

Correlations between advertising and R&D expenditures: dealing with important intangibles

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EXPENDITURES ON RESEARCH AND EXPERIMENTAL development (R&D) and advertising by companies are forms of capital investment in *intangible* commodities as opposed to capital investment in *tangible* commodities such as plant and equipment. The amounts spent on both advertising (adspend) and R&D are positively related to the profitability of commercial enterprises. Various studies have recorded the links between R&D and adspend at the level of firms, sub-sectors and sectors of industry for particular countries. However, no analyses appear to have been published on the associations between these two kinds of investment either at national level or in international comparisons. The findings presented here indicate that the most-developed countries spend between two and six times more on R&D per capita than on advertising. In less R&D-intensive economies, however, adspend may equal or exceed R&D expenditure per capita. In four countries examined, that have the lowest investment in R&D as a percentage of GDP—namely South Africa, Greece, Portugal and Poland—adspend actually exceeds gross expenditure on R&D. I focus on the link between R&D and adspend in South Africa between 1989 and 2004, for which a highly significant correlation ($r = 0.99$) was found. I also examine international comparisons of reliable data and indicator series concerning these factors in 17 other countries between 1995 and 2004. In the majority of EU and other countries for which relevant advertising and R&D data were available, significant correlations were also found between these two variables. Because total advertising figures tend to be published within the first quarter of the following year, it may be possible to use these statistics to forecast national R&D expenditure. The benefits for businesses to continue investing in both advertising and R&D, even under adverse economic conditions, are also discussed.

Introduction

Expenditures on research and experimental development (R&D) and on advertising by firms are forms of capital investment in intangible commodities as opposed to investment in tangible commodities such as plant and equipment.¹ As countries move from the industrial age into an information and knowledge economy, it is increasingly important to develop their intellectual capital and

manage their intangible assets. In addition to nurturing their skilled people, businesses need to consider the importance of investments in the 'soft assets' of advertising expenditure (adspend) and R&D. The sums spent on both advertising and R&D are positively related to the profitability of companies.² Numerous studies have dealt with the connection between R&D and advertising expenditure at the level of firms, sub-sectors and sectors of industry in a country. However, no analyses appear to be available that examine the associations between these two kinds of investment either at national level or in international comparisons. Possible patterns in the associations between advertising and R&D expenditure per capita in South Africa and other developing and developed countries have been described briefly by the author in *South African Science and Technology Indicators* 1996.³

This paper focuses on the connection between R&D and adspend in South Africa between 1989 and 2004. It examines trends in international data and indicator series concerning R&D and advertising expenditure, covering most OECD (Organisation for Economic Co-operation and Development) member-countries and reporting on trends in developing states. The paper has two broad goals. The first is to examine national spending on advertising as a possible predictor of R&D expenditure and the reasons why this might be a useful exercise for certain countries. The second is to focus attention on the strategic nature of investments in the two intangibles of R&D and adspend and their importance for future economic growth.

Methods

Good quality medium- to long-term data series were available to provide the means for an informed and balanced analysis of the links between adspend and R&D expenditure in various countries. The analysis draws on statistics from two unrelated but reliable sources. All R&D expenditures are from the electronic version of the *OECD Main Science and Technology Indicators* of June 2006.⁴ Adspend data were from the European

Advertising and Media Forecast database of April 2005.⁵ All amounts are available from these sources in Purchasing Power Parity (PPP) US dollars, which permits realistic international comparisons. Using PPP US\$ as a standard reference avoids the problem of exchange rate fluctuations. All expenditures quoted in this article are therefore given in PPP US\$. Because of the irregular appearance of R&D surveys in South Africa between 1993 and 2001, the data are best examined in a more extensive archive based on the Department of Science and Technology's *National R&D Survey* data series. Adspend data are based on local surveys conducted by Adex Nielsen Media Research South Africa, as reported in the local press.⁶

Measurements of R&D expenditure are explicitly aimed at recording investment in only the direct performance of R&D activities. This quantity comprises labour costs (such as the salaries of researchers and technicians), other outgoings (such as laboratory consumables) and capital expenditure. R&D expenditure tends to be measured in national surveys of research performing organizations, and in most countries as conducted according to guidelines provided by the OECD. Adspend comprises the costs of advertising in all display and classified media such as newspapers, magazines, directories, television, radio, cinemas, and, most recently, the Internet. Because there is little literature available on comparisons between R&D and advertising expenditures at the level of countries, this paper presents such data for the first time and discusses some possible explanations for the associations and significant correlations found. As such the paper is inductive and some proposals are discussed that should be useful to pursue in the future.

Results

Correlation analyses assume that there is a linear relationship between the two variables under consideration. To check this, the seven matching sets of data points for R&D expenditure and advertising expenditure available for seven years between 1989 and 2004 were recorded as a scatter plot, which showed that there was indeed a strong linear association between the two factors (Fig. 1). A Pearson correlation coefficient analysis of these data yielded a very high correlation of 0.99, significant at the 1% level. In 1989 and 1991, gross expenditure on R&D (GERD) exceeded adspend by 14.6% and 14.1%, respectively. Subsequently, GERD fell behind adspend, by 21% in 1993 and 33% in 1997. In 2001, GERD was 22% less than

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adspend and 16% less in 2004.

It could be argued that the high correlation between these two variables was because growth in both is a direct result of inflationary increases in gross domestic product. If the effects of the latter are normalized by using constant 2000 rands, however, the correlation drops only slightly to $r = 0.94$, also significant at the 1% level, implying that the association between the two variables is not confounded by inflationary factors.

Between 2003 and 2004, adspend increased by R2.7 billion, or 23.3%, while R&D expenditure grew by R1.9 billion (19.1%). Between 2004 and 2005, adspend rose by a further R2.8 billion (27.7%); the forthcoming 2005/06 R&D Survey will indicate whether R&D growth has kept pace with adspend. These rising trends reflect the buoyancy of the South African and global economies. Any economic slowdown is likely to affect growth in both types of expenditure.

Table 1 shows that the close association between total adspend and GERD prevails in most of the OECD countries examined. The data show highly significant correlations ($P < 0.01$) at national level in 15 of the 17 countries examined. R&D and adspend statistics for the other 13 member countries of the OECD either suffered from breaks in the OECD tabulations or were not included in the European Advertising and Media Forecast database.

Studies of the association between R&D expenditure and adspend are commonly conducted at the level of the firm or for particular sectors or sub-sectors of industry in a country or region. To the best of my knowledge, this is the first time that the connections between these two variables have been demonstrated for a group of leading countries. The reasons for these close associations in most countries are not clearly understood, not least because decisions regarding investment in the two areas of R&D and advertising appear to be made independently of each other (see discussion).

Figure 2 shows how countries differ in the extent that GERD expenditure exceeds adspend. In general, those where GERD as a percentage of GDP is relatively large (that is, research-intensive countries) also tend to devote proportionately more resources to R&D than to advertising. For example, Swedish investment in R&D is 5.2 times greater than adspend, while GERD is about 4.0% of GDP. In contrast, where research intensity is relatively low and GERD is less than 1% of GDP, R&D expenditure and adspend tend to be of a similar order. In four countries examined

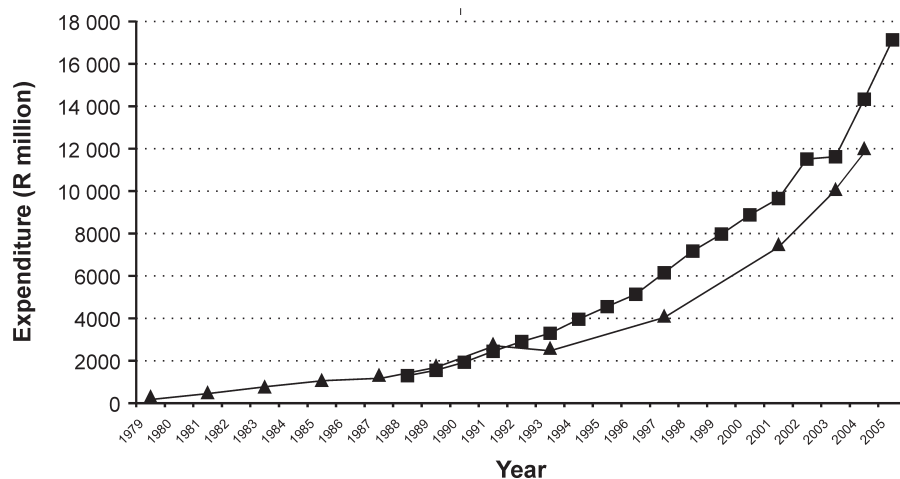


Fig. 1. Time series of R&D and advertising expenditures in South Africa ($r = 0.99$ for 1989–2004). ■—■, Adspend; ▲—▲, R&D expenditure.

Table 1. Pearson correlation coefficients of the associations between total R&D and advertising expenditure for available data for various countries for the years 1995–2004*.

Country	Pearson correlation coefficient	Sample size	Significance level (P)
Finland	0.982	10	<0.001
Czech Republic	0.981	10	<0.001
USA	0.964	10	<0.001
Belgium	0.963	10	<0.001
Austria	0.952	10	≤ 0.001
Japan	0.913	10	<0.001
France	0.911	10	<0.001
Ireland	0.911	10	<0.001
Spain	0.904	10	<0.001
Hungary	0.889	10	<0.002
Portugal*	0.925	9	<0.001
UK*	0.919	9	<0.002
Italy*	0.882	9	<0.005
Poland	0.861	10	<0.005
Netherlands	0.751	10	<0.01
Canada	0.683	10	<0.05
Germany	0.427	10	<0.50, not significant

Sources: European Advertising and Media Forecast Database (2005)³; OECD (2006).⁴
 *Matching data were available for 1995–2003 only.

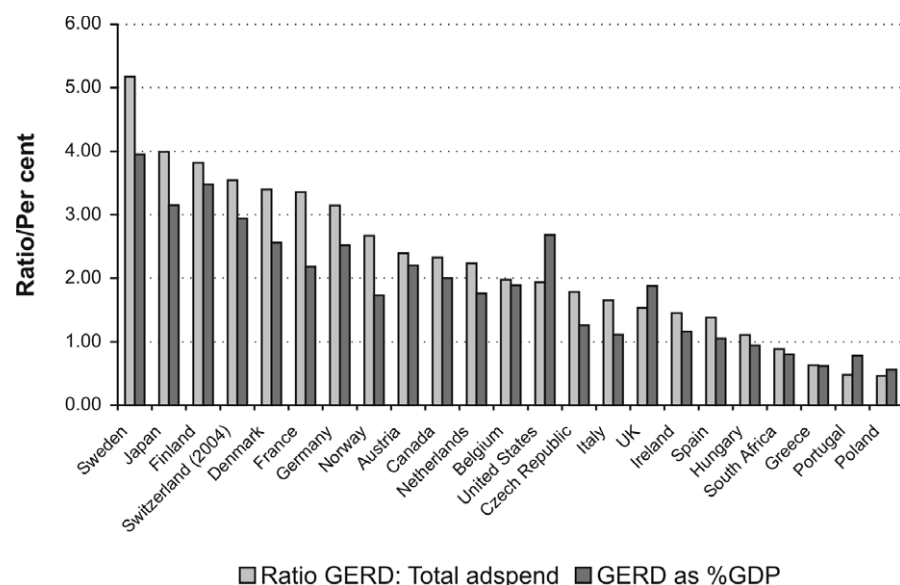


Fig. 2. Ratio of gross expenditure on R&D (GERD) to total advertising expenditure compared to GERD as a percentage of GDP, 2003 (or closest year available).

with the lowest R&D investments—South Africa, Greece, Portugal and Poland—adspend actually exceeds GERD.

In rich countries the business sector tends to perform most of the R&D; for OECD countries in 2003 an average of nearly 64% of total R&D was performed by industry.⁴ In South Africa the corresponding investment by the business sector was about 56% of total R&D.⁷ The private sector would also be expected to be the largest source of advertising expenditure. Of the top 100 advertisers in South Africa in 2005, national and provincial government accounted for less than 4% of total adspend.⁶ In most countries, the business sector appears to be the driving force behind both R&D and adspend. I chose to compare GERD and total adspend of countries rather than just business expenditure on R&D, because data were not available on the sectoral breakdown of adspend for countries. However, the correlation of the business component of R&D expenditure with adspend proved to be similar to that of GERD. This is because in most countries, business expenditure on R&D tends to exceed 50% of GERD, and the proportion of R&D performed by business tends to remain fairly constant. The three countries with the lowest research intensities—Portugal, Greece and Poland—have much lower business R&D contributions of 32%, 31% and 27% of GERD, respectively.⁴ The sustained, relatively high investment of South African firms in R&D bodes well for the country, and it appears that government would be well advised to allocate increased resources and attention to R&D to promote and support long-term sustainability of the economy across all sectors.

Figure 3 shows that in all countries except the United States and United Kingdom, adspend was less than \$300 per capita of the population in 2003. The U.S.A. spends the most on advertising at \$517 per capita; the corresponding figures for the U.K. and South Africa are \$364 and \$101, respectively. However, the U.S.A. has a healthy GERD per capita of \$1004 (corresponding to \$558 for the U.K. and \$85.9 for South Africa).

Of the countries that submit R&D data to the OECD, South Africa has one of the lowest R&D expenditures per capita. For 2003 (or for the closest available year for some countries), of the 40 nations reported on by the OECD, South Africa's figure exceeds that of seven countries, namely the Slovak Republic, Poland, China, Argentina, Turkey, Mexico and Romania. South Africa thus compares fairly well for

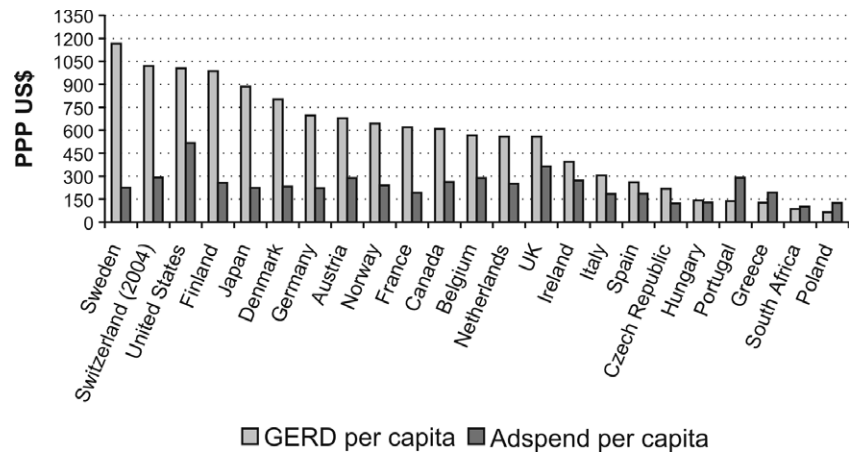


Fig. 3. Gross expenditure on R&D per capita and advertising expenditure per capita of the population in 2003 or closest available year (PPP US\$).

a developing country. However, given the nation's priorities to improve the quality of life of all its people, will this level of R&D investment be sufficient to produce the knowledge and understanding required to support a competitive economy and to achieve its social and economic objectives?

Discussion

It is clear that investment in R&D in South Africa has dropped behind the growth in adspend. Does this mean that the country is veering towards being a consumption-orientated society rather than a knowledge-seeking one? Blankley and Kahn⁸ discuss reasons why total GERD measured in the R&D surveys between 1987 and 2003 was affected by the succession of different agents that undertook the surveys on behalf of government in those years. Because different survey protocols were involved and since we lack documented records of the survey methods employed, it is uncertain whether total R&D was overestimated or underestimated in these surveys, particularly between 1987 and 1991. It appears likely, however, that R&D expenditure was underestimated, particularly in the business sector and, to a lesser extent, in the higher education sector in 1993 and 1997, and possibly also in 2001. It is also possible that the R&D survey of 1991 overestimated R&D expenditure. Nevertheless, the significant correlation found between R&D and adspend in South Africa, in both current and real terms, between 1989 and 2004, appears to offer a promising means to shed some light on the accuracy of previous estimates of national R&D expenditure.

Since 2002, the Centre for Science, Technology and Innovation Indicators of the Human Sciences Research Council has been assigned national responsibility for

conducting annual R&D surveys. It is speculative to suggest that, because of increasingly comprehensive and regular R&D surveys, the ratios of GERD to adspend are returning to the position where GERD could soon equal or slightly exceed adspend. As coverage by the *R&D Survey* improves, however, it appears that GERD is likely to maintain a level of about 83–86% of adspend. At the time of writing, the 2005/06 *National R&D Survey* is still in preparation. Given adspend of R17.1 billion for 2005, GERD of about R14 billion (an increase of R2 billion over 2004) is to be expected if the ratio remains at the 2004/05 level. This increase in GERD would bring it to about 0.91% of GDP, from 0.87% in 2003/04. Sustained growth at this rate could see government attaining its target of R&D expenditure equivalent to 1% of GDP for 2008.

The figures on adspend recorded by Adex Nielsen Media Research are widely published and regarded as fairly accurate (although there are arguments concerning underestimates of the full costs of newspaper and classified advertising in the dominant print media). R&D expenditure is less well understood, however, and probably underestimates the true situation in South Africa, particularly in the business sector, where we lack a comprehensive national register of R&D performers. The survey is traditionally conducted through the distribution of questionnaires to all known or likely performers of R&D, and the magnitude of the results depends on the efficiency of the survey agent and the goodwill of the respondents in answering the questionnaire and providing accurate returns. Moreover, it is difficult to include the many small firms that undertake R&D.

The high incidence of statistically significant correlations between adspend and GERD in 15 of the 17 OECD countries for

which the required nine consecutive years of data were available indicates that, in these cases, adspend can be used as a fairly reliable predictor of GERD. Advertising statistics are crucial to the marketing industry and are therefore a marketable commodity in their own right. Consequently, the annual adspend figures become available soon after the close of the calendar year. Furthermore, the European Advertising and Media Forecast database also predicts adspend for countries by media type for up to three years in advance. In comparison, R&D surveys tend to take a long time to complete, and the process of approving and releasing the results also tends to delay the appearance of GERD figures in some countries. Most R&D survey results are released about two years after the corresponding calendar year, but in some countries they appear later.

Being able to forecast GERD based on adspend figures thus appears to be a useful exercise for countries where the correlations are highly significant. It is a fairly straightforward statistical procedure to forecast R&D expenditure for at least the current year for which adspend figures are available, if the correlation between the two is known. Adspend can also be used to predict GERD, even when correlations are low, when there is some other form of relationship such as a quadratic or cyclical one. There may also be lags or a more complex association. Recognizing these more complex links between the two variables is useful for deepening our understanding of their trends and the underlying dynamics of these variables in particular economies and regions.

Advertising and R&D are two intangible investments that successful firms need to make. Thus, the highly competitive pharmaceutical industry is both advertising-intensive and invests heavily in R&D.⁹ Business enterprises tend to be the driving force behind investments in R&D and advertising in competitive countries. It is thus important for firms as well as governments to be aware of the longer-term benefits of these two intangible investments, especially under stressful economic conditions. In a recession, businesses may be tempted to cut back on both R&D and advertising, but this can lead to underperformance in the medium to long term. Andras and Srinivasan² found that both R&D and advertising expenditure are positively and significantly related to the performance of firms. They caution that companies therefore need to be wary about reducing investments in R&D and advertising in response to economic stress

so as not to affect medium-term performance. Morbey and Dugal¹⁰ showed that companies that increased R&D expenditure during the 1982 recession performed better than those that held back. Moreover, Andras and Srinivasan² report on the Strategic Planning Institute's Profit Impact of Market Strategy study, which found that enterprises that increased advertising expenditure during a recession outperformed the average of all businesses by nearly 250%.

At the micro-level, enterprises must examine ways to ensure that their investment in R&D provides an optimal pay-off. Poor management or communication strategies can reduce the benefits of otherwise sound R&D activities. Schleiffer¹¹ described the relationships between marketing and R&D departments, in which the latter strive to produce successful and innovative products and processes. Marketing departments aim to increase sales of successful products (goods and services) and raise their firm's competitiveness. The two kinds of departments thus work for the same types of outcomes and successes for their organizations. Schleiffer observed, however, that, in reality, relationships between the two departments are generally not good, nor do they communicate well with each other. They do not understand each other's language nor approach to their profession, although they desire the same outcomes for their firms. Furthermore, technologists should be in touch with the emotional appeal of their products and the attributes that the marketing departments wish to promote. R&D staff have to interact more closely with their customers and clients. Finding meaningful ways of bringing the two groups together in an organization can only improve business performance. There is also benefit to be had from the finance and manufacturing departments being closely involved with the activities of their R&D and marketing colleagues.

Senior executives of 18 leading South African service companies were interviewed and asked to describe their perceptions of the relationship between their R&D and advertising investments.¹² Of the 11 respondents, seven (64%) reported a positive correlation, whereas the remainder were not aware of the nature of the relationship between the two. None reported a negative correlation. The impression gained was that the connection between the two parts of the business was not something to which local executives gave much thought. Different parts of the company are usually responsible for

these two kinds of investment in its future products and sales. Further evidence for this lack of coordination between R&D and innovation budgets and communication comes from the R&D survey of the business sector. Fifteen of South Africa's largest companies, with permanent R&D and marketing departments, have these sections located in different parts of the country, sometimes as widely separated as Gauteng and the Western Cape, 1500 km apart. It appears that R&D departments tend to be strategically located closest to the technical activity, such as at the main refinery, since they are usually orientated towards technological improvements. Marketing people tend to be placed where the tactical decisions of the company are made, usually the head office.

The richest countries spend between two and six times more on R&D per capita than on advertising. In less R&D-intensive countries, however, adspend tends to equal or exceed R&D budgets. This relationship is expected to be more extreme in developing countries. For Latin America this appears to be the case, because adspend overall was 0.91% of GDP and R&D amounted to only 0.58% of GDP for 2003 (adspend had increased to 1.2% of GDP by 2005).¹³⁻¹⁶ In the case of the world's largest developing countries, China and India, however, this expected relationship is not found. R&D expenditure in China in 2004 was greater than adspend the following year (1.4% compared to 1.0%), and in India investment in R&D in 2002 at 0.80% of GDP is double that of adspend (0.40% in 2005).^{16,17} Brazil dominates Latin American R&D expenditure in monetary terms, and at 0.95% of GDP for 2003 the national R&D budget exceeds adspend of 0.80% in 2005.^{14,16} The investments of these three developing countries in R&D might be expected to herald future vigorous growth in their economies. R&D as a percentage of GDP for these three countries is likely to be greater in 2005 than in the immediately preceding years. Countries with low GERD per capita will tend to be importers of technological know-how and innovated products from those with high GERD per capita, where traditional measures of quality of life also tend to be higher.

Our policy analysts should be aware of the ratio between GERD and adspend in South Africa. Developing countries need to ensure that economic growth is balanced and sustainable and that the enhancement of skills for the future, such as those that are developed through R&D programmes, are encouraged. While there is nothing wrong with a balance between marketing

and R&D in an economy, it needs to be noted when adspend starts outstripping R&D expenditure. A disproportionate growth in adspend could indicate a focus on the generation of sales rather than knowledge. In South Africa, it is important to concentrate on growing the critical core of R&D expertise in the country. If current investment in R&D is boosted by government and business, and in turn by higher education institutions, then the increased sales and employment, which are so badly needed, will follow.

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