Australian firms between 1994 and 1997. Previous studies have used aggregate variables to account for these international factors. The theory and analysis are extended to account for the differing attributes of separate geographic regions. The results show foreign shareholding and competition to be important influences in determining the level of innovative activity in Australia. In particular, strong evidence is found of a positive association of revenue earned in Europe and a negative association of Asian shareholdings with domestic innovation levels.

## **1. Introduction**

Innovation has been identified as a driver of competitive advantage and economic growth (Bosworth and Rogers, 1999; Grossman and Helpman, 1994; Porter, 1990; Romer, 1990, 1994). Australia has historically lagged behind the rest of the OECD countries in terms of R&D effort, with a rank of 18 out of 24 for business R&D as measured by business expenditure on R&D as a percentage of GDP (DIST, 1996, p. 10; Industry Commission, 1995, p. 2). Foreign competition and foreign ownership can be potentially fruitful sources of innovative ideas and products for Australian firms. This is because foreign competition raises competitive pressures to improve, and foreign ownership contributes financial, technical and managerial resources to domestic firms to which they would otherwise not have access.

Little detailed testing of the relationship between innovation, foreign competition and foreign ownership has been conducted, and there has been no research on Australian data. This paper aims to contribute to the knowledge on innovation by examining the relationship between foreign competition, foreign ownership and innovation using a database of large Australian firms.

The following section examines some of the more common beliefs on what drives innovation, as well as research that has examined the relationship between foreign competition, foreign ownership and innovation. Section 3 outlines the empirical framework, which augments previous theory and empirical research with regional variables to capture the diverse economic characteristics of different geographic regions. An explanation of the data and some descriptive statistics are provided in section 4. The results are given in section 5, and section 6 concludes.

## **2. Innovation, foreign ownership and foreign competition**

Innovation is the activity of marketing or implementing new or improved products and processes. Whilst there is a range of technical definitions (Rogers, 1998b, pp. 6-9.), it can be thought of intuitively as the application of new concepts and inventions.<sup>1</sup> It may be formal, being conducted by well-resourced research laboratories, or informal, with the initiative coming from the bright idea of a single employee. Innovation is a dynamic activity of inputs

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<sup>1</sup> Some widely applied innovations may be technically inferior to alternative products and processes, but gain acceptance through the influence of commercial factors such as marketing.

and outputs, and can be risky in that there may be enormous investments of time, labour and money for uncertain future rewards.

The Schumpeterian thesis (Schumpeter, 1943) states that large monopolistic firms engage in the most innovative activity since they can afford to allocate the necessary resources and are in the best position to appropriate the final rewards. The theory has developed to suggest that large firms possess advantages over small firms in access to finance, expertise, scale economies in performing R&D and the ability to spread fixed costs over—and appropriate returns from—a higher level of output. Several papers in the Schumpeterian literature have considered the impact of international factors on domestic innovation levels (Bertschek, 1995; Harris, 1991; Love *et al*, 1996), but the evidence regarding a relationship between market power and innovation is inconclusive. Whilst most studies find a positive relationship between innovation and concentration ratios, this significance disappears when further explanatory variables are introduced. This suggests that the traditional measure of market power is capturing a more complex relationship. The counter-argument is that large firms are bureaucratic, misallocating resources and discouraging employees, and suffer from reduced management control over innovative activity. Empirical studies show that whilst there is a positive monotonic relationship between R&D expenditure and firm size, there is no evidence of large firms possessing an advantage in innovative productivity or output. Although Schumpeterian research has increased the economic understanding of innovation, by focusing on the determination of market factors that promote or discourage innovation, it is limited in its ability to explain what is a highly complex activity. Two of these areas that will be investigated in this paper is the impact of foreign ownership and foreign competition.

### *2.1. Foreign ownership*

Love *et al* (1996) and Rogers (1998c, pp. 13-14) argue that foreign ownership has a positive effect on innovation because of the resources that foreign parties, in particular multi-national enterprises, are able to draw upon and contribute to the domestic firm, which cannot necessarily be reproduced by smaller, indigenous firms. These resources consist of finance, technology, knowledge and managerial expertise. This effect is distinct from the original Schumpeterian argument for the innovative capacity of large monopolistic firms since that is concerned with scale economies and market power effects. Instead, the foreign ownership effect captures the manner and extent to which an overseas shareholder is able to add value to the domestic firm and reduce barriers to innovative activity.

The nature of the relationship between the foreign shareholder and the domestic firm is important to consider. The effect on innovation depends not only upon the set of resources that a foreign party possesses, but how those resources complement the resources of the domestic firm. Where the foreign party exerts significant influence over decision making in the group of related firms, this will also impact heavily on the innovative behaviour of the domestic firm.

No robust and consistent relationship between innovative activity and foreign ownership can be drawn from the empirical literature thus far. Two separate studies on Scottish and West German manufacturing firms show a significant and positive relationship between innovation and foreign ownership (Bertschek, 1995; Love *et al*, 1996). The Australian evidence is minimal and inconclusive. Two studies by Rogers using the IBIS database (1998a, 2000) found foreign ownership to have little or no impact on innovation. On the other hand, analysis conducted using the Australian Workplace Industrial Relations Survey found that foreign ownership reduced the likelihood of process innovation (Drago and Wooden, 1994; Rogers, 1998c). A study of manufacturing firms in Northern Ireland also yielded a negative and significant relationship (Harris, 1991).

An explanation that has been put forward for this negative relationship is that when a domestic firm becomes part of an international group of companies, the foreign parent may decide that, given the relative economic conditions of the respective firms and regions involved, it is more profitable to conduct the group's innovative activities offshore. Political and cultural factors could also influence such a decision. Harris's (1991) explanation for the apparent negative relationship was that Irish labour productivity had consistently been the lowest of the major UK regions for recent decades. The region also had the lowest levels of value-added production owing to the relatively low quality of its manufactured goods. As a result, manufacturing plants owned by firms outside the region saw R&D activities transferred out of Northern Ireland with a resulting reduction in the stock of technical expertise. Domestic production focused on goods in the mature phase of the product lifecycle where the focus is on mass production techniques. These conditions are not conducive to innovative activity and explain why the case has gone against the *a priori* expectations of a positive relationship.

## 2.2. *Foreign competition*

Another argument for a positive relationship between foreign ownership and innovation is increased exposure to international competitive forces (Bertschek, 1995). However, this argument stands alone and need not necessarily rely on a foreign shareholding; the foreign competition effect may equally be received from import competition or domestic export activity. The argument does run counter to the Schumpeterian argument, which favoured market power. International competition is argued to provide incentives to innovate, as exposure to international markets changes the competitive environment faced by firms. This not only occurs in market structure, but also from the contrasting styles of competitive behaviour and conduct of different markets and their players. The need to adapt to a new market, increased pressure to improve quality, and reduce price, and exposure to new ideas may stimulate the domestic firm to innovate.

The empirical evidence on foreign competition and innovation provides more consistent results than those on foreign ownership. Import penetration was found to have a positive and significant effect on the innovative activity of domestic West German manufacturing firms (Bertschek, 1995). The Northern Ireland study by Harris (1991) indicates that export intensity (exports/total sales) had a positive and significant relationship with innovation. Rogers also found that international competition, defined as significant import penetration or domestic industry exports, had a positive effect on product innovation for Australian firms.

An issue with both of these factors, as noted by Bertschek (1995), is the direction of causation. Does foreign shareholding promote innovation or is it attracted to innovation? Likewise, does foreign competition promote innovation or does such innovation increase competition? Both effects may operate together since one need not exclude the other, and consequently any results are best thought of as 'associations' rather than causation.

## 3. **Empirical framework**

The estimating equation used is an adaptation of that used by Love *et al* (1996) to more explicitly account for international factors. Their equation is consistent with Schumpeter's original argument that monopoly power and the corresponding large absolute size of such a firm give it advantages in innovative output through economies of scale and scope in performing R&D and superior opportunities for appropriation of the rewards. However, most of the research has been cross-sectional industry studies. This potentially blurs the affects of

industry structure and firm characteristics. Another issue is that it is not only current factors which are important in explaining innovative activity, but also expectations about future, post-innovation market power and rewards.

With these issues in mind, their estimated equation combined industry variables from previous research and re-emphasised firm-level characteristics. Furthermore, by including a component for expected profits from innovation, their model accounts for both current and anticipated factors. By extending their model to specifically include international factors, the following is proposed.

$$I = \alpha_0 + \alpha_1 \pi_i^e + \alpha_2 S_i + \alpha_3 F_i + \varepsilon \quad (1)$$

where  $I$  is a continuous variable measuring innovative activity and taking a value greater than zero;  $\alpha_0$  is a constant;  $S_i$  is a vector of market and corporate structure variables;  $F_i$  is a vector of variables representing international factors; and  $\varepsilon$  is an error term.

The quantity  $\pi_i^e$  represents the expected profits from innovation and is unobservable. In profit-maximising equilibrium it is a function of firm and industry variables,

$$\pi_i^e = \beta_0 + \beta_1 S_i + \beta_2 F_i + \mu \quad (2)$$

Substituting (2) into (1) gives,

$$I = \phi_0 + \phi_1 S_i + \phi_2 F_i + \tau \quad (3)$$

where:  $\phi_1 = \alpha_1 \beta_1 + \alpha_2$  and  $\phi_2 = \alpha_1 \beta_2 + \alpha_3$

This equation expresses innovation in terms of exogenous industry and firm variables. Such a formulation allows the explanatory variables to have both a direct effect on innovation and an indirect effect through their impact upon the expected profits of innovation. However, Love *et al* (1996) did not attempt to separate and identify these two effects. The equation is the basis of this paper's empirical investigation.

### *Innovation*

An appropriate measure of innovation is an issue that arises in empirical studies of innovation. Limited data availability frequently restricts the options. A variety of statistics have been used, and are typically defined as input measures, output measures and process innovation (Love *et al*, 1996; Rogers, 1998b). An input measure is used in this paper for a

number of reasons. Process innovation—although considered the preferred innovation measure—has no measurable statistic available and therefore remains an ideal. Output statistics have the advantage that they measure the innovative outcomes that deliver increases in welfare, but are also biased towards ‘significant’ discoveries and ones of technical rather than economic importance (Love *et al*, 1996). Several surveys in Australia (ABS Innovation Survey, Business Longitudinal Survey and Australian Workplace Industrial Relations Survey) use simple yes/no answers to questions on whether or not firms have implemented innovations, but these are clearly subjective. Intellectual property statistics, such as patents and trademarks, could also be employed but these do not always represent a commercial application.

Input measures rely on the assumption of a link between such inputs and actual outputs and constant innovative productivity across firms. The most widely employed input measure is an R&D intensity ratio, defined as R&D expenditure over a measure of firm size. The advantage of input measures is that they are widely available and, in profit maximising firms, can be expected to have a high correlation with innovative effort. The main disadvantage is that firms may have incentives to misreport financial information concerning R&D expenditure (Percy, 1997). There may be an incentive to overstate R&D expenditure when tax concessions apply, as is the case in Australia, or understate R&D expenditure on the grounds of commercial sensitivity. It is expected that both affects apply to the sample data, although it is difficult to assign an *a priori* assumption as to which affect is dominant, suffice to say that each will counteract the other. In Australia, firms are legally required to report R&D where it is ‘material’.<sup>2</sup> The concept of material in the Australian accounting framework, despite having stated guidelines, is reliant upon professional judgement.<sup>3</sup> The guidelines serve to limit misreporting of financial information to relatively small proportions of firms’ activities. Another concern with this data set is that, being confined to large firms, it is unrepresentative of the Australian population of firms. Rogers (2000) compares the data to Australian Bureau of Statistics data on R&D expenditure for 1996 and shows that the IBIS data represents a substantial proportion of Australian R&D (48 per cent in total). This is because large firms

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<sup>2</sup> AASB accounting standard 1011 “Accounting for Research and Development”

<sup>3</sup> AASB accounting standard 1031 “Materiality”, where materiality is defined as information which if by "its omission, misstatement or non-disclosure has the potential to adversely affect a) decisions about the allocation of scarce resources made by users of the financial report-, or b) the discharge of accountability by the management or governing body of the entity.



account for most of the business R&D in Australia and the IBIS database has a good coverage of large Australian firms. R&D expenditure is considered a good proxy for innovative activity for the purposes of this paper, although its disadvantages should be kept in mind.

#### *Corporate and market structure*

The corporate and market structure variables that are included in this estimation are total revenue, concentration, gearing, the lagged profit margin and a diversification measure. Total revenue and concentration (the 4-firm concentration ratio) are included to account for firm size and market power, following the Schumpeterian idea that large, monopolistic firms are likely to innovate more because they can appropriate the returns more easily, and they have access to more resources with which to innovate.

Gearing and the lagged profit margin are included to capture the firms' financial position. Financial gearing is included to capture whether more highly geared firms find it difficult to innovate due to an undue reliance on debt financing, which is often considered to be more difficult to obtain than the use of equity or internal funds. A firm's cash flow is theorised to counter capital market imperfections. However it is unclear as to which way the causality runs, that is, whether strong cash flow encourages innovative activity or reflects successful past innovations.

Diversification has been proposed to offer economies of scope in R&D and increase appropriation opportunities across differentiated markets. The counter argument is that highly specialised firms have considerable knowledge of their product or service, and would therefore be in the best position to determine how this could be improved, or what other innovation may best serve their customers needs.

#### *International factors*

The variable used in this paper to capture foreign competition incorporates operations in foreign countries rather than exports. The theoretical implications are that the competitive forces, commercial relationships and knowledge transfers will be stronger than if the firm were just selling into foreign markets. Foreign ownership is determined by whether an Australian firms' parent company is located in a foreign geographic region.

#### **4. The IBIS Database**

The IBIS database contains financial information on a sample of large Australian firms, which is obtained from a variety of sources including published accounts and surveys. The database has been used extensively at the Melbourne Institute of Applied Economic and Social Research as part of a collaborative research program entitled “The Performance of Australian Enterprises: Innovation, Productivity and Profitability.” The data set used in this analysis is a pooled sample of 1160 observations, and the dependent and explanatory variables are outlined in Table 1.

The R&D intensity ratio used in this paper is defined as R&D expenditure divided by total revenue. Several firms were identified which exhibited extreme R&D activity and were identified as specialist R&D performers. To remove these outlying observations, the sample was restricted to firms with R&D intensity of less than 0.3245. Even with this restriction, the sample range of innovation (0.0001 to 0.3245 per cent) covers a vast spectrum of innovative behaviour by firms. However, a firm with an R&D intensity of 0.25 per cent is likely to have quite a different attitude and approach to the conduct of innovation than does a firm with an R&D intensity of 25 per cent. The question is whether a single estimating equation used to analyse both is appropriate. This problem has been left unaddressed in the literature, although industry dummies have been used to capture technological opportunity (Rogers (1998a) used specific dummies for technological opportunity). However, insofar as the Schumpeterian literature focuses on industrial structure variables, which are almost identical across industries, this is not so much a methodological issue as compared to an empirical investigation of internal firm characteristics. Attempts are made in this paper to account for different innovative behaviours. As discussed above, a number of the most highly innovative firms were eliminated from the sample. The sample was then divided into an average across all firms, low innovators (defined as firms that have an R&D intensity of between 0 and 0.5 per cent) and high innovators (defined as firms that have an R&D intensity of between 1.3 and 32.5 per cent).

Given the disparity in earnings, the logarithm of total revenue is used for all estimations and accounts for the absolute size of the firm. Theory suggests a positive relationship between firm size and innovative activity. Empirical studies suggest larger firms spend more on R&D, but there is no such evidence of a relationship between size and innovative productivity or output. Previous analysis of this data set found evidence of a U-shaped relationship where the

smallest and largest firms displayed higher R&D intensities (Rogers, 1999a). From Table 1 it can be seen that low innovation firms have slightly higher revenue than high innovation firms, which provides some early indication that small firms are going to be bigger innovators.

**Table 1: Descriptive statistics for dependent and explanatory variables**

	Entire sample	Low innovation	High innovation
<b>Dependent variable</b>			
Innovation (R&D expenditure/total revenue)	1.5	0.2	4.4
<b>Corporate and market structure</b>			
Total revenue (log)	12.24	12.42	11.86
4-firm concentration ratio	0.27	0.27	0.26
Financial gearing (non-current liabilities/shareholders funds)	0.66	0.59	0.72
Lagged profit margin (net profit before interest & tax/total revenue)	0.07	0.06	0.06
Specialisation ratio (core activity revenue/total revenue)	0.57	0.56	0.62
<b>Foreign variables</b>			
<i>Revenue earned in (per cent of total revenue):</i>			
Central & South America	0.07	0.05	0.03
Asia	1.16	1.13	1.34
Europe	0.98	0.68	1.24
Middle East & Africa	0.02	0.04	-
North America	1.55	1.47	1.07
<i>Ultimate holding company in (per cent of firms):</i>			
Asia	0.41	0.37	-
Europe	6.89	4.84	12.50
North America	5.91	4.28	9.29

The 4-firm concentration ratio represents the degree of market power in the Australian industry in which each sample firm operates. Note that it takes account only of Australian firms in the domestic market and neither import penetration nor overseas markets where the firms compete. Theory suggests a positive coefficient on this variable although the empirical evidence is inconclusive, as previous analysis of this data set discovered evidence of a negative relationship between concentration and innovative activity (Rogers, 1999a). Table 1 indicates that there is not any great difference in the market structure facing firms with different innovation levels.

The average gearing of firms in this sample is 0.7, with high innovation firms slightly more highly geared on average than low innovation firms. Although it might be expected that debt financing is negatively related to innovative activity, a study of research intensive firms in the USA by Acs and Isberg (1991) found debt financing to be more frequently utilised. The

lagged profit margin represents the sample firm's cash flow, as previous period high profits may encourage firms to innovate through access to inexpensive internal financing. The 1-year lag is to cover lead times in organising innovation projects. Given the importance of expected rewards discussed previously, it is acknowledged that highly innovative firms may suffer in the short term and accept low current profits with the view to greater pay-offs in the long term. Consequently, no *a priori* assumption about the coefficient is made. Several problematic observations were found in the financial gearing and lagged profit margin variables. A few of these observations were isolated and extreme, and close analysis of the data showed some observations to be suspicious of data entry error, whilst others showed sample firms with unique histories and circumstances (such as extremely large changes in balance sheet items and profit performance). These observations were dropped from the sample to prevent biasing the results.

The specialisation ratio is a proxy for each sample firm's level of diversification. Although diversification can offer economies of scope in innovative activity, Rogers (1999a) found that more specialised firms demonstrated higher levels of innovative activity. Hence there is no *a priori* view on which direction the sign will take.

The IBIS database also contains information on financial segment reporting which allows for the construction of foreign competition exposure variables. Australian companies are required to provide segment level accounts where the geographical location of profit and loss statement and balance sheet items are material to users of those financial reports.<sup>4</sup> A foreign geographical segment is defined as an area outside Australia "which serves a purpose beyond facilitating export sales from the company's or group of companies' domestic operations" (AASB 1005.06).<sup>5</sup>

Foreign revenue is defined as the ratio of revenue earned from operations in foreign regions to total revenue, and measures the relative importance of foreign earnings in total earnings. Very little revenue is earned by Australian firms (of any innovative level) in Central/South America or the Middle East and Africa. Almost one per cent of revenue is earned by firms operating in Europe (from the entire sample) although the bulk of this comes from firms

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<sup>4</sup> AASB Accounting Standard 1005 "Financial Reporting by Segments"

<sup>5</sup> The accounting regulations do not provide a standard set of geographic regions and so companies are free to describe any region or combination of regions they desire. Consequently, these had to be collated for the purposes of this paper.

characterised by high innovation intensity. The Asian market is an important source of revenue for Australian firms (relative to the other region) with high innovation firms getting slightly more revenue than the others. North America tops the list of revenue raisers, and in this instance it is “low innovation” firms that have the greatest share.

A dummy variable is defined for firms with an ultimate holding, or parent, company from a foreign geographic region. There is a *prima facie* case for the coefficients on both these variables to be positive. However, it is necessary to consider more closely the nature of such international relationships. Consequently, each variable is included for five different geographic regions, and each region is chosen to broadly capture distinctive regional characteristics. These characteristics are not specified but are expected to be economic and cultural. For example the challenges and competitive forces facing an exporting firm are anticipated to differ between African and North American markets. Likewise, the resources brought to an Australian firm by a European shareholder may reasonably differ from those of a South American shareholder. It could also be expected that a Japanese parent company may form a different style of commercial relationship with its Australian subsidiary than a parent company from the UK. Given the range of influences involved, *a priori* assumptions are not made as to the sign on the respective coefficients for the international variables. However, it is anticipated that more useful information can be obtained by using this approach rather than with aggregated variables for international factors. In line with official statistics on foreign direct investment in Australia, the majority of parent companies for Australian firms are located in Europe or North America.

A set of industry dummy variables is included to account for industry level effects, for example technological opportunity, not otherwise specified in the model.

## 5. Results

The results of the estimations are presented in Table 2.<sup>6</sup> The first column reports the results across the entire sample, column two contains estimates for firms classified as ‘low innovators’ and the last column has results for the ‘high innovators’.

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<sup>6</sup> There are no firms in the estimated sample with parent companies in the Middle East/Africa or Central/South America geographic regions.

### 5.1. *Innovation intensity (entire sample)*

Total revenue is negative and significant at the 1 per cent level for the full sample. The coefficient also appears to be large when it is considered that the marginal unit is the log of a \$1000 increase in total revenue ( $\beta = -0.0044$ ). These results suggest that the theory of large firm advantages in innovation and performance of R&D is not applicable, at least for the group of firms considered here. This implies that smaller firms possess the innovative advantage through their greater management control, flexibility and employee involvement (see for example, Mowery and Rosenberg, 1989; Rosenberg and Steinmuller, 1988; Teece, 1987 for a more detailed analysis on internal firm structure and innovation). There is no evidence that financial constraints are an important factor in innovation activity, as neither financial gearing nor lagged profit margin is significant. Looking at the entire sample reveals that innovation intensity increases the more a firm concentrates on its 'core competencies'. This is consistent with Rogers (2000), and is additional evidence in support of the total revenue findings, which indicates support for close managerial control in innovation.

Investing in Asia or having an Asian parent company does not improve the chances of innovating according to these estimates. In fact, as the amount of revenue (as a share of total revenue) from Asian countries increases, innovation intensity begins to decline. Similarly, if the ultimate holding company is based in the Asian region, the chance of innovating also declines. This may be due to poor knowledge flows with the region. Despite efforts in Australia in recent years to build business, educational and cultural links with Asia, these take time to mature. A negative coefficient on an ownership variable implies a negative contribution of resources. Harris (1991) found a similar result, but the explanation in this case—that is, Northern Ireland's low productivity economy—does not match Australia's situation. The explanation may be cultural differences that complicate and stifle scientific and commercial relationships. These factors, combined with the centralised organisation of many Asian firms, may lead parent companies from this region to conduct innovation activity in their company groups outside of Australia.

In contrast, earning revenue in Europe is associated with an increase in innovation intensity (at the 1 per cent significance level). This result is consistent with the observation that European markets are sophisticated with high productivity economies, and the scientific and business links with Australia are strong. As such, the competitive forces and knowledge flows are expected to be high in this region. Having a parent company located in North

America or Europe is also associated with an increase in innovation activity, although this is only significant at the 10 per cent level of significance.

Looking at the entire sample may mask some variation across results, and it is for this reason that the following sections now turn to examining firms who have low innovation and firms who have high innovation.

**Table 2: The impact of foreign ownership and foreign competition on innovation**

	Innovation intensity	Low innovation intensity	High innovation intensity
Constant	0.0530*** (0.011)	0.0024*** (0.001)	0.1152*** (0.030)
Total revenue (log)	-0.0044*** (0.001)	-0.0001 (0.000)	-0.0064*** (0.002)
4-firm concentration ratio	0.0076 (0.005)	-0.0001 (0.000)	0.0229* (0.013)
Financial gearing	0.0000 (0.000)	0.0000 (0.000)	-0.0011 (0.001)
Lagged profit margin	0.0061 (0.008)	0.0002 (0.001)	-0.0145 (0.018)
Specialisation ratio	0.0122*** (0.004)	-0.0004** (0.000)	0.0228** (0.009)
<i>Revenue earned in (share of total revenue):</i>			
Central & South America	0.0837 (0.066)	0.0414*** (0.008)	-0.5519*** (0.135)
Asia	-0.0276** (0.012)	0.0027*** (0.001)	-0.0419*** (0.016)
Europe	0.1325*** (0.038)	0.0026 (0.002)	0.1609*** (0.050)
Middle East & Africa	-0.0842 (0.051)	-0.0407*** (0.006)	- -
North America	-0.0072 (0.013)	0.0003 (0.001)	-0.0563 (0.042)
<i>Ultimate holding company located in:</i>			
Asia	-0.0110*** (0.002)	-0.0013*** (0.000)	- -
Europe	0.0071* (0.004)	0.0000 (0.000)	0.0029 (0.007)
North America	0.0088* (0.005)	0.0000 (0.000)	0.0054 (0.007)
Industry dummies	Significant	Significant	Significant
R <sup>2</sup> - adjusted	0.1263	0.1160	0.2228
F - statistic	17.63	25.95	9.28
Significance Level	0	0	0
Observations	1160	537	312

Notes: Standard errors, using White's robust method, in brackets.

The set of industry dummies ( $Z^*$ ) are significant as a group in all regressions.

\*\*\*significant at 1% level, \*\*significant at 5% level, \*significant at 10% level

### 5.2. *Low innovation intensity*

In contrast to the full sample of firms, greater specialisation appears to detract from the innovative activity of firms with low levels of innovation, an observation that is significant at the 5 per cent level. This suggests that firms with low levels of innovation benefit more from diversification due to the associated economies of scope and appropriation benefits.

In contrast to the average results, the greater the amount of revenue earned in Central/South America and the Asian region, the greater is the innovative output from low innovation firms. This may be a reflection of the types of products that are sold in these markets, where Australian firms have to be innovative in order to compete with cheap products from local competitors. Revenue earned in Middle Eastern and African markets however has a negative impact on innovative activity. Having a parent company in Asia reduces the degree of innovation intensity for “low innovation” firms, a result that appears to be influencing the average across all firms.

### 5.3. *High innovation intensity*

The full sample results on total revenue appear to be largely driven by high innovation firms, with the coefficient on the log of total revenue reported as being negative and significant at the 1 per cent level. The coefficient on this sample is also large ( $\beta = -0.0064$ ). There is also little evidence to support the Schumpeterian argument for market power. The 4-firm concentration ratio is only positive for firms with high innovation intensity, and is only significant at the 10 per cent level. This is in contrast to previous work on this data set, which found evidence of a negative relationship (Rogers, 2000).

An important characteristic of firms with high innovation intensity is that they have no Asian parent company. Additionally, a greater share of revenue from this region (and from Central/South America) is associated with a decline in innovative activity (in contrast to firms with low innovation intensity). Additionally, these firms were earning no revenue from the Middle East/African region, reinforcing the apparent negative impact of this region on the innovative activity of other Australian firms. This is indicative of the low levels of Australian investment in this region (less than 1.4 per cent of total Australian investment abroad),<sup>7</sup> and could be related to the observation that Australia has historically sold commodities to this market,

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<sup>7</sup> International Investment Position, Australia 1998–99: Supplementary Country Statistics, ABS Cat. No.



which are goods that do not usually require a high degree of innovative effort. It may also be indicative of the lower productivity levels and lower states of economic development in many of the countries.

## **6. Conclusion**

This paper has examined the relationship between foreign ownership, foreign competition and innovation. International variables do help explain innovation levels in Australia but the direction and magnitude of their impact depends upon the geographic region involved. In particular, the results suggest that parent companies located offshore are not particularly interested in using their Australian arms as a vehicle for innovation. Weak evidence was found regarding knowledge transfers from European and North American owners, although given the high incomes and sophisticated markets in USA and Canada and their strong scientific and business links with Australia, a more robust and positive result could have been expected. Asian parent companies were associated with a detraction from innovation, and no Asian parent company owned a highly innovative Australian firm.

The foreign competition variables showed stronger relationships with innovation levels than did foreign ownership. This implies that the economic effect of increased competitive pressure and associated knowledge flows are of greater importance than the resources contributed by multinational companies to domestic firms. This may be explained by Australia's high productivity economy, which already has many of the skills and resources required for innovation. It may also be that these companies already have access to sufficient levels of internal resources, given the sample data is of large Australian firms. Strong evidence was found of a positive relationship between innovation and European competitive forces, possibly because these economies and markets are well developed and they already have high levels of technology. There was also robust evidence of a negative impact of Asian ownership on the innovation levels of domestic firms. This effect may be due to cultural differences or the centralisation of Asian company groups. The evidence suggests that high levels of innovation are associated with small and specialised firms. This goes against the traditional Schumpeterian arguments and highlights the need for tight management control in successful innovative activity. However, it should again be noted that this is a large firm sample and these firms may already possess sufficient levels of internal resources and economies of scale.

## References

- Accounting and Auditing Handbook (1998), Vol. 1. Part 2., Sydney, Prentice Hall.
- Acs, Z. and S. Isberg (1991), "Innovation, firms size and corporate finance", *Economic Letters*, 35, pp. 323-6.
- Bertschek, I. (1995), "Product and Process Innovation as a Response to Increasing Imports and Foreign Direct Investment", *Journal of Industrial Economics*, 43(4), pp.341-57.
- Bosworth, D. and M. Rogers (1999), 'R&D and Profitability' in Dawkins, P., M. Harris and S. King (Eds) *How Big Business Performs: Private Performance and Public Policy*, Allen & Unwin, Melbourne.
- DIST (1996), *Australian Business Innovation: A Strategic Analysis. Measures of Science and Innovation 5*, Science and Technology Policy Branch, AGPS, Canberra.
- Drago, R. and M. Wooden (1994), "Unions, Innovation and Investment: Australian Evidence", *Applied Economics*, 26, pp. 609-15.
- Grossman, G. and E. Helpman (1994), "Endogenous Innovation in the Theory of Growth", *Journal of Economic Perspectives*, 8(1), pp. 23-44.
- Harris, R.I. D. (1991), "Technology and Regional Policy: A Case Study of Northern Ireland", *Applied Economics*, 23, pp. 685-96.
- Industry Commission (1995), *Research and Development*, AGPS, Canberra (Overview and 3 volumes).
- Love, J., B. Ashcroft and S. Dunlop (1996), "Corporate Structure, Ownership and the Likelihood of Innovation", *Applied Economics*, 28, pp. 737-46.
- Mowery, D.C. and N. Rosenberg (1989), *Technology and the Pursuit of Economic Growth*, Cambridge, Cambridge University Press.
- Percy, M. (1997), "Financial Reporting Discretion and Voluntary Disclosure: Corporate Research and Development Expenditure in Australia", *PhD Thesis*, Queensland University of Technology.

- Porter, M. (1990), *The Competitive Advantage of Nations*, New York, Free Press.
- Rogers, M. (1998a), "Research and Development, Intangible Assets and the Performance of Large Australian Companies", Melbourne Institute of Applied Economic and Social Research Working Paper 2/98, University of Melbourne.
- Rogers, M. (1998b), "The Definition and Measurement of Innovation", Melbourne Institute of Applied Economic and Social Research Working Paper 10/98, University of Melbourne.
- Rogers, M. (1998c), "Innovation in Australian Enterprises: Evidence from the GAPS and IBIS Databases", Melbourne Institute of Applied Economic and Social Research Working Paper 19/98, University of Melbourne.
- Rogers, M. (1999a), "Innovation in Australian Workplaces: An Empirical Analysis", Melbourne Institute of Applied Economic and Social Research Working Paper 3/99, University of Melbourne.
- Rogers, M. (1999b), "The Influence of Diversification and Market Structure on the R&D Intensity of Large Australian Firms", *Industry Economics Conference*, July, Melbourne.
- Rogers, M. (2000), "Understanding Innovative Firms: An Empirical Analysis of the GAPS", Melbourne Institute of Applied Economic and Social Research Working Paper No. 08/00, University of Melbourne.
- Romer, P. (1990), "Endogenous Technical Change", *Journal of Political Economy*, 98(5), pp. S71-102.
- Romer, P. (1994), "The Origins of Endogenous Growth", *Journal of Economic Perspectives*, 8(1), pp. 3-22.
- Rosenberg, N. and W. E. Steinmuller (1988), "Why are Americans such poor imitators?" *American Economic Review*, 78(2), pp. 229-34.
- Schumpeter, J. (1943), *Capitalism, Socialism and Democracy*, London, Allen and Unwin.
- Teece, D., (1987), *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*, Cambridge Mass., Ballinger.

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