The Economic Significance and Regulatory Analysis of the Canadian Railway Transportation Industry

by

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CONTENTS

ABSTRACT

As globalization of the world economy increases, transportation economics becomes more and more important. Lots of economic activities are directly or indirectly related to transportation; hence transportation has influences far beyond the sector itself.

This paper presents a methodology to examine the significance of transportation and railway in the Canadian economy and also provides an analysis that uncovers the government regulating behaviour in the railway transportation sector which is a highly regulated industry, in the past as well as in the future, with the purpose of examining the necessity of regulating a natural monopoly industry.

Based upon the theoretical microeconomic results, feasible solutions can be found in favour of both the firms and the whole society. Through the study of the consequences of government regulatory interference, we are trying to find a win-win strategy to keep railway active with efficient regulations.

Key words: Monopoly, Natural Monopoly, Transportation, Railway, Regulation, Subsidy.

Introduction

The developing transportation technology has brought once-distant nations into close association. A country as vast as Canada is highly transportation intensive. It is interesting to take a look into the industry, which has a close relationship with economic and social welfare. Railway as a typical natural monopoly industry presents both benefits and costs of dominating a specific market. Some economists argue that monopoly will creep out the public utilities while others believe that with good regulation, the benefits of monopoly in the railway industry can be well justified. This paper looks into the historical and current monopoly situation in this industry and examines the impact of government interferences by subsidizing and regulating the industry.

Part I gives an overview of the transportation industry by briefly introducing the Aggregate Transportation Function and the significance of the transportation and railway industry. By presenting the features of railway, Part II presents an outlook of the railway industry, and introduces the monopoly market structure. Part III gives a theoretical study on the railway industry to show how natural monopoly came into power in railway and the positive and negative affects to the economy and social welfare and discusses how a government regulator should deal with natural monopoly. Part IV justifies the government regulatory efforts. The analysis from the social welfare point of view shows how subsidies work for regulating a monopolistic industry like

railway. This part also points out some problems faced by the regulators while using a marginal cost pricing strategy to subsidize monopolists who suffered operating losses, and warns of over-subsidization.

The rail industry of Canada is among one of the most efficient railways in the world, but it deserves more supportive public policies. The natural monopoly characters of railway can benefit the shipper, the carrier, the public and even the whole economy under modest regulation.

PART I THE TRANSPORTATION INDUSTRY

Information technology has speeded up the delivery of goods that can be digitized, including music, movies, books, photos, but we still need transportation to move the items that consist of atoms, such as books, cars, and goods. Besides, people must still rely on planes, trains, ships, trucks and buses to get to their destinations. Beginning with the use of other animals and including the development of wheeled vehicles, ships, and machine-powered vehicles, even hot balloons, transportation has extended into space.

1.1 Transportation Modes

Transportation has gone through several thousands years with the economy and now has developed 5 main modes: water transportation, rail transportation, air transportation, trucking and pipeline transportation. Each mode has its unique distinguishing features to meet with the special demand of the consumer or the geographic condition. In general, water transportation is used for the movement of bulk commodities of relatively low value per tonne, such as coal, ore, grain, gravel and salt, of course via waterway such as sea, lake, river and canal. Rail transportation is used principally for the movement of such bulk goods as grain, coal, ore, lumber and chemicals. It can be used for the movement of containers and other types of merchandise freight. Air transportation is used to move both large and small items when speed is more important than cost or when remote areas like desert, virgin forest, are inaccessible by land or water. Trucks are used in many ways. Small trucks or vans

are used as delivery vehicles in cities and towns. Big trucks can transport logs, petroleum, consumer goods and a great variety of industrial products. The container trucks can also be used as an inter-mode transport method connecting rail and marine transportation. Pipeline transportation is a very special mode of the five, it can deal with petroleum, petroleum products, gas and certain chemicals, those other modes can hardly handle at a relatively low cost.

1.2 Economic Resource Allocation

One may want to define an aggregate transportation function in terms of the economic resources allocated to transportation. The aggregate transportation function (ATF) takes into account not only the transportation capital stock including vehicles, infrastructures, but also the services related to transportation such as insurance, coast guard, harbours and ports. ATF is divided into three levels by different agents or suppliers, including individuals, businesses and government, as shown in Figure 1-1.

The first layer is individuals; they use cars to meet their everyday transportation needs. At this layer, individuals are the suppliers and demanders by providing and consuming the transportation services. They create the supply and demand themselves. The output is not being used to create another good or service, thus it is considered a final demand also. The resource allocated to this sector is the automobile rendered as transportation equipment.

The business sector is also a supplier of transportation services for both its own and private use. Business creates goods and services as well; the demander could be individuals (consumers), business or government. E.g. an individual calls a cab to a

show; airlines rent trucks to move goods in-house; the government rents a helicopter to carry first aid goods, etc. The resources allocated to this sector are rent, capital and labour as well.

Finally, as reported in Figure 1-1 the government is a supplier of transportation output in terms of infrastructure as well as services associated with its infrastructure, for example, traffic control, coast guard services, etc. Please note that it is an input to the production of other goods and services when used by business. For other demanders like consumers and government itself, the output is a final demand.

Figure 1-1: The Aggregate Transportation Function in the Economy

Agent/Supplier	Purpose	Mode/Resources (Output)	Demanded By (Final Demand/Input)
Individuals	Personal	Automobile	Consumers
Businesses	Business/Personal	Automobile Taxicab Bus Truck Rail Marine Air Other	Consumers Business Government
Government	Business/Personal	Roads/Services Ports/Services Airports/Services	Consumers Business Government

Source: Transport Canada (1992), "The Importance of Transportation in the Canadian Economy"

To analyse the transportation industry resources, we usually focus on the business and government levels, which are commercial and passenger transportations. The resources at the individual level, i.e. personal use of vehicles are not considered in this paper. This paper will mainly focus on the government and business level, especially when

analysing the monopoly impacts.

1.3 Methodology to Determine the Economic Role of Transportation

Whether an economy develops appropriate transportation or whether existing transportation contributes to the economy is a question as difficult to answer as that of the chicken and the egg. But obviously, the growth of an economy has only been possible as a result of constantly improving means of movement. In this section we examine the economic impact of rail together with the whole transportation industry. Since the economic impact can take many forms, we consider the following eight criteria which reflect the significance of transportation in the economy to avoid unilateralism:

1) GDP measurement on an industry value-added basis; 2) GDP measurement on expenditure/final (domestic) transportation-related demand; 3) the number and earnings of persons employed; 4) the amount of capital invested; 5) the amount of public expenditures to aid the transportation system; 6) the tax role; 7) the pivotal role of transportation activities; and 8) transportation as a user of energy products.

In each criterion, we will discuss how or what the railway contributes to the industry. This two-step methodology can take the interaction between different modes into account, because the transportation needs have to be satisfied by other modes in one way or another.

1.4 Economic Significance Analysis

The Canadian economy is one of the most transport-intensive in the world due to the small population, large physical size, and heavy dependence on international trade.

This uniqueness makes the transportation sector more important to the economy than it is for most nations.

We now analyze the impact by using the above mentioned methodology.

1) GDP Measurement on an Industry Value-added Basis

Historically, the most widely used measure of transportation's role in the economy has been the "Transportation Bill". The Transportation Bill is constructed from statistics on revenues and expenditures, and attempts to measure the total sum of economic transactions for transportation services, equipment, and so forth. But while this reflects how much is spent on transportation throughout the economy, it does not measure how much the transportation industry contributes to the total economy, nor does it evaluate the final demand for transportation, which is consistent with other measurements such as the Gross Domestic Product. [1]

To improve the above statistics' weakness, U.S. transportation economists found that the importance of transportation can be measured using the system of national accounts (National Income and Product Accounts is used in the U.S.) on either an industry value-added or expenditure/demand basis.

The Annual Report of Transport Canada shows that transportation industries accounted for 38.6 billon of 1997 dollars, or 4.1 per cent of GDP on a value-added basis in 2001. Railway contributed 4.9 billion dollars which represents 12.2 per cent of the whole

[1] XiaoLi Han & Bingsong Fang (1998), "Measuring Transportation in the U.S. Economy".

industry contribution, or 0.5 per cent of GDP. The percentage is rather low if you consider that rail carries 63 per cent of the freight (tonne-kilometres) in the market. The main reason for a relatively low GDP percentage is that Canadian rail has a lowest freight rate in the world. A research of the Australia Productivity Commission shows that the rail freight rate in Canada is 60 per cent below the international average. While carrying major freight, but at an undercharging rate, rail supports quite a lot industries in Canada like the grain and coal industries, etc. It also strengthens the competitive position of Canada in world trade through lower transportation costs. This is one major contribution of the rail industry.

2) GDP Measurement on Expenditure / Final (Domestic) Transportation-related Demand

Transportation-related final demand is the measure of transportation as a component of GDP, which includes the value of all goods and services delivered to final users for transportation purposes no matter which industry produced them, for example, expenditures for personal consumption, investment by both business and government, current government expenditures, as well as exports less imports. It is different from the GDP measurement on the industry value-added basis which is the GDP the industry generates. Transportation-related final demand is a more general measurement on the demand basis for transportation from all the industries, and thus has a higher absolute value than the measurement on the value-added basis has.

Final domestic demand measures the final demand for transportation regardless of who

supplies the demand, domestic producers or imports. It differs from transportation-related final demand in that it excludes the balance of trade in the transportation goods and services, instead of looking only at the expenditures made for goods and services produced within Canada.

Transportation-related final demand represented 14.9 per cent of total expenditures in the economy. The final transportation-related domestic expenditure was s 133 billion of 1997 dollars which represents 13.7 per cent of the total final domestic demand in year 2001.

3) The Number and Earnings of Persons Employed

The direct economic impact of transportation is closely related to the employment it generates. In 2000, the total workforce in the sector reached 826,400 people with over 18,000 jobs created during the year. Throughout the period 1996 to 2000, transportation accounted on average for 7 per cent of total full-time employment in Canada. In 2000, there were over 12 million full-time employees in Canada. An estimated seven per cent of these employees were involved in activities related to transport actions. Railway had 40.9 thousand employees in 2000, which is only 5.1 per cent of the total transportation industry. Table 1-2 shows the employment in transportation sector in year 2000. Observe that compared with the other ground transportation mode—trucking, which hired 320 thousand employees, railway has much less labour input but higher tonne-kilometres output (299 tonne-kms and 138.5 tonne-kms, respectively).

Table 1-2: Employment in the Transportation Sector (2000)

Transport Services/Infrastructure	Thousands of workers
Air	85.9
Marine	24.4
Rail	40.9
Truck	320
Bus/Urban Transit	66
Taxi	13.5
Highways	69.6
Other	73.3
Total	**693.6**

Notes:

1. Due to confidential data that has only been included in Totals or the Grand Total, the individual sections do not necessarily add to the sums shown in the table.
2. Excludes part-time employees.

Source: Transport Canada, Annual Report 2001

Besides that, the earnings of full-time employees working directly in transportation are highly competitive on average. In 2001, full-time employees in the transportation industry earned an average annual wage of $38,532, or 11.6 per cent over the national average of $34,528 for the total economy.

Table 1-3 shows that wages in the transportation sector are superior to those in many other fields. The weekly wage for railway was 877 dollars which is 20 per cent above the average industry level and 34 per cent higher than the total economy level. The relatively high wage rate guarantees a sufficient labour force supply to support a sustainable economic development.

Table 1-3: Average Weekly Earnings in Transportation and Warehousing Sector by Mode[1], 2000

Transportation Modes	Current dollars
Rail	**877**
Water	930
Air	859
Truck	680
Public Transit	592
Pipeline	1,208
Total Transport and Warehousing [2]	728
Total Economy	**654**

Notes:

1. Tabulations based upon the North American Industrial Classification System (NAICS).
2. Does not include owner-operators, private trucking, delivery services or government employees

Source: Transport Canada, Annual Report 2001

Thus transportation makes a substantial contribution to the economy in both the number of people employed and income generated by wages.

4) The Amount of Capital Invested

Investment in the transportation sector in 2001 reached 31,739 million 1997 dollars which accounted for 3.1 per cent of GDP. Business investment in transportation equipment makes up the largest part of investment in transportation and accounts for 2.4 per cent of GDP. Almost 91 per cent of investment by the government is for the infrastructure, as shown in Table 4-3. The business side is vice versa.

Table 1-4: Investment in Transportation, 2001

	Millions of 1997 dollars	Per cent of GDP
Business Investment in Transportation	**24,619**	**2.4**
Transportation Infrastructure (roads and railways)	3,125	0.3
Transportation Equipment	24,362	2.4
Inventories	-2,868	-0.3
Government Investment in Transportation	**7,120**	**0.7**
Transportation Infrastructure (roads)	6,468	0.6
Transportation Equipment	652	0.1
Total Investment in Transportation	**31,739**	**3.1**

Source: Transport Canada, Annual Report 2001

The railway industry is a highly privatized industry especially after the successful privatization of CN in 1995. It pays for the infrastructure and the equipment itself. The high initial and regular investment helped the natural monopoly power in railway to come into force (further discussion in Part III).

5) The Amount of Public Expenditures to Aid the Transportation System

In addition to the huge sums privately invested in transportation facilities, large annual capital expenditures are made by federal, state, and local governments on transportation facilities, especially highways. For example, the government expenditures on transportation for the past five years have ranged from $17 billion to $18 billion a year. In the year 2000/01, $17,893 million dollars was spent by federal, state, and local governments in building and managing domestic transportation facilities (see Table 1-5 for detail). This represents an important item in the government's budget every year.

Table 1-5: Public Expenditures on Transportation

(2000/2001)

	Millions of dollars
Transport Canada Expenses	1,233
Other Federal Expenses	771
Provincial/Territorial[1] Expenses	7,660
Local [2] Expenses	8,228
Total Transport Expenditures	**17,893**

Notes:

1. Net of federal transfers as reported by the provinces.
2. Calendar year basis; net of federal and provincial transfers.

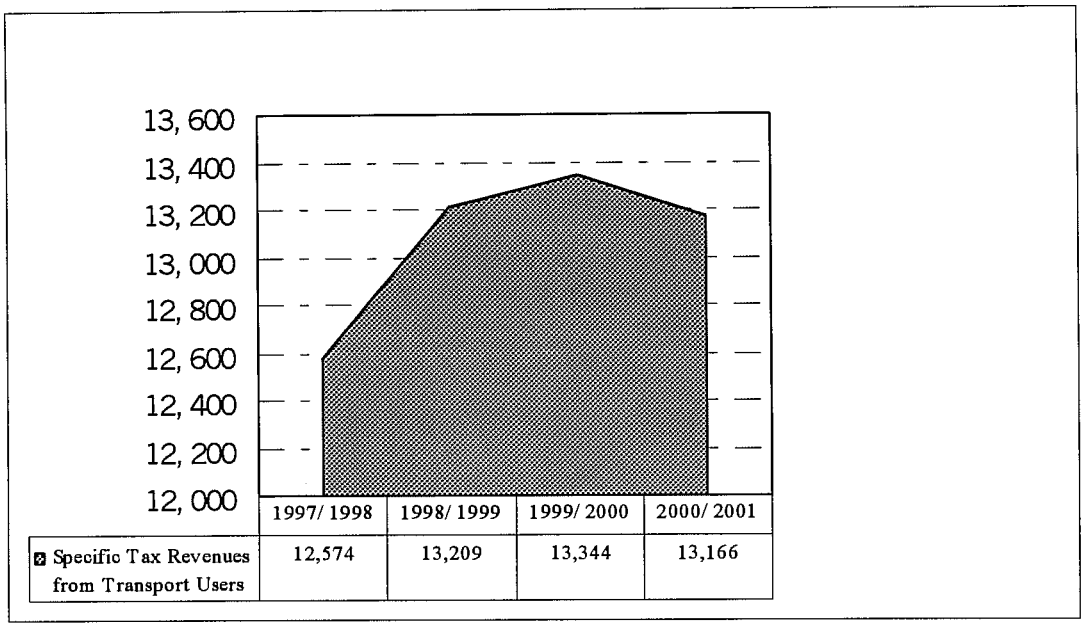
Source: Transport Canada, Annual Report 2001

The expenditure on rail was $301 million, which only made up 1.6 per cent of the total government expenditure in transportation, while road made up almost 74 per cent. By eliminating the grain movement subsidies under the Western Grain Transportation Act (WGTA), which was more than 600 million dollar in 1994, government dramatically lowered its expenditure allocated to railway. The economic impact will be further discussed in Parts III and IV.

6) The Tax Role

Transportation does more than only spend public funds on facilities; it also generates tax revenues for the various levels of governments. Chart 1-6 shows that the government has stable tax revenues of around $13 billion coming from the transportation sector since 1998 by levying federal excise fuel taxes, provincial motive fuel taxes and licences and fees. For every litre of regular gas, the federal government collects 10 cents in gasoline tax.

Chart 1-6: Tax Revenues Collected from Transportation



Source: Transport Canada, Annual Report 2001

As to the railway, in 2001, $654 million was contributed to tax revenues including fuel tax, capital tax, property tax, sales tax etc. It was more than the government expenditure of $301 million in 2001. Thus from a tax point of view, transportation and railways are also a very important part in the economy as a collector and payer of taxes.

7) The Pivotal Role of the Transportation Activities

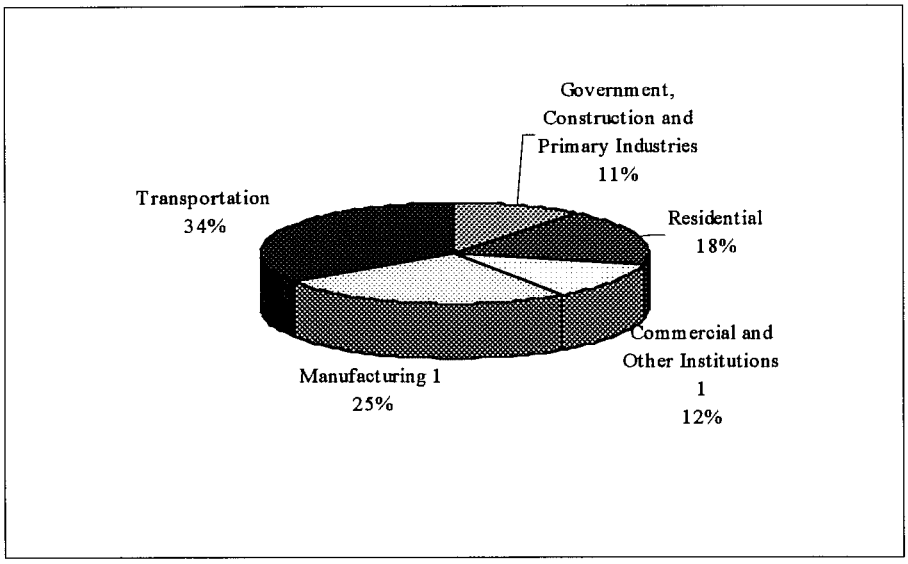
People always focus on the services that transportation sector provides, but it should also be noted that transportation is a major consumer of the industrial production of the nation. In 2001, personal expenditures on transportation equipment (new and used) reached $42,968 million dollars; business and government invested $34,607 million

dollars in transportation equipment and infrastructure like roads and railways. Transportation activities are a major contributor to the Canadian economy.

8) Transportation as a User of Energy Products

A close interrelationship exists between transportation and energy. In 2000, transportation accounted for 34 per cent of total energy use in Canada. As Figure 4-6 shows, this sector is the largest energy user in Canada. Figure 4-7 reports that road transportation as the biggest consumer in transportation sector used about 74 per cent of the total energy. Pipeline, air, marine, rail consumed 9, 9, 5, and 3 per cent, respectively.

Figure 1-7: Energy use in the Canadian Economy, 2000

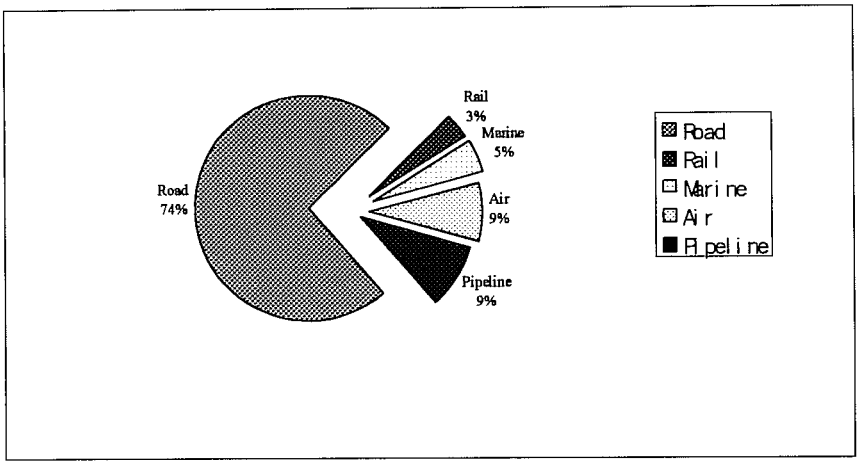


Source: Transport Canada, Annual Report 2001

Transportation is also a heavy user of energy products. But as Figure 1-8 shows, rail uses only 3 per cent of the total consumption in the industry. The small share of railways suggests that it is an ideal way out for transportation to achieve environmental

targets as a Kyoto Protocol carrier.

Figure 1-8: Energy Use by Mode, 2000



Source: Transport Canada, Annual report 2001, based on Statistics Canada's Quarterly Report on Energy Supply-Demand.

1.5 Summary

By considering that transportation accounted for 4.1 per cent of GDP, 14.9 per cent of total final transportation-related demand, and 7 per cent of the workforce; besides $31,739 million (3.1 per cent of GDP) investment, $17,893 million in public expenditure was spent on this sector, more than 13 billion dollars tax was collected, its important role as a buyer of other industries' production, and its close relationship with the energy industry, one can readily acknowledge the pivotal importance of transportation in the Canadian economy.

Railway has more economic impact than is suggested by those figures. It supports the other industries by providing low freight rates; it finances its infrastructure and consumes less public expenditure and creates tax revenues; it is a big buyer of locomotive and infrastructure products and consumes less energy. For all those reasons, rail plays a major role in the Canadian economy

PART II OUTLOOK OF THE RAILWAY INDUSTRY

In this part, we will discuss the characters of railway itself and the railway industry as well.

2.1 Features of Railway

Railway is highly efficient for carrying heavy loads over long distances. Technically speaking, a rail wagon can carry 110 tonnes, about four times what a normal truck can carry. Thus, bulk commodities such as grain, coal, sulphur, logs, chemicals and forest products are the backbones of the rail industry with traffic volumes of 290 million tonnes in 2001.

As explained in the previous section, rail is more energy efficient and environment friendly than most other transportation modes. It has a significant environmental advantage when comparing greenhouse gas emissions (GHG). Although rail currently carries approximately 60 percent of surface goods by volume in Canada, it contributes only 4 percent to overall national GHG emissions. Railways are already the most fuel-efficient surface mode. On average rail is five times more fuel-efficient than inter-city truck and generates one-fifth of the GHG emissions of truck (RAC data).

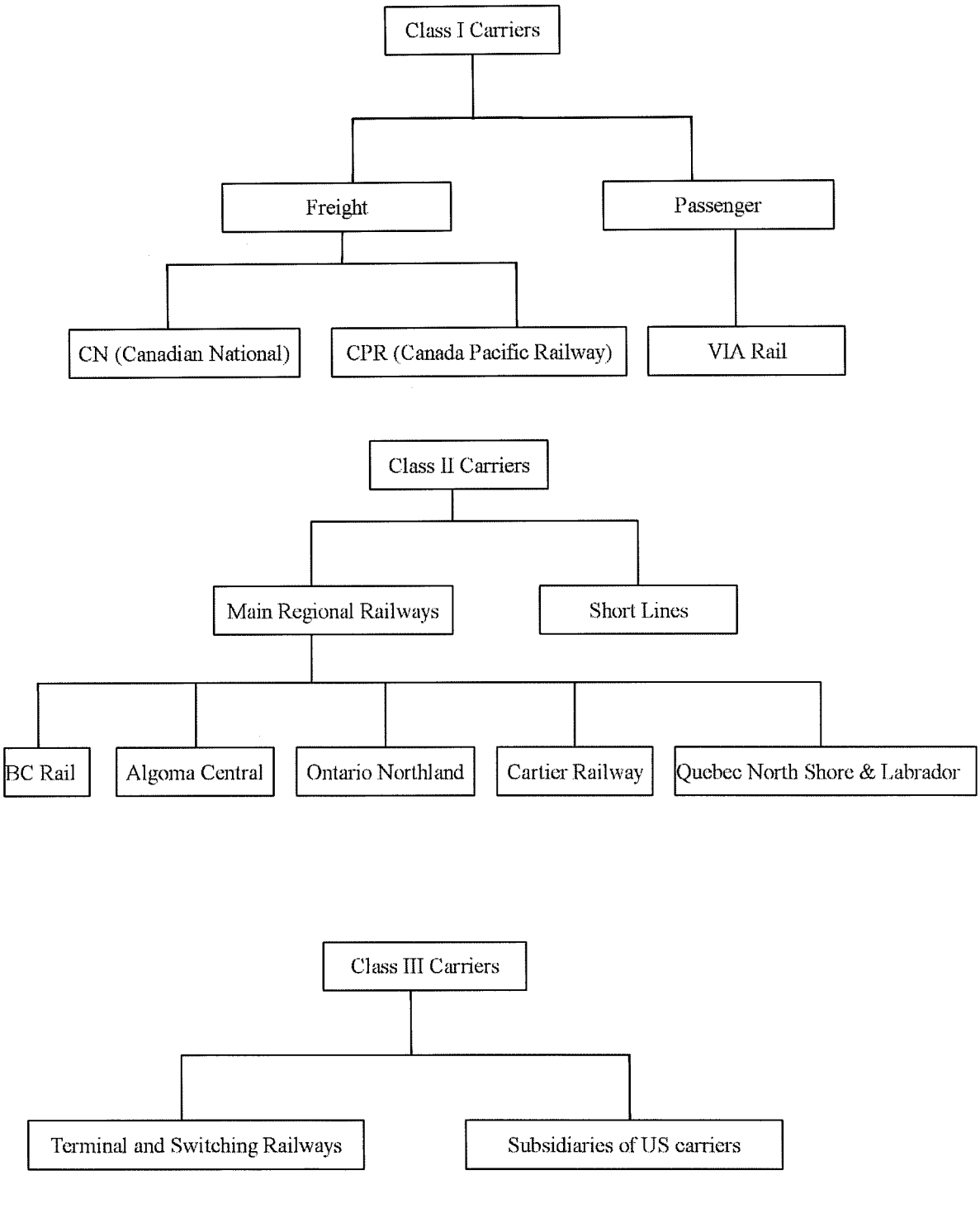
Rail provides an environmentally responsible alternative to the pervasive and rapidly increasing problems of highway overcrowding, land use, and massive highway infrastructure costs. A 100-car freight train can take 275 heavy-load trucks off already congested roads while a big truck causes 2.5 to 3.5 times as much congested as a car. Railway can also save land resources and lower the infrastructure cost. New urban expressways cost up to $60 million per kilometer, while railways cost on average $9

million.

2.2 Major Components of the Railway Industry in Canada

As Chart 2-1 shows, the Canadian rail network is made up of two Class I carriers – Canadian National (CN), and Canadian Pacific Railway (CPR)—accounting for roughly two thirds of the rail infrastructure network and 90 per cent of the industry revenues. The five class II carriers are regional railways (BC Rail, Algoma Central, Ontario Northland, Cartier Railway and the Quebec North Shore & Labrador) which accounted for 2 per cent of industry revenues in 2001, while short lines also accounted for 2 per cent. Class III carriers are mainly terminal or switching railways and the small subsidiaries of US carriers which generate the remaining industry revenues. With respect to the infrastructure, Class II carriers, which are some 50 regional and short line railways, account for most of the remainder. The dominant players, CN and CPR have strong domestic networks, significant links into the US, including ownership of several US rail lines, and a growing number of regional railway affiliates from which to serve North American markets. They also have easy access to Canada's major ports and to interior communities, either directly or indirectly, through truck-rail inter-modal service. While the freight transport market is duopolized by CPR and CN, the passenger transport market is monopolized by VIA Rail which dominates 95 per cent of the market in terms of the inter city rail passengers and inter city passenger kilometres. This structure is graphically shown in Chart 2-1.

Chart 2-1: Railway Carrier Structure



PART III THEORETICAL STUDY ON RAILWAYS

3.1 How Natural Monopoly Came into Power?

Railway can be considered as a natural monopoly industry. Natural monopoly is a monopoly that does not arise from government intervention in the marketplace to protect a favoured firm from competition but rather from special characteristics of the production process in the industry under the current state of technology. Theoretically, natural monopoly arises when there are very large 'economies of scale' relative to the existing demand for the industry's product, so that the larger the quantity of the good a single factory produces, the cheaper the average costs per unit gets — right up to production at a level more than sufficient to supply the entire demand in the relevant market area. However, the existence of economies of scale is still not sufficient to assure the existence of a natural monopoly. The concept of 'natural monopoly' also refers to the case where the firm has a cost function C(•) which exhibits subadditivity on the comprehensive set $K^C = \{Q \in R_+^m : Q \leq Q^0\}$ if for Q'+Q"=Q $\in$ K^C, C(Q')+C(Q")>C(Q). The function indicates that a single firm may produce any output more efficiently than any number of smaller firms[2] (Spulber, 1989). This might occur when production of the good requires extremely large initial capital investments to enter the market even on a modest scale, but then producing additional output requires only very modest additional outlays beyond the fixed initial investment. Under such circumstances, the firm that initially starts out with the largest share of the market is in

[2] We should also note that in the single good case, declining average cost, which reflects economies of scale, is sufficient for subadditivity, but subadditivity does not require economies of scale to be present. Other characteristics, such as cost complementarities, can be sufficient for subadditivity.

a position to price its output at a level below its competitors' costs of the business – and the larger its market share gets, the lower its unit costs become, until a monopoly position is finally obtained.

Railways are among the most capital-intensive businesses, the initial investment on the rail infrastructure and locomotive to enter the business being enormous. The capital invested in railways is relatively immobile for the short and medium term, which also means the sunk cost is very high. This provides a significant barrier to the entry of new competitors on specific corridors and injects an element of caution into significant new investments by existing companies. But once the investment is made, it has a very low marginal cost. The average cost curve is downward sloping, as the total cost is spread over a huge output quantity. It permits large profit gains as traffic density rises. It has all the theoretical characteristics of natural monopoly, and practically it is not surprising that the market is dominated by two duopolists - CN and CPR, after pricing out other competitors or merging with them.

3.2 Monopoly Benefits:

3.2.1 General Benefits

Let's suppose that the firms form a cartel no matter how many firms enter the market, (this is a rational assumption in an industry like railway transportation), so the cartel solves the problem of

$$\max_{Q} \{P(Q)\,Q - C(Q)\}$$

where P(Q) is the inverse market demand function and C(Q) is the cost function. Obviously, the optimal industry output and price will be unaffected by the number of

firms of the industry.

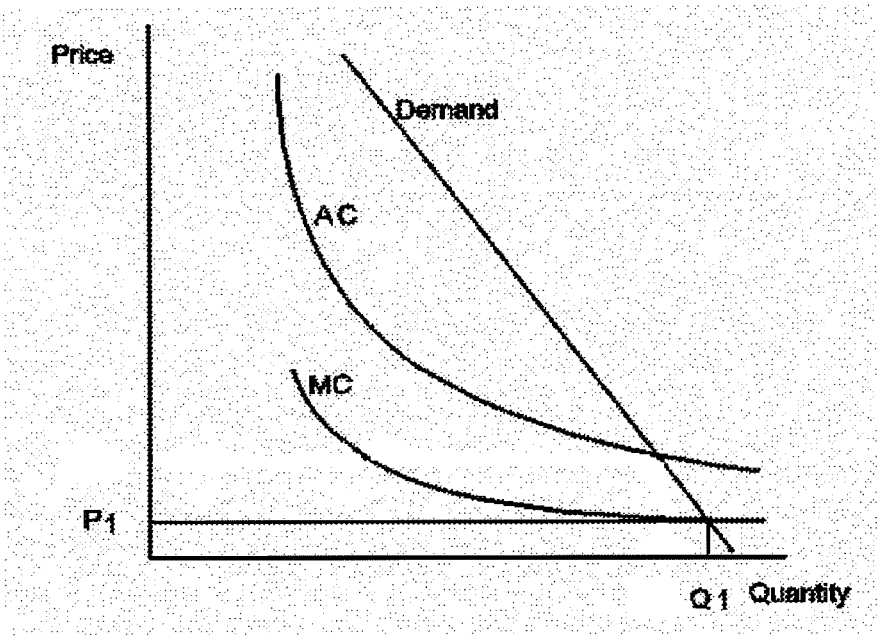
If the government does not control the entry of firms into this industry, according to traditional microeconomic theory, the equilibrium number of firms will be $J^* = \Pi_m / K$, where Π_m is the total monopoly profit in this industry and K is the fixed cost for each entrant. In terms of welfare this means that free entry leads to a complete dissipation of monopoly profits.

This is also easy to understand intuitively in the case of the rail industry. The economies of scale exist because another firm that entered would need to duplicate existing rail lines, whereas if only one firm existed, this duplication would not be necessary. And one firm that serves everyone would have a lower cost per customer than two or more firms. From the point of view of the rest of society, monopoly is a blessing, since monopolists can in fact produce transportation services they will demand at a lower total cost in resources than multiple competing firms could.

3.2.2 Monopoly Benefits Magnified in an Increasing Return to Scale Industry

The monopolist might be better able to exploit scale economies because they are producing on a larger scale to satisfy a large proportion of total market demand. It is worthwhile to mention that the rail industry is a typical increasing return to scale industry, with a concave total cost function and downward sloping marginal cost curve. If the monopolist achieves substantial increasing returns to scale, it can operate on the lower part of the cost curves. The profit-maximizing equilibrium output becomes Q1 at price P1. This is a higher output and lower price than under perfect competition.

Figure 3-1 Monopoly Cost and Demand Curves



3.2.3 Other Monopoly Benefits

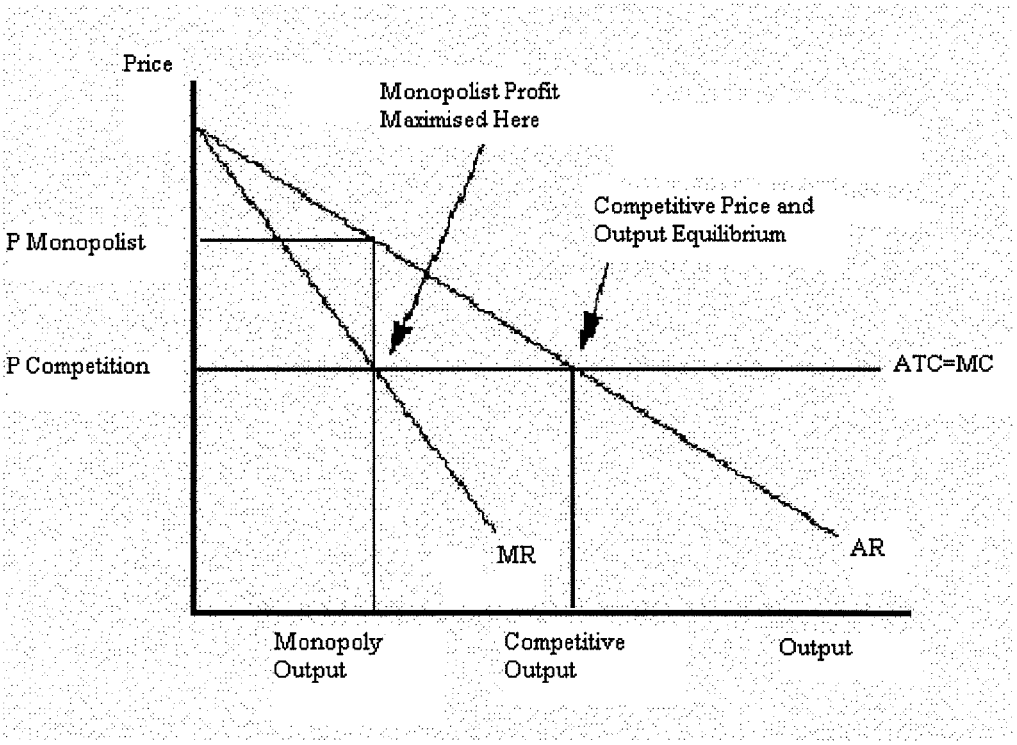
In the railway industry, the railway network is definitely a huge investment at the beginning stage. In a perfect competition market, each firm would build its complete independent railway network, which might be overlapping each other, in order to provide competitive services and tariffs. Monopoly can avoid over-investment to cut the setup cost and benefit the final rail service users with a lower price.

3.3 Monopoly Also Hurts

However, once the firm has attained a monopoly position, there is the likelihood that it will use its unusual dominance of this market to maximize profits by restricting output below the competitive level, and raise prices. Prices would be set above marginal costs so that the overall social welfare will be below the maximum theoretically achievable. To simplify the study, and represent more general cases, we assume that the cost

structures for both the competitive firm and the monopoly are the same and the output can be produced at a constant marginal and average total cost. Figure 3-2 shows that just as with other monopolies, a natural monopoly maximizes profit by choosing the output where MC = MR. And just as with other monopolies, the firm is socially inefficient -- it produces less than the socially best output.

Figure 3-2: Monopoly versus Perfect Competition



It is therefore argued by some economists that such natural monopolies represent instances of 'market failure'. To avoid the 'market failure' generated from the natural monopoly, government stepped in to regulate prices or output levels in such an industry so that the price will more closely approximate marginal costs of production.

In some cases, a firm may have substantial domestic monopoly power but face intensive competition from overseas producers. This limits their market power and

helps keep prices down for consumers. But for the rail industry, there is not much international competition, therefore the government interference and regulation loom to make a difference in this industry.

3.4 How to Deal with Natural Monopoly?

As we analyzed in the previous section, consumers and the economy can benefit from the modest monopoly or be undermined by the abused monopoly power. Thus how to deal with natural monopoly became an important issue for regulators. There are 3 ways of dealing with Natural Monopoly: 1) leave the market unregulated; 2) regulate monopoly; and 3) government ownership. The first way is absolutely passive and the last one is not feasible since the governments cannot allocate such an enormous expenditure on an industry to deal with the natural monopoly problem. In contrast, the government was trying to privatize CPR and CN. The 1995's privatization of CN is termed by governments[3] "the largest and most successful privatization" or "the most successful initial public offering" in Canadian history. The only feasible solution is to intervene in the market through series of regulations. Regulators have five major methods to regulate monopoly. i) to set up regulated prices. There are two ways to set prices, one is to set the price equal to average cost, the other one is to peg the price around the marginal cost[4] ii) to regulate the monopoly output, especially for the passenger and Grain transportation since quite a few branch lines are unprofitable, thus monopolists tend to shut them down or reduce output to avoid losses or earn profits by

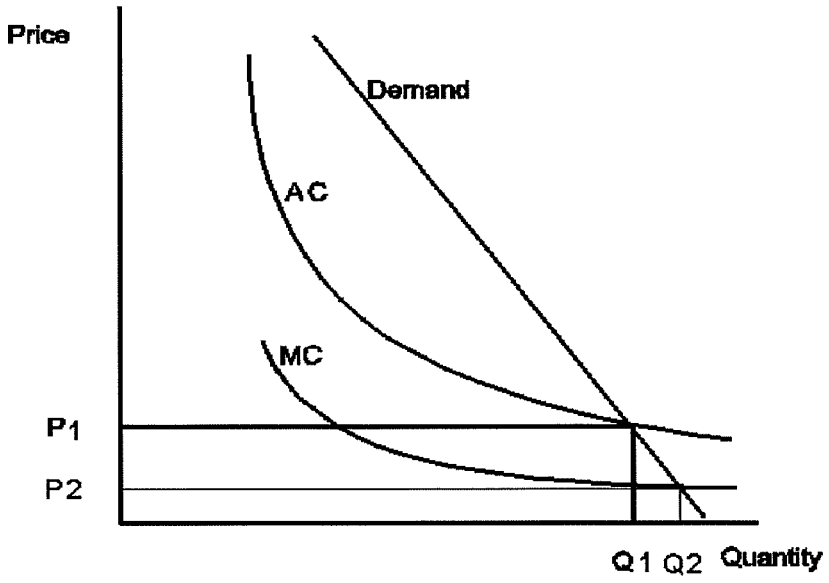
[3] The Federal Government and Provincial governments
[4] The consequences of the two price setting strategies will be discussed in the following part.

raising prices, which would lead to a social welfare loss; iii) to regulate market entry; iv) to regulate service levels, which does not belong to our research area; and v) to regulate the technology. Theoretically, the output level is hard to regulate since the demand curve is not available or predictable. We now discuss the two pricing strategies and their effects.

1) Average Cost Pricing

Take a simple case as Figure 3-3 shows for example, when regulators set the price ceiling at a level where average total cost equals to demand. At (P_1, Q_1), the economic profit is zero (normal rate of return). At Q_1, $P_1 > MC$, which means additional output is valued by consumers more than it costs to produce it. This means that average cost pricing is not Pareto efficient.

Figure 3-3: AC Pricing and MC Pricing



2) Marginal Cost Pricing

Regulators set a price where MC = Demand, implying that the monopoly incurs losses. A government could subsidize monopoly but that is costly to administer. Generally, average cost pricing is more practical, but normal rate of return is not acceptable for the monopolists and investors. Practically, cost curves and demand conditions are usually unknown, so, if the current price is considered abnormally high, then the price is lowered, and if it is below normal, the price is increased accordingly.

Regulators may choose the **second** regulatory option to set price equal or close to marginal cost. Since the natural monopolist by definition faces a situation where his marginal costs will be lower than his average per unit costs, forcing the monopolist to accept a price equal to his marginal cost will result in a loss. Consequently, what the government regulators could do is either to fix the price of the product at the marginal cost of production and pay the monopolist a subsidy to allow him a 'fair return' on his investment, or else fix the price above its marginal costs to accomplish the same end at greater social cost[5].

[5] As we discussed, from the society point of view, the most efficient point, which minimizes the social cost, is where price equals to marginal cost. If the government can't give out the subsidy to compensate the monopolist's loss of fixing the price at marginal cost, the greater social cost from the dead weight loss will occur, since the price will go automatically above marginal cost (meanwhile output will be suboptimal) to avoid a loss.

PART IV ECONOMIC ANATOMY OF GOVERNMENT REGULATION

4.1 Government Regulatory Efforts

As we discussed in the previous section, theoretically, the government has five possible methods in general to regulate monopoly, i) regulating prices; ii) regulating monopoly output; iii) regulating market entry; iv) regulating service levels; and v) regulating technology. But railways is not a technology-intensive industry as telecommunication and software industries, thus the regulator can neglect the regulation of technology. As service levels can hardly be measured economically, we will not discuss them here. The government mandates market-entry, rate-making, and other economic regulations via the National Transportation Act (NTA).

i) Regulating Prices

The main focus of government regulation is to control market power by setting prices that limit the monopolistic abuse of any particular rail. Before 1987, CN and CPR were permitted to set rates collectively, and all rates had to be published. They were both Crown Corporation at that time, and actually the freight rates were under "Crown control". The Nation Transportation Act of 1987 first gave bargaining power to the shippers. Carriers and shippers that agree on rates and services can sign confidential contracts[6].

As we disused, applying price regulation means that enormous subsidization will occur to compensate the losses that monopolists suffer since the government would choose

[6] Except for grain, the only regulated goods.

MC pricing to minimize social welfare losses. Thus how to balance subsidies and price became a major issue. The history of subsidies can reflect the regulation change to a certain extent.

ii) Regulating Monopoly Output

The original purpose of regulating monopoly output is to prohibit the monopolist from lowering output and raising prices. But in the railway industry, since prices are fully regulated, the possible reason for the monopolists to reduce output is a fixed certain level of output can not recover operation costs. The NTA limited the abandon rate of rail track to 4 per cent a year. Accordingly the government gives out subsidies to branch lines and VIA rail to offset the regulation losses.

iii) Regulating market Entry

The government regulates market entry to protect social welfare from being depleted by the huge sunk cost caused by free-entry. Some economists argue that natural monopoly has natural barriers which are huge network and locomotive investments that would deter other entrants, so that government does not necessarily need to regulate market entry. The role of infrastructure in railway and the fact that CN and CPR own most of the rail network make entering as a Class I carrier almost impossible. The over-construction of rail during the last century has made CN and CPR suffer from under-operation and high maintenance costs. The only possible entrants are those shortline operators, but they are still burdened by licensing and leasing or buying rail tracks.

4.2 Subsidies Reflect the Government Regulation Change

A transportation subsidy is a direct or indirect[7] *transfer of resources from the government to the enterprises engaged in the provision of transportation or to the users of transportation services. The subsidy provided usually confers an advantage to the users or encourages them to engage in an activity that they would otherwise not choose. The general aims of transportation subsidies are to ensure adequate provision of transportation services that are deemed to be desirable to the public interest; and to provide economic or social benefits to specific groups, users or regions; usually to lower the price paid for transportation*[8].

However the government can still use interventions other than subsidies with similar effects to those of direct payments, for example, price setting or tax levy.

4.2.1 Current Structure of Subsidies to Railways

The direct federal subsidies, grants and contributions to the whole rail industry are made up of two parts subject to the service type, passenger and freight transportation.

I) Subsidies to passenger services

The subsidy to passenger services is mainly to VIA Rail, the only operator in the market. The latest report (Table 4-1) from Transport Canada shows that the direct federal subsidies to VIA Rail reached 310.2 million in year the 2001-2002.

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[7] DIRECT - a ***direct payment*** to a specific group (usually a carrier but including a Crown corporation or other non-departmental government agency).

INDIRECT - the ***net expenditure*** for the provision by a government department, agency or Crown Corporation of a transportation-related service or infrastructure that benefits a specific group.

[8] The Auditor General of Canada, 1995 report, Chapter 6, section 6.17

Table 4-1: Direct Federal Subsidies, Grants and Contributions by Mode, 2000-2002

	2000/01	2001/02
Passenger		
VIA Rail	231.6	310.2
Freight		
Hopper cars	18.2	16.4
Grade crossings	7.5	7.5
Other	8.1	8.1
Total Rail	**265.4**	**342.2**

Source: Transport Canada, Annual Report 2001

The report also shows that the operating loss before funding from the Government of Canada and income taxes was 172.8 million dollars. Meanwhile, the subsidy received from government to compensate the operating loss was 153.7 million dollars, which covered almost 89 percent of the operating loss. Besides that, VIA received another 103.4 million dollars capital funding which made the total subsidy to VIA rail reach 257.06 million dollars.

Table 4-2 shows the government subsidies on operating loss which is called operating funding[9], and capital funds. The amounts are determined on the basis of operating costs less commercial revenues excluding employee future benefits and non-cash transactions relating to capital assets and future income taxes, and are based on the operating budget approved by the Government of Canada for each year. There might exist an operating funding surplus sometimes when the funding exceeds the loss due to the management improvement or traffic volume rise, for example VIA rail has a 41 thousand dollars surplus in 1997.

[9] Operating funding, which pertains to services, activities and other undertakings of the Corporation for the management and operation of railway passenger services in Canada, is recorded as a reduction of the operating loss (VIA Rail).

Table4-2: Government Subsidies and Operating Loss (VIA Rail)

(In thousands)	2001	2002
Operating loss	143,240	172,759
Subsidy for operating loss	163,293	153,682
Capital Funding from Government	151,742	103,377
Total Subsidies Received	315,035	257,059

Source: VIA Rail Annual Report, 2002

II) Subsidies to Freight Transportation

Subsidies to freight transportation are mainly aimed at infrastructures like hopper cars and grade crossings instead of freight rate as it used to be. The subsidy for freight transportation was $25.7 million in 2000/2001.

4.2.2 What the Subsidization Used to Be

Historically, subsidies were used in exchange for regulatory power by the government while the railway was highly controlled by monopolists at that time. The first railways in Canada were allowed to set tariffs and service levels in the absence of any regulatory intrusion. The monopoly power, especially in western Canadian markets, was noticed by the governments. By entering into the contractual relations with rail carriers to secure the concessionary rate levels in return for subsidies, governments began to deal with the monopoly rate problem. Beginning with a 3.4 million one-time subsidy in 1897, the Government of Canada entered into an agreement with the Canadian Pacific Railway whereby in turn CP would build a rail line through the Crows Nest Pass and would reduce rates on the eastward movement of grain to the Lakdhead by 3 cents per 100 pounds. Later on, once the regulating power was established in the industry, subsidies became compensations to the losses caused by regulation.

1) Subsidy to VIA Rail

The subsidy to VIA used to be one of the largest part of the subsidies to transportation, which was $441.5 million in 1990. It dropped dramatically in the first five years of 1990s from 1990's $441.5 million to 1994/95's $301 million. Until 2001, the desubsidization continued, government funding for every mile a passenger travels was cut to 15.8 cents from 45.6 cent in 1990.

Rail passenger subsidies have been one of the largest Canadian transportation subsidies. Prior to 1967, rail carriers were expected to subsidize losses on passenger services from profits earned on other traffic by themselves. Beginning 1967, the federal government provided subsidies to rail passenger carriers. According to the 1990's record, the subsidy was $441.5 million for that year. VIA was incorporated in 1977 to provide for passenger rail transportation services across Canada. Before that, the Railway Act of 1967 subsidized up to 80 percent of approved losses on passenger services provided by CN and CPBetween 1967 and 1979, subsidies totaled a massive $1.27 billion (current dollars). Although the level of subsidy payments has declined marginally since 1989, it is still large.

Figure 4-3: Direct Federal Subsidies, Grants and Contributions by Mode, 1993-1997

	93/94	94/95	95/96	96/97
Passenger				
VIA Rail	342.7	301.0	301.0	235.8
Freight				
WGTA	633.0	644.0	209.8	0.0
ARFA	9.4	9.3	2.2	0.0
Branch lines	15.3	17.4	9.7	0.0
Hopper cars	17.8	19.1	18.2	17.1
Grade crossings	9.6	8.0	8.2	7.4
Other	16.9	16.4	18.1	20.2
Total Rail	**1044.7**	**1015.2**	**567.2**	**280.6**

Source: Transport Canada, Annual Report 1997,1998.

2) Subsidies for grain movement

Government subsidization of railway construction is a well-documented feature of Canada's development. One of the famous involvements by the government is the "Crow rate", which provided farmers with a fixed rate for transporting grain produced in Western Canada for export. The Crow's Nest Pass rates remained largely unchanged between 1897 and 1982[10]. For many years the railways have carried export grain at far less than it cost them to haul it. Additional indirect subsidies result when a government agency provides transport infrastructures and does not charge sufficient user fees. To promote the grain export and stimulate the carriers, the government gave out subsidies under the Transportation Act. The subsidies for the grain movement used to be the biggest part of the total subsidies.

The Western Grain Transportation Act (WGTA) was passed in 1983 to facilitate the transportation and handling of Western grain. The subsidies for WGTA (repealed on

[10] The Auditor General of Canada, 1995 report, Chapter 6, section 6.21-6.22

August 01, 1995) reached 644 million dollars in the 1994/95 period, accounted for 92.5 per cent of the subsidies to rail freight transportation and 63.4 percent of the total rail subsidies. Figure 3-6 shows that in the year 1991, it was 779 million dollars.

According to Bonsor (1995), this huge subsidy exists for some reasons. From one side, it encourages cross-hauling of grains. In 1993, grain destined for U.S. markets was being moved by rail to Thunder Bay from western Canada in order to collect the WGTA subsidy and then was moved back west prior to entering the U.S. From the other side, the subsidy made the existence of a vast network of very lightly used uneconomic (but for the subsidy) Prairie lines possible. According to the Grain Transportation Agency (1991), it is estimated that approximately half of the Pairie grain dependent[11] branch lines (3,000 miles) are high cost lines and should be abandoned.

3) Subsidies for the Atlantic Region Freight Assistance (ARFA) Program

The origins of ARFA derive from the decision made by the Dominion government to have an all-Canadian route for the Intercolonial Railway, which was completed in 1876. This railway ran from Halifax to Rivière-du-Loup and connected there to the Grand Trunk line to Montreal and the rest of central Canada. This decision resulted in a route 250 miles longer than the shortest possible route through the United States.

The Maritime Freight Rates Act was passed in 1927. This Act provided for a 20 percent subsidy on "preferred" movements, which were defined as: local rail traffic between

[11] A branch line is termed grain dependent if 60 per cent or more of traffic on the line is grain. (Norman Bonsor, 1995)

points in the Select Territory (the Maritime provinces and the Canadian National lines through the Province of Quebec to near Lévis); and traffic westbound from the Select Territory to the rest of Canada. In 1967, the ARFA extended the 30 per cent subsidy to truckers on the Maritime portion of outbound traffic. In 1970, subsidies for truck movements within the region were set equal to rail. In 1991, the total subsidy under the AFRA to rail carriers was 23.3 million dollars.

4.3 The Economic Analysis of Government Regulating Behaviour

While successfully regulating the railway industry, the federal government also met problems when it found that railway is not as active as other industries due to over-subsidization. First, monopolists have no incentive to hold down costs, which results in padded expense accounts, higher than normal wages, unnecessary costs, etc. Second, monopolists have no incentive to introduce technology improvements or improve the service level. Thus, policy change according to the various situations became important for the regulator.

The subsidies to VIA are in compensation for the operating loss caused by regulated prices. The MC pricing strategy caused huge subsidies in the past. Government limited the monopoly power to maintain a price close to MC price throughout several decades. Even after eliminating some subsidies to unremunerative passenger services under section 290 of the Railway Act[12], in 1995, the revenue/cash operating expenses ratio maintained a twelve-year increase from 28.9 per cent to 64.5 per cent, which was also

[12] Other than those to VIA Rail Canada, which as a Crown corporation received direct budgetary funding (Transportation in Canada, 2001).

favored by the increasing traffic demand. It is also due to the regulation change on the subsidies which stimulated the incentive to lower their managing and operation cost. The Crow Rate which remained almost unchanged for 85 years from 1897 to 1982 is a typical pricing strategy to regulate the natural monopoly power. The subsidies under WGTA are consistent with the purpose of the Crow Rate, which provided over $600 million a year. Grain shippers and the whole grain industry benefited more than the direct subsidy receiver- rail, because almost 80 per cent of the grain-dependent rail branch lines are unprofitable.

On 27 February 1995, the government announced the termination of both the Western Grain Transportation Act Program and the Atlantic Region Freight Assistance Program, effective August 1st and July 1st respectively. To a certain extent, subsidies under the Western Grain Transportation Act represent an income supplement rather than a transportation subsidy. After fully regulating the railway industry by heavy subsidies for several decades, the federal government began to eliminate or gradually downsize the subsidy to create a healthier market environment, and also succeed to put a tap on the government expenditure.

The desubsidization has effects on freight rates, service levels and system efficiency. After the desubsidization, shippers will pay the full or higher rate, which will be nearly double the amount that they currently pay in the grain movement sector. And each VIA Rail passenger will pay an extra 15.8 cents for each mile he travels. In these circumstances it is likely that shippers, passengers and producers will expect higher levels of service and system performance in return. The removal of the subsidies to

ARFA also removes the incentive for backtracking. Backtracking happens to the movement of grain from Western Canada to Thunder Bay and then back westward for ultimate shipment to the United States. This occurs because movements are subsidized from origin to the Thunder Bay. The termination of the subsidies put an end to these subsidy-chasing uneconomic backtracking that waste resources through circuitous routings.

At the beginning of the 90s, the Federal government began to downsize the government budget deficit. People may doubt that the desubsidization was due to the fiscal burden. But even if this were true, the analysis of the policy change and the regulation effects shows that downsizing subsidies gave the market power back to the industry, stimulated the monopolists to improve their services, made Canadian railway more competitive, and helped it emerge as one of the most efficient railways in the world.

Part IV Conclusion

There is a continuous debate about whether monopoly power in a market has a negative or positive effect on economic welfare. Standard theory suggests that monopoly can lead to a loss of economic welfare because prices are higher and output lower than under competitive conditions. However this is based on assumptions about the costs of production and also the aims and the objectives of businesses.

In the case of the rail industry in Canada, natural monopoly brought economies of scale, but also created a social welfare loss compared with competitive industries. Under this exceptional circumstance, monopoly can be tolerated and regulated by the government. The lower regulated prices relieved the transportation cost for other industries and also improved the competitive position of Canadian export goods and thus contributed greatly to the whole economy.

In writing this paper, I found that transportation economics is not widely studied compared with labour economics or environmental economics. "For more than a generation, North American transportation economics has not a comprehensive textbook accessible to the general public." (Boyer, 1998) But it deserves more consideration, since transportation has a significant influence on the economy. To encourage the railway industry, the government can improve and create a more efficient policy environment.

Firstly, there is the possibility of opening up the market for shortliners. Shortline railways gather traffic from a small geographic area and forward it to large mainline railway companies. They are important to customers because they wxpand the

coverage of railways. Meanwhile, shortlines are also important to mainline railways as feeders and collectors connecting their own higher density operations. Shortlines are also a good way out for the tracks abandoned by the class I carriers. The operation of short lines can make the whole rail industry more efficient because they work with lower operating costs and greater capacity to serve local customers. Generally, short lines have fewer employees who can execute a wider variety of tasks. They are not constrained by labour agreements as restrictive as Class Is. Short lines can save important equipment costs since they need less motive power than long haul Class I rails.

Secondly, abandonment prohibition orders should be lifted or reduced. Since 1985, government orders have prohibited any abandonment of grain-dependent branch lines. While abandonments can still occur under this prohibition, they require approval of the Governor in Council, in addition to the normal abandonment approval from the National Transportation Agency. The rationalization of railway tack is due to the following reasons (Transport Canada Annual Report 2001): 1) reduced demand on certain lines; 2) changing transportation requirements; 3) competition from trucking, and; 4) an economic imperative to reduce costs. Emulating the US shortline model that emerged after the passage of the Staggers Act in 1980, Canadian shortlines began proliferating with the passage of the Canada Transportation Act in 1996. Before 1996, carriers had abandoned about 13,660 kilometres of track and transferred 1,550 kilometres to shoreline operators. After mid-1996, carriers transferred over 9,800 kilometres of track to shortline operators and abandoned about 3,780 kilometres

(Transport Canada Annual Report, 2001). Lifting the abandonment order can give the asset managing right back to the railways, which can also help Canadian railways create a healthier capital structure and attract more investment from private sector to relieve the fiscal burdens.

Finally, deregulation of freight rates could be phased in. Establishing fair and reasonable rate levels that are non-discriminatory has been difficult because of variations in financial structure, resources among railways, the degree of direct or indirect competition, the commodities being transported, alternative routings, and the permissible rates of return. It is further complicated by political and regional development considerations. Since deregulation of the rail industry in 1987, shippers have benefited from a 35 per cent decline in real freight rates. Today, rail freight rates paid by Canadian shippers are the lowest in the world - 60 per cent below the international average. Further deregulation can release the market power to keep railways active.

Railway was a highly regulated industry in the past and is still going to keep this character due to the natural monopoly power. So, good policies play a key role in the industry. The century's history of regulating, subsidising, and desubsidising the rail industry in Canada tells us that there is no steady-state optimal policy and the theoretical system maximization is not achievable due to the unobservable demand curves and unknown market conditions. Therefore government regulators are making efforts to find better time-varying strategies for the healthy growth of the industry and higher contributions to the Canadian economy as well.

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