Prescription Drug Importation, Investment and Employment in Michigan

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Executive Summary

Authorization of the importation of prescription drugs from countries with lower prices than the United States is an increasingly attractive proposition for state and federal policy-makers. The short-run benefit of reductions in prices of selected prescription drugs for selected patients may be viewed as a sufficient reason to favor importation. However, there may be longer-run effects of importation of prescription drugs that are less desirable, including reduced investments and altered regional investments in pharmaceutical research and development.

With separate approval processes used in different markets, pharmaceutical companies practice price discrimination. Prices of prescription drugs are higher in the United States than in most countries that have negotiated discounts or set prices. Differences in prices between the United States and other countries of one-third to one-half may provide the opportunity for firms in a low-price country to export a drug to high-price country at a profit – giving rise to the concept of "importation" from the perspective of the high-price country. Currently, importation of prescription drugs from Canada to the United States may exceed $1 billion.

Public policies, such as current Senate Bill 2328, The Pharmaceutical Market Access and Drug Safety Act, could permit sales of imported prescription drugs. Prior research has suggested limited effects of importation because pharmaceutical companies have limited the export of drugs, but legislation could limit this practice. Further research has found that much of the price benefit of importation may be captured by firms involved in the distribution of drugs.

Pharmaceutical industry research and development (R&D) investments in the United States exceed $32 billion per year and have been steadily increasing over the past two decades. The implementation of importation policy could result in a rapid opening of distribution

channels into the United States. With the lowest international prices being adopted (with prices closer to production and distribution costs), the returns on investment would fall and R&D spending would quickly be reduced. Three scenarios of R&D investment reduction are considered: (1) Creation of an international market with global prices, (2) Mechanisms for export control, and (3) Legislative relief.

Even with the creation of an international market, R&D investment would not cease immediately, but it would slow rapidly by 75% reduction over two to three years. After transitioning to a new, lower level of R&D, I suggest that the upward trend in research may resume. The overall incentives for more R&D investment, including basic science and clinical advancements may continue along current trends. However, any such upward trend would be dwarfed by the initial decrease in R&D investment.

The export control scenario suggests investments at 50% of current levels after three years, with the upward trend continuing thereafter. The Congressional Budget Office's review of importation legislation focused on export control in the short-run and uniformly high world prices in the long-run as reasons why importation would not significantly affect drug spending. Similar to limited export control, the restriction of new drugs to the United States market would also limit sales and investments to 50% of current levels.

A third scenario considers the case where the legislation itself is changed during or shortly after passage. Full implementation of importation policy may not be politically viable. For purposes of symmetry, not necessarily precision, I suggest a 25% reduction in R&D investments associated with legislation that is repealed. With legislative relief, R&D investments may return to current levels over time, but not to the current trend level. Investors' confidence in the ability of pharmaceutical companies to provide appropriate, risk-adjusted rates of return would likely be forever diminished.

With a decline in R&D investment of 25% to 75%, pharmaceutical companies will have to decide where to physically invest in employment. While Michigan has been an attractive

state for life sciences, it may not remain so in the future. Estimates of the economic impact in the State of Michigan in terms of jobs and personal income are prepared with a standard multiplier analysis and data from the Bureau of Labor Statistics. In addition to direct job loss associated with reductions in R&D, there would be an indirect effect of job losses at suppliers and induced effects of job losses at support industries, resulting in a six-fold impact on employment and personal income. Accordingly, the pharmaceutical industry in Michigan currently represents 74,492 total jobs and $3 billion in personal income.

The likely effects of prescription drug importation would be substantial job loss in Michigan and substantial reduction in personal net income over the next decade. Under a scenario where the pharmaceutical industry leaves Michigan disproportionately to the national trend, there would be 100 thousand fewer jobs and $29 billion less in personal income. If Michigan follows the national reduction in R&D investment under international pricing, there would be 75 thousand fewer jobs (601 thousand fewer job years of employment) and $21 billion less in personal income, as compared to a trend rate of 3%. Under export control there would be 50 thousand fewer jobs and $14 billion less in personal income. Under legislative relief there would be 25 thousand fewer jobs and $7 billion less in personal income.

All scenarios for investment and applications to Michigan are dependent upon the particular rules of the legislation, how they would be enforced, investors' concerns about returns in the industry and the relative attractiveness of Michigan as an R&D location. Legislation to authorize importation of prescription drugs could have a substantial impact on Michigan's economy. As a state and as a country, the economic impact of pharmaceutical R&D investment as a means of employment and personal income should be considered alongside other factors in the evaluation of this legislation.

For purposes of comparison with lost personal income due to importation, there would be savings associated with lower prescription drug prices. Over the next decade, a reduction in prices by one-third could save $12 billion and a reduction in prices by one-half could save $19

billion. Note that these savings in spending are similar to the personal income losses associated with scenarios of export control and the transformation of prescription drugs into an international market. These savings in spending would accrue to individuals who purchase prescription drugs, to insurance companies and to the importing firms, some of which reside outside of Michigan. Thus, there exists a trade-off between savings in pharmaceutical prices to some consumers and the employment of other citizens in Michigan.

Prescription Drug Importation, Investment and Employment in Michigan

Abstract:

This manuscript provides an analysis of selected aspects of pharmaceutical investment and employment in the wake of pending public policy decisions on importation of prescription drugs to the United States from Canada or other countries. Two research questions are raised:

1. What would be the likely effects of prescription drug importation authorization on investment in new prescription drugs?
2. What would be the likely effects of prescription drug importation authorization on employment associated with the pharmaceutical industry in Michigan?

Answers are provided through use of a simple model of investment and location decisions in the pharmaceutical industry. This model relies upon data for pharmaceutical research and development (R&D) investment and employment and a series of assumptions regarding permitted and adopted behavioral responses to changing public policy.

Three scenarios of R&D investment are considered: (1) Creation of an international market with global prices – and a 75% reduction in R&D, (2) Mechanisms for export control – and a 50% reduction in R&D, and (3) Legislative relief – and a 25% reduction in R&D.

Estimates of the economic impact in the State of Michigan in terms of jobs and personal income are prepared with a standard multiplier analysis and data from the Bureau of Labor Statistics. In addition to direct job loss associated with reductions in R&D, there would be an indirect effect of job losses at suppliers and induced effects of job losses at support industries, resulting in a six-fold impact on employment and personal income. The likely effects of prescription drug importation would be substantial job loss in Michigan (20,000 to 133,000 jobs) and substantial reduction in personal net income over the next decade ($6 to $35 billion in discounted, 2004 dollars).

All scenarios for investment and applications to Michigan are dependent upon the particular rules of the legislation, how they would be enforced, investors' concerns about returns in the industry and the relative attractiveness of Michigan as an R&D location. Legislation to authorize importation of prescription drugs along the lines currently being considered (SB. 2328) could have a substantial impact on Michigan's economy. As a state and as a country, the economic impact of pharmaceutical R&D investment as a means of employment and personal income should be considered alongside other factors in the evaluation of this legislation.

Prescription Drug Importation, Investment and Employment in Michigan

I. Introduction

Authorization of the importation of prescription drugs from countries with lower prices than the United States is an increasingly attractive proposition for state and federal policy-makers. The short-run benefit of reductions in prices of selected prescription drugs for selected patients may be viewed as a sufficient reason to favor importation. Polls, such as the one conducted by "askapatient.com", find that a majority of Americans favor "importation of drugs so that Americans can purchase them at cheaper prices." Even as an unlawful activity, US consumers purchased an estimated $1.1 billion dollars worth of prescription drugs from Canada in 2003. (Loyd, 2004).

However, there may be longer-run effects of importation of prescription drugs that are less desirable. Possible consequences of importation include: (a) reduced total investments in pharmaceutical research and development (R&D) due to lower expected global profitability; (b) altered regional investments in pharmaceutical R&D due to changes in the overall scale of investments; (c) restructured patterns of exportations of prescription drugs; and (d) reduced future availability of new medications and therefore reduced future health benefits.

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In this analysis, I focus on (a) and (b) – the effects of importation on prescription drug R&D in total and the effects on employment in the state of Michigan. Some consideration is given to (c) – actions that may mitigate some of the effects of importation. I do not consider directly the future health consequences of such public policy decisions or the short-run benefits of lower prices, as might be included in a welfare economics analysis. Again, I focus quite directly on the macroeconomic impact of importation policy on employment and by extension, personal income in the state of Michigan.

II. Prescription Drug Pricing

To start an analysis of prescription drug importation policy, it may be helpful to review the pricing phenomenon that gives rise to importation opportunities. As publicly owned companies with obligations to shareholders, pharmaceutical companies are expected to set prices in a manner that will maximize long-run profitability. For prescription drugs that are protected by patents, pharmaceutical companies have some ability to set prices – limited by the extent to which other patented and/or generic products are potential substitutes and the willingness and ability of persons to pay for prescription drugs.

With separate approval processes used in different markets and by different payers, and with the controlled means by which patients have access to medications (i.e. by prescriptions from health professionals), pharmaceutical companies are often able to set or negotiate a range of prices for prescription drugs. In the extreme case, pharmaceutical companies practice third-degree price discrimination – setting different prices for each payer based upon their demand for a particular prescription drug. Within the United States, prescription drug prices may differ among purchasers (PBMs, wholesalers, government programs, etc.). Internationally, prescription drug prices differ among countries. In some countries, pharmaceutical companies set or negotiate prices. In other countries, government agencies set prices based upon reference prices or other mechanisms.

Current prices paid for prescription drugs by each payer likely exceed variable production and distribution costs, but not necessarily full (capitalized) costs that include R&D. There are some exceptionally low prices offered as charity (e.g. AIDS drugs in Africa), but it is generally expected that these prices will exceed marginal costs. Pharmaceutical companies sell prescription drugs as "brand name" products until patents expire, at which time "generic" products may be produced. Generic products are typically sold at lower prices than the brand name products they copy, but still above average total production and distribution costs.

Long-term public policy towards patents in the United States has been designed to encourage R&D by protecting the ability to sell products at prices that cover full costs that include R&D investments. Recent changes in public policy have been aimed at decreasing approval times for new drugs, adding to the available time under patent protection and giving further incentives for R&D. (Carpenter, et al, 2003)

Prices of prescription drugs are higher in the United States than in most countries that have negotiated discounts or set prices. Referencing pricing or mandates that set prices for new prescription drugs at levels of existing drugs, sometimes including generic drugs, generally result in prices that are lower than prices set by pharmaceutical companies in the United States. As examples of analyses of international price differences, Anderson et al. (2004) suggest that selected prices are 52% lower in Canada than in the United States. Danzon and Furukawa (2003) suggest that selected prices are 33% lower in Canada than in the United States. Since there are a large number of prescription drugs and a large number of prices paid by different payers within each country, the 52% and 33% numbers are “averages” that may not apply to price differences facing a particular patient seeking to purchase a particular prescription drug. Still, differences in prices of one-third to one-half may provide the opportunity for firms in a low-price country to export a drug to high-price country at a profit – giving rise to the concept of “importation” from the perspective of the high-price country.

There are eight (or more) sets of exchange prices in the pharmaceutical distribution chain, as depicted in Figure 1 (adapted from van der Walde, et al., 2003, Figure 35). Consumers out-of-pocket costs (cost e) are largely determined by their insurance status. Patients with Medicaid (in most states) or selected private insurance policies face no out-of-pocket costs for prescription drugs. Most patients with private insurance for prescription drugs face cost-sharing in the form of deductibles (commonly referred to as "copays") or co-insurance (a percentage of drug prices). Copays may vary based upon prescription drug source (retail versus mail-order) and perhaps by the type of drug source as some insurers or pharmacy benefit managers (PBMs) have limited networks of locations where insurance is accepted. Copays also vary based upon the status of a particular drug on a benefit schedule (commonly referred to as a prescription drug "formulary"). It is increasing common for insured consumers to face tiered copays, with low amounts charged for generic drugs, higher amounts for selected brand-name prescription drugs (so-called "preferred" drugs) and the highest amounts for non-preferred drugs. Formularies often include a limited number of drugs in a therapeutic class in the preferred "second-tier" based on efficacy, cost-effectiveness or other considerations.

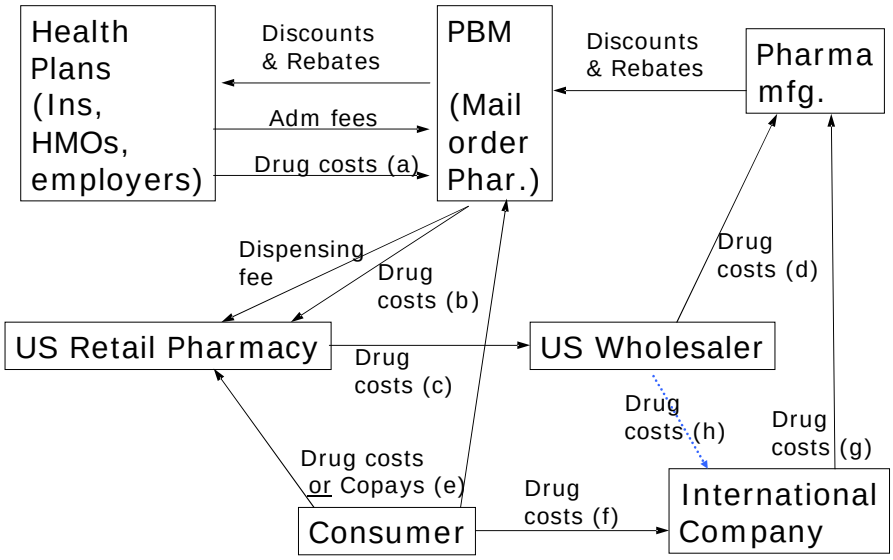
Consumers without insurance for prescription drugs (or without insurance for a particular drug, or with insurance with a copay in excess of list price) pay the list price for drugs, unless they qualify for a patient assistance program. Some 6 million consumers qualified for patient assistance programs in 2003. (PhRMA, 2004)

List prices paid by consumers and prices paid by insurers may vary by source (retail versus mail order) as well as a complex set of relationships that insurers have with PBMs (cost a), that PBMs have with retail pharmacies (cost b), that retail pharmacies have with wholesalers (cost c), and that wholesalers (including PBMs) have with pharmaceutical manufacturers (price d).

Importation of prescription drugs potentially adds three sets of prices to pharmaceutical distribution chain. Consumers might purchase drugs directly from an international company

(cost f, as currently occurs unlawfully). Consumers might also purchase prescription drugs from retail pharmacies (a new cost e) that have, in turn, purchased them directly or through wholesalers from international companies (cost h, the truly new cost pattern that would be added with importation legislation). To the extent that consumers have insurance that covers the cost of prescription drugs, their pattern of prescription drug purchase may note be altered, but the cost to the pharmacy and/or insurance company may change.

FIGURE 1. Pharmaceutical Distribution Chain



Source: Adapted from van der Walde, et al., 2003, Figure 35.

Note that importation and the creation or existence of an international exportation company is one mechanical approach by which international pricing can be implemented. An alternative approach is for payers to refer to international prices when setting prices (so-called reference pricing). Sometimes reference prices become the list price in a country. Other times, the reference price is only the amount which an insurer will reimburse a patient, resulting in

either (a) a cost-sharing amount of the difference between a list price and a reference prices, or (b) incentives for pharmaceutical companies to lower their list prices to reference prices (Kanavos and Reinhardt, 2003) Given the price-setting ability of manufacturers while prescription drugs are under patent, most payers in the United States can not use reference pricing or otherwise negotiate prices in the same manner as government agencies. Government agencies outside of the United States, as well as the United States Department of Defense and Veteran's Administration, act as monopsonistic buyers, forming a bi-lateral monopoly with respect to pharmaceutical manufacturers and resulting in some degree of price-setting behavior.

The essential factor for the existence of importation of prescription drugs is that the drug cost for the international company (g) is sufficiently lower than other drug costs (costs e or f for consumers) and/or cost (d) to cover any transactions costs associated with the export-import process. Perhaps differentials of one-third to one-half of prescription drug prices between the United States and Canada for selected prescription drugs could justify importation.

There are a host of complex considerations in the pricing of prescription drugs. For simplicity of exposition, this analysis will merely note that there are states of the world in which list prices in the United States may exceed list prices in other countries, giving rise to interests of consumers, wholesalers or others for importation legislation.

III. Prescription Drug Importation

As an unlawful activity, importation of prescription drugs from Canada to US patients are estimated to have accounted for over $1 billion of $216 billion in total purchases in 2003. (Loyd, 2004) Current Senate Bill 2328, The Pharmaceutical Market Access and Drug Safety Act, would permit sales of prescription drugs imported from Canada (or one of 24 other countries). Restraint of trade provisions included in SB 2328 would limit the ability of pharmaceutical companies to avoid the export of drugs to Canada and elsewhere. Senate Bill 2393, The Safe

Import Act, is similar, but does not prohibit the limitation of supply to other countries. Organizations such as the American Public Health Association, Families USA and AARP all support SB 2328, but not SB 2393. (American Public Health Association, 2004)

If SB 2328 is passed, I expect that international purchases would likely expand among consumers in the United States. The magnitude of the expansion of consumers' direct purchases will depend on relative prices (cost f vs. cost e on the distribution chain) and the extent to which (a) consumers have been concerned with the unlawful nature of the current activity and (b) the extent to which importation would truly be restricted to United States distribution channels. If consumers in the United States have not been concerned at all with the unlawful nature of their current activity, then current sales could already account for all the potential sales. If importation is restricted to sales that require prescriptions to be filled in retail or mail order outlets operating in the United States, the additional transaction costs could reduce the cost differential and limit an expansion in sales.

If Medicaid programs, states, state purchasing pools and Medicare drug programs can all participate, a much larger share of prescription drug purchases would be expected to follow the importation channel. How much market share could importation take? PBMs may be covering 57% to 66% of the U.S. population and would likely move quickly to importation – to the extent that costs are lower (cost d vs. cost h, net of all rebates and other factors). (Drug Cost Management Report, 2003)

Between consumer purchases, governmental programs and PBMs, effective prices in the United States could be reduced to the lowest available international price, inclusive of any added transactions costs.

Kanavos et al. (2004) recently reviewed the evidence on prescription drug importation in Europe – which is referred to by the more general description of "parallel trade". In contrast to the 0.5% market share of importation in the US from Canada, importation holds a 25% market share of high volume prescription drugs in six European countries. As expected, the extent of

importation is related to price differences. Importation accounted for 6.3% of total prescription drug sales in Norway and 16.5% of total prescription drug sales in the UK, both in 2002. (Macarthur, 2004) A study in Finland found that parallel importing may have limited price increases and that much of the benefit associated with limiting price increases was captured by the importing firms. (Linnosmaa et al., 2003) A study of five European countries found benefits for insurance companies from importation. (West and Mahon, 2003) Permitting importation from Greece and other countries with relatively low prices was found to expand the value of importation. Exportation accounted for 22% of the Greek market in 2002. (Kontozamanis et al., 2003)

In their own work, Kanavos et al. (2004) found small benefits to insurers (1-2%) and no immediate benefit to consumers covered by national health insurance for prescription drugs. They also found no changes in domestic prices over the period 1997-2002 in the face if lower import prices – in direct violation of the usual economics law-of-one-price. The fact that lower prices were available through import channels did not generally lead pharmaceutical companies to lower their list prices in most countries. This is rational behavior on the part of pharmaceutical companies. Since patents still hold, the act of lower prices would amount to pharmaceutical companies competing with themselves for market share. Any prescription drugs that can be sold at list prices result in greater profits than drugs sold at import prices. Benefits that occurred due to importation were largely (90%) captured by the importing firms in the form of transactions costs and firm profits.

If importation is authorized in the United States, there may be greater opportunities for short-run gains to uninsured consumers and insurance companies/PBMs due to the relatively greater price differences between the United States and other countries (as compared to prices among European Union countries). Insured patients would not be expected to benefit in the short-run, unless insurers elect to encourage purchase of imported prescription drugs though use of lower copays. One could imagine a situation where an insurance company offers a lower

copay (e.g. at a tier-one or tier-two level of, say $10, rather than a tier-three level of, say $20) for prescriptions filled from an import company (assuming that the insurance company's cost savings was greater than or equal to the difference in copays, say $10 in this example). Firms engaged in the import process would be expected to gain from the process – especially if these firms include current wholesalers who already engage in the drug supply chain. However, the total impact on pharmacies, insurers, PBMs and wholesalers is unclear. Many of the current drug costs are passed along to employers and an elaborate process of discounts and rebates exists. Only if these arrangements were truly transparent could one determine the net impact on current prescription drug intermediaries.

IV. Prescription Drug Investment

A distinguishing feature of the pharmaceutical industry is its substantial investment in R&D. Research and development investments have been increasing steadily over the past two decades. United States pharmaceutical R&D investments exceeded $32 billion in 2002, which is even more than the amount spent by the National Institutes of Health (NIH). (PhRMA, 2004) The results of pharmaceutical R&D investments have been a number of new molecular entities and a number of new prescription drugs.

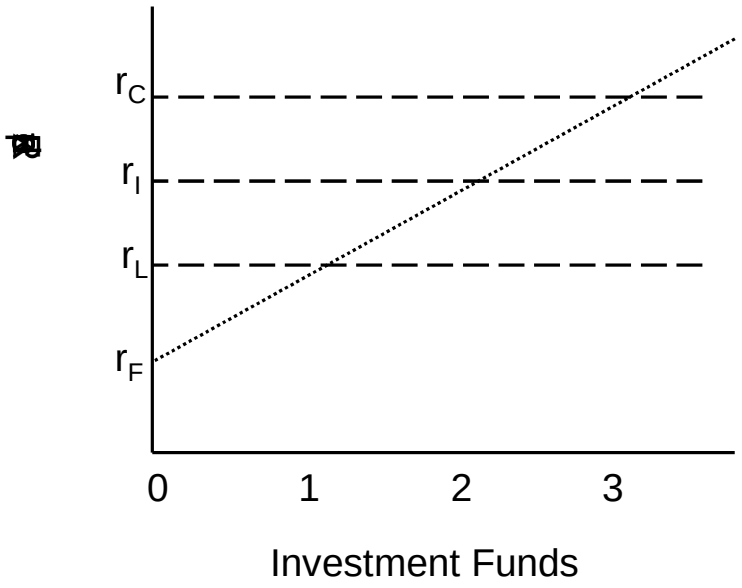
Pharmaceutical R&D investments, as with investments by most firms, are determined by the expected return-on-investment (ROI). (Grabowski and Vernon, 2000) Pharmaceutical companies invest in new drugs because they expect to realize returns that meet or exceed the cost of acquiring investment funds. As expressed below in equation form, expected returns are determined by the expected contribution margin per unit (price less variable cost), the volume of sales, and the fixed cost of the R&D investment. In a time-series context, all amounts would be calculated as net present values of future cash flows, discounted by the risk-adjusted, required rate of return.

Expected ROI = [(Expected Price – Variable Cost) x Volume] / R&D Investment

Although the logic is somewhat circular, pharmaceutical spending and resulting R&D investments have been associated with increasing insurance coverage for prescription drugs in the US over the course of the 80's and 90's. (Danzon and Pauly, 2002) (The circular part is that R&D has resulting in newer, more expensive prescription drugs, generating a demand for insurance coverage.) Insurance coverage encourages investment due to higher expected volumes of sales due to lower out-of-pocket prices for consumers and perhaps less sensitivity to price – to the extent that insurers and PBMs are less sensitive to prices than consumers. There may be some continuing room for growth in sales associated with Medicare's new prescription drug benefit, which contains a provision that Medicare will not become involved with negotiating prices.

Important in the consideration of R&D investment is a view of the investment-returns generating process. We generally think of investment funds being directed towards those firms and industries with the greatest expected returns. In normal markets, returns are the result of investments and firm performance. When there are exogenous shocks (such as a change in public policy), non-market determined returns can be a short-run result. As depicted in Figure 3, at the current expected rate of return (r_C) we observe a level of funds in the industry for R&D (3). If circumstances changed such that there were only a risk free rate of return (r_F) available (in a risky industry), there would be no funds available from rational investors.

FIGURE 2. Expected Returns and Investments Funds



Source: Author

Expected returns in an era of authorized importation (r_I) would be less than current levels, but presumably still above the risk free rate, resulting in a reduction of funds to a lower level (2). (Note that the location of investment funds 0-3 and expected returns r_F - r_C are for graphical representation and are not drawn to any scale reflecting relative values.) An importation policy may not affect all firms equally. Firms that happen to produce and invest in products that have greater international price differences would see the largest decreases in expected returns. Such firms may see their returns fall to low levels (r_L), perhaps sufficiently low levels that investment funds are insufficient to support a viable R&D enterprise. There are economies of scale in pharmaceutical R&D and firms with insufficient funds may cease to achieve sufficient profitability to continue to exist. (Filson and Masia, 2004) A key in this figure is the relationship between r_I, and r_L, If r_I, < r_L, there is no incentive for investment.

Pharmaceutical firms are currently investing with an expectation of a set of prices and costs that are based, at least in part, on the current sets of prices and costs. For most

pharmaceutical companies, R&D investment is supported by current period cash flows, suggesting a percentage of revenues budget model. In contrast, much of biotech R&D is supported by new equity and debt, suggesting a more directly transparent ROI budgeting model. In aggregate, one can expect that expected ROI will determine R&D expenses.

It also has been suggested that advances in combinatorial chemistry and bioinformatics hold promise for future research productivity (lower R&D Investment costs) adding to incentives for pharmaceutical R&D. (Cockburn, 2004)

Promises of future research productivity would be welcome to an industry that has experienced substantial increases in R&D costs per new drug over the past decade. Recent estimates by DiMasi et al. (2003) suggest a cost per new drug in excess of $802 million (in 2000 dollars). This estimate has been repeated often in the popular press. (Goozner, 2003) Researchers at Bain, the consulting firm, estimated costs per new drug to be $1.1 billion in the period 1995-2000 and $1.7 billion in the period 2000-2002, inclusive of post-launch studies. (Gilbert et al, 2003)

Obviously, not all drugs will be “blockbusters” with revenues exceeding the $1 billion threshold. As a result, we observe that some 30% of successfully marketed drugs supported the pharmaceutical R&D enterprise though the mid-90’s, when the average cost of R&D was $500 million. (Grabowski 2002)

To sustain a business model where 30% of products must support all investments, prices of select high volume products must be in excess of variable costs of production and distribution. These blockbuster prescription drugs are exactly the targets of importation. The dilemma faced by policy makers in this regard has been stated well by others:

> “… parallel trade represents an interesting, albeit difficult-to-balance, policy dilemma, touching upon the principles of free trade policy, the determination of health and

pharmaceutical policy, and the existence or not of industrial policy in the pharmaceutical sector." (Kanavos 2004, with reference to Danzon 1998)

"Balancing the rewards of innovation of future drugs with the availability of already developed drugs continues to be a central policy issue facing the industry." (Philipson, 2002)

V. Future Prescription Drug Investment

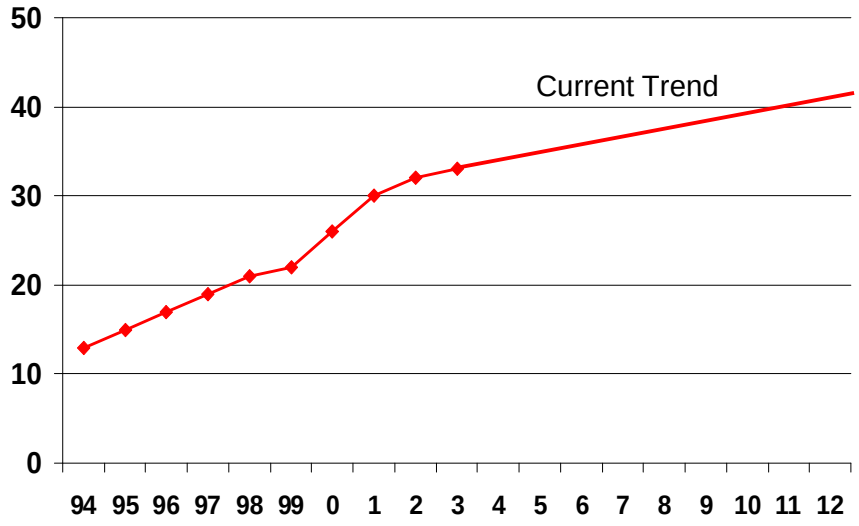
To consider the impact of importation policy, it is helpful to think about the expected course of prescription drug investment absent changes in policy. Simple moving averages (looking back 3 to 5 years) of R&D investments by US companies over the period 1984-2003 suggest annual rates of increase of 12.5%. A simple linear regression of the time trend of R&D investments over the period 1984-2003 suggests an increase in spending of $1.57 billion per year (95% confidence interval $1.40 to $1.73, adjusted $R^2 = 0.95$), which is less than a 6% annual rate of increase currently, slowing to a 3% annual increase over a decade.

As depicted in Figure 4, The base case of the current trend in R&D spending is a 3% growth rate per year. Analyses using 0% and 6% annual rates of increase are also presented.

Next, I consider three alternative futures for R&D with respect to importation policy. Briefly, these three alternative futures employ assumptions concerning the particular rules of possible legislation, how they would be enforced and investors' concerns about returns in the industry. These alternative futures are presented in an unranked manner. That is to say, each course of future events is possible, but it is not easy to suggest which course of events is more likely to occur. Rather than provide a prediction of type of legislation might be passed, I provide predictions about the implications of various forms of legislation and behavioral responses.

FIGURE 3. The Future of Pharmaceutical R&D – Current 3% Trend

(Billions of $US in R&D Spending, 1994-2013)



Source of data: PhRMA, 2004. Trend calculated by author.

V.1. An International/Generic Market

The starting point for consideration of alternative futures is the future that appears to be envisioned in the proposed legislation. (Senate Bill 2328, 2004) The implementation of importation policy could result in a rapid opening of distribution channels between Canada and/or lower priced markets and wholesalers, PBMs and consumers in the United States. With the lowest international prices being adopted (with prices closer to production and distribution costs), R&D spending would quickly be reduced. While current export controls limit European markets from abiding by the law of one price (Kanavos, et al. 2004), public policy could remove such controls. In a market with the lowest international prices, revenues available for pharmaceutical company R&D would be reduced. For biotechnology companies, venture capital, and monies from equity and debt would be substantially restricted. Investors would not

be confident in returns in a market where the lowest available price could be uniformly applied. Remaining R&D investments would be focused on the higher market volume and/or lower development cost products, as is the case with generic companies. Note that such a pattern of investment would run counter to orphan drug policy – but drugs developed under this policy represent a relatively minor component of total R&D.

We currently observe that pharmaceutical companies and biotechnology companies have substantially higher percentages of revenues associated with R&D costs than do generic drug companies. (van der Walde, et al., 2004) As a corollary to international pricing, Hughes et al. (2002) suggests that a rapid movement to generic pricing of prescription drugs would greatly reduce R&D spending - down to perhaps 20% of its current level.

Many products are currently in the R&D pipeline. Approximately 34% of R&D spending is preclinical, 5% phase I, 10% phase 2, 20% phase III, 20% approval and phase IV and 11% uncategorized. (PhRMA, 2004) Therefore, I do not suggest that R&D investment would cease immediately, but it would slow rapidly over two to three years. After transitioning to a new, lower level of R&D, I suggest that the upward trend in research may resume. The overall incentives for more R&D investment, including basic science and clinical advancements may continue along current trends, making more candidates available for R&D investment. (Berndt, 2001; Cockburn, 2004) However, any such upward trend would be dwarfed by the initial decrease in R&D investment.

V.2. Export Control

Another view of the implementation of importation policy is that it may apply to existing products, but may not easily be applied to new products. It may be possible for pharmaceutical companies to license new products only in the United States (approximately half of the global market). Foregoing international licensure would mean foregoing the volume of international sales, but would also remove the prospect of an international price comparison. No registration

means no price in another country, no exports to another country and no imports to the United States. Eliminating half the market for many new prescription drugs would eliminate half of the interest in R&D investment.

The export control scenario suggests investments at 50% of current levels after three years, with the upward trend continuing thereafter. However, it bears note that legislation that includes compulsory licensing would negate actions to control exports, leading to the international pricing scenario.

In the Congressional Budget Office's review of importation legislation, they focus on export control in the short-run and uniformly high world prices in the long-run as reasons why importation would not significantly affect drug spending in the US – by only 1 percent. (CBO, 2004) Since export control is explicitly ruled-out under current legislation, the CBO may be underestimating the short-run potential for importation to affect spending. As a "restraint of trade", the current Bill prohibits denial of sales or restriction of sales to registered exporters or selling at prices higher than an officially negotiated price. (Section 27) However, if current pricing (with transactions costs associated with importation added) follows the lower range of estimates of price differentials, importation may not be as widespread as proponents hope.

If international prices are negotiated at higher levels – meaning that drugs are only introduced in selected countries, the international pricing process itself may result in fewer opportunities for importation and a smaller reduction in R&D investment. This aspect of pricing is a concern to Canadian analysts. (Graham, 2003) Perhaps new prescription drugs will not be made available to Canadian citizens, since doing so could reduce pharmaceutical company profitability.

A 'worst-case' scenario of Canadian prices being applied to the total US market suggests a decrease in R&D of $15 billion – nearly 50%. (Graham, 2003) This result is similar to the model of Vernon (2002/2003) that suggests a decrease in R&D expenditures of 36% to 48% if US prices were lowered to average prices outside the US.

Again, under the export control future for pharmaceutical importation, I suggest a 50% reduction in R&D investments over three years, with a continuation of the trend thereafter.

V.3. Legislative Relief

The first two scenarios presented consider the case where the legislation works as hoped and prices of US prescription drugs quickly falls to the lowest available levels – ultimately down to generic pricing levels, and the case where reasonable supply control and pricing strategies of pharmaceutical companies limit the efficacy of the legislation. A third scenario considers the case where the legislation itself is changed during or shortly after passage.

Quite simply put, full implementation of importation policy may not be politically viable. For some of us, the Medicare Catastrophic Coverage Act is not a distant memory. (Rice, et al., 1990) After passage, but before implementation, an expansion of Medicare into long-term care was stopped. One can easily envision legislative relief for the pharmaceutical industry after announcements of substantial numbers of lay-offs at pharmaceutical and biotechnology companies.

In many respects, estimating the reduction in expected R&D investments is most difficult in this case. For purposes of symmetry, not necessarily precision, I suggest a 25% reduction in R&D investments associated with legislation that is repealed. With legislative relief, R&D investments may return to current levels over time, but I would not expect a complete return to the current trend level. Policies that can change once can be changed again. Investors' confidence in the ability of pharmaceutical companies to provide appropriate, risk-adjusted rates of return would likely be forever diminished. To the extent that pharmaceutical companies use real options reasoning, the option of the government to change prices would have to be considered. (McGrath and Nerkar, 2004)

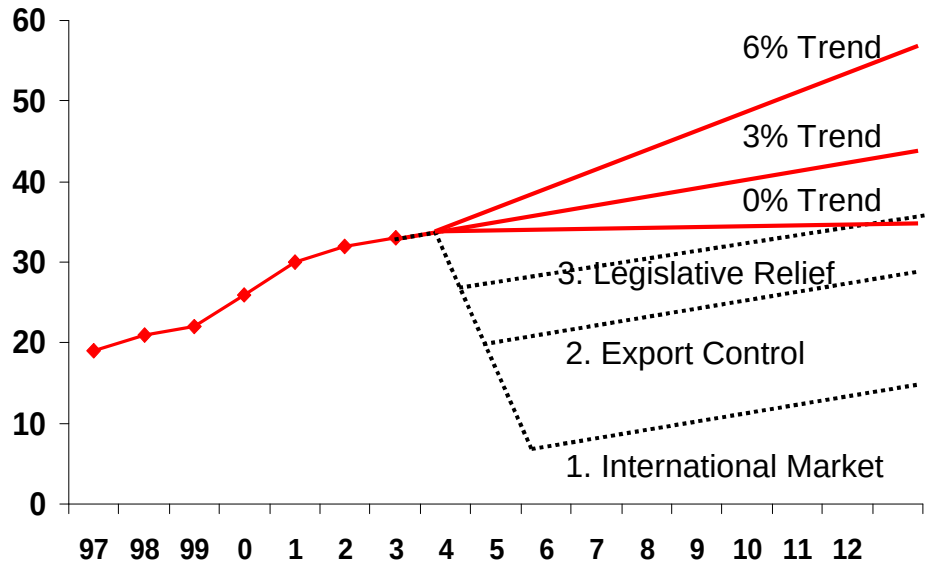
For investors to provide funds to the pharmaceutical industry under conditions of reduced confidence, higher expected returns would be required. In reference to Figure 2, the

process of r_C being reduced to r_I would raise the level of r_L, reducing the likelihood of funds being invested in the industry.

The three scenarios for future R&D spending are depicted in Figure 4. As compared to the alternative current views of annual growth in R&D spending, all importation scenarios suggest that R&D spending would not return to current levels in the next decade.

FIGURE 4. The Future of Pharmaceutical R&D – Three Scenarios

(Billions of $US in R&D Spending, 1997-2013)



Source of data: PhRMA, 2004. Trends and scenarios calculated by author.

VI. Importation Policy and Employment

As suggested above, Canada and other countries face prices that are generally lower than those in the United States. If importation authorization were to be approved in the United States, the likely consequences would include lower expected returns to pharmaceutical

companies and, in turn, reduced R&D investment in the pharmaceutical industry. The direct implication of reduced R&D investment in the pharmaceutical industry is reduced employment in this sector of the economy. According to a study by Bain, Germany's policies on drug prices were associated with $8 billion in lost pharmaceutical industry employment. (Bain 2002)

Research and Development is the cornerstone of pharmaceutical and biotech industries – the source of new products. Ultimately, the majority of R&D expenses are associated with employment. Further, remaining jobs in the pharmaceutical industry – manufacturing, marketing and administration are derivative from R&D. Absent good data for estimation, I assert that declines in R&D spending would be reflected in proportional declines in total employment. There may well be a lag in changes in manufacturing and other expenses as compared to changes in R&D investments. For simplicity of exposition, such a lag time is not incorporated in the current analysis.

With a decline in R&D investment of 25% to 75%, depending on the three importation scenarios, pharmaceutical companies will have to decide where to physically invest in employment. While Michigan has been an attractive state for life sciences, it may not remain so in the future.

In this section, I discuss firm location decisions and then present alternative scenarios for how Michigan might fare under reduced employment associated with importation policies.

VI.1. Firm Location Decisions

There are many factors associated with firm location and relocation decisions. The major categories of factors include: production economics (e.g. wages, infrastructure), idiosyncratic (e.g. home of founder, mergers) and regulatory environment (e.g. taxes). (Cohen, 2000) According to a study by Ernst and Young (1994-1995), a select few infrastructure characteristics are the primary decision drivers: proximity to concentration of universities, clusters of highly educated workers, or alternatively, lifestyle amenities that are attractive to this

pool of talent, control over physical environment, cost sensitivity -- less important than the availability of talent and other requirements (although R&D may be more sensitive to cost than headquarters).

O'Mara's (1999) review of the literature notes that most prior research has focused on the manufacturing sector and has found that location is largely driven by cost factors in the production process, including access to labor. Concentration of industries in particular geographic areas has been tied to both production cost and idiosyncratic factors. Recent studies have aimed to determine whether relocations were efficient but did not aim to identify factors that might predict relocation. The most recent area of inquiry has been identification of the ''best'' locations for business.

VI.2. Pharmaceutical and Biotech Firm Location Decisions

There have been a number of analyses and commentaries on location decisions for pharmaceutical and biotech firms. This work falls almost entirely in the realm of subjective assessments of "best" environments. It has been suggested that regions that provide the best opportunities for biotech companies to prosper offer the following important attributes: presence of major pharmaceutical companies, rich talent pool, research infrastructure, strong investment community, entrepreneurial support and available, suitable real estate. (Byrnes, 2003)

Khan (2003) created a ranking of U.S. locations for biotechnology companies (including life sciences and pharmaceuticals) through measurement of 13 separate factors, based on a Brookings Institution report released in June 2003. The top locations are presented in Table 1, along with other rankings.

According to a Milken Institute study, only a handful of metropolitan areas have succeeded on a scale necessary to ensure industry sustainability. (DeVol et al., 2003) At the top of that list is San Diego. The suggestion is that that clusters of science-based technologies will be the important factors that determine the winners and losers. They conclude that "To

create international comparative advantage in a knowledge-based economy, clustering innovative activity is imperative." (DeVol et al., 2003) According to the study's Biotech Index, the top 12 metros are presented in Table 1.

TABLE 1: Rankings of Locations for the Pharmaceutical Industry

Rank	Kahn (2003)	DeVol et al. (2003)	DeVol and Keopp (2003)
1.	New York, Northern New Jersey	San Diego	New Jersey
2.	Boston, Worchester	Boston	Delaware
3.	San Francisco, Oakland	Raleigh-Durham-Chapel Hill	Indiana
4.	San Diego	San Jose	Connecticut
5.	Los Angeles, Orange County	Seattle-Bellevue-Everett	Pennsylvania
6.	Philadelphia, Wilmington	Washington, D.C.	North Carolina
7.	Raleigh, Durham, Chapel Hill	Philadelphia	Utah
8.	Washington, D.C., Baltimore	San Francisco	Illinois
9.	Chicago	Oakland	Massachusetts
10.	Seattle, Tacoma	Los Angeles-Long Beach	Michigan
11.	Houston	Orange County, CA	
12.	Detroit, Ann Arbor	Austin-San Marcos	

Sources: Kahn (2003), DeVol et al. (2003) and DeVol and Keopp (2003).

DeVol and Koepp developed a ranking of states based on employment concentration. (DeVol and Koepp, 2003) Their ranking of Michigan is number 10, as presented Table 1. An earlier analysis by Clapp et al. (2000) considered outcomes (actual location decisions) rather than underlying factors with a similar ranking; Michigan ranked 13.

Similarly, Michigan Economic Development Corporation (MEDC) has created a series of analyses to suggest that Michigan is good for high-tech industries. (MEDC, 2004) According to MEDC, Michigan ranks fourth in the nation for total employment in high-tech industries, with more than 568,000 high-tech workers. They also report that Michigan ranks second among the 50 states in total private spending on R&D activity. With more than $17 billion spent in Michigan on R&D in 1999, only California can boast more dollars spent.

However, according to a MEDC study, the Life Sciences Corridor in Michigan has not yet reached a dynamic critical mass as a life sciences community. (Freiman, 2003) In communities

that have achieved critical mass, such as San Diego or Boston, there are a critical number of companies, universities, scientists and investors, such that people, ideas and money flow freely between organizations; if one venture fails, it is highly probable that another will soon take its place and absorb the resources thus released.

According to Pfizer chairman and CEO Henry McKinnell, “Michigan could help lead the U.S. into a "golden age of medicine" by encouraging pharmaceutical companies such as Pfizer Inc.” (Christoff, 2004) “But McKinnell cautioned that such a corridor can't happen with policies that hurt drug company profits, such as price controls and opening up the U.S. market to Canadian prescriptions drugs.” "Though some might wish it, this engine of innovation and opportunity won't survive long if it's changed from a high-risk, high-reward system to a high-risk, low-reward system."

At a location that is ranking around number 10 in the US, a substantial reduction, if not complete elimination of the pharmaceutical and biotech industry could occur with a substantial change in R&D investment. For companies such as Pfizer, a reduction in R&D could lead to a decision to consolidate operations to existing, central locations (e.g. Connecticut).

VII. Impact of Firm Location Decisions – Multipliers

> "Now economists are beginning to pay close attention to what is called the ripple effect or the multiplier. Broadly defined, the multiplier means good jobs create more good jobs when the economy is expanding. But it also works in reverse: When jobs disappear, other jobs are cut, deepening the effects of a downturn." (Times Watch, 2002)

Multipliers measure the response of the economy to a change in demand or production. Multiplier analysis generally focuses on the effects of exogenous changes on: a) output of the sectors in the economy, b) income earned by households because of the new outputs, and c) employment (in physical terms) that is expected to be generated because of the new outputs.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for an industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. The total effect is the sum of direct, indirect, and induced effects.

VII.1. Impact Examples

Regional economic models of the biotechnology and pharmaceutical industries have been prepared at several levels. At the national level, Ernst & Young (2000) analyzed the biotechnology industry (excluding pharmaceuticals), finding a total employment multiplier of 2.9. Also at the national level, the UK Department of Health found that having pharmaceutical firms located in the UK results in substantial producer net profits, labor income (above available earnings), R&D indirect effects. (Pharmaceutical Industry Competitiveness Task Force, 2001)

At the state level, PriceWaterhouseCoopers (2002) demonstrated the substantial number of jobs and flow of funds associated with the pharmaceutical industry in New Jersey, but did not consider multiplier effects.

At the local level, multipliers were calculated in an analysis of the biotech/life science industry in San Diego. (DeVol et al, 2004) The life science industry in San Diego accounts for 55,600 jobs, or nearly 5 percent of all nonagricultural employment. Of those jobs, 21,000 are accounted for directly, 12,600 indirectly and 21,000 induced, for a multiplier of 2.6.

Multipliers of employment and total income in published studies vary substantially. The Bureau of Economic Analysis (BEA), following their own input-output methodology (BEA, 1997), has estimated that the pharmaceutical and biotech industries in Michigan are associated with a

multiplier of 6.2 for employment. This large multiplier is explained by (a) high wages in the pharmaceutical industry ($66,307 vs. $37,000 state average) and (b) state-wide employment of suppliers and spending (vs. other studies looking only at a city, resulting in multipliers around 3). For comparison purposes, multipliers for New Jersey and Pennsylvania are 5.8 and 7.1, respectively.

VIII. Analysis of Changes in Locations on the Michigan Economy

To determine the impact of a reduction in pharmaceutical employment, the first step is determining the nature and size of affected firms. County Business Patterns (NAICS) data suggest that there were somewhere between 8,827 and 29,037 persons employed in the pharmaceutical industry, narrowly defined, and life sciences manufacturing and research, broadly defined, in 2001. Details are provided in Table 2.

The Michigan Economic Development Corporation (2003) used Dun & Bradstreet data (Fourth Quarter 2002) to suggest that Michigan's life sciences industry consists of 31,777 employees, 542 companies, and $4.8 billion in sales. Michigan's total employment was corrected for Pfizer and Pharmacia, whose Michigan sites were underreported by 10,100 employees. From 1999-2002, growth of Michigan's life sciences industry has exceeded growth of the United States industry overall, growing 27% in employment, 32% in the number of companies, and 165% for sales.

Within Michigan's life sciences industry, the Pharmaceutical segment employs the most people (17,333), earns the second most in sales ($1.6 billion), but has fewer companies (119). Pharmacia had major manufacturing and R&D facilities in Kalamazoo, and Pfizer's Global R&D division is in Ann Arbor. Together they employed over 10,100, but were headquartered elsewhere, resulting in minimal sales recorded for Michigan.

In contrast, the Bureau of Labor Statistics (2003) reports only 12,000 employees in the pharmaceutical and biotech industries. To be conservative, and consistent with the data

yielding the available multiplier, the BLS data are employed here. While the Bureau of Labor Statistics data almost certainly underestimate total pharmaceutical and biotech employment in Michigan, their numbers would appear to be consistent with the R&D aspect of industry employment.

TABLE 2: Life Sciences Employment in Michigan, 2001

Industry	Industry Code Description	Employees	Payroll ($th)	Firms
325411	Medicinal & botanical mfg	250-499	0	6
325412	Pharmaceutical preparation mfg	7,336	352,783	21
325413	In-vitro diagnostic substance	500-999	0	10
325414	Biological (exc diagnostic)	500	27,045	9
	Pharmaceuticals	8,827	426,372	46
333298	All other industrial machinery	4,251	214,650	123
334510	Electromedical apparatus mfg	100-249	0	6
334516	Analytical laboratory instrument	890	35,236	11
334517	Irradiation apparatus mfg	20-99	0	1
339112	Surgical & medical instrument	2,240	88,135	37
339113	Surgical appliance & supplies	2,478	103,689	52
339114	Dental equipment & supplies	437	14,458	30
541710	R&D in physical & life sciences	4,261	276,679	222
621511	Medical laboratories	3,185	128,668	151
621512	Diagnostic Imaging centers	2,218	122,037	155
	Other Life Sciences	20,210	983,552	788
	Total Life Sciences	29,037	1,409,924	834
	Total Employment in State	4,008,572	142,938,848	236,711

Source: Michigan Economic Development Corporation (2003), as compiled by author.

The second step is determining the wages involved in a potentially displaced firm or industry and the distribution of wages in affected industries. Bureau of Labor Statistics (Table SA07N Wage and salary disbursements by industry -- Michigan) data for 2002 reveal that the pharmaceutical industry is among this highest paid. As is clear from Table 3, employees in the pharmaceutical and biotech industries are relatively well paid in Michigan.

The final step involves multiplying the affected employment by wages to determine the personal income impact associated with a relocating firm. It is common in economic multiplier analysis to consider job-loss as compared to the status quo (no growth). The economic impact of a relocation of pharmaceutical R&D operations away from the state of Michigan would have an estimated direct effect of moving or losing 74,792 jobs and $3 billion in personal income per year, as shown in the top panel of Table 4. This annual level of employment and personal income in Michigan will be entirely lost at the end of 3 years and persist for a decade, as shown in the bottom panels of Table 4.

TABLE 3: Average Annual Incomes in Michigan, by Relationship to the Pharmaceutical / Biotech Industry, 2001

Industry	Annual Income
Direct Employment	
Pharmaceutical / Biotech	$66,307
Indirect Employment	
Business services (accounting, ...)	$50,757
Retail trade	$21,374
Wholesale trade (distribution, ...)	$52,763
Induced Employment	
Health services (physicians, hospitals, ...)	$32,672
Eating and drinking places	$12,692
Other services (education, day care, ...)	$20,109
Hotels, other entertainment	$17,015
Transportation	$38,700
Banking services	$40,552
Printing and publishing	$48,355
Personal services	$19,227
Other goods and services	$41,269

Source: Bureau of Economic Analysis

Categorized and updated by author.

Two notes on these analyses merit attention. First, all analyses discount personal income at 2% per year (a social discount rate). Second, all analyses are projected for 10 years. While multiplier analyses are sometimes presented as perpetuities (forever), such analyses

become unreasonable at some distant time. A loss of all pharmaceutical employment in Michigan forever, at a 2% discount rate, would imply a value of $151 billion, as compared to the $24.2 billion over 10 years presented in Table 4

TABLE 4: Multiplier Effect of the Loss of Pharmaceutical Employment in Michigan, No-Trend in Employment, 2004 dollars

Effect	Jobs Lost	Personal Income Lost
Direct	12,000	$795,682,800
Indirect	24,551	$1,039,455,400
Induced	37,942	$1,183,580,087
Total	74,492	$3,018,718,287

Year	Jobs Available	Personal Income Available
2004	74,492	$3,018,718,287
2005	49,662	$1,973,018,488
2006	24,831	$967,165,926
2007-14	0	$0

Year	Jobs Years Lost	Personal Income Lost
2004	0	$0
2005	24,831	$986,509,244
2006	49,662	$1,934,331,851
2007	74,492	$2,844,605,663
2008	74,492	$2,788,829,082
2009	74,492	$2,734,146,158
2010	74,492	$2,680,535,449
2011	74,492	$2,627,975,931
2012	74,492	$2,576,446,991
2013	74,492	$2,525,928,423
2014	74,492	$2,476,400,414
Sum	670,430	$24,175,709,206

Source of Data: Bureau of Economic Analysis.

Trends and scenarios calculated by author.

Over a decade, there would be 74,492 fewer jobs (or 670,430 person-years of employment) and $24.2 billion less in personal income in Michigan.

Alternatively, one can consider future scenarios as compared to what “would have been” incorporating the trend rate of growth in employment. If Michigan were to grow at the national rate, a 3% trend would be appropriate. Successful initiatives for life sciences in Michigan could result in a higher growth rate of employment. A doubling of the growth rate (to 6%) could be derived from either a higher national trend or a larger Michigan market share. Absent new legislation, Michigan could develop a "dynamic critical mass as a life sciences community" that grows its market share. Analyses of total lost of the pharmaceutical industry from Michigan at 3% and 6% trend rates are presented in Table 5.

TABLE 5: Multiplier Effect of the Loss of Pharmaceutical Employment in Michigan, 3% and 6% Trends in Employment, 2004 dollars

	3% Trend		6% Trend	
Year	**Jobs Lost**	**Personal Income Lost**	**Jobs Lost**	**Personal Income Lost**
2004	0	$0	0	$0
2005	27,066	$1,075,886,982	29,300	$1,164,080,908
2006	54,198	$2,112,228,599	58,869	$2,292,956,976
2007	81,400	$3,110,188,469	88,721	$3,387,970,859
2008	83,842	$3,141,290,354	94,045	$3,520,832,461
2009	86,357	$3,172,703,258	99,687	$3,658,904,322
2010	88,948	$3,204,430,290	105,669	$3,802,390,766
2011	91,616	$3,236,474,593	112,009	$3,951,504,129
2012	94,365	$3,268,839,339	118,729	$4,106,465,076
2013	97,195	$3,301,527,733	125,853	$4,267,502,922
2014	100,111	$3,334,543,010	133,404	$4,434,855,978
Sum	805,097	$28,923,565,151	966,287	$34,587,464,397

Source of Data: Bureau of Economic Analysis.

Trends and scenarios calculated by author.

Under a scenario under which the national growth rate was 6% or under which Michigan would have been successful in securing a larger national R&D share, there would be 133,404 fewer jobs (or nearly 1 million person-years of employment) and $34.6 billion less in personal income in Michigan over the next decade.

A summary of alternative scenarios is presented in Table 6.

TABLE 6: Multiplier Effect of the Loss of Pharmaceutical Employment in Michigan under Alternative Scenarios, 2004 dollars

Scenario	Growth Trend	Ultimate Job Loss	Total Job Years Lost	Personal Income Lost ($Billion, 2004)
Leave Michigan	0%	74,492	670,430	$24.176
Leave Michigan	3%	100,111	805,097	$28.924
Leave Michigan	6%	133,404	966,287	$34,587
International Market	0%	55,869	502,823	$18.132
International Market	3%	75,084	601,571	$21.604
Export Control	0%	37,246	335,215	$12.088
Export Control	3%	50,056	401,047	$14.403
Legislative Relief	0%	18,623	167,608	$6.044
Legislative Relief	3%	25,028	200,524	$7.202

Source of Data: Bureau of Economic Analysis.

Trends and scenarios calculated by author.

These analyses include all employment in the pharmaceutical and biotech industries. Employment in these industries includes persons involved in R&D, manufacturing, marketing and general and administrative personnel. The model considers the decline in employment to occur uniformly over three years. In the very short-run, only R&D employment would be affected. However, with a decline in R&D, declines in all other positions would follow.

To the extent that manufacturing and other areas of pharmaceutical employment are slower to change in response to importation, the above numbers may overestimate short-run employment and personal income loss. However, since the Bureau of Labor Statistics employment counts seem to include only part of the pharmaceutical / biotech industries, as compared to the Dun & Bradstreet data, there may be off-setting over/under-estimates of employment and personal income loss.

In a model with similar premises, considering profit regulation, not importation, Vernon (2002/2003) suggests that employment levels would not decrease for five years. However, regulating prices for new drugs would be progressive, whereas importation could be much more immediate.

IX. Discussion

This brief analysis has considered some of the likely effects of prescription drug importation on R&D. I suggest three scenarios under which reductions in R&D would range from 25% to 75%. Response to importation could be extensive and quick, resulting in a truly international market for prescription drugs with prices approaching generic levels – and R&D investments approaching generic levels. Response to importation could be muted through actions taken by pharmaceutical companies to control exports, and thereby controlling imports to the United States. Finally, even if legislation permitting importation is passed, there could be legislative relief – actions taken by legislators and/or regulators to mitigate damage to the pharmaceutical industry. Alternative views of how importation is implemented suggest ways in which fully implemented importation authorization would only have 50% or 25% reductions in R&D.

Upon determining that R&D expenditures are affected by importation legislation, pharmaceutical companies must decide *where* to take the reductions in investments. From the perspective of the state of Michigan, employment loss could be complete – the pharmaceutical and biotech industries could leave the state to consolidate investments in more preferred locations (e.g. the East Coast or the West Coast where there are already critical masses of investments). Alternatively, the impact on Michigan could be proportional to national trends. The three national scenarios are applied to Michigan. Of course, it is possible that in the face of national consolidation of investments, Michigan becomes a preferred location and employment

increases. However, given the ratings of “best places” for pharmaceutical and biotech companies, consolidation is Michigan would not appear likely.

The total effect of importation on Michigan is determined though the application of multipliers of direct pharmaceutical employment. Adding the indirect effects of job losses among suppliers and induced effects of job losses among support industries, the total effect is a six-fold impact on employment and personal income. The likely effects of prescription drug importation would be substantial job loss in Michigan (20,000 to 133,000 jobs) and substantial reduction in personal net income over the next decade ($6 to $35 billion).

All scenarios for investment and applications to Michigan are dependent upon the particular rules of the legislation, how they would be enforced, investors’ concerns about returns in the industry and the relative attractiveness of Michigan as an R&D location. Legislation to authorize importation of prescription drugs along the lines currently being considered (SB. 2328) could have a substantial impact on Michigan’s economy. As a state and as a country, the economic impact of pharmaceutical R&D as a means of employment and personal income should be considered alongside other factors in the evaluation of this legislation.

IX.1. Additional Factors to Consider

The motivation for importation legislation is to permit savings to consumers through lower prices. While some analysts have suggested that these savings may be modest, at a minimum they should be related to the effects on the industry. If there are substantial losses in employment and personal income, this could only be because of substantial inroads to importation and lower prices.

According to Verispan (2004) data presented in Table 7, nearly $5 billion was spent on brand-name prescription drugs in Michigan in 2003. At one-third to one-half savings associated with importation (ignoring transactions costs), $1.6 to $2.5 billion dollars could be saved once importation is fully implemented. This amount would diminish over time as current branded

products become available as generics (in which case they would be available domestically at lower prices – there would be no importation of generic drugs).

For purposes of comparison with lost personal income due to importation, savings associated with lower prescription drug prices are presented in Table 7. Three important assumptions applied to these calculations are the percentage savings associated with importation (one-third and one-half), the growth rate in spending each year and the rate of prescription drugs becoming generic each year. A growth rate in spending of 12% per year (the moving average from 1984-2003, at a 3-year or 5-year lag; then discounted at 2% per year). A generic transformation rate of 15% per year was assumed. Savings associated with importation could be $12.4 to $18.8 billion.

TABLE 7: Retail Sales and Savings for Prescription Medication in Michigan, 2003

Prescription Medication Type	**Spending**	**One-Third**	**One-Half**
Michigan Retail Dollars Brand Only	$4,914,096	$1,621,652	$2,457,048
Michigan Retail Dollars Generic Only	$999,244	--	--
Total Retail Sales for Michigan 2003	$5,913,340		
Spending Savings 2005-2014		$12,424,279	$18,824,665

Source of Data: Bureau of Economic Analysis. Scenarios calculated by author.

Note that these savings in spending are similar to the personal income losses associated with scenarios of export control and the transformation of prescription drugs into an international market. While not purely coincidental, that lower prices are somewhat proportional to lost income, there is not a direct connection that makes this an expected result.

These savings in spending would accrue to individuals who purchase prescription drugs internationally without insurance (currently 0.5% of purchases if Michigan is an 'average' state), to insurance companies and self-insured employers who provide prescription drug coverage – which may appear to consumers and employers in the form of reduced future premiums, and to the importing firms, some of which reside outside of Michigan. If the Kavanos et al. (2004)

analysis of Europe applied to Michigan, then the bulk of savings generated in Michigan due to lower prescription drug prices could be captured by out-of-state wholesalers and not Michigan residents.

The loss in personal income is for those persons associated with the pharmaceutical industry, very broadly defined given the multiplier of 6.2. The savings in terms of lower prices is for those persons who consume prescription drugs and/or the companies that are involved in the transactions of buying and selling prescription drugs.

Given that Michigan is a relatively pharmaceutical-intensive state in terms of employment, a one-third to one-half savings in spending could be similar to the amount of personal income lost due to lower employment (over the next 10 years), if pharmaceutical companies reduce R&D investment proportionally to national trends. Under scenarios where Michigan suffers a larger than proportionate loss of employment (e.g. Leave Michigan), there is a net loss in personal income to residents of Michigan.

IX.2. Additional Factors Not Considered

There are a number of factors that were not considered in this analysis that would belong in a complete welfare analysis. Some of these factors include: the loss in health status associated with a reduction in the creation of new prescription drugs; Creation / destruction of a critical mass for life sciences development in the state of Michigan and additional jobs; Taxes on income / property (State and local budget impact) associated with pharmaceutical industry location in Michigan; Philanthropic contributions of pharmaceutical firms and their employees.

Some analysts, notably Lichtenberg (2003), have argued that improvement in health status associated with pharmaceutical improvements has been substantial over the past couple of decades. While there are no guarantees that new prescription drugs would yield the same benefits in terms of reductions in morbidity and mortality of current prescription drugs, the trends in health improvement would be expected to be positive.

In total, importation would require a re-thinking of public polices in Michigan towards life sciences investments.

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