NAFTA@10

John M. Curtis and Aaron Sydor

Editors

Foreword

The research assembled in this volume has been undertaken by academic and government researchers writing in a personal capacity. Foreign Affairs and International Trade Canada managed and assembled this volume with the objective of contributing to, and encouraging, debate on an issue of major importance to the Department, to the Government of Canada, and to Canadians. The views expressed in this volume, however, are those of authors and do not reflect the views of the departments represented in this volume or of the Government of Canada.

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The Potential Gains of Deeper Canada-US Regulatory Cooperation: A Cash Flow Analysis of Faster Drug Approvals

Doug Blair, André Downs & Fidèle Ndayisenga
Policy Research Initiative

Introduction

There is considerable evidence and widespread conviction that NAFTA has generated substantial economic benefits for Canada.[1] Recently, in the context of the 10th anniversary of NAFTA, concerns have been expressed that the full potential benefits of NAFTA are not being realized due, in part, to the different regulatory approaches of Canada and the United States. For a small economy whose trade largely depends on a single giant neighbouring market, it is important for Canada to carefully weigh the benefits and costs for its industry, governments, and citizens of maintaining exiting regulatory differences with the United States.

Research to date suggests that there are clear economic benefits to regulatory convergence between Canada and the United States. For example, Ndayisenga and Downs (2004) found that investment in Canada could have been substantially higher if our regulatory reforms had kept pace with the U.S. from 1976 to 1998. They also estimated that if the level of regulatory reforms in Canada had kept pace with U.S. levels over this time period, Canada's per capita income would have been, on average, 1.9% higher.

Much can be gained, therefore, by exploring ways and means in which regulatory differences can be bridged or their impact ameliorated. More regulatory co-operation with the United States would be one means to capture these economic benefits while simultaneously safeguarding and improving the integrity of the regulatory system.

The External Advisory Committee on Smart Regulations (EACSR) recognized this, and recommended "primary and immediate focus" on North American regulatory cooperation. Further, the Security and Prosperity Partnership of North America (SPP) agreement signed by leaders in March 2005 committed Canada, the U.S. and Mexico to work together to enhance North American regulatory cooperation to promote competitiveness, productivity and growth, while maintaining high standards for health and safety. The International Policy statement issued in April 2005 re-confirmed the Government of Canada's commitment to pursue regulatory compatibility within North America under this new partnership agreement.

[1] See Downs, 2004 and Canada, 2005. p.3.

One of the key policy questions now facing the Canadian government is where to focus efforts to deepen regulatory cooperation with the United States. This chapter begins to address this issue by examining the potential gains from faster new drug approvals: an area that has long been at the heart of the discussion of deeper regulatory cooperation.

First, the chapter discusses the reasons why drug approvals are the focus of the analysis; the cash flow model is then used to derive estimates of potential economic gains. Results from the cash-flow model are presented at the product level, and sector wide effects are derived from these estimates based on studies concerning the effects of new drug introduction on total drug expenditures. Macroeconomic effects are estimated using Statistics Canada input/output multipliers. Finally, potential societal benefits and limitations to the analysis are discussed.

Focusing on Regulatory Approvals

The EACSR (2004) observed a "lack of harmonization between Canadian and American regulations, approval processes, long wait times in Canada, and a 'tyranny of small differences' between Canada and the U.S." (External Advisory Committee on Smart Regulation 2003). Differences in regulatory requirements to get products approved or registered for the Canadian market impose additional costs on industries and consumers. Examples described in Blair (2004a) include the costs of additional testing for the Canadian market for pesticides products (specific Canadian field trials for residue, efficacy, and crop tolerance data) and for new chemicals. The EASCR (2004) cited differences in fortification of food and beverage products and trans-fat labelling, among others.

Differences in product standards between Canada and the United States can create impediments to domestic production (by shortening production runs to serve different markets or by diminishing the ability to promote products, secure investment, or service niche markets in Canada), and can impede the ability to export Canadian production to the United States, for example, differences in food product regulation (health claims, nutrition labelling, fortification) and differences in automobile standards (seat belt standards, daytime running lights).

Impediments to timely market access have been a particular concern across a number of economic sectors. For industry, regulatory decision times directly affect time to market that, in turn, affects the ability to earn a return on investment in product development. While these issues have been highlighted for many years, there is surprisingly little in the way of quantitative estimates of the actual economic implications of longer regulatory approval times and higher regulatory costs in Canada.

New drug approvals in particular have been the subject of much discussion, dating back to the 1992 Review of the Canadian Drug Approval System, also known as the Gagnon Report. The Gagnon Report argued in favour of improved timeliness and efficiency of new drug approvals while transforming the regulatory system as a whole. Since that time there has been an ongoing debate between establishing a timely and efficient regulatory system and the protection of Canadians.

In 2002, the Speech from the Throne introduced the Smart Regulation Strategy. A key commitment in the strategy was to "speed up the regulatory process for drug approvals to ensure that Canadians have faster access to the safe drugs they need, creating a better climate for research in pharmaceuticals." (Government of Canada, 2002).

The External Advisory Committee on Smart Regulation looked into specific regulatory issues surrounding the Canadian drug review process. The Committee determined that the drug approvals process in Canada is the slowest among industrialized countries, that it was lacking in transparency, that there are significant backlogs in the system, and that a slower process does not necessarily indicate a more rigorous regulatory regime, but rather a regulator with limited resources and capacity.

The Committee suggested that Canada focus its energies in areas where the potential for risk is greater, or where Canada can contribute value-added to the regulatory process. It recommended developing a Canadian framework for international regulatory cooperation as a means to developing a more strategic regulatory approach, "when an independent Canadian process does not add to the quality of outcomes." (External Advisory Committee on Smart Regulation, 2004).

What would be the economic consequences of enhanced regulatory cooperation with the US? For the purposes of the analysis presented here, we attempt to estimate the potential economic gains that could accrue if regulatory cooperation with the U.S. (either bilateral or unilateral) led to a reduction in decision times for new drugs. It should be noted that there may be other means to reduce regulatory decision times for new drugs, such as adding resources to the drug review process in Canada.

A Cash Flow Model

To assess these issues, we use a cash flow approach to compute measures of the profitability of commercial ventures including R&D projects, and to assess the impacts of regulatory costs on firm decision-making. Cash flow models have the advantage of capturing not just the hard costs, such as those of research and development, production and marketing, and regulation, but also the potential opportunity costs, as well as the risks and uncertainty of investments. A cash flow analysis better captures the dynamic nature of investment decisions and a full range of the financial considerations of businesses.

Heller (1995) developed quantitative estimates of the impact of regulatory delays using discounted cash flow scenarios for commercializing biotechnology products in Canada and the United States. Heller found that the profitability of drug firms is most seriously affected by protracted delays in regulatory approval. Heller estimated that if regulatory approval delays were reduced by 2 years, it would improve the rate of return on investments for drug firms by at least 5.5 percentage points.[2]

[2] Background Economic Study of the Canadian Biotechnology Industry. James G. Heller Consulting Inc., June 1995.

More recently, DiMasi (2002) studied a sample of 68 randomly selected investigational drugs from 10 pharmaceutical firms to determine the effects of shorter development and regulatory review times on capitalized costs for the drug industry. DiMasi found that a 50% reduction in regulatory review times would reduce capitalized costs by 7.6%.

Schwartz (2003) also developed a model to estimate the financial impacts of product approval delays at the firm level. While Schwartz bases his work on the pharmaceutical industry, he notes that the model can be used to evaluate the effects of regulatory delays on net present value for any product approval process.

Grabowski et al (2002) developed a rate of return model to examine the worldwide returns on R&D for drugs introduced into the U.S. market. The study assesses the impact of changes in various model parameters (margins, tax rates, sales profiles, cost of capital and regulatory review times) on after-tax cash flows, R&D costs, net present value and internal rates of return.

Cash flow modeling has also been used in regulatory impact analysis in the United States. The U.S. EPA Office of Pollution Prevention and Toxics developed a cash flow model to assess the impacts of regulations on biotechnology products in 1997 (United States Environmental Protection Agency, 1997).

Using the academic literature as a guide, a basic cash flow model of regulatory cost was developed and then applied to the issue of new drug approvals. The analysis involved developing "typical" product profiles for new human drugs based on estimated product development costs, expected regulatory costs and approval times, market sales over the product life-cycle, and the average number of new drug products introduced to the Canadian market each year.

The cash-flow model was applied to simulate the effects of various policy scenarios (reduced regulatory decision times and reduced regulatory costs – scenarios that might be achieved through greater regulatory cooperation with the U.S.) on sales, net income and rates of return for new products. Preliminary estimates at the product level were then used to derive sector-level estimates.

The model is of a general nature and can be applied to assess a range of policy options and how they affect private sector investment decisions.

A Basic Cash Flow Model

A basic model for examining firm decisions in light of regulatory costs considers changes in revenue and costs, as well as changes in one-time and annual regulatory compliance costs. The basic model can be expressed as follows:

$$PV = - CO - \int CA_t \, e^{-rt} \, dt + \int \pi_t q_t \, e^{-rt} \, dt$$

Where;
q_t = quantity sold in period t
π_t = is profit per unit in period t
CA_t = annual regulatory compliance costs in period t
CO = one-time regulatory costs
r = the discount rate.

A firm will find it profitable to enter the market if the present value of net revenues (i.e., profits) from the sale of a good or service exceeds the present value of the regulatory costs i.e. PV > 0.

In developing a model relevant to examining Canadian policy variables, we refined and added a number of important considerations that allow the model to focus on specific regulatory parameters, namely Canadian regulatory costs and regulatory decision times. We also refined a number of model parameters to reflect Canadian business realities.

The model with refined regulatory cost parameters is as follows:

$$PV = \int_{t0}^{T} [CF_t]\, e^{-rt}\, dt,$$
where $CF_t = Rev_t - RD_t - M_t - Rac_t - Rcc_t - TX_t$

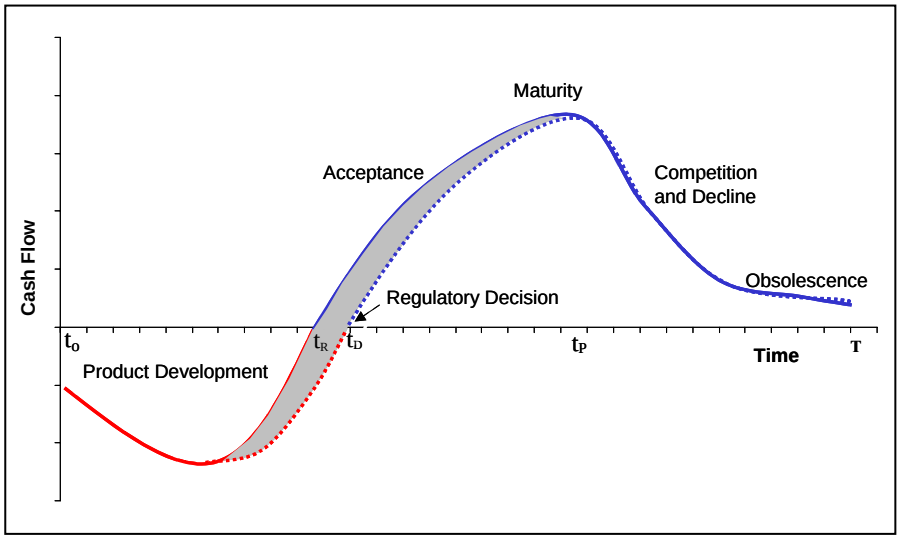
Where:
CF_t = Cash flow at time t
Rev_t = Revenues at time t
RD_t = Research and development expenditures at time t
M_t = Production and marketing cost at time t
Rac_t = Regulatory approval costs at time t; and
Rcc_t = Ongoing regulatory compliance at time t.
TX_t = taxes at time t

Regulatory Decision Times

A regulatory "delay" can be defined as the difference between the expected time of decision (i.e., based on performance standards set by the regulator, or based on decision times observed in other jurisdictions) and the actual time of regulatory decision.[3] Figure 1 shows a stylized depiction of the life-cycle cash flows for a patented drug product where sales peak around the time of patent expiry, followed by a sharp sales decline due to generic competition. The product life-cycle covers the period $T\text{-}t_o$ where t_o is the date at which product discovery and development begins and T is the date at which sales are no longer viable to maintain the product on the market.

[3] For a detailed discussion of factors that influence decision times, see Public Policy Forum (2003).

Figure 1: Stylized Cash Flow Scenario for a Regulated Product



The shaded area represents the change in cash flow resulting from faster regulatory decisions.

The net present value of the cash flow in Figure 1 is given by:

$$PV = \int_{t0}^{tR} [CF_t]e^{-rt}\,dt + \int_{tR}^{TD} [CF_t]\,e^{-rt}\,dt + \int_{TD}^{TP} [CF_t]e^{-rt}\,dt + \int_{TP}^{T} [CF_t]e^{-rt}\,dt$$

$\int_{t0}^{tR} [CF_t]e^{-rt}\,dt$ is the value cash flow from inception to expected time of regulatory approval;

$\int_{tR}^{TD} [CF_t]\,e^{-rt}\,dt$ is the present value cash flow lost or gained due to actual regulatory approval time;

$\int_{TD}^{TP} [CF_t]e^{-rt}\,dt$ is the present value cash flow during period of exclusivity (from entry restrictions, such as patent protection); and,

$\int_{TP}^{T} [CF_t]e^{-rt}\,dt$ = Present value cash flow after patent expiration.

As modeled, the direct cost of regulatory decision time has two distinct components. First, there are foregone sales because of the very existence of "delay". Second, in the presence of delays, sales occur at a later period than it would be the case in the absence of delay imposing a cost that can be attributed

solely to the time value of money. Our estimates of the impact of regulatory decision times include these two costs, but do not distinguish between them.

Limitations to the Analysis

The cash flow analysis summarized in this paper provides estimates of potential economic gains of faster approvals for new drug products in Canada. These estimates are based on synthetic scenarios of R&D and market size derived from the academic literature, not observed Canadian-specific data. We do not assess whether faster regulatory decisions in Canada would affect the quality of those decisions. Safety, quality and efficacy are held constant in the analysis, under the assumption that those new drugs that would be approved in Canada are simply approved sooner.

The cash flow model is a closed, static model: it assumes no other policy or economic changes (e.g., tax incentives, exchange rate fluctuations, etc.) and does not include dynamic effects such as potential increases in investment and higher rates of product introduction due to improved financial returns in Canada. Based on anecdotal evidence from industry, the hypothesis was put forward that faster decisions and lower regulatory costs would make more products financially viable in the Canadian market and increase the number of new products introduced in Canada each year. There are two potential effects:

- Our cash flow analysis suggests that potential rates of return could increase significantly if new drugs were approved more quickly. This could make more products financially viable in the Canadian market and increase the number of new drugs introduced in Canada each year.
- If faster decisions were achieved through granting of conditional approvals based on US approvals, then in theory we could expect as many new drug introductions in Canada as in the US (or about 200 more new drug approvals in Canada each year - a 75% increase over the current number of new drug approvals).[4]

However, these effects have not been estimated empirically.

Societal benefits are discussed, but not estimated empirically. A number of academic studies are cited which suggest that faster drug approvals could lead to decreased spending on other health care (e.g., hospital spending) coupled with long-term benefits to the health of Canadians (as measured by decreased morbidity, mortality, and improved quality of life).

Finally, we do not attempt to quantify the potential gains from more effective regulatory approaches. One of the recognized benefits of regulatory cooperation is to potentially improve the capacity of regulators to meet their health, safety and environmental objectives. The analysis contained in this paper focuses on potential cost savings to the regulated industries, but not on the potential gains to government regulatory programs. For a discussion of the potential effectiveness gains for regulatory programs, see Griller (2004) and Rawson, West and Appel (2000).

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[4] This is based on a 5-year average of the number of NDS and NAS approvals in Canada compared to NDA and NME approvals in the US over the period from 1999 to 2003.

Parameters and Assumptions Used in the Model

Below we describe the parameters we used in our cash flow model and draw comparisons to the parameters used in other studies.

R&D Expenditures:

Heller (1996) assumed R&D investment for a drug product of $100 million, and evenly distributed expenditures over a 10-year period. Schwartz used a similar approach, with the caveat that the distribution oversimplifies the relationship with the different phases of R&D. Grabowski et al (2002) used more recent estimates of $480 million in after-tax R&D expenditures from Di Masi for the average new drug. To develop scenarios typical to the Canadian market, we used estimates of worldwide R&D expenditures for product development, convert edto Canadian dollars, and scale based on the ratio of Canadian to worldwide market size. This assumes that the Canadian market is expected to recover its share of worldwide R&D expenditures for product development.[5] For new human drugs, we applied this approach to the $480 million Di Masi estimate. According to data from the Patented Medicine Prices Review Board (PMPRD), the Canadian pharmaceutical market represents 2.6% of the world market. The figure we then derive is a capitalized, after tax R&D contribution for a typical new medicine introduced in Canada of $16.9 million ($480 million x Can-US exchange rate x 2.6%).

Capital Costs and Depreciation:

Heller included capital costs of $50 million for manufacturing process development and quality control, written off using a straight-line depreciation in the first five years of income. We employed the same approach as Grabowski, allowing for plant and equipment capital expenditures equal to 40% of tenth-year sales, half applied in the 2 years prior to marketing, and the remaining distributed over the first 10 years of the product's market life.

Production/distribution Costs (COGS):

Heller assumed cost of goods sold (COGS) to be 40% of sales with 2% cost efficiency gains every 2 years. In Grabowski, COGS are 42% in the first year of product sales, and grow by 0.3% annually to 48% by year 20. The average of the 20-year period is 45%. We applied a contribution rate for production and distribution costs of 45% of gross sales in each year of the product life cycle.

Working Capital:

Heller applied working capital in the first year of sales. Like Grabowski, we estimated working capital to be two months of sales for accounts receivables and five months of sales for inventories. These costs are recovered from revenues in the final year of the product life cycle.

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[5] For a discussion of global product development R&D costs and returns from individual markets, see Jarvis (1998).

Marketing Expenses:

Heller applied marketing expenses valued at 10% of sales in each year of product life cycle. Grabowski found that marketing expenses are front-end loaded, valued at 100% of first year sales, 50% in year two, and 25 % in year three. He also allowed for pre-marketing launch expenditures beginning two years prior to product launch, valued at 5% and 10% of first year sales. We followed the Grabowski approach.

Taxes:

We used an effective corporate tax rate (federal + provincial) of 31.8%, as per C.D. Howe, June 2003. For R&D tax credits, we applied a rate of 20% to total R&D expenditures to reduce taxes in first year of sales.

Product Life Cycle and Market Size:

Heller assumed a market life to patent expiry of ten years, with peak sales of $265 million achieved in year two and remaining at that level until year twenty. Grabowski found that the top 10% sellers showed a rapid increase in sales from year zero to year ten, which then plateaus until year fourteen, at which point sales fall off drastically due to generic competition. They observed that the sales profiles for the next decile of products, as well as the mean and median sellers are much less pronounced, both in terms of growth and decline after patent expiry. For the purpose of developing typical Canadian scenarios, we adjusted the worldwide life-cycle patterns from the Grabowski analysis to better reflect the Canadian market. Grabowski's worldwide market profiles are skewed towards the reality of the dominant EU and US markets, where patent term restoration exists. We develop our Canadian market scenarios assuming that peak sales would occur in years nine through twelve, and decline thereafter. Figure 2 provides a comparison of the Grabowski life cycle patterns with our version, applicable to the Canadian situation.

In the absence of time-series sales data for new medicines in Canada, we base our product sales estimates on data from the PMPRB. The PMPRB reports total sales of patented drug products in Canada of $8.8 billion, which implies an average of about $22 million per patented drug.[6] Using this as our basis, we develop product life-cycle scenarios for a top 10% seller and an average seller in the Canadian pharmaceutical market, as shown below in Figure 3. Market scenarios were segmented into top selling and average selling products to give a more accurate depiction of the markets for new drugs in Canada. This approach yields estimates of peak sales for a top 10% seller in Canada of about $200 million. For average sellers in Canada, our approach suggests peak annual sales of about $40 million.

[6] Based on data from the Patented Medicine Prices Review Board we estimate that the number of 1,027 patented medicines in Canada in 2002 represents about 400 active substances (which includes various strengths, package sizes and presentations of the active substance) -- from various Annual Reports of the Patented Medicine Prices Review Board (<http://www.pmprb.gc.ca/>).

Figure 2: Market Life-Cycles for Top Selling Drugs, Worldwide and in Canada[7]

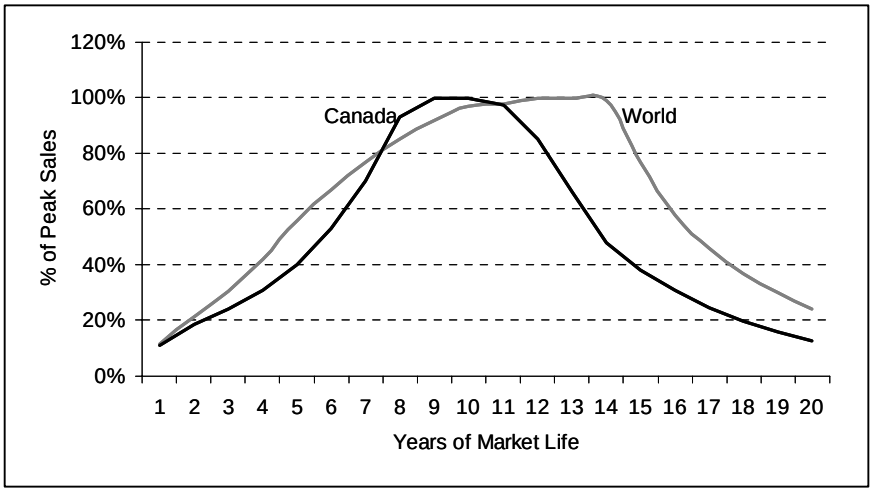
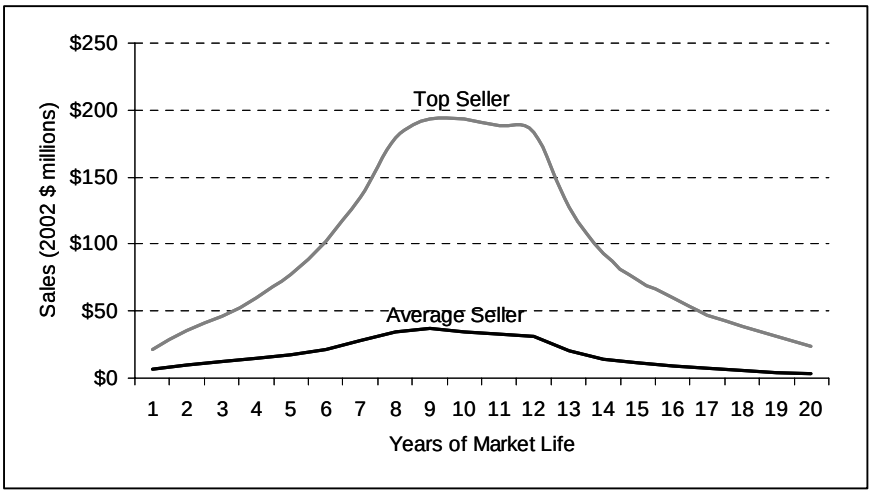


Figure 3: Top and Average Seller Product Life-cycle Scenarios



[7] The world life-cycle pattern is based on data from Grabowski (2002). The Canadian product life-cycle pattern is an estimation, based on the Grabowski analysis, but modified to better reflect the Canadian market situation for new drug products.

Regulatory Approval Costs:

We assume Canadian-specific approval costs to be $2.5 million, and submission evaluation fees of $250,000. Approval costs are distributed over the five years prior to submission for review; fees are assumed to occur in the year of submission.

Ongoing Regulatory Compliance Costs:

We set these costs at 0.1% of sales for each year of sales. Ongoing regulatory fees were set at $1,000, applied to each year of sales for the product life cycle.

Analytical Results

Below we provide a summary of the potential impacts of six and twlve-month faster decisions for new human drugs, and 50% reduction in Canadian specific regulatory approval costs.

Top Seller Scenario*

Policy Scenarios	Rate of Return		Net Income		Sales		
	%	% Change	PV ($M)	% Change	PV ($M)	% Change	PV Sales Impact ($M)
Baseline Scenario	20.0%		$163.0		$897.3		
6 Month Faster Decision	20.7%	3.7%	$177.8	9.1%	$986.5	9.9%	$89.3
12 Month Faster Decision	21.4%	7.2%	$192.7	18.2%	$1,075.8	19.9%	$178.5
50% Reduced Canadian Specific Approval Costs	20.4%	2.3%	$165.0	1.2%	$897.3		
12 Month Faster Decision and 50% Cost Reduction	21.9%	9.5%	$194.7	19.5%	$1,075.8	19.9%	$178.5

* Assumes peak sales at $200 million, 5% discount rate.

Average Seller Scenario*

Policy Scenarios	Rate of Return		Net Income		Sales		
	%	% Change	PV ($M)	% Change	PV ($M)	% Change	PV Sales Impact ($M)
Baseline Scenario	13.4%		$44.3		$289.9		
6 Month Faster Decision	13.7%	1.5%	$45.7	3.0%	$305.7	5.4%	$15.8
12 Month Faster Decision	13.9%	3.0%	$47.0	6.0%	$321.4	10.9%	$31.5
50% Reduced Canadian Specific Approval Costs	13.9%	3.5%	$45.6	2.9%	$289.9		
12 Month Faster Decision and 50% Cost Reduction	14.3%	6.6%	$48.3	8.9%	$321.4	10.9%	$31.5

* Assumes peak sales at $40 million, 5% discount rate.

Our model suggests a present value sales impact of $90 million or $180 million for a top selling drug, for a six-month and twelve-month faster decision respectively. This represents, on average, 9.1% to 16.6% of the present value sales over a twenty-year product life cycle. For average sellers, our model suggests a present value sales impact of $15.8 million to $31.6 million, or 5.2% to 9.8% of sales over a 20-year product life cycle.

In terms of net income, annual gains were estimated to be 8%. Rates of return on new products were estimated to increase by an average of 4.8%, ranging from 4.4% to 5.3%.

Sector-Wide Effects

Data from the PMPRB show that an average of 23 new active substances are introduced to the Canadian market each year.[8] To estimate sector-wide effects of faster drug decisions, we assume that the top sellers (top 10%) would be substantially improved products - about two per year. We assume the remaining twenty-one medicines would be average sellers.

[8] 5-year average from 1997 to 2002. PMPRB Annual reports (<http://www.pmprb.gc.ca>).

Policy Scenarios	Rate of Return		Net Income		Sales		
	%	% Change	PV ($M)	% Change	PV ($M)	% Change	PV Sales Impact ($M)
Baseline Scenario	14.7%		$1,457		$8,611		
6 Month Faster Decision	15.0%	2.2%	$1,520	4.3%	$9,155	6.3%	$544
12 Month Faster Decision	15.3%	4.1%	$1,583	8.6%	$9,699	12.6%	$1,088
50% Reduced Canadian Specific Approval Costs	15.2%	3.0%	$1,491	2.3%	$8,611		
12 Month Faster Decision and 50% Cost Reduction	15.8%	7.2%	$1,618	11.0%	$9,699	12.6%	$1,088
Average	15.3%	4.2%	$1,553	6.6%	$9,291	10.5%	$907

Potential annual gains in the present value of sales for new drug products averaged over $900 million, or an average 10.5% increase. By this we mean that, based on various scenarios of reduced regulatory decision times and costs for industry, the present value of their sales over the life-span of a basket of new drug products normally introduced in one year would be about 10% higher on average than the current present value.

In terms of net income, annual gains were estimated to be 6.6% in the present value of net income from the basket of new drugs normally introduced in one year. Average rates of return on new products were estimated to increase by 4.2%.

Indirect and Induced Effects

As noted above, our estimates of the impact of faster approvals on the present value of sales to firms do not equate to increased sales in the marketplace. To assess the induced effects on the economy, we need to understand how faster approvals could affect firm output as measured by growth in market sales.

There has been considerable study of the numerous factors that affect the overall growth in drug sales, including changes in utilization of drugs; changes in prescribing habits of physicians; a tendency to prescribe and use newer and more expensive drugs; a trend towards using drug therapy instead of other treatments; changes in total population; changes in demographics and health status of the population; and the emergence of new diseases to be treated and old diseases which can now be treated more effectively (Patented Medicines Prices Review Board, 1999).

While some of these influences might have been captured in our market profile scenarios for individual products that were based on Grabowski's

worldwide product profiles, the simple addition of the product level results from our model might not reflect the practical effect of those factors listed above on sales of new drugs in the Canadian market.

To better assess the potential economic effects in Canada, we examined the trend in total Canadian prescription sales from 1988 to 2002 and the extent to which rates of real growth in prescription drug sales can be attributed to the introduction of new drug products.

The most recent studies from the US indicate that utilization and cost effects of new drugs account for between 37% and 68.5% of overall growth in spending on prescription drugs. Estimates of future impact of new drugs range from 30 to 40% (Merlis, 2000). Canadian studies indicate that new drugs can account for between 30% and 101% of the growth in provincial expenditures on prescription drugs (PMPRB, 1999).

Based on these cost driver studies, we assume that 40% of the increase in future prescription drug expenditures can be attributed to new drug introductions.[9] We then applied this rate to the present value of annual increases in prescription drugs, to calculate the impact of faster new drug approvals in Canada (six and twelve months, as above).

Our analysis indicates that, on average, a six-month faster decision time for new drugs would increase total prescription sales by 1.4% annually. A twelve-month faster decision time would increase sales by 2.7% annually. This implies increased annual sales of new drugs of between $200 million and $400 million, based on the total sales of prescription drugs in 2002 of $14.6 billion. (Canadian Institute for Health Information, 2003).

Below, we use the estimated annual increase in sales ($200 million and $400 million) to assess R&D, growth and employment effects on the economy.

R&D, Growth and Employment Effects

Data from the PMPRB indicates that, on average, 10% of sales are invested in R&D in Canada by the human pharmaceutical industry. Applying this investment rate, we calculate that additional investment in R&D in Canada of between $20 million and $40 million could occur annually if new drugs were approved six or twelve months faster, respectively. This represents an increase in R&D investment of about 2% to 4% for this industry sector.[10]

To estimate the economic growth and employment effects of an increase in output, indirect effects on intermediate industries and suppliers are captured using multipliers from Statistics Canada's national input-output model (Statistics Canada, 1998). We introduced the estimated sector impacts from faster new drug approvals to the I/O model as a one-time shock to manufacturing output.

The I/O multipliers provide estimates of the value of increased business activity in one sector on all other sectors of the economy. They do not take into account the induced business effects from spending or saving by households or the

[9] The sales weighted average across the 6 provincial drug reimbursement plans studied by the PMPRB is 49%, as is the simple average of the 3 US study results.

[10] Based on annual R&D expenditures of $1,051 million, Statistics Canada (2004b).

government sector of the increased income.[11] This approach also implies that the potential growth in the pharmaceutical market from faster new drug approvals is a one-time occurrence: it does not enable us to track the cumulative annual effect of increased sales over time. Results should be viewed as long-term effects of a one-time shock to the pharmaceutical market.

Output and Employment Effects (upstream only)

	Industry Sector Values[12]	6 months faster (+$200M/yr)	12 months faster (+$400M/yr)
Increase in Total Output	$14.6 billion	$344 million (2.4%)	$688 million (4.7%)
Direct effect on GDP	$5 billion	$66 million (1.3%)	$133 million (2.6%)
Total direct and indirect effect on GDP		$134 million	$268 million
Direct effect on employment	27,400	1,119 (4.1%)	2,237 (8.2%)
Total direct and indirect effects on employment		2,338	4,676

Potential Societal Benefits

Faster regulatory approvals of new drugs could increase drug expenditures for provincial health plans, private insurers and consumers. But would the potential benefits of these increased expenditures justify the costs?

There have been many studies of the long-term impacts of increased expenditures in health care on mortality, morbidity and quality-adjusted years of life. We cite findings from a number of more recent studies below.

Health Canada's report, Economic Burden of Illness in Canada, assesses the direct and indirect costs of illness in 1998, as determined by the opportunity costs to society of illness or injury (Health Canada, 2002). The report estimates that in 1998 the total cost of illness in Canada was $159.4 billion. This includes direct health care costs of $83.9 billion and indirect costs of $75.5 billion. Hospital care expenditures represent the largest direct cost at $27.6 billion. Major components of the indirect costs include the value of production lost due to long- and short-term disability, which is estimated to be $42 billion. This provides a measure of the potential savings that could be gained if illness and injury were prevented, but it does not address savings due to increased longevity and improvements in quality of life, and it does not assess the potential effect of new drugs on reducing health care costs.

The National Bureau of Economic Research (NBER) has published a number of papers on the benefits and costs of newer drugs. In a series of these

[11] Multipliers from the Canadian Open Output Determination Model, based on the Preliminary 1992 Input-Output Tables for total manufacturing.
[12] Sector information are from Statistics Canada (2004a).

studies, Lichtenberg (2002) conducted an econometric investigation of the contribution of pharmaceutical innovation to mortality reduction and growth in lifetime per capita income. Results showed a highly significant positive relationship across diseases between life expectancy and rates of introduction of new drugs.

Overall, estimates from the literature suggest that faster drug approvals in Canada could:

- Lead to savings in other areas of health care. For example, Lichtenberg (2002) found that that new drugs lead to a reduction in non-drug expenditures at a rate 7.2 times as much as they increase drug expenditures;
- Generate long-term health benefits. For example, MedTap (2003) provides estimates from a number of recent studies of the value of expenditures in health care in the US. These analyses suggest that each additional dollar spent on health care in the past twenty years has produced health gains worth $2.40 to $3.00;
- Generate societal returns on research and development. For example, a major study of returns to investment in health care found that overall, annual societal rates of return lie between one and five times R&D expenditures (Australian Society for Medical Research, 2003).

Conclusion

In 2003, the Government of Canada launched a new approach to the management of pharmaceuticals in Canada called the Therapeutics Access Strategy (TAS). The main objectives of the TAS are to improve the timeliness of reviews, as measured against international benchmarks, to exercise greater vigilance post-approval, through better surveillance, and finally, to improve access to therapies and contribute to the long-term sustainability of the health system. Improved regulatory cooperation is a key feature of the TAS.

In November 2003, a Memorandum of Understanding (MOU) was signed between Health Canada and the U.S. Food and Drug Administration (FDA) regarding the sharing and exchange of information about therapeutic products. The purpose of this MOU is "to enhance and strengthen the exchange of information and existing public health protection cooperative activities related to the regulation of the specific therapeutic products" (Health Canada and the United States Food and Drug Administration 2003). Since signing the MOU, Health Canada and the FDA have held discussions to identify potential areas for joint projects, and to develop a framework for collaboration activities in product quality, bioequivalence, and compliance.

Based on the results shown here for new drug approvals, our assessment is that if these commitments to greater regulatory cooperation lead to concrete improvements in the speed of regulatory decisions, the economic benefits to Canadians could be substantial.

Societal benefits could also accrue. The academic literature suggests that faster approval of new drugs that represent breakthroughs or substantial improvements in patient therapy could reduce spending on other health care and increase long-term health benefits to Canadians. The literature also suggests

regulatory cooperation could improve regulatory protections by allowing regulators to benefit from the expertise of other jurisdictions, and to focus their limited resources on areas of highest risk to Canadians.

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