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CIGI Papers No. 120 – March 2017

Optimal Patent Regimes in a Globalized World: Lessons for Canada

Joël Blit



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About the Author

Joël Blit is a CIGI senior fellow researching the topic of innovation, including exploring intellectual property rights, closing Canada's innovation gap, and the link between Canadian immigration and innovation. Joël is assistant professor of economics at the University of Waterloo, with expertise in the economics of innovation, technology clusters, intellectual property, entrepreneurship and international trade.

About the Global Economy Program

Addressing limitations in the ways nations tackle shared economic challenges, the Global Economy Program at CIGI strives to inform and guide policy debates through world-leading research and sustained stakeholder engagement.

With experts from academia, national agencies, international institutions and the private sector, the Global Economy Program supports research in the following areas: management of severe sovereign debt crises; central banking and international financial regulation; China's role in the global economy; governance and policies of the Bretton Woods institutions; the Group of Twenty; global, plurilateral and regional trade agreements; and financing sustainable development. Each year, the Global Economy Program hosts, co-hosts and participates in many events worldwide, working with trusted international partners, which allows the program to disseminate policy recommendations to an international audience of policy makers.

Through its research, collaboration and publications, the Global Economy Program informs decision makers, fosters dialogue and debate on policy-relevant ideas and strengthens multilateral responses to the most pressing international governance issues.

Executive Summary

Patent regimes have been strengthened across the globe. This paper discusses the theoretical case for strong national patent regimes in the context of a globalized world. The national treatment of foreign inventors gives countries an incentive to free ride, and while this can be overcome through patent rights harmonization agreements, these present coordination challenges. In particular, while more innovative countries will benefit from harmonizing on a higher level of patent rights, less innovative countries will prefer a lower common level. These insights are applied to Canada, where both theory and empirical evidence suggest that Canada's patent regime is doing little to promote domestic innovation, while generating significant deadweight losses for the economy. The conclusion is that Canada's interests would best be served by a weaker national patent regime, subject to its current international obligations. Moreover, any future agreements that increase such obligations would *ceteris paribus* not benefit Canada.

Introduction

Over the last few decades, the protection of intellectual property rights (IPRs), and patent regimes in particular, have been strengthened across the globe. This is perhaps not surprising, given the shift toward a knowledge economy. Yet stronger protection is not necessarily warranted, and it is precisely because knowledge and innovation are playing an increasingly important role in the economy that setting an optimal level of IPR protection is more crucial than ever.

The debate over the optimal level of national IPR protection is ongoing. As pointed out by Keith Maskus and Jerome Reichman (2004), among others, the progressive strengthening of IPRs has been the result, not of a broad consensus among participants, but rather of a small group of powerful private interests exerting their power — with their lobbyists having sway over legislative and regulatory bodies. As a partial counterweight, a large and growing number of academic experts in the area are trying to advocate on behalf of the public interest. They point to the

lack of conclusive evidence that patents promote innovation. In fact, numerous studies have found quite the contrary — that patents stifle follow-on innovation (Murray and Stern 2007; Williams 2013; Galasso and Schankerman 2014). Academics and commentators argue that patents are now so strong, and are being awarded so easily, that they are generating impenetrable patent thickets that clog the innovation pipeline. Some are going as far as to assert that public welfare would best be served by the abolition of patents altogether.

Against this backdrop, there is the increasingly important discussion about how patent regimes fit into the broader international context. With the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), strong IPRs were thrust onto the global scene and its relative merits became a hotly debated topic. A particularly important flashpoint is the impact of this agreement on developing countries. Maskus and Reichman (2004, 283) neatly sum up the view of one camp in stating “to the extent that this imbalance [toward inventors and away from the public interest] makes it harder for entrepreneurs in developing countries to obtain inputs they need to compete in the production of knowledge goods, these countries could discover that the re-regulated global economy had in effect removed the rungs on which they could advance.” In the face of stalled multilateral negotiations, proponents of stronger patents are now seeking to further extend protection beyond what is required by TRIPS through free trade agreements, with the now-defunct Trans-Pacific Partnership (TPP) being a particularly good case in point, with several so-called TRIPS-plus provisions being included in the deal. Here too, scholars are warning that “there is mounting evidence that the effect of increased intellectual property standards via free trade agreements is stifling creativity and competition” (Frankel 2012).

The world is moving toward greater harmonization of IPR standards, both as a result of multilateral and bilateral trade and investment agreements, and because patent offices around the globe are increasingly cooperating. Smaller offices are taking the lead from the most important ones, such as the US, European and Japanese patent offices (Drahos 2010). This should please proponents of increased harmonization across patent offices, such as David Kappos and Stuart Graham (2012), who rightly point to benefits from different offices cooperating on the examination of patents. But such coordination

comes at the cost, for smaller countries, of no longer implementing policies that maximize domestic welfare and instead accepting patent policies that favour the more important players.

This paper begins by examining the theoretical case for patents, including a discussion of the benefits and costs of stronger patent regimes. It then places this analysis in the international context, outlining the free-rider problem generated by the national treatment of patent inventors and discussing how it can be overcome by harmonization. However, harmonization is not without its own challenges, as even in the absence of industry lobbying, countries will seldom agree on the optimal harmonized level of patent protection. As will be discussed, the fundamental problem is that patents generate royalty flows from less innovation intensive countries to more innovation intensive ones, resulting in the latter set of countries pushing for levels of harmonization that are above the level that would maximize global welfare.

Drawing on this discussion, this paper ends with an analysis of the relative merits of Canada's patent regime. As will be discussed, the case for having such a regime is weak at best, suggesting that Canadian welfare would be maximized by implementing the weakest possible domestic patent regime that meets existing international obligations. It follows that, in general, it is not in Canada's best interest that future international agreements (such as the TPP) further ratchet up patent protection, unless such provisions are absolutely necessary to strike agreements that bring significant benefits in other areas.

Patents in a Global Context

The Role of Patents

Patents exist to incentivize would-be innovators to invest in the development of their idea. The theory proposes that without patents, innovations would quickly be imitated, eroding the profits associated with the innovation, and therefore discouraging inventors from investing in their idea in the first place. That is not to say that patents are necessary for innovation to occur. Imitation

costs, imperfect (or lagged) knowledge flows, entry barriers or first-mover advantages could all provide sufficient incentives to innovation. But patents can, at least in theory, provide added incentives and result in higher levels of innovation.¹

There is, of course, one major downside to patents. As a result of the temporary monopoly that they confer, they result in higher prices and deadweight losses for society; and the stronger the patent system, the larger these losses. Thus, in theory, patents trade off static welfare losses arising from the temporary monopoly, for dynamic gains associated with the increased incentives to innovate (Arrow 1962; Nordhaus 1969). Much of the debate over patents has therefore been on how strong to make them so as to achieve this optimal tradeoff.

Unsurprisingly, the pro-patent lobby has been largely led by the pharmaceutical industry, which, along with medical equipment, is the industry where patents are most effective in appropriating product innovation (Cohen, Nelson and Walsh 2000). Opposing this view are an ever-increasing number of commentators and academics, many of whom are calling for the outright abolition of patents. In an influential paper, Michele Boldrin and David Levine (2013) argue for abolition, stating "the case against patents can be summarized briefly: there is no empirical evidence that they serve to increase innovation." Yet they acknowledge that outright abolition may be infeasible in the short run and propose an alternative approach that would phase out patents over time by gradually reducing their coverage and strength. Boldrin and Levine are, of course, not the only ones

1 While this paper focuses on this principal and direct potential impact on innovation, it should be noted that patents could also increase innovation both by facilitating the diffusion of knowledge and by creating a market for ideas. Increased diffusion could arise because patents are required to describe the technology in sufficient detail for someone skilled in the art to be able to reproduce the innovation. However, in practice, inventors (and their lawyers) have an incentive to not fully disclose their innovation and the disclosure requirement is not always effectively enforced by patent examiners. Furthermore, engineers developing a new product are often explicitly told not to search for related technologies in existing patents to avoid the possibility of a wilful infringement lawsuit (with its associated larger damages). Not surprisingly, then, Canadian high-tech firms do not rate patents as particularly useful sources of new information (Industry, Science and Technology Canada 1989). Patents can also create a market for innovations by establishing property rights, which facilitates transactions such as the licensing or sale of an innovation. This market for innovations can ensure that innovations end up in the hands of the agent that can use it most productively, such as, for example, the firm that has complementary assets such as a strong manufacturing operation and/or distribution channel.

to take such a dim view of the patent system. Many others also argue that the patent system is broken and patents are too strong (see, for example, Jaffe 2000; Bessen and Meurer 2008; Scherer 2009; Jaffe and Lerner 2011; Kahin 2016).

Patent Strength

The strength of patents derives from a number of main attributes: length, breadth, enforceability, coverage and restrictions on patent rights. The length (or term) of the patent refers to the number of years that the patent will be in force from the date of application, and hence the years that the patent holder will earn monopoly rents on the innovation. The patent's length is therefore directly correlated with its value. Breadth refers to how much intellectual material is covered by the patent. Breadth can be interpreted as the extent to which products that are nearby in product space infringe on the patent. Alternatively, breadth can be interpreted as how costly it would be to invent around the patent. Either way, the broader the patent, the more valuable it is because it more effectively restricts competition.

Enforceability of patents is also crucial. Courts must strike a balance between, on the one hand, awarding damages for infringement of valid patents and, on the other, invalidating patents that fail to meet the criteria for patentable material. This is particularly important given the oft-reported failure of the US patent office to uphold its own rules for what is patentable subject matter (see, for example, the infamous Amazon "one-click" patent no. 5,960,411, which can hardly be argued to be non-obvious; patent no. 6,025,810, which claims to transmit information faster than the speed of light by using the fifth dimension, which does not meet the utility criterion since it does not work; or patent no. 6,368,227, which claims a method of swinging on a swing by alternately pulling on one chain and then the other, which does not meet the novelty criterion since children have been doing this since time immemorial). Commentators have argued that since the Court of Appeals for the Federal Circuit was established in 1981 to hear appeals of patent cases, there has been a significant shift toward upholding patents that might before have been deemed invalid.

Patent coverage refers to the types of inventions that are patentable. The statutes in the United States maintain that to be patentable, an invention must be a machine, a manufactured

product, a composition made from two or more substances or a process for manufacturing objects. In practice, however, the patents office and the courts have stretched these definitions, awarding patents on life forms, on business methods and on software. Restrictions on patent rights have also been curtailed, with fewer countries imposing working requirements or applying compulsory licensing, both of which can also effectively limit the strength of patents.

Determining the optimal strength of patents is crucial. Patents that are too weak may not provide significant incentives for would-be innovators, and patents that are too strong generate needlessly large deadweight losses to society. If patent length is increased from 10 to 20 years, this will increase the incentives to innovate (any innovations that would not have recouped the investment over a 10-year monopoly period but are able to do so over 20 years will now be undertaken); however, it will generate larger deadweight losses, not only on the new innovations, but also on innovations that would have occurred anyway under the 10-year patent regime. Determining the optimal strength of patents would, therefore, necessitate full knowledge of all potential innovations, and for each of these their development cost, their value to society and their value to the firm both with and without a patent. Of course, the task becomes much easier if, as Boldrin and Levine claim, patents in fact do not promote more innovation. This view is supported by the findings of Mariko Sakakibara and Lee Branstetter (1999), who examine Japan's 1988 expansion of patent scope and find no effect of stronger patent protection on research and development (R&D). In this case, patents are unambiguously welfare destroying and should therefore be abolished. However, other empirical studies find that stronger patents can promote increased R&D, at least in certain industries and in more developed countries, although perhaps only up to a point (Kanwar and Evenson 2003; Allred and Park 2007; Qian 2007; Kyle and McGahan 2012; Park 2012; Blit and Zelaya 2015). Where the evidence is more clear is that strong patents can hinder follow-on innovation (Murray and Stern 2007; Williams 2013; Galasso and Schankerman 2014).

As discussed below, a second case where having a domestic patent regime is unambiguously welfare destroying is for a small, open economy in a global IPR context.

The Free-rider Problem

The 1883 Paris Convention for the Protection of Industrial Property established the principle of “national treatment.” Under this principle, all signatory countries agreed to treat foreign inventors from other signatory countries in the same manner as nationals. This applied both to the process for filing patents and to the protection and legal remedy against infringement that a patent holder enjoys. This same principle is now enshrined in TRIPS, a compulsory requirement for World Trade Organization (WTO) membership.

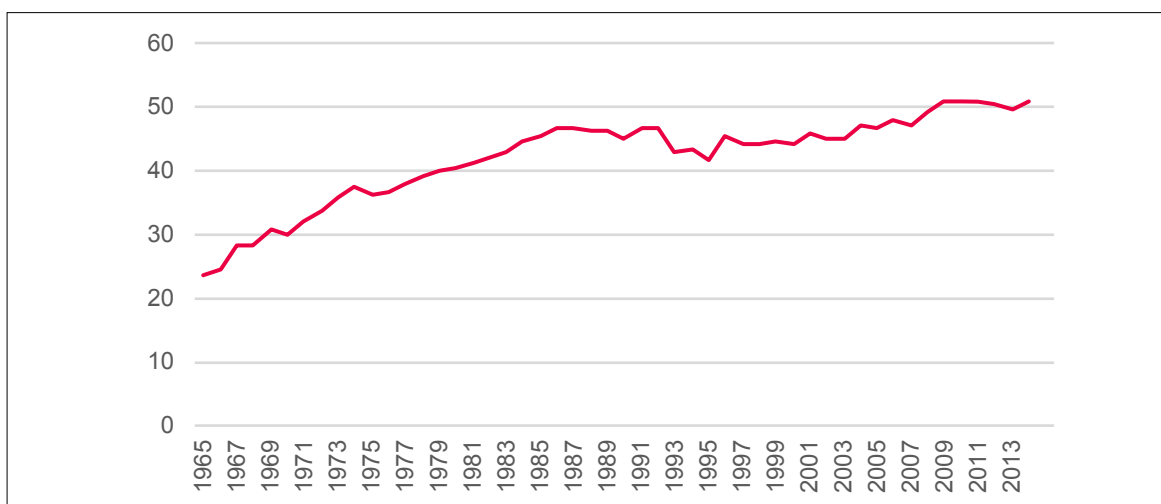
Given the widespread membership of the WTO, inventors can now patent their invention in all of the world’s largest economies — and, as a result of the ongoing integration of the global economy, they have increasingly done so. Today, in most patent offices, the majority of inventors are foreign. As shown in Figure 1, a little more than half of inventors filing a patent with the US Patents and Trademarks Office (USPTO) in recent years were foreign residents. Of the world’s 10 patent offices with the most applications, six exhibit more applications by foreigners than by natives. The trend is even more pronounced for smaller patent offices, with 22 of the top 30 offices having more foreign than domestic applications. The most notable exception is the Japanese Patent Office, where foreigners account for fewer than 20 percent of inventors, although this share has doubled over the last 25 years as the Japanese patenting system has become more similar to Western ones. A full

breakdown of the number of domestic and foreign patent applications in 2014 for the 40 patent offices with the most applications is presented in Table 1.

Given that most inventors take advantage of national treatment and obtain patents abroad, patent regimes would be expected to affect the incentives of both natives and foreigners alike. That is, when considering whether to invest in developing an innovation, a would-be inventor would compare the cost of development with the profits that they would derive not only in their home market, but also in foreign markets. Foreign patent protection should therefore also promote domestic innovation. Recent empirical evidence suggests this is indeed the case. Walter Park (2012) finds this to be true for patent protection in developed countries (which are the larger foreign markets). Joël Blit and Mauricio Zelaya (2015) find that, on average, firm R&D investment responds more strongly to changes in foreign patent strength than changes in domestic patent strength, particularly for firms in smaller economies.

Hence, given that all large patent offices embrace the principle of national treatment, it is less necessary to incentivize would-be innovators with strong domestic patents, since they may already be adequately incentivized by foreign patent regimes. This is particularly true for small markets, whose patents do not significantly affect

Figure 1: Percentage of Inventors on USPTO Patent Applications That Reside in a Foreign Country



Data source: USPTO.

Table 1: Patent Applications by Domestic and Foreign Residents (based on Residence of First-listed Inventor) for the 40 Patent Offices with the Most Patent Applications

Patent Office	Total Applications	Foreign Applications	Percent Foreign
China	928,177	127,042	13.7%
United States of America	578,802	293,706	50.7%
Japan	325,989	60,030	18.4%
Republic of Korea	210,292	46,219	22.0%
European Patent Office	152,662	77,167	50.5%
India	42,854	30,814	71.9%
Russian Federation	40,308	16,236	40.3%
Canada	35,481	31,283	88.2%
Brazil	30,342	25,683	84.6%
Australia	25,956	23,968	92.3%
Mexico	16,135	14,889	92.3%
Iran	13,802	119	0.9%
Hong Kong	12,542	12,350	98.5%
Singapore	10,312	9,009	87.4%
Indonesia	8,023	7,321	91.3%
Thailand	7,930	6,924	87.3%
New Zealand	7,728	6,092	78.8%
Malaysia	7,620	6,267	82.2%
South Africa	7,552	6,750	89.4%
Israel	6,273	5,148	82.1%
Turkey	5,097	331	6.5%
Ukraine	4,813	2,356	49.0%
Argentina	4,682	4,173	89.1%
Vietnam	4,447	3,960	89.0%
Philippines	3,589	3,255	90.7%
Chile	3,105	2,653	85.4%
Colombia	2,158	1,898	88.0%
Egypt	2,136	1,384	64.8%
Kazakhstan	2,013	271	13.5%
United Arab Emirates	1,472	1,443	98.0%
Peru	1,287	1,204	93.6%
Morocco	1,097	742	67.6%
Pakistan	922	776	84.2%
Algeria	813	719	88.4%
Saudi Arabia	787	135	17.2%
Belarus	757	105	13.9%
Uruguay	676	639	94.5%
Uzbekistan	568	223	39.3%
Costa Rica	568	552	97.2%
Tunisia	542	400	73.8%

Data source: WIPO Statistics Database.

Note: Figures are for 2014.

firm incentives.² For these countries, domestic patents offer a monopoly that inflates prices and generates deadweight losses, while providing little to no tangible benefit in terms of promoting additional domestic innovation. In fact, even larger countries will tend to implement weaker-than-optimal patent regimes, since the benefits of doing so accrue equally to all consumers and firms around the world and the costs are restricted to their country. That is, the principle of national treatment gives rise to potential free riding.

Harmonization of Patent Protection

To the extent that countries can each independently choose the strength of their patent regime (or even choose not to have a regime), they will each choose a patent strength that is well below what would be globally optimal. Fortunately, this free-rider problem is not difficult to overcome through the creation of binding multilateral agreements that establish a common/harmonized level of patent protection. The challenge, from the perspective of (rich) innovating countries, is to incentivize countries with few innovations to join such an agreement, since there is little benefit for them to do so. The richer countries have achieved this by embedding IPR harmonization in trade agreements.

There is no inherent reason why patent protection (and IPRs more generally) should be linked to trade agreements. In fact, until the 1990s, agreements on intellectual property were completely separate from trade agreements. Injecting IPRs into the General Agreement on Tariffs and Trade (GATT) in the form of the TRIPS agreement was perhaps the greatest victory of the US copyright and patent lobby. One justification for linking IPRs and trade is that the WTO offers a dispute resolution mechanism to settle disputes over non-compliance with IPR guidelines. However, the injection of TRIPS into the GATT largely seems to be a concession that less innovative countries made to more innovative countries (and, in particular, to the United States) within the broader GATT negotiations. As Suzy Frankel (2012) argues, in reference to Australia and New Zealand, net users of IPRs may be prepared to accept higher levels of harmonized IPRs if the free trade agreements that ratchet up IPRs also bring trade benefits.

This discussion hints at the primary challenge in overcoming the free-riding problem through an agreement that harmonizes IPRs. The optimal level of protection varies for different countries depending on their innovative intensity. That is, even if countries agreed to establish a common strength of patents, they would not agree on what this should be. Less innovative countries would optimally choose a lower harmonized strength of patents than a more innovative country, since, in a global system, patents generate monopoly profits that increase welfare in the innovator's home country through profit repatriation (while generating deadweight losses in the market issuing the patent). In general, the flow of profit will not be equal in both directions and *ceteris paribus*, the country receiving the net positive inflow will prefer stronger harmonized patents that increase the magnitude of these flows. They would, the theory suggests, advocate for an inefficiently high level of patent protection that exceeds the level that would maximize joint welfare.

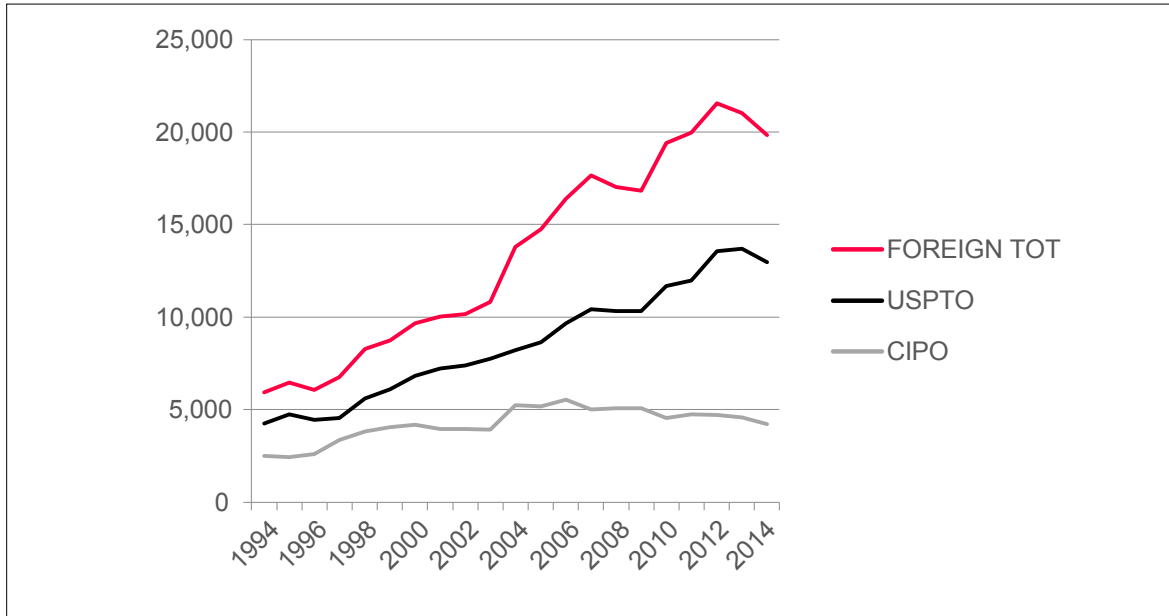
Suzanne Scotchmer (2006, 329–36) considers a simple model of two countries, each wanting to choose the harmonized level of patent protection that maximizes welfare in their country. One country can be thought of as being the home country and the other as being an aggregation of the rest of the world. In the model, the level of protection is the length of patents. A country's welfare depends on the home market consumer surplus and firm profits that accrue from innovations developed in the home country, the home market consumer surplus that accrues from innovations developed in other countries, the foreign market firm profits that accrue from innovations in the home country and the cost of home country innovations.

In the case of two identical countries, each country has the same number of innovators/firms, each selling their patented product in both markets. Because of the symmetry, consumer surplus, profits, deadweight losses, innovation costs and the monopoly profit inflow and outflow are the same for both countries for any level of protection. Thus, each of the two countries would choose the same optimal harmonized level of patent protection.

The same result will hold in the case where one country's economy is larger than the other's but the two countries' innovative intensity is the same (that is, if the larger country is twice as large it also produces twice as many innovations). The

² In such countries, domestic patents might have a significant impact only on the small subset of innovations that are country-specific.

Figure 2: Number of Patent Applications by Canadian Residents through CIPO, the USPTO and All Foreign Patent Offices Combined



Data source: WIPO Statistics Database.

magnitude of monopoly profit flows will depend not just on the number of innovations each country generates and sells abroad, but also on the size of the foreign market. Intuitively, monopoly profit inflow and outflow will be the same because while the smaller country has half as many innovations, it sells them in a market that is twice the size, earning twice the profit on each innovation. Thus, while not all of the four terms contributing to welfare will be identical in the two countries, they will balance each other in such a way that the countries will agree on an optimal harmonized level.

Disagreement arises when the two countries have different innovative intensities. Consider the case of two equally innovative countries (in terms of the absolute number of innovations), but where the home country is smaller. Here, the smaller (and hence more innovation intensive) country would optimally choose a higher harmonized level of protection because strong patents do not generate as large deadweight losses in a smaller country and because they increase the net profit flow into that country. Similarly, if the two countries are the same size but one is more innovative, the more innovative (and also more innovation intensive) country will optimally choose a higher harmonized level of protection. It could further be shown that this country would

choose a harmonized level of protection that is higher than that which would be chosen by a social planner that maximized joint welfare.

Consistent with the model's prediction, one view of the United States' push for ever-increasing global IPRs is that, as one of the countries with the highest innovation intensity, it is putting forth an agenda that maximizes its welfare by pushing for a level of patent protection that is beyond the level that would maximize global welfare. However, it should be noted that many experts believe that the United States has, in fact, pushed for IPRs that are much stronger than what would maximize even its own welfare because US IPR and trade policy has been captured by its strong IPR lobby (Ryan 1998). It is therefore entirely possible that the world has become subservient to the special interests of a handful of US industries, and global welfare may be lower as a result.

Lessons for Canada

With the previous discussion in mind, the paper now turns to the Canadian context and whether domestic patent protection benefits or hurts Canada. Does the existence of a relatively strong Canadian patent regime promote innovation in Canada? The paper then examines what Canada's position should be regarding the strengthening of global IPRs through trade agreements. As a case study, it examines the extent to which the further increase in the harmonized level of patent protection that was embedded in the TPP agreement was to Canada's benefit by determining whether Canada is more or less innovation intensive than its would-be TPP partners.

Canadian Patents and Domestic Innovation

As already discussed, the principal justification for having a patent regime is that it promotes domestic innovation. To the extent that this is true, patents trade off static welfare losses for dynamic gains. But as already discussed, a domestic patent regime is unambiguously welfare destroying for smaller economies that enjoy national treatment abroad. Canada is just such a country — its economy is small relative to the rest of the world and its innovators enjoy national treatment in the world's major markets (Canada joined the Paris Convention in 1923). The theory thus suggests that Canadian innovators would derive sufficient incentives to innovate from the existence of foreign patents in major markets such as the United States and Europe. The theory further predicts that the Canadian patent regime does little to promote domestic innovation. But to what extent is the empirical evidence consistent with this prediction?

If the existence of Canadian patents is an effective incentive for domestic innovation, Canadian innovators should be observed to be taking out patents through the Canadian Intellectual Property Office (CIPO). Thus, an examination of the relative number of patents that Canadian residents obtained in each of the USPTO and CIPO offers a first test. The results are surprising, and consistent with the view that CIPO provides very little incentive, if any, for Canadians to innovate.

A search of the websites of both CIPO and the USPTO for patents granted in 2000, with at least

one inventor residing in Canada, yields 1,129 CIPO patents and 4,300 USPTO patents. A similarly large gap can be observed for the most recent year of 2015, with 2,937 CIPO patents and 8,903 USPTO patents having at least one Canadian inventor. As shown in Figure 2, over the last 20 years, Canadians have consistently applied for far fewer patents in Canada than they have outside of Canada, with the United States representing more than half of all foreign patent applications by Canadians.

This relative lack of interest in Canadian patents by Canadian inventors suggests that Canadian patents may not be playing much of a role in promoting domestic innovation. Not only do most Canadian inventors not patent in Canada, it is likely that even among those who do, obtaining a Canadian patent is merely an afterthought, since obtaining a temporary monopoly in the larger US market is what is truly lucrative and, hence, more likely to drive incentives to innovate.

It is, of course, possible that Canadian patents are promoting domestic innovations that are only targeted at the home market. That is, perhaps there is little overlap between what Canadians are patenting in Canada and what they are patenting in the United States. There might be value in a Canadian patent system if, as proposed under this scenario, US patents incentivize a certain type of Canadian innovation (those innovations amenable to a world market) while CIPO patents incentivize innovation targeted at addressing Canadian-specific needs.

The plausibility of this scenario is studied by examining the extent to which patents taken out in Canada by Canadian inventors are also taken out in the United States. The first 100 CIPO patents applied for by Canadian inventors in the calendar year 2000 are considered. For each of these 100 patents, a search of the USPTO website is conducted to determine whether the same innovation is also protected by a US patent. While the search begins by finding patents with the same inventor names and/or title, a match is only allocated if the Canadian and US patents have identical or almost identical abstracts. This approach is conservative in that it is likely to find fewer matches than there actually are, either because the search is unable to find the matching patent (due, for example, to spelling errors in the inventor name or changes to the title), or because the criteria for determining a match is too stringent (for example, in cases where the abstract was

revised substantially between subsequent patent filings). In spite of this, it was found that 93 of the 100 Canadian patents had a corresponding US patent, with a further two patents having likely USPTO matches covering the same innovation. The small sample size notwithstanding, the evidence strongly argues against the scenario where CIPO patents play a different but still important role in promoting Canadian innovation targeted at the Canadian market.

Overall, it can be concluded from the actions of Canadian inventors that they care much more about receiving patent protection in the United States (and possibly also in other countries) than in Canada. Not only do they take out many more patents in the United States than they do in Canada, but it would seem that Canadian patents are a subset of the US patents taken out by these inventors. As such, and given the much larger size of the US market, it is highly unlikely that Canadian patents incentivize Canadian innovation to any significant degree, since the majority of patentable Canadian innovations are being patented in the United States (at least 93 percent of them, based on the small sample).

CIPO and Foreign Inventors

In Canada, the majority of patents are taken out by foreigners. As shown in Figure 3, Canadian inventors represent, on average, only about 13 percent of all inventors applying for CIPO patents over the last 10 years. In fact, Canada is singular among large and middle-sized economies in Canadian inventors' relative disuse of domestic

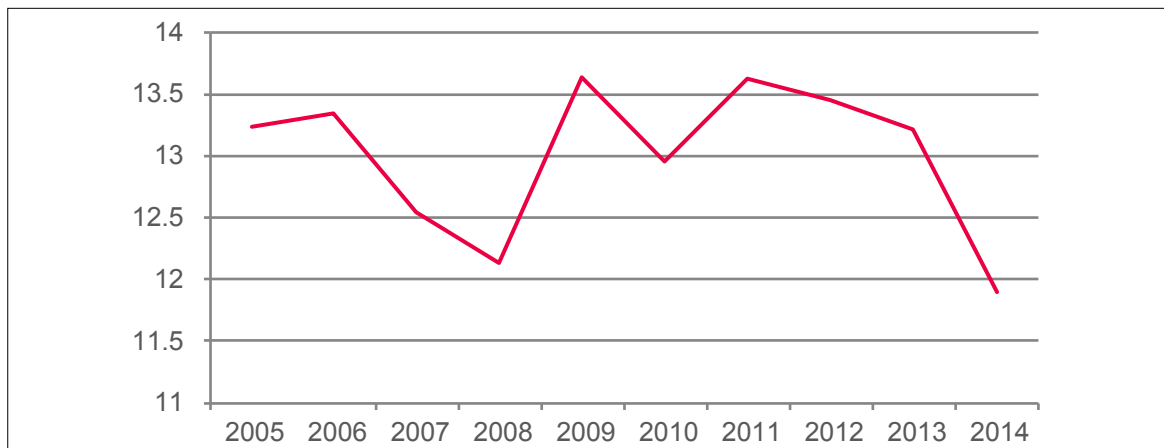
patents relative to foreign patents. Figure 4 plots — for different countries and for the year 2014 — the number of patents taken out in the USPTO (the most important patent office) as a fraction of the number of patents taken out in the home office. Here, too, it is seen that among the countries with larger markets, Canada is an outlier in its inventors' lack of use of the domestic patent office. These figures suggest that if Canada's strong patents indeed promote innovation, they mostly promote innovation abroad.

Canada and the TPP

The analysis of optimal harmonized levels of patent protection (see the section “Harmonization of Patent Protection”) offers guidelines for thinking about the extent to which the strengthening of patent regimes that was embedded in the TPP is good for Canada. The answer depends, first, on whether the ratcheting up of patent strength is primarily a result of lobbying by the IPR lobby, as many experts believe. If these special interests have managed to capture governments and push for a harmonized level of patent strength that is beyond the welfare-enhancing optimum for any country, then stronger patents (and even current patents) are unequivocally welfare destroying for all countries.

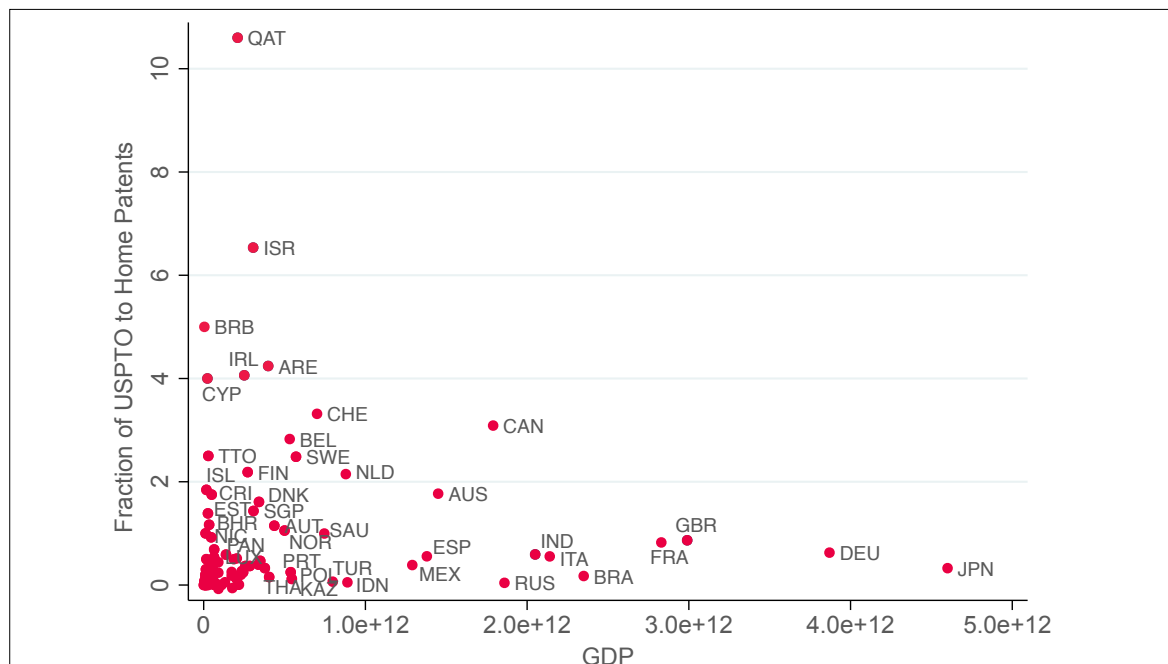
If, instead, it is assumed that special interests have not captured patent policy and countries have in fact always proposed the harmonized level of patent protection that maximizes their welfare, then Canada's position should depend on whether it perceives itself as being more or

Figure 3: Percentage of Canadian Inventors on CIPO Patent Applications



Data source: WIPO Statistics Database.

Figure 4: Fraction of Patent Applications to the USPTO Relative to Applications to the Home Patent Office for Inventors of Different Countries (as a Function of That Country's GDP in Current US dollars)



Data source: WIPO Statistics Database and World Bank World Development Indicators.

Note: Data is for 2014.

Country abbreviations: ARE = United Arab Emirates; AUS = Australia; AUT = Austria; BEL = Belgium; BHR = Bahrain; BRA = Brazil; BRB = Barbados; CAN = Canada; CHE = Switzerland; CRI = Costa Rica; CYP = Cyprus; DEU = Germany; DNK = Denmark; ESP = Spain; EST = Estonia; FIN = Finland; FRA = France; GBR = Great Britain; IDN = Indonesia; IRL = Ireland; ISL = Iceland; ISR = Israel; ITA = Italy; JPN = Japan; KAZ = Kazakhstan; LUX = Luxembourg; MEX = Mexico; NIC = Nicaragua; NLD = Netherlands; NOR = Norway; PAN = Panama; POL = Poland; PRT = Portugal; QAT = Qatar; RUS = Russia; SAU = Saudi Arabia; SGP = Singapore; SWE = Sweden; THA = Thailand; TTO = Trinidad and Tobago; TUR = Turkey.

less innovative than its would-have-been TPP partners. Specifically, if it has a higher innovation intensity than the GDP-weighted average of its partners (the “foreign” country in the model), then it can expect to receive a net inflow of monopoly profit and the strengthening of patents would be beneficial. Alternatively, if it has a lower innovation intensity than its partners, then any strengthening of patents will negatively affect Canadian welfare.

To determine Canada’s innovation intensity relative to its partners, patent data from the WIPO statistics database is combined with GDP data from the World Bank for the 12 Pacific Rim countries that drafted the TPP: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam and the United States. GDP is measured at market prices in current US dollars. A country’s level of innovation is measured using triadic patent counts, that is, the number of innovations that have been patented at all three major patent

offices: the USPTO, the European patent office and the Japanese patent office. The advantage of this measure over the number of patents in any single office (such as the USPTO) is that it helps remove home bias and bias due to strong trade ties with a single chosen patent office country. Triadic patents also have the advantage that they take into account, to some extent, the large variance in the value of different patents. That is, marginal innovations are rarely patented in all three patent offices and hence triadic patent counts are a better measure of the number of innovations that surpass some minimum value threshold. For each triadic patent, an application year is assigned based on the earliest year that a patent application for that innovation was submitted to any patent office worldwide. As before, the patents are assigned to countries based on the country of residence of inventors.

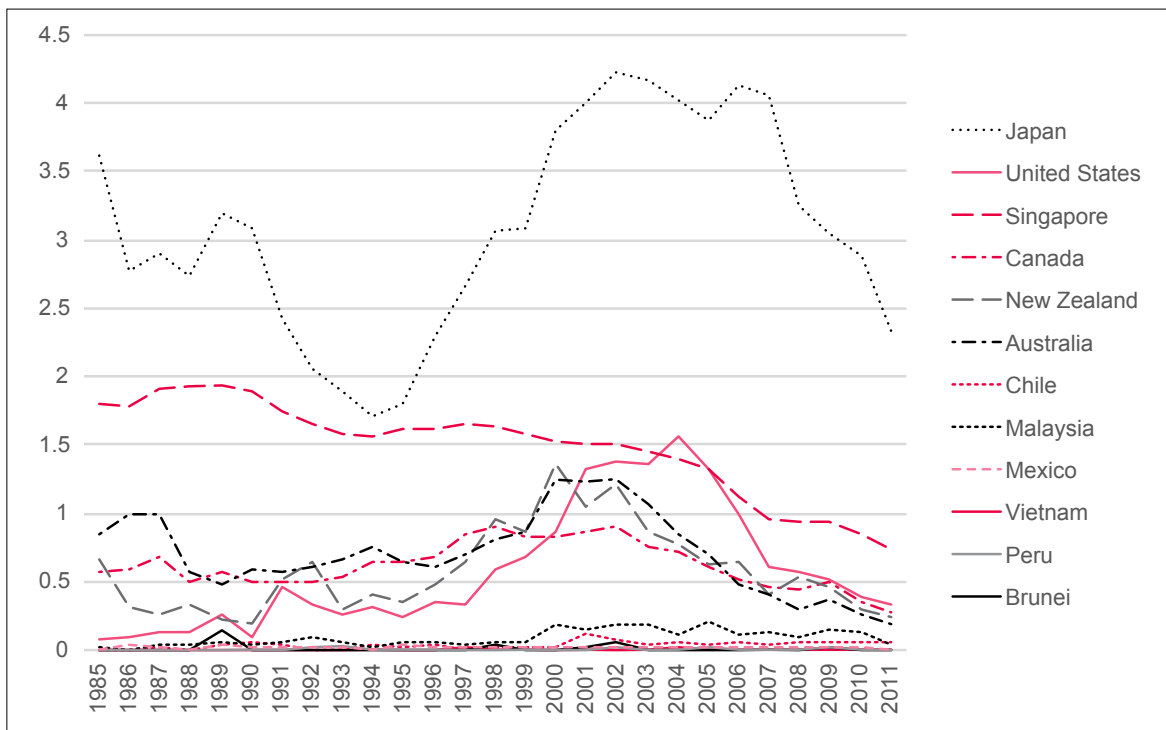
There are three principal drawbacks to using triadic patents. First, some patents are missed since not all valuable innovations are patented in all three patent offices. Second, data is only available for 1985 to 2011. Third, no data is available for Brunei Darussalam and Vietnam. To address the latter, USPTO patent counts for these two countries are used, and these counts are deflated by the ratio of USPTO to triadic patents taken out by the world in the respective year. For example, in 2011, the world as a whole had 503,582 USPTO patents and 43,449 triadic patents. Therefore, Vietnam's 13 USPTO patents and Brunei's zero patents are deflated to 1.12 ($13/503,582 \times 43,449$) and zero respectively. Regardless, neither of these countries is large or an important innovator, and they are, therefore, inconsequential to the analysis that follows.

Figure 5 plots the patenting intensity for each of the 12 partner countries over time. Canada is patent intensive relative to the majority of its TPP partners. In the latest year, 2011, only Japan, the United States and Singapore were more patent intensive. Thus, Canada could expect patent profit inflows to be larger than outflows with eight of its 11 trade partners.

However, what matters most is the direction of flows with the largest of the trade partners, since the magnitude of flows is proportional to the size of the market. For example, the fact that Canada would likely have positive inflows with Brunei matters little in welfare considerations because these flows, while positive, are likely to be tiny as a result of Brunei's small market size. What matters is the direction of flows with the largest markets, as these would be large, and increasing or decreasing them by choosing an appropriate level of patent strength harmonization is what will have the greatest impact on Canadian welfare. Figure 6 shows patenting intensity and relative market size for each of the 12 trade partners for 2011. The figure clearly shows that the two dominant markets are Japan and the United States — the two countries with the highest innovation intensity.

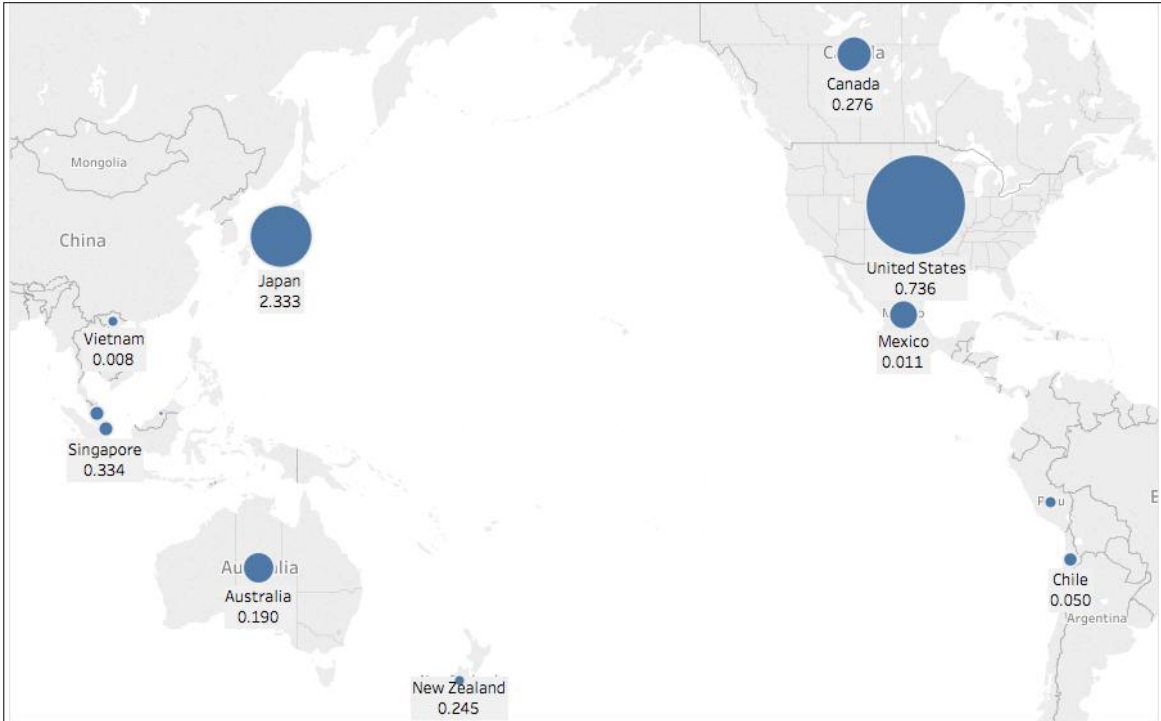
To determine whether Canada would benefit from a stronger or weaker harmonized patent strength with the sum of the trade partners as a whole, Canada's innovation intensity is compared with a GDP-weighted average of its trade partners' innovation intensity. Or, equivalently, Canada's innovation intensity is compared to the sum innovative output

Figure 5: Triadic Patenting Intensity (Number of Triadic Patents/GDP) for each Participant in the TPP, 1985–2011



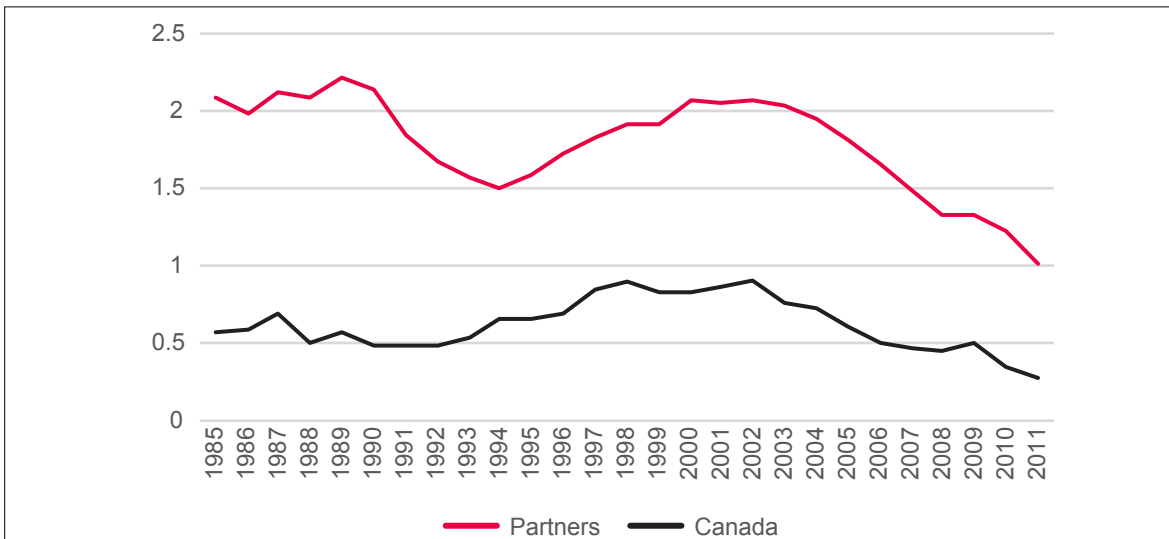
Data source: Author's own calculations using WIPO Statistics Database and World Bank World Development Indicators.

Figure 6: Relative Market Sizes (Represented by the Size of the Circles) and Triadic Patenting Intensity (Number below the Country Name) for each of the TPP Partners



Data source: WIPO Statistics Database and World Bank World Development Indicators.

Figure 7: Canadian and Weighted TPP Partner Patenting Intensity in Patents per Billion Dollars of GDP (1985–2011)



Data source: WIPO Statistics Database and World Bank World Development Indicators.

of its 11 trade partners, divided by the sum of their GDPs. For 2011, the weighted sum of Canada's TPP partners' innovation intensity is 1.01 per billion dollars of GDP. For Canada, it was 0.28 per billion dollars of GDP in that same year. As shown in Figure 7, Canada has consistently had a gap in innovation intensity relative to the weighted average of its TPP trade partners. This suggests that Canada is not best served by a stronger harmonized level of patent protection. In fact, the large discrepancy between Canada's innovation intensity and that of its aggregated trade partners suggests that stronger patent protection among TPP partners will generate significant welfare losses for the Canadian economy.

Conclusion

The basic theoretical case for patents is well established. Patents incentivize inventors to pursue innovations when they otherwise would not because of the threat of imitation, thereby trading static welfare losses for dynamic gains. The real merits of patents, however, are much less clear, with a number of studies showing that patents have no significant effect on innovation. In practice, the debate on how strong to make patents is further complicated by the fact that patent regimes operate in an international context where foreigners receive national treatment. This gives rise to incentives to free ride, and while this can be addressed through the harmonization of IPR, countries will not generally agree on the optimal harmonized level. In particular, more innovation intensive countries will push for levels of protection that are above globally optimal levels, since they would benefit from increased international royalty flows (at the expense of their partners).

Given this discussion, the prescription for Canada is simple. Canada is a relatively small and not particularly innovative economy. Theory suggests that in the Canadian context, having patents will lower welfare — generating deadweight losses while having a negligible effect on promoting domestic innovation. The empirical evidence supports this view. Only about 13 percent of Canadian patents are taken out by Canadian inventors, meaning that in 87 percent of cases, Canadian consumers suffer the higher monopoly prices associated with patents, while the economy

receives no additional incentives to innovation in return. Even for the 13 percent of patents with Canadian inventors, it is unlikely that the Canadian patent system played a significant role in incentivizing this domestic innovation, since most of these innovations are also patented in the much larger US market. As such, based on the evidence, it is difficult to make the case for having a Canadian patent system.

Nevertheless, two very valid cases can be made for having a Canadian patent system on other grounds. First, Canada wants to be a responsible global player and not free ride off our foreign partners' IPRs. That said, the current global patent frameworks were not written by Canadians or with the welfare of Canadians in mind. Rather, they were written by a small group of relatively innovative countries, with the view to maximize their welfare. In fact, that is the optimistic view. A more cynical, but altogether plausible, view is that the existing global IPR framework was written in response to pressure from the IPR lobby and that existing levels of IPRs are welfare destroying for all countries. Canada's responsibility is thus not to match US IPRs, which, irrespective of whether IPR policy was indeed captured by private interests or not, would make patents stronger than what a global social planner would choose. Rather, Canada has the right to adjust its patent system to more closely align to the harmonized patent strength that Canada would choose. This is what it means to be a responsible global player.

Second, Canada must live up to its existing TRIPS (and other international) obligations. While the abolition of our patent system would be a first best, Canada must remain a good partner and not disregard its international commitments. But as discussed, patents are not all or nothing. Canada has, as a country, significant leeway in how strong it chooses to make its patents. While Canada may not have much flexibility in some of the levers (such as the 20-year duration of patents), it does have flexibility in other dimensions such as what is patentable material, how narrowly patents should be defined, how patents should be interpreted by the courts, and restrictions on patent rights. These levers can be just as powerful in limiting the deadweight losses associated with patents, and also in ensuring that patent gridlock does not stifle innovation.

But for Canada to exert its sovereignty and implement policies that advance Canadians,

it cannot further constrain itself by signing agreements that strengthen patents and restrict its policy options. Canadian policy makers need to recognize that the continued ratcheting up of patent rights is not in Canada's best interest (nor is it in the interest of most other countries). In this respect, the TPP was not a good agreement for Canada in that it further strengthened an IPR regime that is already too strong. The only way a case can be made for signing onto the TPP or other such agreements is if they bring important trade benefits that outweigh the potentially significant IPR costs.

Contrary to the United States, whose patent system favours the interests of inventors, Canada has a system that has historically attempted to strike a balance between the interests of inventors and the interests of users (Maskus 2001). But Canada's system is increasingly becoming unbalanced, serving foreign firms at the expense of Canadians. In addition to Canadians bearing higher prices as a result of patent monopolies, the evidence suggests that, rather than encouraging domestic innovation, current patent systems could be stifling it. It is thus incumbent on Canada's policy leaders to develop IP policies that, while adhering to the country's international obligations, effectively stem the tide of ever-stronger patent protection.

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