EXTENDING PATENT LIFE:

Is it in Australia's Economic Interests?

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STAFF INFORMATION PAPER

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Moving towards the Productivity Commission

The Federal Government, as part of its broader microeconomic reform agenda, is merge in by Bureau of Industry Economics, the Economic Panning Advisory Commission and the Industry Commission to form the Productivity Commission. The three agencies are now co-located in the Treasury portfolio and amalgamation has begun on an administrative basis.

While appropriate arrangements are being finalised, the work program of each of the agencies will continue. The relevant legislation will be introduced soon. This report has been produced by the Industry Commission.

CONTENTS

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EXECUTIVE SUMMARY

One of the outcomes of the recently completed Uruguay Round of multilateral trade negotiations was an agreement on Trade Related Aspects of Intellectual Property Rights (the TRIPs agreement). TRIPs strengthens intellectual property (IP) around the world by raising both the level of IP protection and the strictness of its enforcement. Amongst many other things, TRIPs sets a minimum twenty year term for patents to run. In acceding to the TRIPs Agreement, Australia increased the statutory term both for new patents and for patents which are already running, from sixteen to twenty years.

This study estimates the economic effect on Australia of these changes.

For as long as they run, patents help prevent 'free riding' on patented technology. This generates revenue for IP producers and costs for IP users. Extending patent terms increases the potential revenue IP producers can earn from the sale or use of their IP.

This study investigates the effect on Australia's economy of longer patent terms by summing two estimated effects:

- the benefits of reduced free riding by other countries on Australian IP; and
- the costs of reduced free riding by Australia on the IP of other countries.

Because Australians import far more IP than they export, increasing patent terms is likely to impose a net cost rather than a net benefit on Australia.

The study's central findings are as follows:

- The direct cost to the Australian economy of extending patent terms ranges from a probable underestimate of $376 million in net present value terms, to a probable overestimate of $3.8 billion.
- The direct cost to Australian consumers of intellectual property will be between $1.5 billion and $7.4 billion in net present value terms, although these costs to Australian consumers will be offset somewhat by gains of between $1.1 billion and $3.6 billion to Australian producers.
- Two thirds or more of the direct cost to Australia will come from the extension of Australian patents which were already in force on 1 July 1995.

- There is no economic justification for extending patents already in force. Doing so imposes costs on IP users, and only provides 'windfall' gains to producers on IP *already produced.* This does not increase incentives for IP production in the future.

- Although the change in patent terms was not in Australia's interest, Australia has gained much more from other measures in the Uruguay Round than it has lost from extending patent terms. Accordingly, agreeing to the extension of patent terms may have been in Australia's interest if it was necessary to secure other gains from the round. However, this paper is in no position to judge the extent to which it was necessary in this instance.

- Because Australia is a strong net importer of IP, it will rarely be in Australia's interest to protect IP more than international agreements require.

- The political economy of IP protection currently appears to favour IP producers over IP users and IP exporting countries over IP importing countries.

- Australia's interests in multilateral negotiations on IP are likely to be aligned with the interests of other economies which are IP importers. This includes most (if not all) countries except the United States which has a massive IP trade surplus.

- Our information base about the economics of IP is poorly developed both in Australia and overseas.

- Although some important data will continue to be inherently difficult to collect - for instance on the R&D incentive effects of patents - it would be relatively straightforward to improve substantially the quality of our IP information base in several areas.

This study has not estimated the economic benefit of additional research and development projects induced by the increase in patent terms. However, if the original period of patents is already substantial, as it was in the developed countries, extensions of patent terms provide much smaller additional incentives for IP producers than first appearances suggest. Investors in IP production will heavily discount the value of any additional revenue generated after sixteen years because of traditional commercial principles of discounting future income and also because the value of patents tends to fall over time.

Even if IP producers can perfectly predict that a particular IP investment will generate a patent which will retain its value through to its twentieth year, the four year (25 per cent) extension in patent terms would only increase the net present value of the patent at the time it is 'sealed' (granted) by 5 per cent. If, as seems more likely, the IP producer expects the value of his or her patent to fall over time - or is unwilling to bank on any belief that it will not - the extra four years' protection could increase incentives to produce patents by as little as half a percent.

EXTENDING PATENT LIFE: IS IT IN AUSTRALIA'S ECONOMIC INTERESTS?

1 Introduction

In 1994, the Agreement on Trade Related Aspects of Intellectual Property Rights (the TRIPs Agreement), arrived at as part of the Uruguay Round of international trade negotiations, substantially increased the level of intellectual property (IP) protection available internationally (see Box 1). It did so by raising both minimum levels of IP protection and the level of enforcement which participating countries must provide. In contrast to some of the other outcomes of the Round - for instance the liberalisation of agricultural trade - the outcomes of TRIPs have been subjected to relatively little economic analysis either at the time of the Agreement or subsequently.

This study seeks to estimate the direct economic impact on Australia of one of the most important measures contained within TRIPs - the provision of a minimum patent term of twenty years. In Australia's case this involved an extension of four years over the previously provided term of sixteen years for standard patents.[1]

The paper is structured as follows. The economics of IP rights in Australia are briefly outlined in section two. The methodology of the paper is briefly set out in section three and more fully presented in sections four and five. Results are set out in section six and some conclusions are offered in section seven.

2 The economics and political economy of intellectual property

Once the creation of a particular piece of IP has been funded, the marginal cost of supplying it to users is typically very low. IP is a 'non-rival' good - unlike physical goods and real estate, one person's use of IP is no barrier to others using it.

[1] Australia has a two-tiered system of *standard* and *pretty* patents. Petty patents have a maximum duration of six years. When introduced in the late 1970s, pretty patents were intended to be subjected to lower inventiveness standards than standard patents, although the extent to which this aspiration has been realized in practice has been limited (see BIE 1994, Chapter 5 for details).

Box 1: The Uruguay Round and the TRIPs Agreement

The Uruguay Round concluded at Marrakesh on 15 April 1994, when 111 national governments signed new agreements including a revision of the General Agreement on Tariffs and Trade (GATT), the *World Trade Organisation (WTO) Agreement* (1994).

The new agreement continues the progress of past GATT rounds in reducing trade barriers and other assistance to industrial goods on a multilateral basis. However, the breadth of the new agreement has broken new ground. In contrast to previous GATT rounds, the Uruguay Round agreements extend to agriculture, services (GATS), Trade Related Investment Measures (TRIMs) and the protection of intellectual property (in the TRIPs Agreement). The Uruguay Round also establishes the 'World Trade Organisation'.

Article 33 of the TRIPs Agreement expressly requires each signatory to set a minimum patent term of 20 years counted from the filing date of each patent. Several signatory countries (eg. France, Germany and the United Kingdom) already had patent terms of 20 years. For the United States and Canada, a three year increase was required. For some developing countries the new agreement required substantial increases in patent terms. Nigeria for instance had patent terms of only five years before the TRIPs agreement.

Before the Uruguay Round, IP issues at the international level had been the preserve of the United Nations' World Intellectual Property Organisation (WIPO), which continues to administer a range of multilateral IP conventions.

According to the Department for Foreign Affairs and Trade,

Australia supported the inclusion of intellectual property rights in the Uruguay Round on the grounds that better defined and enforced multilateral disciplines in the area could contribute to the growth of international trade and lead to benefits for both importers and exporters of products with an intellectual property right component. (Condon 1994)

In response to the TRIPs agreement, Australian legislation has extended the term of patents, both those in existence and those yet to come into existence, from 16 to 20 years.

These characteristics create a central dilemma in the microeconomics of IP. If the creation of IP is funded from private sales to consumers, allowing others to copy freely may undermine the market price of the product and so undermine incentives to create IP in the future.

Where the production of IP must be funded from the sale of patent protected inventions, the optimal amount of IP protection is easily identified, at least in theory. The optimal level of protection provides *just* enough incentive for entrepreneurs to risk funding IP production. Any less protection and the world is deprived of a valuable invention; any more and the use of the invention is unnecessarily constrained, because it costs more than it needs to cost.

Innovation can often proceed satisfactorily without IP protection. Where this is the case, then by the principle enunciated above, it is best that IP protection not be given. Apart from retaining exclusive use of trade names and trademarks, those who developed and marketed the innovations behind MacDonald's restaurants or Macquarie Bank's cash management trusts, for instance, received little protection against those who copied their ideas. But this did not impede innovation. In each case the innovators innovated, despite the knowledge that others would 'free ride' by imitating their success. In each case the market rewarded the innovators handsomely but at the

same time, imitators constrained the successful innovators' prices. Indeed in these circumstances, far from undermining innovation, the imitators probably quickened the pace of innovation by placing competitive pressure on the original innovators and each other.

Where IP protection is necessary to fund the development of an invention, it should be provided only over a finite time period judged to be appropriate to rewarding the original investors in innovation. If IP protection had been provided for an indefinite period for the first reciprocating steam engine in the seventeenth century, the subsequent development of reciprocating engine technology - in the internal combustion engine, for instance - could have been severely constrained.

From an economic point of view then, the task of IP protection is not to prevent free riding but to govern it in the interests of economic welfare. Free riding should be permitted in the many circumstances where it provides net economic benefits. And it should be restricted in those circumstances where it does more harm than good, namely, where it is likely to undermine the viability of developing useful IP.

It is impracticable to 'tailor-make' IP rights to the theoretical ideal set out above. Indeed, the theoretical optimum would require patents to be of different length for different inventions. If IP rights were tailor-made in this way, the administration of IP law would be highly complex and uncertain, not least for the creators of IP. Instead, although there are several different kinds of IP right pertaining to different areas within each field (such as patents, petty patents, copyright, trademarks and so on), IP rights tend to be provided on a common or standardised basis.

If patent lengths are to be uniform, what length should they have? As this study reveals, our current state of knowledge as to the optimal length of patent terms is not well developed. Indeed, currently we lack much of the data which would help us develop that knowledge.

Retrospective and prospective changes to patent terms

While the prospective increase in the terms of patents *yet to be granted* will increase incentives to invest in the production of intellectual property, this cannot be so when extending the terms of patents which are already running. The extension of patents already in existence generates unambiguous costs with no gains. Clearly once an invention has been funded and a patent granted, the extension of *that* patent does nothing to increase incentives for future research and development, and it retrospectively increases the patent protection available to the original IP production to a level above that necessary to bring it about.

This is a matter of some importance because well over half the net present cost of the extension of patent terms is attributable to the extension of existing patent terms (see Section 6). The TRIPs agreement itself appears to be unclear on whether it mandates the extension of existing patent terms. Article 33 of TRIPs requires that "the term of [patent] protection ... shall not end before the expiration of ... twenty years counted from the filing date". And Article 70:2 specifies that "this Agreement gives rise to obligations in respect of all subject matter existing at the date of application of this Agreement".

On the other hand, Article 70:1 makes it clear that the TRIPs agreement is not intended to have retrospective effect: "This Agreement does not give rise to obligations in respect of acts which occurred before the date of application of the Agreement". If the application for and sealing of a patent can be regarded as an "act" within the meaning of Article 70:1 then that article would ensure that TRIPs did not mandate the extension of existing patents.

The extension of patent terms already in existence is also inconsistent with the objectives of TRIPs expressed in Article 7, which are to 'contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare'. Portugal is one country which has extended the terms of future patents pursuant to the TRIPs agreement but without extending the term of existing patents.

According to the AIPO,

> Whilst the TRIPs Agreement does not specifically set out to which patents the 20 year term is to apply, it was believed that the intention of Article 33 was that it should apply to all existing patents, and not just those applied for or granted after a specific date. Balancing the interests of all the parties, the new 20 year term was to apply to all patents whose 16 year term would have expired on or after 1 July 1995 and to all patents granted after 1 July 1995, this date being chosen to provide sufficient time for both patentees and competitors to rearrange their affairs to accommodate the new term. (AIPO, Personal communication)

International issues

There are also important international dimensions. The optimum IP policy for a nation depends upon whether it is considering its IP regime unilaterally (without regard to the regimes of other countries) or is participating in multilateral negotiations to set minimum standards of IP protection across many countries.

In each case a country's interest will be determined by the combination of two different effects. Stronger IP rights will generally increase incentives for the creation of IP, but they will increase the price of IP to users.

Unilateral action on intellectual property rights

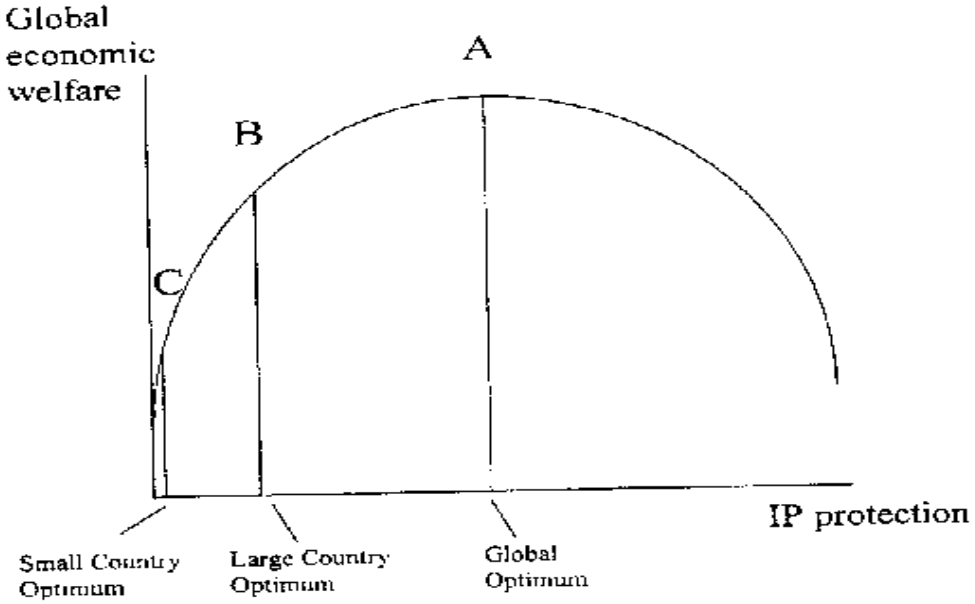
If a country had complete freedom to act unilaterally - including confidence that it would face no international retaliation - its best strategy would probably involve providing protection to IP produced domestically but not to IP produced offshore. This would provide incentives for domestic IP production at the same time as maximising the scope for free riding on foreign IP. In the 19th century, many countries in fact adopted this strategy. However, the scope to do so has now been heavily constrained by international agreements which entrench the 'national treatment principle'. Under the agreements (which now include TRIPs), signatory countries accord to the nationals of other countries 'treatment no less favourable' than that accorded to their own nationals (Article 3.1 TRIPs). [2]

Even where countries are required under a national treatment principle to provide equal protection to domestic and imported IP, there are likely to remain strong incentives for them to free ride on other countries' IP if they can reduce their own IP protection unilaterally. This is because reducing IP protection unilaterally will increase the amount of free riding the country can do, whilst the amount other countries free ride on its own IP remains the same.

Where a country reduces IP protection unilaterally this is likely to reduce the incentives to IP production in that country. This is of little significance if the country makes a small contribution to the world's IP, but of greater significance if the country is a major IP producer. Thus other things being equal, the smaller a country's contribution to the world's stock of IP, the more minimal would be its optimal IP protection regime considered from a unilateral perspective. These considerations are illustrated in Figure 1.

[2] There remain some (relatively unimportant) exceptions to this principle. For instance, Australia's public lending and educational lending rights provide payments to owners of intellectual property, but generally payments are only made to Australians.

Figure 1: Unilateral IP Protection



Australia provides a good illustration of these principles. More than 90 per cent of Australian patents are granted to non-residents. Thus most Australian patents do not appear to underwrite Australian research and development (BIE 1994, p. 47). In light of this, the implications of revoking Australia's IP protection have been discussed from time to time (see eg. IAC 1986, p. 109, BIE, 1994, p. 38).

However international agreements such as the TRIPs Agreement are now constraining the extent to which this extreme unilateralism is possible for Australia.

Even before TRIPs, the Intellectual Property Advisory Council (1984) noted:

> ... withdrawal from the international patent system would probably be politically impossible. It would be likely, in any event, to affect the supply of technology by foreign firms to Australia, and to detract from the ability of Australian firms to penetrate large foreign markets with innovations originating in Australia. (p. 109)

The BIE (1994, p. 50) reached a similar conclusion recently:

> it does not appear to be in the broad national interest to alter the system in any way that contravenes international conventions and agreements and thus may invoke trade or political retaliations. On the other hand, neither is it in Australia's national interest to pursue the protection of patent rights beyond accepted international norms.

Extreme unilateral action to lower Australia's standards of IP protection would be in breach of Australia's existing international obligations and would be likely to lead to retaliation by firms and countries which are major exporters of IP to Australia. Thus a policy inspired by the idea of rapidly improving Australian access to imported technology could have the opposite result as those foreign suppliers who were capable of protecting their IP by means other than patents (for instance, by controlling the supply of technical expertise) refused to supply Australia.

Minimum international standards of IP are appropriate precisely because of the scope for excessive 'free riding' when unilateralism predominates. Although a country may weaken incentives to innovate by lowering IP protection, where it can lower IP protection unilaterally, it will also gain by increasing the scope for domestic IP users to free ride on foreign IP producers. Other things being equal, the smaller the country, the fewer IP producers lie within its borders, the greater its capability to free ride and so the lower the IP protection it has an incentive to provide. Figure 1 illustrates how countries acting unilaterally are in a 'prisoners' dilemma'. It shows how all countries have an interest on their own to move *away* from the position which would best represent their collective interests.

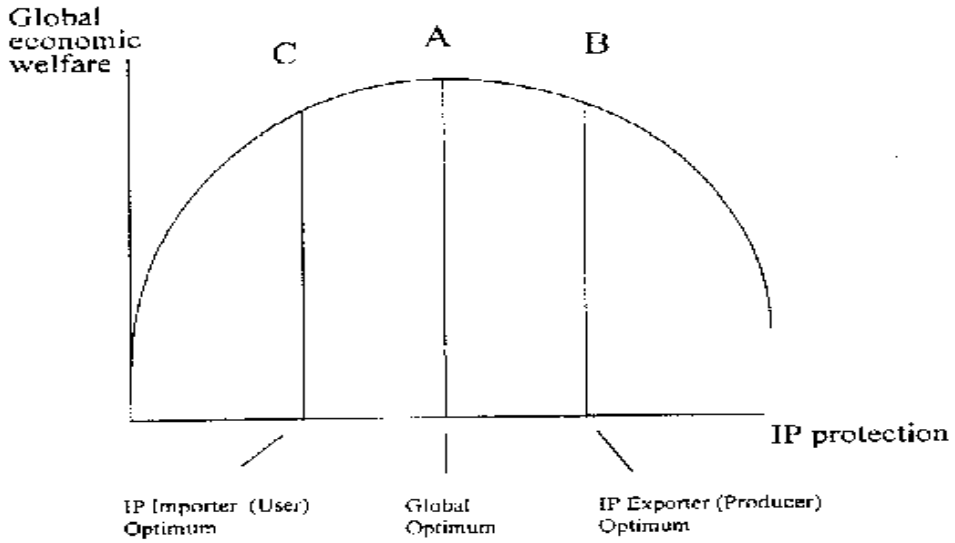
Multilateral negotiation and minimum levels of intellectual property protection

Countries' interests are different when they are negotiating the minimum level of IP protection to be applied *multilaterally*. Here multilateral negotiation internalises many of the free riding incentives that would otherwise undermine international incentives for the production of IP.

In multilateral negotiations a country can increase its scope to free ride on others by negotiating to lower IP protection. But in doing so, it will also increase the scope for others to free ride on its own exports of IP. A country's national interest in multilateral IP protection is thus affected more by its expected *balance* of trade in IP, rather than the extent of its IP protection on imports (which is the dominant consideration from a unilateral perspective).

Thus from a multilateral perspective, countries that are net exporters of IP have an interest in stronger international IP rights, while net importers have an interest in weaker international IP protection. These considerations are illustrated in Figure 2.

Figuer 2: Multilateral IP protection



According to figures from the Organisation for Economic Cooperation and Development (OECD) (see Table 1), the United States is a massive net exporter of technology. Thus most other countries are net importers of IP. The United States' technology receipts exceed its payments by a factor of five. All other OECD countries (except Sweden) are either close to balance or in deficit. The US trade surplus in technology is also over twice the size of the collective trade deficit of all OECD countries other than the United States. This leaves a large OECD technology surplus with countries not reported in the OECD source. These are mostly developing countries.

Australia is an economically developed country but is nevertheless a strong net importer of IP (see Table 1). Other things being equal, it has an interest in lower levels of IP along with most other countries, particularly developing countries in the region. As the Prices Surveillance Authority (PSA 1993, in BIE 1994, p. 47) report on the prices of farm chemicals commented:

> ... given that Australia's principal exports are farm products, minerals and tourism, while its imports are technology-intensive goods, [See also Box 2 below] ... enhanced intellectual property rights can only adversely effect our terms of trade. It is therefore by no means certain that Australia should always seek to align itself with the first world countries . . . which . . . have a vested interest in strengthening intellectual property rights on a global basis.

Table 1: Technology balance of payments, 1990, by type of transfer [a], (US$m)

Country	*Receipts*	*Payments*	*Balance*	*Receipts to Payments Ratio*
Australia	220	277	(57)	0.79
Austria	71	235	(164)	0.3
Belgium	1,879	2,505	(625)	0.75
Canada	755	811	(57)	0.93
Denmark	380	334	47	1.14
Finland	43	307	(264)	0.14
France	1,896	2,507	(611)	0.76
Germany	5,421	6,548	(1,127)	0.83
Italy	705	1,226	(521)	0.58
Japan	2,344	2,569	(225)	0.91
Netherlands	640	1,202	(562)	0.53
New Zealand	37	24	2	1.1
Norway	131	148	(17)	0.89
Spain	400	2,177	(1,776)	0.18
Sweden	223	41	(990	5.47
United Kingdom	2,286	2,385	183	0.96
United States	16,470	3,133	13,337	5.26
All other countries[b]	N/A	N/a	(7,646)	n/a

a Commercial transactions related to international technology and know-how transfers. It consists of money paid or received for the use of patents, licences, know-how, trademarks, models, designs, technical services and for industrial research carried out abroad. However, in the case of the United States, it only includes payments and receipts for royalties and licence fees. b The balance for *All other countries* is the difference between receipts and payments for the countries shown. This is an underestimate of the technology balance of payments for these countries because the figure for the United States only includes payments and receipts for royalties and licence fees.

Source: OECD (1993).

In keeping with this perspective, Australia entered the Uruguay Round with a negotiating position which sought international minimum patent terms of 15 years - one year less than Australia's patent term at the time. However, the minimum patent term ultimately negotiated in the round was 20 years.

Producers' and consumers' interests and the political economy of intellectual property

The above sub-sections have explored some of the differing interests of countries which are net producers (ie. net exporters) of IP and countries which are net consumers (ie. net importers) of IP.

Achieving an international IP system which is best for the world as a whole can be compromised if international standards do not reflect a *balance* of interests between net exporters and net importers but are biased in the direction of one or other interest. By analogy, the national interest of a country will be poorly served if its objectives are biased in the direction of either IP producers or IP consumers within the country.

In this regard, there are some instructive similarities between the political economy of IP and the political economy of domestic tariff protection. With tariff and IP protection alike, producers are relatively few in number and well aware of their interests in protection. Consumers on the other hand are relatively numerous, and the costs of protection to them are both widely spread and generally not identified explicitly in the price of the goods they buy. There is thus a danger that producers will be better mobilised to defend their interests than consumers. Some comments are offered on this in the conclusion.

This having been said, there remain important differences between tariff protection and IP protection. Economic theory suggests that many of the popular arguments for trade protection are fallacious, that even for countries acting *unilaterally*, free trade will generally be best unless there are quite specific circumstances justifying trade protection (such as where tariff protection can improve the terms of trade for a country acting unilaterally). And from a multilateral perspective the case for free trade is substantially stronger again.

By contrast there can be little doubt that IP protection, including multilaterally agreed minimum standards of protection, can often be economically beneficial. The important question is how much protection is beneficial. Putting it another way, when does the cost of IP protection to a country's consumers begin to outweigh its benefit to that country's producers?

3 Methodology

This study estimates the direct economic effect on Australia of the international extension of patent terms. It does so by summing two estimated effects:

- the benefits to Australia of reduced free riding by other countries on Australia's existing IP; and
- the costs to Australia of reduced free riding by Australia on the existing IP of other countries.

These effects have been estimated and summed for the next thirty years with the results expressed in Section 6 both as net present values and as annual amounts.

To produce the estimates it was necessary to estimate the average number of Australian patents granted to Australians, Australian patents granted to foreigners and foreign patents granted to Australians over the relevant period and then to estimate the 'average' value of each of these kinds of patents (including their declining value over the patent term). In doing so, it was necessary to make various assumptions. Some of these assumptions were necessitated by the poor state of the data kept on intellectual property both in Australia and elsewhere.

While the Australian Industrial Property Organisation (AIPO) has an extensive data base on patents and patent applications, it has only limited data on the number of patents in force by country of residence of the patent holder. Hence this study has assumed that the relative number of patent applications *lodged* by Australian and overseas residents in each application year (calendar or financial) is representative of the number of patents *granted* to Australian and overseas residents in the same periods. It has also assumed that patents held by Australian and foreign residents decline in value at similar rates.

There is no comprehensive data available on patent unit values. Hence this study has used a range of patent values drawn from the limited data that is available, and from the more reliable estimates of patent unit values derived in various economic studies. Also, patents typically decline in value over their active life. Thus it is necessary to determine the rate at which the value of a representative patent declines as the patent term matures. In all these areas it would be possible to improve our data collection, and so improve our understanding of the economic issues involved, at relatively low cost.

On the other hand, some assumptions were necessitated not by any lack of data, but by the fact that the study estimates the effects of economic developments in the future. In particular, the number of foreign patents owned by Australians has been increasing strongly in since the 1970s and the estimates presented here assume that this trend continues into the future. Assumptions made are tested in a series of four sensitivity tests (Cases 2 to 5).

Finally, the study has been unable to estimate one important economic effect of increased patent terms - the economic benefit of research and development projects induced by the increase in patent terms which would not have gone ahead without longer patent terms. Whilst this is an important omission in principle, its practical importance would seem to be small or negligible (see Section 5).

4 The volume of patents

This section provides some summary data on Australia's patent system. Trends in applications and grants are examined first, broken down by country of residence of the applicant. This is followed by data on the stock of patents in Australia. Finally, trends in the rate of decline of patent renewals are scrutinized.

Patent applications and grants

In Australia

Published data relating to patent applications by country of residence of the applicant were obtained from the World Intellectual Property Organisation (WIPO). This was supplemented by data from the Australian Industrial Property Organisation (AIPO)[3]. The data indicate that domestic applications account for around 30 per cent of all patent applications received in Australia (Figure 3).

However, as the contrast between Figures 3 and 4 illustrates, only a fraction of patents which are applied for are sealed.[4] Although they account for 30 per cent of patent applications made, Australian residents have received, on average, only 9 per cent of the Australian patents granted each year over the period shown.

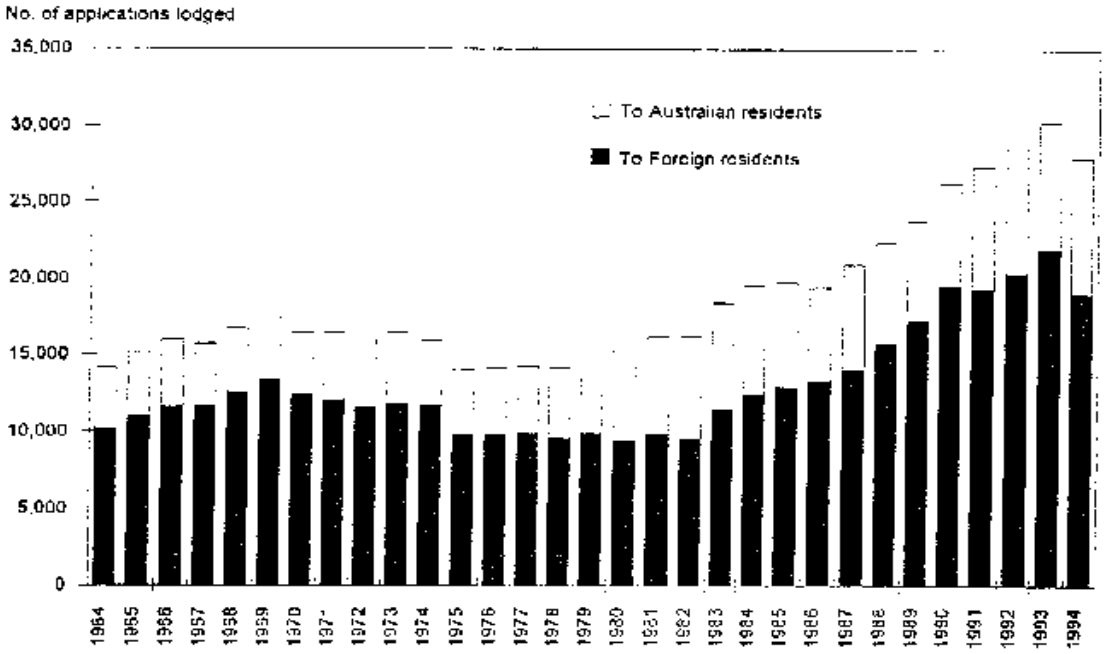
While the low success rate of Australian patent applications might seem disappointing, the achievement of a 9 per cent market share in the domestic market does not seem unreasonably low given that Australia undertakes only about 1 per cent of the world's research and development (IC 1995, p. 101).

After a trough in the early 1980s, new patent grants have increased to around 12 000 per annum since 1990.

[3] The source of the data published by the WIPO.

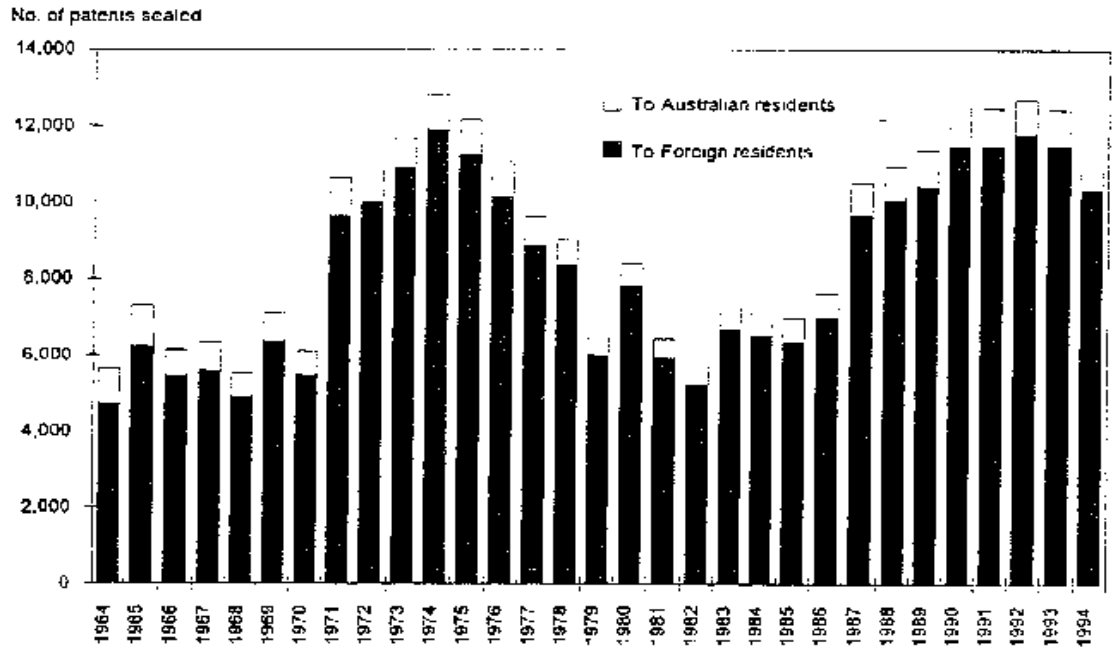
[4] Patent applications may be complete or provisional. Of the 8311 applications lodged by Australian residents in 1994, only 1282 were complete. Complete applications contain a full description of the invention, including the best method known to the inventor of putting the invention into effect, and end with one or more claims defining the invention. A provisional application describes the invention, and lapses automatically 12 months after filing. The AIPO does not process provisional applications, but when a patent is sealed, it is deemed to have commenced when the first application for the patent was lodged. Hence many applicants lodge provisional applications in order to protect an invention while they continue to develop it.

Figure 3: Applications for standard patents lodged in Australia by Australian and overseas residents, 1964 to 1994



Sources: WIPO (1994), AIPO (1995, personal communication).

Figure 4: Standard patents sealed in Australia, 1964 to 1994



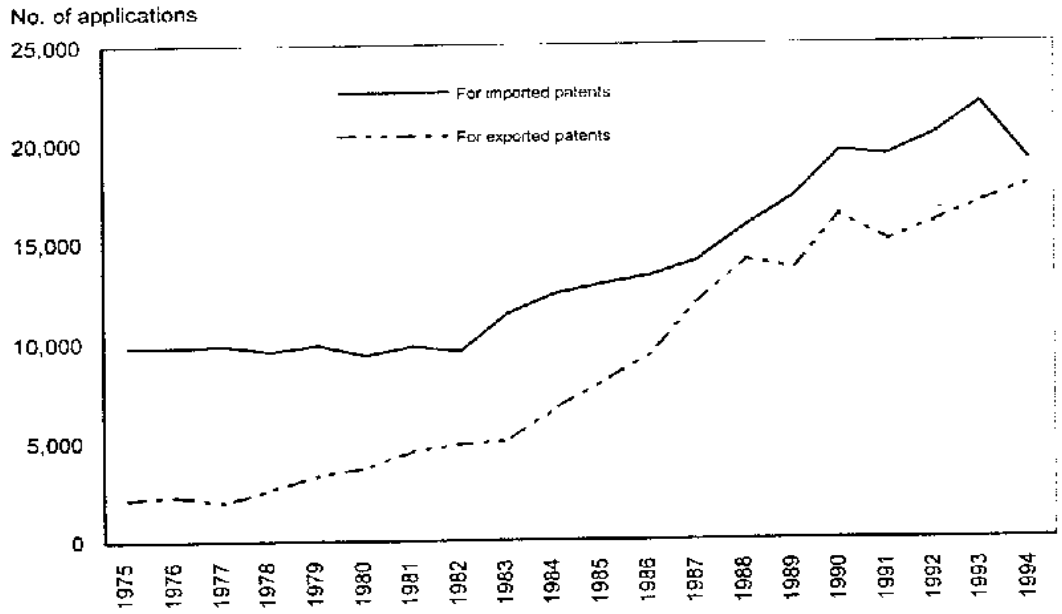
Sources: WIPO (1994), AIPO (1995, personal communication).

In Australia and overseas

Details on the number of Australian-owned patents in force overseas are unavailable. But data are available on the number of applications for overseas patents lodged by Australians over the period 1975 to 1990[5]. In Figure 5, the data have been extrapolated to 1994, and graphed alongside data relating to the number of applications for Australian patents lodged by overseas residents.

It is evident from these results that the number of patents issued abroad to Australian patent holders (the volume of patents exported) has risen strongly since the mid 1970s. Gains from these exports will offset the losses which will accrue from extending the patent term for patents owned abroad (Australian patent imports). Moreover they will grow over time. Estimates of the economic effect of extending patents have taken this trend into account and assumed that it will continue into the future. To the extent that this projected trend over (under) estimates the actual improvement in Australia's balance of technology trade, the estimates appearing in Section 6 will under (over) estimate the cost of increasing patent terms.

Figure 5: Applications for imported and exported patents, 1975 to 1994



Source: OECD (1993), WIPO (1994), AIPO (1995, personal communication).

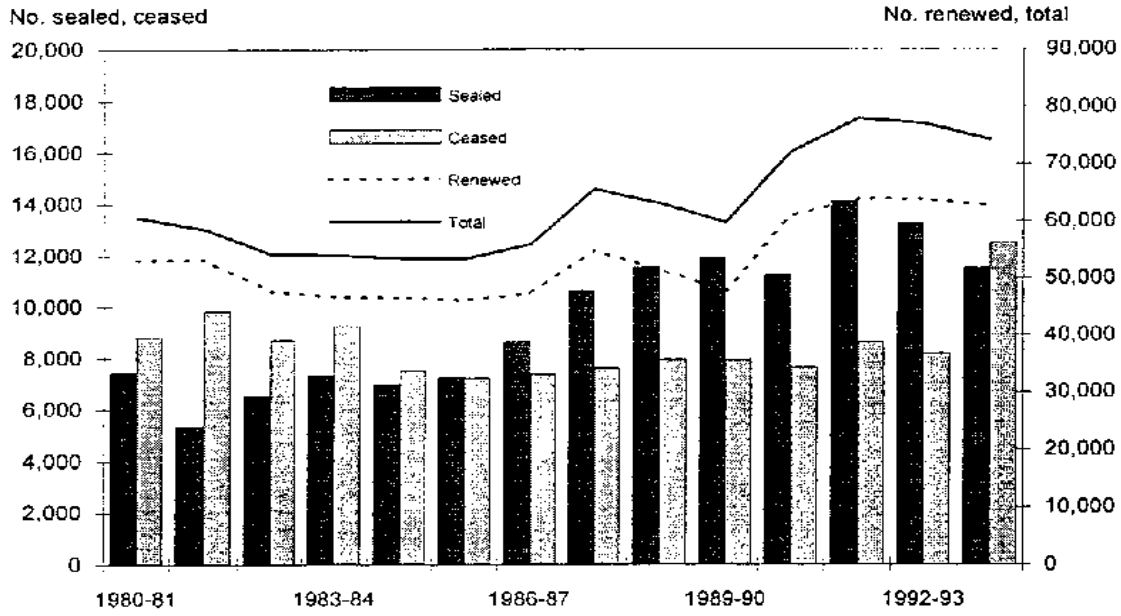
[5] Data for 1991 to 1994 are the authors' estimates.

The stock of patents in Australia

Trends in the numbers of standard patents sealed, ceased, renewed and in force in recent years are shown in Figure 6. Australia has approximately 75 000 patents in force, and more than 10 000 new patents are sealed each year.

Patents cease at the end of the statutory protection period unless they lapse sooner because their holders fail to renew them. Owners must renew their patents by paying an annual fee on the third and subsequent anniversaries of the day the application for the patent was lodged. The annual fee increases from $115 to $790 over the life of the patent. Because patent renewal is not costless, about 8000 patents registered in Australia have been lapsing each year, although the figure was closer to 12 000 in 1993-94.

Figure 6: Standard patents sealed, ceased, renewed and total 1980-81 to 1993-94



Source: AIPO (1994)

5 The value of patents

Given the comprehensive data base that has been constructed on patent *volumes* by the AIPO, the most difficult data issue relates to patent *values.* There are no published data available on the value of individual or groups of patents. There are, however, estimates of the private value of patents.

Griliches (1990) mentions three methods that have been used in the economic literature to estimate private valuations of patent rights (including, in some cases, the value of the invention as well) over the life of the patent:

- surveying patent holders;
- measuring the change in a firm's market value when it receives 8a patent; and
- using patent renewal data to infer patent values.

Griliches notes that the most extensive survey of patent holders was conducted in the 1950s by the Patents and Trademarks Foundation of Washington DC:

> Among the patents reported to be in current use and with relevant numerical responses and a positive gain (accounting for about 20 per cent of all relevant responses), the mean value was $577 000, but the median value was only around $25 000. If one includes all the no gain, loss, and not yet used patents, the mean gain falls to about $112 000, and the median is close to zero or below ... Even this lower mean number is quite impressive, roughly equivalent to US$473 000 per average patent in 1988 prices (using the GNP deflator to convert it from 1957 prices). (Griliches 1990, p. 1679)

The BIE (1994, p. 22) noted two problems with these estimates:

> First, the patent value measures the private value of the invention and not necessarily the net commercial gains that are due to the patent protection itself ...
>
> On the other hand, the mean private value of patents is based on outdated data obtained from 1938, 1948 and 1952 patent cohorts [ie. patents sealed in those years]. In the meantime there has been a significant increase in the average real value of R&D expenditure per patent which should be reflected in a rise in the mean commercial value of recent patents.

Several authors[6] have used changes in stock market valuations to estimate the private benefit of a variety of patentable innovations. Most use data from the United States. While these studies use more up-to-date information, thus avoiding the problem of the passage of time on average patent values, changes in stock market valuations reflect potential sales of products incorporating or utilising the patented product or process, as well as the additional value created by using the patent protection alone. This suggests that such a method will tend to produce overestimates[7].

This method does not appear in the literature on Australia. In this context, it is worth noting that at least 60 per cent of the individuals and firms in Australia's patent-seeking community are not publicly listed (Mischlewski and Dormer 1995, p. 9).

[6] See Griliches (1990, pp. 1682–8) and Austin (1995).

[7] On the other hand, the method will underestimate patent values if the stock prices before the patent is granted capture some positive expectation of the acquisition of the patent.

The only Australian data available comes from an Australian Bureau of Statistics (ABS) survey of firms which conducted research and experimental development in Australia in 1992-93.

The ABS collected, among other things, data on patent licence fees and royalties paid and received in 1992-93 (see Table 2), and some data on the number of patent applications lodged and patents granted by respondents between 1 July 1991 and 30 June 1993. From this data one could estimate the annual flow of income to a typical patent holder.

Table 2: Firms conducting R&D in Australia, patent licence fees and royalties, payments and receipts, 1992-93[a,b] ($'000)

	Source/Destination	*Amount ($'000)*
Payments by firms conducting R&D to:	Australian patent holders	4 626
	Overseas patent holders	266 843
	Total	**271 468**
Receipts to firms conducting R&D from:	Australian patent users	32 254
	Overseas patent users	49 151
	Total	**81 405**

a Excludes higher education sector.
b ABS asks for information in its survey about "patent licence fees and patent royalties", so that the entire amounts shown in this table relate to patents and not to other forms of IP.
Sources: ABS (1995, Tables 13 and 14), ABS (1995, personal communication).

Unfortunately, the data excluded information pertaining to the patent activities of the higher education sector, and did not include estimates of the number of patents to which the royalty payments and licence fees applied.

In any event, royalty and licence fee data is a poor indicator of a patent's value because a great deal of the value of patents is exploited 'internally' within the operations of the firms which own them, rather than by being sold to third parties in return for royalties.

Informal discussions with patent-holding firms indicated that the internal exploitation of patents by large manufacturing firms in Australia is often of the order of 95 per cent of the total value of the patent. (That is, of the total value of the patent, only five per cent comes as royalties.) On the other hand there are 'technology' companies which sell most or all of their technology to their customers. Where such firms do not sell the patents they develop, but licence them to users, the technology producers would have very high rates of 'external' exploitation of their patents.

Unfortunately, this study has been unable to estimate the rate of external exploitation of the stock of patents. It is unlikely that a large proportion of the value of patents represents patents licenced out by technology companies. Accordingly, the base case (Case 1 set out in Section 6) assumes in its estimate of the value of patents, that royalties represent 25 per cent of the total value of patents, with 75 per cent of their value being generated internally. Such a figure is probably an overestimate of the level of external exploitation of patents. The sensitivity of the results to this assumption is tested by lowering the rate of external exploitation from 25 per cent to 15 per cent (Case 3).

If the owner of an exported patent also has direct foreign investment in the export market it will facilitate the internal exploitation of that patent. This suggests there may be some correlation between the extent of foreign direct investment and the extent to which exported patents are exploited internally. Direct foreign investment in Australia is approximately three times the level of direct Australian investment abroad. Thus the rate of internal exploitation of patents may be higher for Australian patents held by foreigners than for foreign patents held by Australians. This possibility is modelled by assuming that Australia's patent imports have a 15 per cent rate of external exploitation whilst its exports have a 40 per cent rate of external exploitation (Case 4).

The decline in patent values over the patent term

This section first discusses the likely decline over time in the returns to an individual patent. This, in turn, is used to examine the economic effects of increasing the statutory duration of patent protection. Finally, the model is applied to Australia.

A successful patent can be viewed as a right to receive a stream of income over the life of the patent. If that income stream were to be constant, its net present value could be established by using the standard formula for the net present value of a limited-term annuity. The Bureau of Industry Economics (BIE) used this approach to obtain a rough guide to the effect on a patent holder of increasing the patent term, assuming a discount rate of 15 per cent. The 15 per cent discount rate has a remarkably corrosive effect on the value of an income stream after sixteen years. Indeed after sixteen years, an additional four years flow of funds at the same annual level

(a 25 per cent increase in the total flow of funds generated over the patent term) increases the net present value of the patent at the time of its commencement by just 5.2 per cent.[8] This result illustrates well enough the way in which discount rates dilute much of the potential for increased patent lengths to fund increases in IP production. In reality, extending patent lengths is likely to improve incentives by substantially less than this. Although there are exceptions to the rule, generally speaking, the revenue flow for a representative successful patent (one which runs the full term allowable) is likely to decline after the first few years of the patent.

A study by Watermark Patent and Trademark Attorneys[9] (see later in this section), found that patent renewals declined by around 16 per cent each year, so that only around 10 per cent of applications lodged in Australia each year made full use of the 16 year statutory period.

If the decline in the renewal rate continues at the same rate as in the first sixteen years as indicated by the Watermark study, the extension of the patent term will increase the average value of a patent at the time it is granted by only 0.5 per cent, or one-tenth of the BIE's figure of 5.2 per cent[10]. Even if the decline in patent renewals ceases after Year 16, the increase in net present value from the extension is still only 0.75 per cent.

The fact that the net present value of the 'average' patent is increased only negligibly by a 25 per cent extension in its term does not demonstrate that this is the case for all patents. If, at the time of their investment, investors in IP production are able confidently to judge that the patent they are seeking will retain its value better than a typical patent, then its expected net present value will be above the negligible levels set out immediately above. However, unless the patent can be confidently expected to *rise* in value towards the end of its patent - which is an unusual but perhaps not impossible circumstance - the net present value of the patent will still increase by only five per cent or less.

---

[8] Following the BIE (1994, p. 44), the net present value (NPV) of a constant stream of income of $1 per annum over 16 years at a discount rate of 15 per cent is:

$$NPV_{16} = (\$1.00/0.15)*[1-(1+0.15)^{-16}] = \$5.95$$

and $NPV_{20} = \$6.26$.

So the increment is $(NPV_{20}/NPV_{16}-1)*100 = 5.2$ per cent.

[9] Mischlewski and Dormer (1995).

[10] That is, the annual revenue generated by a patent in Years 17 to 20 will be lower than that generated in Year 16, and in Year 20 the revenue generated will be only 5 per cent of what it was in Year 1. Taking this decline in annual revenues into account will reduce NPV(16) to $4.64 and NPV(20) to $4.66.

These considerations square with the authors' discussions with private sector patent holders, who indicated that in project evaluation of the commercial viability of research and development projects, the value of patents was discounted to negligible levels after about ten years. The representative of one large firm commented that after ten years one would generally expect a new generation of technology to render existing patents obsolete.

Aggregating to the national level

Extending the statutory term of all patents by four years can be measured as a change in a country's balance of payments for IP:

where:

X represents payments to Australian patent holders for patents sold overseas; and

M represents payments by Australians to overseas patent holders.

Let  represent the change in net present value from years 16 to 20. That is:

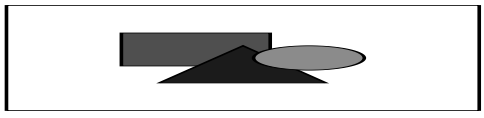
 $= NPV_{20} - NPV_{16}$

Then by lengthening the IP right duration from 16 to 20 years, the net effect on the country's balance of existing IP payment flows in the external accounts is:

This net effect has two components:

- windfall (W) to all patent holders whose patents, still in existence on 1 July 1995, can now be extended for an additional four years; and
- prospective (P) component, which measures the impact on a country's balance of IP payments of extending all patents applied for on or after 1 July 1995 by an additional four years.

The windfall (W) will have 16 elements stretching back from 1994-95 to 1979-80 patent applications:



where:

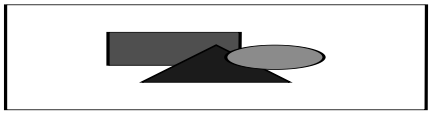
 refers to the change in net present value from extending patent life by 4 years, discounted back to the present;

 refers to the declining series of renewals over 20 years for Australian patents used abroad;

 refers to the average annual unit value of Australia's patent export receipts; and

similarly for  and  with respect to foreign patents used in Australia.

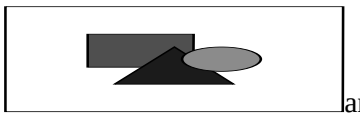
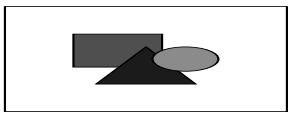
The prospective (P) component will be the net present value of the sum of an infinite series of increased patent licence payments. The simplest way to estimate this component is simply to extrapolate from 1994 levels. Applying the standard formula for the net present value of an infinite annuity, and using a real discount rate () yields:



Unlike the windfall (W), the prospective component (P) will not begin to accrue until 2012, and it will only come into full effect in 2015, twenty years after the policy change in 1995.

Extending the statutory term of all patents by four years will also increase the amount of income transferred to domestic patent holders from domestic patent users.

This transfer will have a windfall (WD) and a prospective (PD) component, as above, with:

 and 

where:

 refers to the change in net present value from extending patent life by 4 years, discounted back to the present;

 refers to the declining series of renewals over 20 years for Australian owned patents used in Australia;

 refers to the average annual unit value of Australian owned Australian patents.

Applying the model to Australia

For the purposes of this study the following assumptions are made:

- values are in 1995 dollars;

- the time basis for discounting is 30 June 1995, the date the relevant legislation effected the change in patent terms; and

- the data set takes patents sealed from 1 January 1979 to 31 December 1994 (in line with data provided to the Commission by the AIPO).

The data relating to the number of patents sealed has also been modified to exclude those patents relating to pharmaceuticals for human use, as these patents could already be renewed in Australia for a period of twenty years, and thus were not affected by Australia's accession to the TRIPs Agreement.

Discount rate

As noted previously, the BIE (1994, p. 44) adopted a discount rate of 15 per cent when assessing the *private* returns to patent holders. In fact, the BIE canvassed private return rates of 15-30 per cent for overseas research and development investments (*ibid.*, p. 24).

But in estimating the net effect on Australia, it is clear that a real *social* discount rate,  , should be used, since it is the change in *Australia's* economic welfare that is to be measured and not the change in a particular individual's fortunes.

There is a considerable literature about the appropriate basis for selecting the size of  .[11] It is not possible to canvass all of the issues here, but it is noted that:

there is no need to account directly for taxation or subsidy impacts in a social discount rate, as is the case in the rates applying to individuals and companies;

risk is a much smaller consideration at the national level than it is at the individual or corporate level. In any event, it may be a sounder analytical approach to account for risk in valuing the streams of benefits and costs which are to be discounted than to 'load' the discount rate;

there are situations where  is appropriately measured as the after-tax rate of interest received by consumers (i)[12], or the after-tax rate of interest received by producers (r)[13], or the social rate of time preference (). In other cases, a weighted average of two or more of those rates can be

[11] Stiglitz (1982) gives a good exposition of many of the issues involved, while the Department of Finance (1991) gives an Australian perspective which is particularly aimed at Commonwealth-sector investment decisions.

[12] Where the Government increases taxes to fund a project, reducing private consumption by an equivalent amount.

[13] Where the Government issues bonds to fund a project, reducing the level of private investment by an equivalent amount.

appropriate, while there are reasonable scenarios where r_2 may be greater or smaller than those values;

- in the present case, it seems reasonable to assume that the government is constrained from:
  - imposing a lump-sum individual tax;
  - imposing a 100 per cent pure profits tax on companies; or
  - being able to tax different types of labour at different rates.

Under such conditions, Stiglitz (1982) found that r_2 might be project-specific and that it need not lie between i and r nor between r and r_2.

Writing specifically in the context of Commonwealth Government project funding, the Department of Finance (1991, pp. 56-7) advocated a benchmark real discount rate of 8 per cent, comprising a 5 per cent real risk-free rate plus a 3 per cent margin to account for the social opportunity cost of capital. Arguably, the margin would be inappropriate in this study since relatively trivial amounts of government spending are affected by the decision to have longer patents.

In this paper, a real social discount rate of 5 per cent is employed, and we examine the impact of a 10 per cent rate in a sensitivity analysis.

Patent renewal rates in Australia

While patents may be renewed annually for up to 20 years after the year in which they were applied for, not all patents applied for and sealed remain in force for the full 20 years. According to the Intellectual Property Advisory Council:

> the majority of patents issued do not run their full term. Of the patents commencing in a given year, about 7% cease each year after the 4th year, so that about 50% cease by the end of the 10th year and less than 20% are renewed for the 16th year (IPAC 1984, p. 36).

More recently, a study by Watermark Patent and Trademark Attorneys found that between 14 and 18 per cent of patents sealed in any one year lapse each year after their third anniversary, and that "[A]bout 10% of all applications which are lodged in Australia remain in force for [their] full term" (Mischlewski and Dormer 1995, p. 8).

Applying the Watermark findings to the data provided by the AIPO and WIPO, we can estimate the numbers of patents in force in Australia at the end of 1994 by origin and application year (see Table A3). From this data, and that provided by the OECD, we have estimated the number of patents granted, by origin, since 1979 that would remain in force in the sixteenth and twentieth years from application (see Table 3). These estimates are used in the calculations of net present values which are given later in the paper.

Table 3: Estimates of standard patents extant in Australia in the 16th and 20th year from year of application[a]

Application Year	*Australian patents of Australian origin*		*Overseas origin*		*Overseas patents of Australian orgin*[b]	
	16th year	*20th year*	*16th year*	*20th year*	*16th year*	*20th year*
1979	98	49	1216	605	230	114
1980	102	51	1246	621	201	100
1981	119	59	1352	673	350	174
1982	122	61	1290	642	409	204
1983	105	52	1224	610	314	156
1984	124	62	1290	642	446	222
1985	128	64	1296	645	552	275
1986	115	57	1263	629	573	285
1987	107	53	1232	613	515	257
1988	116	58	1250	622	597	297
1989	113	56	1152	574	516	257
1990	99	49	1032	514	502	250
1991	103	51	1151	573	512	255
1992	96	48	1182	589	545	271
1993	101	50	1151	573	577	287
1994	109	54	1031	513	610	304

a These figures are extrapolated from those in Table A3. In particular, following Mischlewski and Dormer (1995, p. 8), it has been assumed that the decline rate in patent renewals is constant at 16 per cent from year 3 to year 20. A zero lapse rate was assumed for the first two years. The net effect of these assumptions is that of all patents sealed in any one year, 10 per cent will be renewed for their 16th year, and 5 per cent will be renewed for their 20th year. The figures exclude patents relating to pharmaceuticals for human use. b Assuming that 33 per cent of applications for overseas patents are sealed in any one year. This is midway between the application to sealing rates for Australian owned Australian patents (around 12 per cent) and overseas owned Australian patents (around 54 per cent). This assumption is varied upward to 43.5 per cent in Case 2.

Sources: Estimates based on IPAC (1984), Mischlewski and Dormer (1995) and statistics from WIPO (1994), AIPO (1995, personal communication) and OECD (1993).

Annual patent unit values

As noted above, there is little published data available on annual patent unit values. For this reason this study has used a range of patent unit values.

Lower estimates of annual patent unit values can be estimated from the ABS' survey data shown in Table 2. As mentioned above, these data are likely to underestimate considerably patent values because they relate to licence fees and royalty payments, and exclude the value to a patent holder of using their patent themselves.

In addition there are several other problems with using the ABS data:

- we do not know how many patents the payments and receipts figures apply to;
- there is a large discrepancy between the ABS estimates of patents applied for and patents granted between 1 July 1991 and 30 June 1993 and the number of applications received and payments granted reported by the AIPO for the same period; and
- the payments and receipts data are measured in 1992-93 values.[14]

Four scenarios have been modelled using the ABS data. In the base case it is assumed that patent licence fees and royalties account for 25 per cent of the aggregate value of patents in force, and that one third of applications for overseas patents lodged by Australians are granted[15]. Under these assumptions, average annual patent unit values are:

$A59 343.39 for Australian owned Australian patents ();

$A43 774.63 for foreign owned Australian patents (); and

$A27 825.17 for foreign patents owned by Australians ().

Appendix B shows the details of how these estimates were derived.

One would expect differences in annual unit values for Australian-owned and foreign-owned patents for several reasons, including the fact that Australians typically hold patents in different fields to those in which foreigners hold patents. The BIE (1994) provided a sectoral breakdown of all patents sealed in Australia in 1992, and of those patents sealed in 1992 which were held by Australian residents alone (see Box 2 and Appendix C.).

However, one would not expect Australian-owned patents to be less valuable in the larger world market than they are in Australia. This unexpected result seems to be the result of a lack of data regarding the number of Australian-owned patents in force overseas (see Appendix B). To overcome this anomaly it has been assumed that the annual unit value of Australian patents licenced overseas is the same as that for Australian patents licenced domestically in the base case (Case 1), Case 2 and Case 3 scenarios. The assumption is relaxed in Case 4.

[14] The ABS data used in the calculations have been modified to take account of these factors. See Appendix B for details.

[15] This second assumption is modified in Case 2, to bring the sealing rate for applications for Australian owned overseas patents closer to the sealing rate for applications for overseas-owned Australian patents. This modifies estimated patent volumes but does not affect estimated patent values.

The assumption in Case 3 that patent licence fees and royalties account for only 15 per cent of the value of patents increases  to $A72 957.71 and  to $A98 905.65. As mentioned above, this scenario also assumes that the annual unit value of Australian owned patents licenced overseas () is the same as that for Australian-owned patents licenced domestically ().

Box 2: Sectoral breakdown of patents held by Australian and overseas residents

Most patents held by Australian residents were classified to the mechanical engineering (including general engineering, building, engines and pumps), miscellaneous articles, transport equipment and electrical and electronics sectors[16].

Overall, the sectors in which most new patents were sealed were chemicals and drugs (nearly 30 per cent), miscellaneous articles (14 per cent), and mechanical engineering, instruments and electrical and electronics (each around 10 per cent).

Sector by sector, the data show strong patent activity by Australian residents in the mechanical engineering, agriculture, transport equipment and mining sectors. Foreign patent holders dominate patent activity in all sectors, but are especially dominant in the higher value chemicals and drugs sector, and in the food processing, instruments and textiles and clothing sectors.

Case 4 relaxes this latter assumption, assuming instead that royalties and licence fees account for 40 per cent of the value of overseas patents owned by Australians, but that they still account for 15 per cent of Australian-owned, and foreign-owned, Australian patents. This assumption reduces  to $17 390.73.

The upper bound estimates of annual unit values are derived from the results of the Patent and Trademarks Foundation survey. This survey which may already overestimate the value of patents owned by foreigners in foreign countries (see above), will be even more likely to overestimate Australian annual patent unit values because the value of Australian patents registered overseas appears to be lower than the average value of patents registered overseas. Griliches updated the mean value of the patents surveyed in the Patent and Trademarks Foundation survey to US$473 000 in 1988 prices. Indexing the figure to 1995 values, and converting to Australian dollars gives $A895 057. As mentioned above, this figure relates to the stock value of a patent to a patent holder, rather than the annual income or value accruing from the patent. So, assuming a patent life of 17 years and a private discount rate of 15 per cent (as adopted by the BIE 1994), this is equal to an annual patent unit value of $A148 013.

[16] Excludes software development which is protected by copyright.

6 Results

The net economic impact on Australia of extending the statutory patent term by four years has been calculated as the net present value of the sum of annual transfers to Australian and overseas patent holders commencing in 1995 and continuing until 2025.

As shown in Table 4, extending the statutory period of all Australian patents still in force on 1 July 1995 by four years involves a direct cost, in net present value terms, of between $A431 million and nearly $A3.3 billion on Australia.

The additional transfers to patent owners arising from extending Australian patent terms is presented as a series of undiscounted annual amounts. The changes impose annual costs on Australia which will be between $A58 million and $A233 million this calendar year, rising annually to between $A84 million and $A379 million by 1998, after which time the annual cost will decline gradually as Australia's patent exports are assumed to continue their strong growth from a relatively low base (see Table D1, Appendix D).

The assumptions in Case 2 make Australian patent exports more valuable than they are in other scenarios, which means that in Case 2 Australia becomes a net exporter of patented technology in the year 2012. In the Base Case and Case 3, Australia becomes a net exporter eight years later. In the other cases, Australia remains a net importer of patents for the entire period, although in Case 5 its balance of payments in patents continues to improve gradually.

The transfers to domestic patent holders from domestic users of those patents, in net present values, and annual amounts, are shown in Tables 4 and D2. The windfall profit to existing Australian patent holders and cost to Australian consumers from this effect is estimated at between $132 million and $460 million. The transfers relating to patents sealed on or after 1 July 1995 range between $27 million and $190 million. The net present value of the total transfer from Australian consumers of patented technology to either Australian or foreign patent holders from now until 2025 is between $1.5 billion and $7.4 billion.

Table 4: Estimated financial impact on Australia, and on Australian users of Australian owned patents, of extending statutory patent lengths, in net present values using discount rates of 5 and 10 per cents[a]

	Base Case(b)	*Case 2(c)*	*Case 3(d)*	*Case 4(e)*	*Case 5(f)*
Net transfer to Australia from extending patent terms					
5 per cent	*$m*	*$m*	*$m*	*$m*	*$m*
Windfall	-772	-537	-1 287	-2 302	-3 267
Prospective	-21	161	-35	-819	-577
10 per cent	*$m*	*$m*	*$m*	*$m*	*$m*
Windfall	-590	-431	-984	-1 671	-2 440
Prospective	-11	52	-18	-286	-210
Transfer to Australian patent owners from Australian patent users					
5 per cent	*$m*	*$m*	*$m*	*$m*	*$m*
Windfall	185	185	308	308	460
Prospective	76	76	127	127	190
10 per cent	*$m*	*$m*	*$m*	*$m*	*$m*
Windfall	132	132	221	221	330
Prospective	27	27	44	44	66

a In mid-1995 values. b Uses ABS data. Assumes royalties and licence fees data account for one quarter of an 'average' patent's value, and that an Australian owned patent exploited overseas is worth the same amount as an Australian patent exploited in Australia. Assumes 33 per cent of applications for Australian owned overseas patents are sealed. This is the midpoint between the sealing rates of Australian owned Australian patents and overseas owned Australian patents. c As b, except assumes sealing rate of Australian owned overseas patents is the midpoint between the sealing rate used in the base case and the sealing rate of overseas owned Australian patents. d As b, except assumes patent licence fees and royalties data account for only 15 per cent of the value of an 'average' patent. e As d, except assumes royalties and licence fees data account for 40 per cent of the value of an average patent exported by Australian residents. f Uses Griliches data.

7 Conclusions

Multilateral extension of patent terms is not in Australia's economic interests

Considered on its own, the extension of patent terms has imposed costs on Australia. However, the magnitude of those costs is not clear. The direct costs range from a conservative underestimate, in net present value terms, of $A376 million to a probable overestimate of $A3.8 billion. Although an extension of patent terms will increase incentives for research and development in a beneficial way, it seems clear that the magnitude of this effect will be small if not negligible (see Section 5).

Agreeing to extend patent terms may have been in Australia's broader interests

Although, on its own, the extension of the patent term was not in Australia's interests, the TRIPs agreement was part of a much larger package of measures embodied in the Uruguay Round and Australia, like most, if not all countries, was a clear beneficiary from the totality of measures embodied in the round.

The estimated overall gain to the Australian economy from 'key features' of the completion of the Uruguay Round - excluding the TRIPs Agreement - has been estimated at an increase in annual GDP of $4.4 billion (IC 1994, Appendix H). This clearly swamps any costs to Australia from extending patent terms.

In fact, consistent with the arguments set out here concerning Australia's economic interests, the Department of Foreign Affairs and Trade's initial negotiating position was to argue for a 15 year minimum multilateral patent term. To the extent that it was necessary to secure even a substantial proportion of the results from the Uruguay Round, agreeing to a patent term longer than the term supported in Australia's initial negotiating position would have been in Australia's interests.[17]

However, this study is not in a position to assess the extent to which agreement to twenty year patent terms was necessary to securing other outcomes in the round.

[17] According to the Australian Industrial Property Organisation (AIPO), Australia initially advocated a minimum period of 15 years for the term of a standard patent, as a suitable compromise between the needs of developing and developed countries. Australia acceded to a minimum term of 20 years in order to ensure the successful completion of the Uruguay Round negotiations of the GATT.

The political economy of IP seems weighted in favour of net producers/exporters of IP

It was suggested above in Section 2 that the political economy of IP protection was subject to a hazard which is familiar in the area of trade protection, namely, the relative weighting of policy in favour of producers and against consumers.

There is some evidence that the political economy of international IP negotiations has suffered in this way. The initiatives embodied in the TRIPs agreement and the impetus for bringing international IP within the aegis of the GATT/WTO structure, received their earliest and strongest support from major American IP producers (Drahos 1995).

One of the most economically significant changes in the patent regime was the extension of patents which had already been granted. This measure represents a windfall gain to producers and a corresponding loss to the consumers of IP. Precisely because it is a windfall to producers it has no economic justification - it cannot be expected to elicit any increase in research and development. Thus this measure would appear to reflect the interests of producers in individual countries over consumers in the same countries, and the interests of producer (net exporting) countries over those of consumer (net importing) countries.

Moreover, it appears that those negotiating the TRIPs agreement on Australia's behalf have given more weight to the interests of Australian producers of IP and Australia as an IP producer than to the interests of Australian consumers of IP and Australia as an IP consumer. Thus in various official discussions of the TRIPs agreement, the benefits of increasing IP protection to Australian exporters of IP and Australia as an exporter of IP intensive products have been stressed. In contrast, there has been very little if any comment on the (negative) effects this will have for Australian consumers of IP (including Australian firms which use IP) and of Australia as a net importer of IP and IP-intensive goods. (See, for example, Department of Foreign Affairs and Trade, 1993).

IP stands in contrast to most other matters negotiated under the auspices of the GATT. Where trade and investment liberalisation is concerned, 'concessions' made by one country to another (that is, measures which will impose some adjustment pressure on them) are typically measures which will improve the national economic welfare of the country making the concession, even if it will do so at some domestic adjustment cost to adversely affected industries and employees. And in the rare events where trade liberalisation 'concessions' actually harm national economic welfare, there is a strong likelihood that they will increase global economic welfare. By contrast the extension of patent terms already in existence - a concession made by Australia and other net importers of IP - can only harm international economic welfare. Given this, and the fact that it will harm far more countries than it will help, it is unfortunate that it was not possible to develop a coalition of interests sufficient to resist this move.

Improving information

As this study, and in particular the range between the upper and lower cost estimates, has highlighted, there remain major gaps in the information base available to us in the area of IP. Currently it is difficult if not impossible to access reliable statistical information relevant to a wide range of questions about IP. Many important phenomena relevant to IP protection policy will continue to be difficult to observe. For instance, it will never be easy to measure the extent to which IP protection induces additional research and development activity. But our information base can only improve if we at least attempt to collect such information from firms in the field. In other areas it would be possible for the ABS and/or AIPO as part of its administration of patents, to collect on a regular periodic or ongoing basis much more accurate information than is currently to hand on a range of important matters, in particular:

- the total value and level of internal exploitation (as estimated by patent holders), sealing and renewal rates of patents; and

- the ways in which these figures vary depending on the size of firms, the industry in which they operate, their ownership, and location and the place of patent registration.

Currently it is not possible to generate satisfactory statistics on most of these matters. Without such data, it is not possible to determine with confidence Australia's economic interest when Australia negotiates international agreements on minimum standards of IP, or when it sets national standards of IP protection within the bounds allowed by international agreements.

Opportunities for further research

While the costs of extending patents are relatively small compared with the gains from the Uruguay Round, it should be borne in mind that extending patents was itself just one measure within TRIPs. The TRIPs Agreement, under which the extension to patent terms was negotiated, also obliged Australia to modify its IP laws in a range of other ways. For example, Australia agreed to the introduction of an exclusive rental right for holders of copyright in sound recordings and computer programs.

It appears that these and other changes were adopted without a clear understanding of their likely effects on economic welfare both in Australia and elsewhere. Accordingly these other areas also seem worthy of investigation. By examining them we can improve our understanding of IP issues, and help inform our trade negotiators more fully for the time when the TRIPs agreement and other international IP agreements come up for renegotiation or modification.

APPENDIX A: QUANTITY DATA

Table A1: Standard patents granted in Australia, 1976 to 1994

Year	*To Australian residents*	*To Foreign residents*	*Total*
1976	910	10,164	11,074
1977	768	8,868	9,636
1978	701	8,337	9,038
1979	467	6,012	6,479
1980	620	7,805	8,425
1981	505	5,929	6,434
1982	483	5,248	5,731
1983	557	6,690	7,247
1984	610	6,526	7,136
1985	609	6,379	6,988
1986	617	7,010	7,627
1987	814	9,701	10,515
1988	904	10,037	10,941
1989	987	10,406	11,393
1990	1,060	11,456	12,516
1991	991	11,491	12,482
1992	924	11,791	12,715
1993	971	11,488	12,459
1994	1,051	10,333	11,384

Sources: WIPO (1994), AIPO (1995, personal communication)

Table A2: Standard patents granted, renewed, ceased and in force in Australia, 1980-81 to 1993-94

Year ended 30 June	*Granted*	*Renewed*	*Ceased*	*Total in force*
1981	7,457	53,217	8,813	60,674
1982	5,352	53,302	9,829	58,654
1983	6,555	47,773	8,719	54,328
1984	7,336	46,779	9,262	54,115
1985	6,990	46,587	7,525	53,577
1986	7,247	46,177	7,236	53,424
1987	8,658	47,326	7,363	55,984
1988	10,643	54,990	7,648	65,633
1989	11,565	51,505	7,965	63,070
1990	11,932	47,816	7,937	59,748
1991	11,252	60,891	7,644	72,143
1992	14,108	63,847	8,624	77,955
1993	13,265	63,792	8,202	77,057
1994	11,525	62,680	12,527	74,205

Source: AIPO (1994)

Table A3: Estimates of standard patents extant in Australia at 31 December 1994[a]

Application Year	*Australian origin*	*Foreign origin*	*Total*
1979	116	1 495	1 611
1980	145	1 823	1 968
1981	200	2 348	2 548
1982	246	2 672	2 918
1983	252	3 023	3 275
1984	354	3 785	4 139
1985	432	4 528	4 960
1986	463	5 258	5 721
1987	513	6 108	6 621
1988	664	7 377	8 041
1989	770	8 114	8 884
1990	803	8 683	9 486
1991	460	5 329	5 789
1992	409	5 225	5 634
1993	416	4 918	5 334
1994	493	4 850	5 343
Totals	6 735	75 537	82 272

a The total column for the years 1979 to 1991 is based on AIPO data. Totals for 1992, 1993 and 1994 are based on AIPO and WIPO data. Breakdowns by country of origin were estimated using proportions as at the time of sealing, as shown in Table A1.

Sources: AIPO (1994, and 1995, personal communication) and WIPO (1994)

APPENDIX B: UNIT VALUE ESTIMATIONS

B2 Using the ABS data

Australian patents used within Australia

From Table 2, patent licence fees and royalties received by firms conducting R&D in Australia from Australian patent users in 1992-93 were $32.3 million (excluding the higher education sector). This tranlates into $33.6 million in mid-1995 values.

The final column of Table A2 shows the number of patents in force on 30 June each year. However, the $32 million mentioned above applies to the whole of a year and not just one day. Consequently, to obtain an average unit value of Australian

owned patents ($\mathcal{V}^D$), it is necessary to divide through by the *average* number of standard patents in force in Australia (those held by Australian residents, Q^D, and those held by overseas residents, Q^M) in 1992-93 can be estimated as the number renewed plus half of the number sealed that year:

$$63\ 792 + (13\ 265\ /2) = 780\ 424.5 = Q^{D+}Q^M$$

From Table A3, the estimated proportion of Australian patents held by Australian residents on 30 June 1994 is 6735 / 82 272 = 5765.1328. applying this proportion to the above 1992-93 figure yeilds:

$$Q^D \approx 0.0818626 * 70\ 424.5 = 5765.1328.$$

Then $\mathcal{V}^D = \mathcal{V}^D Q^D / Q^D \approx \$33\ 559\ 953 / 5765.1328 =$ **$5821.20.**

Overseas patents used in Australia

We have from Table 2, that payments to overseas patent holders by firms conducting R&D in Australia in 1992-93 were valued at $226.87 million ($277.5 million in mid-1995 values) and, following on from the above calculations, the number of Australian patents in force held by overseas residents (Q^M)were:

$$70\ 424.5 – 5765.1328 = 64.659.37$$

So the average unit value of Australian patents owned by overseas residents ($\mathcal{V}^D$) was:

$\mathcal{V}^M = \mathcal{V}^M Q^M \; / \; \mathcal{V}^M \approx$ \$277 647 380 / 64 659.37 = **\$4294.00.**

Australian patents used overseas

The estimation required here is more difficult. While Table 2 provides an estimated of payments to Australian firms conducting R&D by overseas patent users of \$49.1 million (\$51.1 million in mid-1995 values), the number of Australian-orgin patents in force overseas (Q^X) in 1992-93 (or any year) is unknown.

According to a study by Llewellyn (1981), on average, each Australian invention pantented in Australia was also patented in 3.25 foreign countries (p/6). If we apply this proportion to the ABS data, then:

$$Q^X = 3.25 * Q^D = 18\ 736.682$$

Consequently, the average unit value of foreign patents held by Australian residents ($\mathcal{V}^X$) was:

$\mathcal{V}^X = \mathcal{V}^X Q^X / Q^X \approx$ \$51 141 106 / 18 736.682 = **\$2729.46.**

B2 Modifying the ABS data to incorporate the rest of the economy

There are clearly some deficiencies in the ABS data used to estimate patent unit values. The data excludes patent activity in the higher education sector, and the data on patent applications presented in the survey conflicts with information provided by the AIPO.

According to the ABS survey from which Table 1 is drawn, Australian firms conduting R&D lodged 1101 applications for standard patents in Australia between 1 July 1991 and 30 June 1993. According to the aIPO, 2806 applications for standard patents were lodged by Australian residents during the period. While the ABS provided numbers of standard patents granted during the period, by country of residence of the applicant, the AIPO does not provide complementary information on a financial year basis.

The discrepancy between the number of patents lodged by Australian residents in Australia is explained by the fact that the ABS survey was limited to firms conducting Research & Experimental Development in Australia in 1992-93.

To overcome this deficiency, the ABS data in Table 1 can be inflated by a proportion equal to the difference between the ABS' estimate of applications lodged by Australian residents between 1 July 1991 and 30 June 1993 and the actual number of applications received by the AIPO in that period.

Then $\mathcal{V}^D = \mathcal{V}^D Q^D / Q^D \approx$ \$85 530 634 / 5765.1328 = **\$14 835.85**

$\mathcal{V}^M = \mathcal{V}^M Q^M / Q^M \approx$ \$707 609 640 / 64 659.370 = **\$10 943.66**

and $\mathcal{V}^X = \mathcal{V}^X Q^X / Q^X \approx$ \$130 337 823 / 19 736.682 = **\$6 956.29**

B3 Accounting for in-hose and external exploitation rates

As mentioned in Section 5, based on information obtained from a range of patent holders, it is realistic to assume that royalties and licence fees account for one quarter of the aggregate value of a patent. Making this adjustment raises:

$\mathcal{V}^D$ to **\$59 343.39**

$\mathcal{V}^M$ to **\$43 774.63**

and $\mathcal{V}^X$ to **\$27 825.17**

B4 Indexing factors

Australian GDP Deflator	1992/93	106.2
	1995	110.5
United States		
GDP Deflator	1998	88.3
	1995	118.4
Exchange Rate at June 1995	US\$/\$A	0.7086

Sources: IMF (1995), RBA (1996).

APPENDIX C: SECTORAL DISTRIBUTIONS

Table C1: Sectoral distribution of patents sealed in Australia, 1992

Industry/ Sector	*Share of patents held by Australian residents*[a]	*Share of total patents sealed*
Agriculture	5.1	2.2
Mining	4.2	3
Food processing	1.5	2.4
Textiles and clothing	1.3	1.7
Paper and printing	2.3	2.9
Chemicals and drugs	8.3	29.7
Metal and mineral processing	4.7	5.3
Transport equipment	11	6.2
Mechanical engineering	28.3	11.7
Instruments	8.1	10.7
Electrical and electronics	10.5	10.2
Miscellaneous articles	14.7	14
TOTAL	**100**	**100**

a Australian residents held only 8 per cent of all patents sealed in 1992.

Source: BIE (1994, p. 36).

Table C2: Shares of patents sealed by Australia, 1992

Industry/ Sector	*Held by Australian residents*[a]	*Held by overseas residents*
Agriculture	18.5	71.5
Mining	11.2	88.8
Food processing	5	95
Textiles and clothing	6.1	93.9
Paper and printing	6.3	93.7
Chemicals and drugs	2.2	97.8
Metal and mineral processing	7.1	92.9
Transport equipment	14.2	85.8
Mechanical engineering	19.4	80.8
Instruments	6.1	93.9
Electrical and electronics	8.2	91.8
Miscellaneous articles	8.4	91.6

Source: Estimates based on BIE (1994, p. 36).

APPENDIX D: ANNUAL COSTS OF EXTENDING PATENT TERMS

Table D1: Estimated annual costs to Australia of extending statutory patent lengths 1995 to 2025 ($m[a])

Year	Base Case[b]		Case 2[C]		Case 3[d]		Case 4[e]		Case 5[f]	
	W	P	W	P	W	P	W	P	W	P
1995	-33.3		-29.6		-55.4		-71.2		-122.6	
1996	-63.7		-57.5		-106.2		-133.2		-233.0	
1997	-85.8		-75.0		-143.0		-189.6		-320.3	
1998	-99.1		-83.6		-165.2		-232.4		-378.6	
1999	-96.1		-79.8		-160.1		-230.2		-370.1	
2000	-88.1		-68.9		-146.8		-229.3		-351.1	
2001	-78.1		-56.0		-130.1		-225.3		-325.4	
2002	-70.0		-45.6		-116.6		-221.9		-304.6	
2003	-63.8		-37.6		-106.3		-219.3		-288.6	
2004	-57.3		-29.3		-95.4		-216.0		-271.5	
2005	-54.7		-27.4		-91.2		-209.0		-261.1	
2006	-50.0		-23.8		-83.3		-197.1		-242.4	
2007	-49.0		-22.8		-81.7		-194.8		-238.7	
2008	-49.4		-23.5		-82.3		-194.3		-239.3	
2009	-46.7		-19.9		-77.9		-193.9		-233.0	
2010	-40.4		-12.1		-67.3		-189.3		-215.3	
2011	-25.5	-7.0	-5.8	3.2	-42.6	-11.7	-127.6	-55.7	-141.3	-52.1
2012	-13.3	-11.9	-1.1	7.3	-22.2	-1.9	-75.1	-103.0	-79.2	-94.0
2013	-4.5	-15.1	1.3	12.3	-7.4	-25.1	-32.2	-143.4	-31.0	-127.3
2014		-16.7		18		-27.9		-177.9		-153.5
2015		-13.7		22.7		-22.8		-179.8		-147.6
2016		-10.6		27.4		-17.7		-181.7		-141.8
2017		-7.5		32.1		-12.6		-183.6		-135.9
2018		-4.5		36.7		-7.5		-185.5		-130.1
2019		-1.4		41.1		-2.4		-187.4		-124.3
2020		1.6		46.1		2.7		-189.2		-118.4
2021		4.7		50.8		7.8		-191.1		-112.6
2022		1.8		55.5		12.9		-193.0		-106.8
2023		10.8		60.1		18.0		-194.9		-100.9
2024		13.9		64.8		23.1		-196.8		-95.1
2025		16.9		69.5		28.2		-198.7		-89.2

W - Windfall. P - Prospective cost. a In mid-1995 values. b Uses ABS data. Assumes royalties and licence fees data account for one quarter of an 'average' patent's value, and that an Australian owned patent exploited overseas is worth the same amount as an Australian patent exploited in Australia. Assumes 33 per cent of applications for Australian owned overseas patents are sealed. • c As b, except assumes 43.5 per cent of applications for Australian owned overseas patents are sealed. d As b, except assumes patent licence fees and royalties data account for 15 per cent of the value of an 'average' patent. e As d, except assumes royalties and licence fees data account for 40 per cent of the value of an average patent exported by Australian residents. f Uses Griliches data.

Table D2: Estimated annual cost to Australian users of Australian owned patents of extending statutory patent lengths ($m(a))

Year	Base Case[b]		Case 2[C]		Case 3[d]		Case 4[e]		Case 5[f]	
	W	P	W	P	W	P	W	P	W	P
1995	4.9		4.9		8.1		8.1		12.1	
1996	9.2		9.2		15.3		15.3		22.9	
1997	13.6		13.6		22.7		22.7		34.0	
1998	17.5		17.5		29.2		29.2		43.8	
1999	17.6		17.6		29.3		29.3		43.8	
2000	18.4		18.4		30.7		30.7		45.9	
2001	18.9		18.9		31.5		31.5		47.1	
2002	18.5		18.5		30.9		30.9		46.2	
2003	18.3		18.3		30.5		30.5		45.6	
2004	18.1		18.1		30.1		30.1		45.1	
2005	17.6		17.6		29.4		39.4		44.0	
2006	16.9		16.9		28.2		28.2		42.2	
2007	16.7		16.7		27.8		27.8		41.6	
2008	15.9		15.9		26.5		26.5		39.7	
2009	15.6		15.6		26.0		26.0		38.8	
2010	16.1		16.1		26.8		26.8		40.0	
2011	10.9	5.0	10.9	5.0	18.2	8.3	18.2	8.3	27.3	12.4
2012	6.8	9.3	6.8	9.3	11.3	15.4	11.3	15.4	17.0	23..1
2013	3.2	12.9	3.2	12.9	5.4	21.6	5.4	21.6	8.0	32.3
2014		16.1		16.1		26.9		26.9		40.2
2015		16.4		16.4		27.4		27.4		40.9
2016		16.7		16.7		27.8		27.8		41.7
2017		17.0		17.0		29.3		28.3		42.4
2018		17.3		17.3		28.8		28.8		43.1
2019		17.6		17.6		29.3		28.3		43.9
2020		17.9		17.9		29.8		29.8		44.6
2021		18.2		18.2		30.3		30.3		45.3
2022		18.5		18.5		30.8		30.8		46.0
2023		18.8		18.8		31.3		31.3		46.8
2024		19.0		19.0		31.7		31.7		47.5
2025		19.3		19.3		32.2		32.2		48.2

W - Windfall. P - Prospective cost. a In mid-1995 values. b Uses ABS data. Assumes royalties and licence fees data account for one quarter of an 'average' patent's value, and that an Australian owned patent exploited overseas is worth the same amount as an Australian patent exploited in Australia. Assumes 33 per cent of applications for Australian owned overseas patents are sealed. This is the midpoint between the sealing rates of Australian owned Australian patents and overseas owned Australian patents. c As b, except assumes sealing rate of Australian owned overseas patents is the midpoint between the sealing rate used in the base case and the sealing rate of overseas owned Australian patents (43.5 per cent). d As b, except assumes patent licence fees and royalties data account for only 15 per cent of the value of an 'average' patent. e As d, except assumes royalties and licence fees data account for 40 per cent of the value of an average patent exported by Australian residents. f Uses Griliches data.

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