1

CANADIAN THESES ON MICROFICHE

I.S.B.N.

THESES CANADIENNES SUR MICROFICHE

National Library of Canada
Collections Development Branch

Canadian Theses on
Microfiche Service

Ottawa, Canada
K1A 0N4

Bibliothèque nationale du Canada
Direction du développement des collections

Service des thèses canadiennes
sur microfiche

NOTICE

The quality of this microfiche is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us a poor photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this film is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30. Please read the authorization forms which accompany this thesis.

THIS DISSERTATION
HAS BEEN MICROFILMED
EXACTLY AS RECEIVED

AVIS

La qualité de cette microfiche dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de mauvaise qualité.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, examens publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de ce microfilm est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30. Veuillez prendre connaissance des formules d'autorisation qui accompagnent cette thèse.

LA THÈSE A ÉTÉ
MICROFILMÉE TELLE QUE
NOUS L'AVONS REÇUE

National Library
of CanadaBibliothèque nationale
du Canada

25

Canadian Theses Division

Division des thèses canadiennes

Ottawa, Canada
K1A 0N4

65759

PERMISSION TO MICROFILM — AUTORISATION DE MICROFILMER

• Please print or type — Écrire en lettres moulées ou dactylographier

Full Name of Author — Nom complet de l'auteur

Gillian Wogin

Date of Birth — Date de naissance

25-11-44

Country of Birth — Lieu de naissance

England

Permanent Address — Résidence fixe

38 Mount Pleasant Avenue
Ottawa, Ontario
K1S 0L8

Title of Thesis — Titre de la thèse

The wealth-maximizing behaviour of the Canadian Pacific
Railway: lands, freight rates, and the Crow's Nest
Pass Agreement

University — Université

Carleton University

Degree for which thesis was presented — Grade pour lequel cette thèse fut présentée

Ph.D.

Year this degree conferred — Année d'obtention de ce grade

1984

Name of Supervisor — Nom du directeur de thèse

J.C. McManus

Permission is hereby granted to the NATIONAL LIBRARY OF
CANADA to microfilm this thesis and to lend or sell copies of
the film.The author reserves other publication rights, and neither the
thesis nor extensive extracts from it may be printed or other-
wise reproduced without the author's written permission.L'autorisation est, par la présente, accordée à la BIBLIOTHÈ-
QUE NATIONALE DU CANADA de microfilmer cette thèse et de
prêter ou de vendre des exemplaires du film.L'auteur se réserve les autres droits de publication; ni la thèse
ni de longs extraits de celle-ci ne doivent être imprimés ou
autrement reproduits sans l'autorisation écrite de l'auteur.

Date

Jan. 5th 1984

Signature

Gillian Wogin

THE WEALTH-MAXIMIZING BEHAVIOUR OF THE
CANADIAN PACIFIC RAILWAY: LANDS, FREIGHT
RATES, AND THE CROW'S NEST PASS AGREEMENT

by

Gillian Wogin, B.Sc., M.A.

A thesis submitted to
the Faculty of Graduate Studies
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

Department of Economics
Carleton University
Ottawa, Ontario
November 1983

© 1984 Gillian Wogin

Make Rocket

1985.

Ph.D.

1984

W/ot

1123 5125 01 5X

COR-PI*11)

The undersigned hereby recommend to
The Faculty of Graduate Studies and Research
acceptance of the thesis, submitted by
Gillian Wogin, B.Sc., M.A.
in partial fulfilment of the requirements
for the degree of Doctor of Philosophy.

.....
Chairman, Department of Economics

.....
Thesis Supervisor

.....
External Examiner

Carleton University

January 27, 1984

ABSTRACT

iii

In 1897 the Canadian Pacific Railway and the Dominion government signed the Crow's Nest Pass Agreement. The terms of the agreement contained permanent ceilings on the nominal freight rates for eastbound grain and flour and westbound settlers' effects carried by the CPR. The argument of this thesis is that it was in the Railway's self-interest to have government constrain its freight rates to raise the value of the lands which it owned. The construction of the CPR had been subsidized by the Dominion by granting the Railway with the exclusive right to provide rail transport within a specified area of the Canadian prairies and by land grants within the same area. The Crow's Nest Pass Agreement enabled the Railway to increase its wealth from future sales of land and freight by assuring buyers of land that the CPR would not raise freight rates upon the sale of its lands to settlers.

The interdependence between freight rate and land policies is analyzed to predict pricing behaviour consistent with maximizing total wealth from both sources of revenue. An implication of this analysis is that the combination of land grants and monopoly rights used to subsidize construction resulted in lower and more efficient freight rates than

would have obtained if the Railway had been subsidized in cash. However, since the Railway did not own all the land affected by its rates, the latter were higher than the efficient level. The consequent profits from the Railway's monopoly will be shown to have provided the motivation for the Railway's policy of encouraging early settlement.

A brief background to the history of the settlement of the Canadian prairies and the history of freight rates is presented, with emphasis on the policies of the Canadian Pacific. A model of land values is tested econometrically to examine the impact of the Crow's Nest Pass Agreement, using unpublished, cross-sectional, time series data (1882-1912) from original CPR land sales records for an area in Saskatchewan. An additional test of the hypothesis is conducted by a comparison of the land policies of the CPR and the Hudson's Bay Company. The appendices contain a few revisions to existing data series pertaining to prairie settlement over the period 1878-1913.

ACKNOWLEDGMENTS

For helpful comments, assistance, and encouragement, I owe thanks to the members of my committee, John McManus, Keith Acheson, Steve Ferris, Don McPetridge and external examiner Frank Lewis, to members of the Conference on Quantitative Methods in Canadian Economic History including, in particular, Isabel Anderson, Michael Bordo, Trevor Dick, Knick Harley, Ken Norrie and Michael Percy, and to J.R. Buchanan, Mel Cappe, Ian Clarke, Kevin Clinton, Lyle Dick, Ted Lyon and Ken Wyman. I am grateful to Agriculture Canada, the Treasury Board Secretariat, the Department of Finance, and the Bureau of Competition Policy for opportunities to work on areas related to my thesis. Special thanks are also due to Jocelyne Chapleau, Glenda Berndt, and Louise Moreau for typing the manuscript.

Early work on this thesis was presented at the Conference on Quantitative Methods in Canadian Economic History in London and Kingston.

TABLE OF CONTENTS

<u>ACCEPTANCE SHEET:</u>	ii
<u>ABSTRACT:</u>	iii
<u>ACKNOWLEDGMENTS:</u>	v
<u>TABLE OF CONTENTS:</u>	vi
<u>LIST OF TABLES:</u>	viii
<u>LIST OF FIGURES:</u>	x
<u>INTRODUCTION:</u>	1
<u>CHAPTER 1:</u> Background to the freight rates and lands settlement policies of the Canadian Pacific Railway	4
<u>CHAPTER 2:</u> Theory	40
<u>ANNEXES</u>	
I Demand for productive services: a reminder that derived demand schedules slope down too	99
II The relationship between average and marginal revenue	104
III The welfare gain resulting from the Crow's Nest Pass rate reductions	107

CHAPTER 2: (cont'd).

- IV Effects of prices on relative intensities
of use of inputs: The peculiar nature of
land and freight as inputs 110
- V The variation in land values for a
Cobb-Douglas production function 112
- VI The array of land values allowing for
discrete loading points 116

CHAPTER 3: Testing the Hypothesis 125

Annex to Chapter 3: Regression analysis using
aggregate annual data 181

APPENDIX: The Data 195REFERENCES: 239

LIST OF TABLES

Table	Description	Page
1.1	Freight rates on grain, Regina to Fort William	12
3.1	Regression results	156
3.2	Regression results	157
3.3	Regression results	158
3.4	Average price and average value of revenues from gross land sales, 1893-1930	171
3.5	Wheat production and exports	193
A1	Canadian Pacific land sales	203
A2	Canadian Pacific land sales: irrigated and non-irrigated lands ...	206
A3	Land Sales by the Hudson's Bay Company	210
A4	Hudson's Bay land sales: conflicting sources	212
A5	Annual net homestead entries	213
A6	Dominion expenditures on immigration	215
A7	Land expenditures by the Canadian Pacific Railway	216
A8	Railways in operation: I Canadian Pacific	221
A9	Railways in operation: II All Railways	225

Table	Description	Page
A10	CPR freight rates for wheat, Regina to Fort William	228
A11	Wheat prices, No. 2 Spring at Chicago	231
A12	Wheat yields	233
A13	Wages	234
A14	Interest rates	236
A15	Price index	238

x

LIST OF FIGURES.

Figure	Description	Page
1.1	Section plan of a township	5
1.2	Cost of transporting wheat	13
1.3	Price index 1878-1913	27
1.4	Annual CPR land sales	32
1.5	CPR land revenues	33
1.6	Nominal average annual prices of CPR land sold	34
1.7	Annual number of homestead entries	35
2.1	Equilibrium in the land market	47
2.2	Equilibrium in the freight market ...	48
2.3	The freight market under monopoly ...	53
2.4	The freight market with fraction k of land held by the railway	56
2.5	Marginal revenue for straight-line demand where the railway owns proportion k of land	60
2.6	Demand for land: aggregate and at discrete distances	73
2.7	Demand for land services with production possible in second period	76
2.8	Short and longer run supply of labour and wage rates paid by monopsonist ..	78
2.9	Effect of short and longer run elasticity of labour supply on the annual returns to land	79

lature and possibly this helped him getting his scheme approved. However when his partner and sponsor, Daniel Chase Corbin, saw the terms of the charter Baker had submitted, he "felt that Baker was arranging things just a little too much in his own favour" (Sanford, 1977: 18) and withdrew his support. Without the financing he needed, Baker had to abandon his plans for the line.

By 1896, however, there were several possible railway-builders for the Kootenay Valley. An American millionaire, Fritz Heinze, who owned a smelter at Trail Creek, had acquired a charter from the B.C. government. James J. Hill had already built a railway within the Kootenays to Sandon and was likely to attempt a coast-to-Kootenay line. Corbin too was still in the picture, as were Mackenzie and Mann, the Canadian Northern entrepreneurs. Apparently the CPR did not have the cash for the undertaking⁶ and so president Van Horne had vice-president Thomas Shaughnessy write to Prime Minister Tupper proposing the line in the hope of obtaining a subsidy. Success seemed more likely with the Conservative government which had had a long association with the Railway. However two months later the government fell and Van Horne had to deal with the less sympathetic Liberals and their leader Wilfred Laurier. Laurier, however, proved

INTRODUCTION

The rail freight rates on export grain moving from the prairies to Thunder Bay are the same today as they were in 1899. The origin of these statutory freight rates, known as the Crow's Nest Pass rates, is in the Crow's Nest Pass Agreement of 1897 between the Crown and the Canadian Pacific Railway Company. Among other things the Railway agreed to reduce its rates on east-bound grain and flour and westbound settlers' requirements and never to charge higher rates on these commodities.

Since 1897, inflation has eroded the real value of the Crow's Nest Pass rates to a fraction of the cost of moving grain and a change to the statutory rates now seems imminent, with Bill C-155 before Parliament.

One purpose of this paper is to address the question of why the Canadian Pacific Railway would ever have agreed to such a ceiling on its rates in the first place. I will argue that it was in the Railway's own interest to constrain its rates because it owned land adjacent to its lines. Only by signing such an agreement to prevent its own opportunistic behaviour at a later

date could the Railway realize the maximum value of its wealth from land and freight services combined. Furthermore, I will show that ownership of the land mitigated the potential welfare costs of a transportation monopoly. Granting monopoly rights to a railway and subsidizing its construction with land grants allowed the Dominion to pursue its two objectives of settling the West and providing east-west transportation, at a lower allocative loss than would have been incurred had the railway monopoly been subsidized in cash. The resulting freight rates were at a more efficient level than had the Railway not owned the land. Indeed, maximum efficiency could have been achieved if the Railway had been given all the land in the West.

In the first chapter I present a brief background to the history of land settlement and freight rates, with emphasis on the policies of the Canadian Pacific Railway.

In the second chapter I develop a theory of the interdependence of freight and land policies to predict pricing behaviour consistent with maximizing total wealth from both sources.

In the third chapter I test a simple model of land values to examine the effects of freight rates and other costs on the value of the Railway's lands. I use published time series data for the prairies, and unpublished cross-sectional time series data from original CPR land sales records for a single area in Saskatchewan, both for the period 1882-1912. I also compare land policies of the Railway and an "independent" land owner, the Hudson's Bay Company, over a longer period to assess a pervasive view in the historical literature that the Railway "subordinated" its lands to encourage traffic.

Finally the historical data are documented in the appendix to this paper.

CHAPTER 1

BACKGROUND TO THE FREIGHT RATES AND LANDS SETTLEMENT POLICIES OF THE CANADIAN PACIFIC RAILWAY

I INTRODUCTION

This chapter provides a brief background to the lands and freight rates policies of the Canadian Pacific Railway in the late nineteenth and early twentieth centuries.

II DOMINION LANDS¹

The Canadian survey system of townships followed a rectangular pattern throughout the prairies. A township was a square of thirty-six sections, each section being roughly one square mile, which is 640 acres. Sections were numbered one to thirty-six starting in the southeast corner of each township (figure 1.1). Townships are identified by township numbers running north from the international boundary and by meridians and intermediate range numbers running east and west from the Fort Garry meridian, close to Winnipeg.

Figure 1.1
Section plan of a township

← 6 miles →

- Homesteads
- School lands
- Hudson's Bay lands
- Railway lands

Regulations for the disposal of the Dominion lands were first defined in the Dominion Lands Act of 1883, 46 Vict cap 17 (1883). The regulations gave the settler (over 18 years who was the sole head of a family) the right to take a free homestead of up to one quarter section with opportunities at certain times to acquire an extra contiguous quarter section through the purchased homestead privilege. The payment of \$10 entitled the settler to homestead entry and he obtained title to the land by fulfilling the patent conditions.

Preemption privileges, introduced in 1874, allowed the homesteader, on entry, to reserve the option of buying the adjacent quarter section when he obtained his homestead patent. The privilege was found to be used for speculation rather than settlement and was withdrawn in 1890. The right to purchase homesteads was introduced in 1872 and withdrawn in 1881, the year the terms of CPR land grants were set out. Both preemption and purchased homestead privileges were revived (1908-1918) but preemption was then coupled with residence and cultivation requirements and restricted to townships in which the CPR owned less than eight sections.

Patent conditions varied but usually six months residence and cultivation were required in any one year over a period of three years.

The homestead lands were usually located on even-numbered sections in a township (figure 1.1). This checkerboard array ensured that each free quarter-section would be adjacent to land potentially for sale, the school lands, the Hudson's Bay lands, or the railway lands.

Sections 11 and 29 in every township were set aside to finance public schools. The school lands, administered by the Department of the Interior and later also by the provinces, were usually reserved until neighbouring sections had been settled, and were then sold by auction, typically after good harvests (Martin, 1938: 344). The Dominion Lands Act specified that "in no case shall such lands be put up at an upset price less than the fair value of corresponding unoccupied lands in the [same] township".

The surrender of Rupert's Land had given the Hudson's Bay Company the rights to one twentieth of the land within the "Fertile Belt"--that is, the land between

Lake Winnipeg and the Rockies, and between the U.S. boundary and the North Saskatchewan River. Hudson's Bay lands were designated as sections 8 and the south half and northwest quarter of 26 in every township, the whole of 26 in every fifth township. The Hudson's Bay policy was straight-forward: to sell its lands for the maximum revenue, and to do this it waited until adjacent free homesteads and railway lands had been taken up. The Company apparently

showed no disposition to undertake an aggressive campaign of advertising and sales promotion such as was than being conducted by the Canadian Pacific Railway, but was content to sell small portions at reasonable prices in the expectation that as the government and Canadian Pacific lands were occupied, the value of the remaining estate would increase.

(Galbraith, 1951: 15)

The Hudson's Bay Company's Land policy is compared with that of the Railway in Chapter 3 to assess Martin's observation (1938: 240) that:

in the ulterior problems of permanent and rapid settlement the interest of the [Hudson's Bay] Company could scarcely be expected to compare with that of the government or of a pioneering railway. For the Company their chief concern was to sell their lands to the best advantage; and with the sale of the land their interest came to an end. For the railway the traffic of the immigrant - his chattels and his goods in one direction and his wheat in the other - could be relied on to dwarf the initial prices charged for railway land.

The remaining odd-numbered sections were reserved for the Railway. In its charter of 1881,² the Canadian Pacific Railway was granted twenty-five million acres in alternate sections within a belt of land twenty-four miles either side of its main line. "But should any of such sections consist in a material degree of land not fairly fit for settlement, the Company shall not be obliged to receive them as part of such grant; and the deficiency thereby caused ... shall be made up from other portions in the tract known as the fertile belt, that is to say the land lying between parallels 49 and 57 degrees of north latitude, or elsewhere at the option of the company..." (Statutes of Canada, Victoria 44, Cap. 1 (1881)).

The meaning of "fairly fit for settlement" was not defined further in the Act and it seems that the Company set the standard (Hedges, 1939: 35) and, in its search for land fairly fit for settlement "went far afield and eventually found itself with millions of acres far removed from either main or branch lines..." (Hedges 1939: 36) since the main line belt proved to be insufficient for the whole grant.

The land grant was earned as each twenty miles of railway was built "to admit of the running of regular trains thereon". The quantity of land to be conveyed per mile of track constructed differed according to whether it was part of the eastern or central section of the track. In 1882, however, the Railway persuaded the government to set aside additional tracts, not yet earned but expected to be earned, as reserves for the CPR.

In 1886, rights to 6.8 million acres were given up by the CPR to retire a government loan. This land came partly from the balance of land not yet earned or reserved, but mainly from its First Northern Reserve. Following this relinquishment, the CPR abandoned plans for branch lines into the Reserve.

The Railway thus acquired the rights to sixteen sections out of every thirty-six, both within easy reach of its rail line and also "fit for settlement". Net sales of 3.6 million acres prior to 1897, the year of the Crow's Nest Pass Agreement, had not reduced this proportion by very much. Indeed, accumulated net sales were lower at that time than they had been at the end of 1883, because of the cancellations in the intervening years.

Before the CPR charter, colonization railway companies had acquired the right to buy large areas of land at a dollar an acre. The free grants to the CPR became a precedent later extended to the colonization railways. These companies were not generally a success.

The Dominion policy of awarding land grants to railways and colonization companies came to an end in 1894, "not because it had been supplanted by a new policy but because the government had come to the end of eligible land grants" (Martin, 1938: 408, reporting on comments made by Clifford Sifton). By this time the odd-numbered sections fairly fit for settlement were almost depleted, reserved for the railway companies though often not yet earned. Land grants still outstanding in 1908 were liquidated and opened up to homesteads.

III FREIGHT RATES 1881-1925³

This section summarizes the history of freight rates from 1881 to 1925, when the Crow's Nest Pass Rates on grain were made statutory, and then discusses the terms of the Crow's Nest Pass Agreement. Actual rates are shown in table 1.1 and figure 1.2.

Table 1.1

FREIGHT RATES ON GRAIN, REGINA TO FORT WILLIAM

(Crow's Nest Pass limit = 12.0 cents/bushel)

Period in effect	rate cents/bushel	Events leading to changes
1886	19.8	
1887-90	18.0	
1891-92	17.4	
1893-31 July 1898	13.8	
1 Sep 1898-31 Aug 1899	12.9	1897 Crow's Nest Pass Agreement
1 Sep 1899-6 Oct 1903	12.0	reduction in two steps to 12.0 cent
7 Oct 1903-31 May 1918	10.08	1901 Manitoba Agreement
1 June 1918-11 Aug 1918	12.0	Increase allowed, subject to Crow's limit
12 Aug 1918-12 Sep 1920	14.4	following McAdoo Award (1918) further increased allowed. Crow Agreement temporarily suspended under War Measures Act, July 1918
13 Sep 1920-31 Dec 1920	19.5	"Forty per cent case" interim increase of 35 per cent in the West
1 Jan 1921-30 Nov 1921	18.6	increase reduced to 30 per cent
1 Dec 1921-5 July 1922	17.4	further reductions ordered due to deflation
6 July 1922-1983	12.0	6 July 1922 the three year suspension of "Special Acts" made in 1919 Railway Consolidation Bill expires 1925 Parliament suspends the Agreement indefinitely and makes Crow's Nest Pass rates on eastbound grain and flour a statutory limit.

Figure 1.2

Cost of transporting wheat (cents/bushel)

Source: Mackintosh

History of rates 1881-1925

The so-called "monopoly clause" of the Canadian Pacific Railway's charter of 1881 (Statutes of Canada, 44, Vict., Cap 1, s. 15) prevented competing lines from being built, for twenty years, south of the Canadian Pacific Railway or within fifteen miles of latitude 49. This gave the CPR exclusive rights over the territory south of its main line but the privilege was cut short. Opposition to the monopoly clause was sufficiently vigorous in Manitoba for the federal government and the Canadian Pacific to agree to cancel the clause in 1888, in return for a federal guarantee of interest on \$15 million in bonds:

Following this cancellation, the Manitoba government subsidized a competing Northern Pacific line from the United States border to Winnipeg. General rate reductions were negotiated between Manitoba and the Northern Pacific and the Canadian Pacific followed suit.

According to Currie (1954: 45) the new competition faced by the Canadian Pacific did not live up to expectations, the two companies being "accused of pooling traffic and combining to keep rates up. Furthermore, it

seems that the Northern Pacific's entry in 1888 into Manitoba was a strategic move to keep the CPR from disturbing rates on the Pacific Coast (Regehr, 1976:15). The American company used its presence in Manitoba to prevent the CPR from making reductions on Seattle rates, which the Northern Pacific could not have met without the Interstate Commerce Commission's applying such reductions to the whole of the Northern Pacific's line in the States.

Complaints from Manitoba and the Northwest Territories led to an investigation into the charges. It was found that CPR's rates were generally lower than comparable American rates. The dissatisfaction nevertheless continued and spread to the East where an investigation into the methods of railway control began in 1899, and finally led to the establishment of the Board of Railway Commissioners in 1903, later called the Board of Transport Commissioners for Canada.

In the meantime there were further reductions in freight rates. The Crow's Nest Pass Agreement (which is described below) reduced CPR rates in two stages, in 1898 and 1899. Further reductions followed to match those the Canadian Northern made in the Manitoba Agree-

ment of 1901. This agreement provided financial assistance to the Canadian Northern to build 290 miles of track to the Lakehead, in return for which the Company cut its grain rates by four cents per hundred pounds.

Complaints from farmers served only by Canadian Pacific lines led the Manitoba government to negotiate for similar reductions, "decreases which ... the Canadian Pacific thought could but result in the insolvency of the Canadian Northern" (Currie, 1954:49). The agreement applied only on Manitoba lines to the Lakehead but the CPR applied similar reductions in the Northwest Territories.

Inflation during the First World War pushed operating costs up and, in 1917, the railways applied for an immediate 15 per cent increase in freight rates and passenger fares. The Board of Railway Commissioners agreed that the increase was needed but had to consider the special problem of the Crow's Nest Pass and Manitoba Agreements. The Railway Act ruled against unjust discrimination and the Board felt that special agreements must not be allowed to cause such discrimination. Therefore, it argued, agreements might be set aside.

However the Railway Act exempted "Special Acts" from the Board's jurisdiction. The Board decided the Manitoba Agreement was not a "Special Act" because it was a provincial arrangement, while the Crow's Nest Pass Agreement was, because it was confirmed by the Dominion Parliament, and was therefore binding. The Board proceeded to raise most rates by 15 per cent, grain rates by about 10 per cent, keeping them below the Crow's Nest Pass limit.

A further increase in rates was allowed following the McAdoo award of 1918 in the United States. This award of increased wages to railroad workers led to agitation from Canadian labour for a similar increase, which was granted by Governor-in-Council.

To cover the increased costs, a 25 per cent increase in rates was allowed (as in the US), though in the West this was to include the 15 per cent already awarded. Under the War Measures Act, the Crow's Nest Pass limit was temporarily suspended in July 1918 and rates on export grain rose above the ceiling. Delays in being allowed to apply the 15 per cent increase had caused financial strain for the Grand Trunk and Canadian Northern but

not for the Canadian Pacific. The CPR's rate of return was found to have exceeded a reasonable level and special taxes were levied on it under the War Measures Act.

A further interim increase of 40 per cent in the general rate level (35 per cent on western freight rates) was allowed for the period September 13, 1920 to December 31, 1920. Following a severe drop in the price level, the railways voluntarily cut grain rates, and by the end of 1921 further reductions were ordered by the Board to limit rates to 20 per cent above those in effect before the "Forty Per Cent Case".

In the meantime a new Railway Act was being debated. The Railway Consolidation Bill, introduced in 1918, omitted reference to "Special Acts" which would restrict the powers of the Board of Railway Commissioners. Senator Watson, acting for the government of Manitoba, objected to this amendment which would cancel the Crow's Nest Pass and Manitoba Agreements. When the Bill was passed in 1919, it contained only a three-year suspension of "Special Act" restrictions on rates. After July 6, 1922, "Special Acts" would come into force again. As this date approached, a Special Committee of the House on Railway Transportation Costs was formed so

that the problem would not be left to the Board of Railway Commissioners, which had alienated the West by defending the Canadian Pacific and announcing that rates in the West were already low enough.

The Railway petitioned for permanent cancellation of the Crow's Nest Pass Agreement. It argued that restoration of the Agreement would deplete its revenues because, although legally it applied only to certain commodities on CPR lines in existence in 1897, the unjust-discrimination criterion of the Board would make the rates more generally applicable. The West argued that the contract was legally binding and that thus far the benefits had all gone to the railroad--as soon as the ceiling had been reached, the Agreement had been suspended.

As it happened, the West had strong political bargaining power at this time. The Liberal government did not have a clear majority and was trying to get a budget through the House with tariff reductions which were not large enough to satisfy all members of its party. Because of this difference of opinion, the government needed support from the farmers' Progressive party. Therefore while the Crow's Nest Pass Agreement

was suspended for two more years, the rates on grain and flour were restored at once. This decision persuaded enough of the Progressives to vote with the government and pass a budget with tariff reductions which would not otherwise have satisfied them either. Still having to consider the wishes of the Progressives, the Liberal government allowed the suspension of the Crow's Nest Pass Agreement to expire on July 7, 1924 without taking any further action.

The Crow's Nest Pass rates strictly applied only to Canadian Pacific lines and commodities covered in the Agreement, and the resulting inconsistencies in rate schedules led to complaints. The Board of Railway Commissioners took a view opposite to its "Special Acts" decision of 1917 (ruling now that since the Agreement was not a statute it did not bind the Board) and, on October 14, 1924, rates on westbound commodities were restored upwards to the 1922-4 level, above from the Crow's Nest Pass limit.

The Western provinces appealed to the Supreme Court and the government suspended the Board's ruling, pending the decision to appeal. The full Agreement applied again.

On February 26, 1925, the Supreme Court ruled that the Board could not authorize rates above the Crow's Nest Pass limit and that that limit was to apply only on CPR lines existing in 1897: "Parliament, having by statute assumed the obligations under the Agreement, must change or amend them by statute". Parliament put an end to all this commotion by passing legislation the same year, suspending indefinitely the Crow's Nest Agreement but making Crow's Nest Pass rates a statutory limit, incorporated into the Railway Act, on all grain and flour eastbound to Fort William, and so they remain today.

With the opening of the Panama Canal, Vancouver had become an important port of export. British Columbia and Alberta had been complaining that the "Crow" rates should apply to grain exported through Vancouver. A reduction in rates was allowed, but when grain rates were made statutory in 1925, westbound grain was not included. The Board of Railway Commissioners had on its agenda a petition introduced in late 1924 for the Crow's Nest Pass rates to be applied to westbound grain moving through Vancouver. In September, 1925, the five commissioners on the Board voted 3 to 2 that this petition should be considered as part of the "General Investigation" they were to conduct. In spite of this decision

two of the Commissioners later the same day issued Order 36769 applying the Crow's Nest rates to westbound grain for export. By the time the ruling was appealed there were six Commissioners and the subsequent split vote meant that the Order stood, and still stands.

Freight rates on grain have remained at the statutory level since 1925. The railways have a statutory obligation to move the grain⁴ although the Crow's Nest Pass rates now amount to about one fifth of the costs of moving the grain.⁵

The Crow's Nest Pass Agreement

In the eighteen-nineties, the Canadian Pacific Railway planned to build a line into the mineral-rich Kootenay Valley, from Lethbridge, through the Crow's Nest Pass into the Valley, to Nelson, B.C. The line would secure traffic otherwise likely to be lost to American lines. The British Columbia government was similarly eager to prevent the diversion of traffic to American lines and ports and had already granted a charter to James Baker, in 1890, for the British Columbia Southern Railway to be built from the coast to the Kootenay Valley. Baker was a member of the B.C. provincial legis-

lature and possibly this helped him getting his scheme approved. However when his partner and sponsor, Daniel Chase Corbin, saw the terms of the charter Baker had submitted, he "felt that Baker was arranging things just a little too much in his own favour" (Sanford, 1977: 18) and withdrew his support. Without the financing he needed, Baker had to abandon his plans for the line.

By 1896, however, there were several possible railway-builders for the Kootenay Valley. An American millionaire, Fritz Heinze, who owned a smelter at Trail Creek, had acquired a charter from the B.C. government. James J. Hill had already built a railway within the Kootenays to Sandon and was likely to attempt a coast-to-Kootenay line. Corbin too was still in the picture, as were Mackenzie and Mann, the Canadian Northern entrepreneurs. Apparently the CPR did not have the cash for the undertaking⁶ and so president Van Horne had vice-president Thomas Shaughnessy write to Prime Minister Tupper proposing the line in the hope of obtaining a subsidy. Success seemed more likely with the Conservative government which had had a long association with the Railway. However two months later the government fell and Van Horne had to deal with the less sympathetic Liberals and their leader Wilfred Laurier. Laurier, however, proved

to be willing to provide assistance. James Baker offered the CPR his unused British Columbia Southern Railway charter for a share of the provincial land grants attached to it. The CPR accepted rather than have to wait for a charter of its own and give Hill more time.

Surveying began and Van Horne became impatient to get the subsidy agreement settled. According to Sanford (1971: 33) it was Van Horne himself who "casually hinted to Laurier that the railway might consider a rate reduction throughout the entire west if a substantial cash grant were immediately forthcoming".⁷ The bill to authorize the subsidy quickly followed.

The Agreement was signed on September 6, 1897. In return for a subsidy of \$11,000 per mile, up to a limit of \$3,630,000, the Canadian Pacific agreed to: (1) build the Crow's Nest Pass line from Lethbridge to Nelson; (2) accept the control of CPR rates by the Governor-in-Council or a Railway Commission; (3) convey certain coal-bearing lands, received from the B.C. government through the BCS Railway charter, to the federal government; (4) reduce rates on certain westbound goods (green and fresh fruits and various specified settlers' requirements such as binder, twine, agricultural

implements, and household furniture); and (5) reduce rates by 3 cents per hundred pounds on grain and flour "from all points on its main line, branches or connections, west of Fort William to Fort William and Port Arthur and all points East".

The rate reductions were to be permanent: "no higher rates than such reduced rates or tolls shall be charged after the dates mentioned on such merchandise from the points aforesaid".

The grain rates were to be reduced in two stages, one and one half cents per hundred pounds by September 1, 1898, and the same again by September 1, 1899. Thus while the Crow's Nest Pass Agreement was signed in 1897, the rates now known as the Crow's Nest Pass rates were not instituted in full until 1899.

The Crow's Nest Pass rates established a permanent ceiling fixed in nominal terms. Clearly they still were profitable at the time--the Canadian Pacific was able to reduce its rates further after the Manitoba Agreement. Although inflation has now eroded the real value of the Crow's Nest Pass rates to well below the costs of moving grain, in the late nineteenth century there had

been no recent experience of systematically increasing price levels. In fact, as figure 1.3 shows, the previous two decades had been a time of an overall downward trend in prices. It is unlikely, then, that either the Railway or the settlers anticipated that the real value of the rates would decline over time.

Incidentally, the coal-bearing lands are another legacy of the Agreement which remains today. Attached to this transfer of coal-bearing lands (perhaps the only case of a railway's giving land grants to a government) was another price ceiling still in effect. The Dominion prescribed that these lands should be disposed of "for the purpose of securing a sufficient and suitable supply of coal to the public at reasonable prices not exceeding two dollars per ton of two thousand pounds free on board cars at the mines". At this price for coal, the lands are left unmined today and are now a source of contention between the federal government and British Columbia which now disputes the federal government's rights to these lands.

Figure 1.3

Price index 1878-1913 (1935-9 = 100)

Source: Urquhart and Buckley (1969)

The land policy of the Canadian Pacific Railway⁸

The Canadian Pacific began to formulate its land policy in 1881, one of its concerns at that time being the "danger of forestallment of the best lands by speculators who had no intention of occupying the land..." (Hedges, 1939:67). Its initial policy was to offer land at a flat price of \$2.50 per acre, regardless of its quality or location. (Whether all land, regardless of quality or location, was made available to the potential buyer is not clear.)

According to Hedges, sales were initially intended to be conditional on buyers' cultivating three quarters of the land within four years, or half the land plus erecting an approved building and a rebate was offered of \$1.25 per acre cultivated and cropped in this time. However, cultivation requirements were not at first enforceable as the regulations allowed only for the forfeiture of the rebate and not the land. Enforcement was made effective in 1882, when the Railway introduced its right to cancel the agreement and take possession of the land if the requirements were not fulfilled. In this case the buyer was allowed the value of his improvements

except for cultivation, insofar as they increased the value of the land for agricultural purposes (Hedges, 1939: 69).

By 1882 the Railway decided after all that some sales to speculators were desirable and made arrangements to sell blocks of land to colonization companies, at the same time departing from the flat price. Land within the main line belt was available to land companies at \$5, with a down payment of \$1.25 and the balance forgiven if the land was cultivated within five years.

The flat rate was abandoned generally in 1882, as was the general forfeiture for non-cultivation, but preferential prices continued to be given where cultivation requirements were attached to the land. Prices ranged generally from \$2.50 to \$7.00 an acre; land with cultivation requirements from \$2.50, with rebates given, land without from \$4.00.

The rate of interest on payments made by installment was 6 per cent, the same as was charged by the Ministry of the Interior on the school lands. The Railway, however, also gave a discount of roughly 9 per cent

on the total price to those who paid cash (10 per cent of the amount which would otherwise be outstanding after the first payment was made).⁹

The Railway apparently was lenient with settlers who fell behind on their payments. Records of individual sales in my possession showed that contracts were made "null and void" only after a long lapse of payments due. On the other hand, it seems that the right to cancel for failure to comply with cultivation requirements was exercised:

It has been the policy of the Directors to secure the cancellation, as rapidly as possible, of such sales of lands in large blocks as were made during the period of high speculation to parties who proved to be unable to comply with the conditions as to cultivation. These cancellations amounted to 21,762 acres during the past year, against 280,686 acres in 1886. In many cases the lands recovered have been re-sold to actual settlers, and are now producing crops.

(CPR Annual Report for 1887: 18)

After the land boom in the early 1880s, barely any sales were made. In 1888 prices were reduced (the minimum to \$2.00) in order to stimulate sales. Cultivation requirements were dropped, but amortization payments for settlers were scheduled over ten years, instead of the former six year term. The reduction in prices was not applied to the Southern, or International Boundary, Reserve which was as yet unserviced by railway lines.

In the early 1890s further price reductions were made, except for especially valuable land such as that close to stations. In 1892 a uniform price was applied to the lands in the Red Deer and Battle River districts. Two auctions were held that year, the only instance when CPR land was sold by auction. Sales were high in 1892, but dropped with the depression of the mid-1890s and remained low until 1896. By 1896, the year before the Crow's Nest Pass Agreement, cancellations through the eighties and nineties had reduced accumulated net sales to below the level of 3,631,640 acres sold by December 31, 1883.

After 1897, annual sales, and consequently revenues, increased dramatically, although the administered prices were not changed very much for another ten years. (See figures 1.4, 1.5, and 1.6). Homestead entries similarly increased at this time (figure 1.7).

The Canadian Pacific Land Department pursued an aggressive advertising campaign to encourage settlement of both homesteads and its own lands. Maps, posters and pamphlets¹⁰ were distributed throughout Europe and especially in the British Isles. Emigration propaganda offices were opened in Britain, "friendly relations" estab-

Figure 1.4
Annual CPR land sales (thousands of acres)

Figure 1.5

CPR land revenues (millions of current dollars)

Source: Hedges

Figure 1.6
Nominal average annual prices of CPR land sold

Source: Hedges

Figure 1.7

Annual number of homestead entries (thousands)

lished with steamship agents, philanthropic emigration agents (such as the Children's Aid Society), and the schools. Travelling exhibitions were put on.

In Canada in the late eighties, when an all Canadian route reduced the risk of potential settlers' being diverted to the States, cheap excursion trains were used to encourage people from the eastern provinces to see the West.

The Railway also recruited harvest workers and transported them free to the West, "to work in the harvest fields and perhaps remain to have harvests of their own".¹¹

Conclusion

This chapter has provided a historical background to the land and freight rate policies of the Canadian Pacific Railway.

The essential elements of its lands policy are that it owned roughly 16 out of every 36 sections in townships within the 48 mile Railway Belt along its main

line and that its pricing policy was designed to favour the bona fide settler, rather than the speculator, through lower prices and rebates for immediate cultivation.

The essential features of its freight rate policy are that rate reductions and rate ceiling specified in the Crow's Nest Pass Agreement were apparently at the initiative of the Railway itself, and that the ceiling was not immediately a binding constraint, suggesting that profits were earned at the level of rates established by the Agreement.

It will be seen in the next Chapter that ownership of land led the Railway to benefit from an arrangement such as the Crow's Nest Pass Agreement. Furthermore, while ownership of affected land reduced the Railway's optimal rates below the monopoly level, it will be seen that ownership of only part of the affected land led to freight rates which exceeded the competitive level. It will be shown that the profits which would continue to be earned on transportation gave the Railway an incentive to settle the West earlier than had it owned all the land.

Footnotes to Chapter 1

1. The major source for information on Dominion lands is Chester Martin's "Dominion lands" policy (1938)..
2. Statutes of Canada, 44 Vict., cap 1. (1881)
3. A source of the history of freight rates and transportation is A.W. Currie's Economics of Canadian transportation. The history of the Canadian Pacific in particular is given in Harold Innis's A history of the Canadian Pacific Railway (1923) and (1971). An interesting source of additional information on the CPR is T.D. Regehr's The Canadian Northern Railway: pioneer road of the northern prairies, 1895-1918 (1976) where the perspective is on the CPR's behaviour as a rival.
4. Section 271 of the current Railway Act sets out the rates on grain at the level established in the Agreement of 1897 (Railway Act R.S. c 234 s.1 (1970)), while section 262(1) sets out the railways' obligation to carry the traffic.
5. See Snavely King and Associates (Jan. 1982), 1980 costs and revenues incurred by the railways in the transportation of grain under the statutory rates prepared for the Grain Transportation Directorate, Transport Canada, Report No. TP 3433. The losses are currently borne by the railways and the federal government which provides direct assistance in the form of branchline subsidies.
6. See Barrie Sanford's McCulloch's Wonder: the story of the Kettle Valley Railway (1971) for this account of the events leading to the Agreement. Sanford asserts that the CPR needed cash; Sir Clifford Sifton wrote to the same effect:

I remember as a young minister in Laurier's cabinet, Van Horne and Shaughnessy said a line into the Kootenay mining district would not be considered for fifteen years. Also I remember that within six weeks the same two gentlemen came into my office and said they had to build this line and wanted a large bonus for doing it, that the C.P.R. was on the verge of bankruptcy. We

gave them this bonus against the public sentiment of two-thirds of the people of Canada. They built the line and the Kootenay mining development saved the C.P.R. and a good many other things in Canada

J.W. Dafoe, Clifford Sifton in Relation to His Times (Toronto: Macmillan, 1931: 146n), quoted in Currie (1954: 631)

7. Mr. Sanford has told me that this account of the CPR's initiative was given to him in an interview with an old CPR employee.
8. The major source for information of the Canadian Pacific land grants and their disposal is James B. Hedges' Building the Canadian West: the land and colonization policies of the Canadian Pacific Railway (1939). The terms of sales described in this section are taken mainly from Hedges, Chapter IV "Beginnings of land policy". Additional information is contained in Martin (1938).
9. A discount for cash roughly equal to 9 per cent of the purchase price was observed in the records of individual land sales I examined. That this was a matter of CPR policy was confirmed in an advertising pamphlet Western Canada 1905. See section A(i) in the Appendix to this thesis.
10. For example, Alexander Begg, General Emigration Agent, published information from settlers, along with their names and addresses, in Plain Facts and Practical Hints from Farmers in the Canadian Northwest. Begg, according to Hedges (1939: 97), "was making no attempt to conceal or minimise the difficulties which beset the pioneer ... desirous of attracting ... those persons who were likely to make a success of the venture, who would benefit themselves as well as the Canadian Pacific Railway". (I have, however, seen advertising literature in the National Library in which a settler declares the coldness of the winter to be exaggerated, that he had been known to walk around outdoors in February without an overcoat.)
11. The Manitoba Free Press (1891?), cited in Hedges (1939: 111).

CHAPTER 2

THEORY

The generosity of the company was enlightened self-interest.

(James B. Hedges)

INTRODUCTION

It is no surprise that the land grant subsidies served the objectives of the Dominion government by encouraging the railways to promote settlement. What is perhaps new in this thesis is that the land grants also reduced the potential undesirable allocative effects of a transportation monopoly.¹ The Canadian Pacific Railway's exclusive rights to land adjacent to its lines altered its incentive to charge the monopoly price for freight. The more land it owned, the closer was its optimal freight rate to the efficient level; and indeed had the Dominion's objective been purely one of efficiency it could have achieved it by giving all of the West to the Canadian Pacific.

The land-railway package allowed the Railway to more than offset the reduction in transportation rents through the increase in land values and the elimination of at least some of the welfare loss which would have resulted had it been granted only the transportation monopoly.

The purpose of this chapter is to explore the relationship between the land and freight policies of the Canadian Pacific Railway, recognizing the interdependence between freight costs and land values and hence the tradeoff between freight revenues and land revenues. My thesis is that the Railway maximized its wealth from both sources and did so even in agreeing to the Crow's Nest Pass rate ceiling.

The economic history literature repeats time and again that the Canadian Pacific "subordinated its land prices to further traffic" (Martin, 1938: 398), that the railways were "only incidentally land companies" (Hedges, 1939: 47). This thesis does predict that interest in traffic, would lead the Railway to offer its land at prices below other land companies. But the relationship is symmetric. Because of its real estate, freight rates were lower than they would have otherwise been. And while railway land prices may have been relatively low, in the absolute sense all land values were higher.

Central to this idea is the rationale behind the Crow's Nest Pass Agreement. It will be argued that the freight rate concessions were to the mutual advantage of both settlers and the Railway. Furthermore, while it

was in the Railway's interest, ex ante, to lock itself in to a perpetual ceiling on its rates, the fact that the Railway has long tried to free itself from its obligation does not demonstrate, ex post, a mistake.² It would have been evident to both settler and the Railway at the time of the Agreement that the Railway would eventually want to raise its rates, and that, indeed, was one of the reasons why the Agreement was made. It was a contract designed to curtail opportunistic behaviour.

THEORY OF WEALTH-MAXIMIZING BEHAVIOUR

...only the most extraordinary circumstances permit a monopolist to extract all of the profit potential of his monopoly from manipulation of the price of the monopolized product; in general, auxiliary mechanisms are necessary if the full possibilities of monopoly profit are to be realized

(M.L.Burstein "A theory of full-line forcing", 1960: 62)

Introduction

A model will be developed here to explain decisions relating to freight rates and land sales which maximize the wealth of the Canadian Pacific Railway.

The assumption throughout is that land was valued only as a factor of production whose value was determined by the present value of the net revenues it was

expected to produce. For simplicity it is assumed that it was used only to produce wheat, although the analysis would apply to other crops or livestock. The price of wheat is assumed, probably realistically, to have been exogenous, determined in the world market and unaffected by the relatively small output from the Canadian West,³ and capital markets are assumed to be perfect. Finally, the supply of labour in the early West is assumed to have been inelastic in the short run, though more elastic over the long run.

The labour supply assumption leads to a downward sloping derived demand for land in the short run, if we take the labour supply rather than the wage rate as given, an increase in the amount cultivated reducing the annual return to land by bidding up the wage rate. As a major landowner capable of influencing the cost of labour, the Railway affected the value of its land (at least in terms of its immediate annual returns) by the quantity it supplied to be put in production, sales often being conditional on immediate cultivation as described in Chapter 1. The downward-sloping derived demand schedule (net of increasing labour-costs) allowed the Railway to extract monopoly profits from its land sales, these profits coming not from the consumers of the

final product, wheat, but from the purchasers of the land. The "monopoly" rents from land are thus at the expense of the labour to be applied to the land and are, more accurately, short-run monopsony rents earned from the labour market. In what follows, these monopsony rents may be analyzed directly, from the supply of labour, or indirectly from the rents to be earned from land, referred to loosely as monopoly rents, "monopoly" not in the sense that the CPR owned all the wheat producing land, but that it nevertheless faced a significantly downward sloping demand for the land it did own.

First, a static wealth-maximizing model will be developed for a single period. This allows me to focus on the interaction of freight rates and land values and the effect of this interdependence on the allocation of resources. A two and more period model will then be developed to analyze the timing of land sales, land prices, the consequent rate of settlement, and the problem of cheating.

In moving beyond one period, several complications have to be taken into account, perhaps the most important being the timing of sales and the ability of

of the transportation monopolist to capture all the potential monopoly rents. Other characteristics to be considered are: the possible asymmetry of information between buyer and seller and its effect on expectations and prices; the existence of several landowners, the Dominion government and private agents, with different goals; the distinction between speculators and settlers as buyers of land; the adjustment process which prevented settlement from taking place instantaneously; the ability of the Railway to "produce" land by making it accessible through railway construction; and the varying "quality" of land attributable to its relative proximity to the market and to the railway.

The single period

In a single period model, land values are equal to the net revenue expected in that period. Land which is not settled earns no revenue for the railway, either in direct revenue or from freight. Unsold land potentially serves the purpose of holding down the price of labour but at the sacrifice of a reduced demand for freight.

(i) Independent ownership

Under the simple monopoly case where land and freight policies are pursued independently, land will be sold to maximize the net revenue from land alone. Similarly freight will be priced to maximize net revenues from transportation. The outcomes are represented in figures 2.1 and 2.2 which show the familiar result that under monopoly output is held below, and price above, the socially optimal and competitive level.

It should be noted that even with independent ownership of land and transportation, it is unlikely that policies will in fact be independent. The separate owners will recognize their mutual interest in coordinating their policies to maximize their combined profits. As Burstein (1960: 62) puts it, "there are few circumstances in which a firm with monopoly power over a good used as an input in some economic process does not have an incentive to vertically integrate ...". In other words, if the Railway had not been given land, it likely would either have bought it or come to some other arrangement with the landowners. Indeed where its actions were to have a large local effect on the value of land it

Figure 2.1

Equilibrium in the land market

Figure 2.2

Equilibrium in the freight market

did not own, namely in its irrigation schemes, the Canadian Pacific first bought the scattered sections owned by the Hudson's Bay within the irrigation area.

In figure 2.1, AB represents the demand for land. The demand for land slopes downwards in the single period primarily because of the inelastic supply of labour to be applied to the land. Cultivating more land bids up the wage rate and reduces the net returns to land even if the price of the output, wheat, is unaffected. (See Annex I for a review of the general properties of the demand for a productive factor.) $\bar{L}$ is the fixed stock of land, assumed have to be owned by a single monopolist (or, strictly, a single monopsonist, the only employer of labour to be applied to that land), EF the corresponding marginal revenue schedule. OC is the marginal cost of land, assumed here to be constant up to the point where all land is sold. In the single period case with supply fixed, this cost is the transactions cost of making a sale.

The single-period monopolist maximizes his profits by providing amount L_m , holding the remainder, $\bar{L} - L_m$, off the market, and charging PL_m . (In the case where $\bar{L}$ is less than L_m , then all the land will be sold.)

Similarly the simple monopolist maximizes freight profits at the point where the marginal revenue is equal to marginal cost (figure 2.2) charging PF_m for quantity F_m .

In both cases we have a welfare loss equal to the shaded area which shows the extent to which net value is foregone given the price of the other factor. While the total welfare losses are not simply additive (because the price of one affects the demand for the other), the presence of monopolists as suppliers of land and freight (or 'buyer' of labour and supplier of freight) creates a greater loss in welfare than if only one input were supplied monopolistically.

(ii) Joint ownership

We now turn to the case where the Railway is a supplier of both land and freight. The integrated monopolist's decisions differ because of the interdependence between the price of transport (or land) and the demand function for land (or transport). Freight rates affect net revenues accruing to land and consequently the value of the land itself.

When freight rates fall, the net revenue to land increases for any given price of land, and the demand schedule for land shifts out. Similarly the settlement of land affects the demand for freight. While the simple monopolist maximizes profit from each factor of production by putting marginal cost equal to the marginal revenue from that same factor, the owner of both transportation services and land will consider the net marginal revenue in one factor market in his selling policy for the other.

- (iii) The elements of the theory: the optimal freight rate under joint ownership in a single period

The optimal freight rate for the railway owning adjacent land is the one which maximizes net revenue from both land and freight. Since land values increase as freight rates fall,⁴ marginal revenue from freight alone will be supplemented by the marginal increase in value of the land, and maximizing joint profits will result in a lower freight rate than the level which would maximize profits from freight alone, this regardless of whether the railway has any monopoly power in the market for land (or labour).

Figure 2.3 shows the demand for freight, its marginal revenue schedule, and the marginal cost of supplying freight, assumed here for simplicity to be con-

stant. (A railway would likely have high "fixed" costs and a downward sloping average total cost schedule. The marginal cost schedule might nevertheless be constant.) The outcome which maximizes profits from freight alone is the freight rate P_{fm} and quantity F_m , where marginal revenue and marginal cost are equal. This is the familiar simple monopoly solution which creates a welfare loss equal to the area AEB the extent to which potential value could be realized in excess of additional costs of production. The monopolist who cannot price discriminate (and the Railway, as a common carrier, could not) has no incentive to price at marginal cost since it would mean foregoing the revenue represented by the rectangle HAEG.

Society as a whole would be better off by the amount ABE were freight rates priced at the efficient level P_{fc} with quantity F_c provided. However transactions costs generally preclude the many landowners (the consumers of freight) from getting together to compensate the monopolist for his loss HAEG in order to realize the net gain of AEB.

Now when the railway is the landowner there is no problem in "getting together". The monopolist bears any welfare loss himself--he owns the surplus he creates

Figure 2.3

The freight market under monopoly

when he provides freight. Consequently the monopolist will not charge himself the monopoly price-- he has nothing to gain by exploiting himself.

When the land-owning railway chooses to price freight at marginal cost (P_{fc}) not only does it recoup the foregone revenue (HAEG), on freight previously supplied at the monopoly price, but it also realizes the net welfare gain AEB produced by moving to the most efficient level of production--where the marginal value of freight (its demand price) is equal to its marginal cost. (This increase in use potentially has two components: more wheat is produced and transported per farmed acre; and more land is brought into production. Both adjustments occur because the net farm gate price has risen. The first adjustment--the increased yield per farmed acre--only takes place if land and labour can be combined in variable proportions.)

In this limiting case, where the railway owns all the land and acquires all the surplus, the outcome is equivalent to that of the perfectly discriminating monopolist: the average and marginal revenue schedules are coincident. Price is equal to marginal revenue and so

the monopolist puts price equal to marginal cost, the same allocative outcome as for perfect competition. The difference is that the railway gets all the land rents.

(iv) The general single period case: where the Railway owns a fraction of the affected land

I now turn to the case where the railway owns a fraction k of the land affected by freight rates. Before going on to a formal proof, the marginal revenue schedule can be illustrated geometrically, to show its position relative to the usual marginal revenue curve where no land is owned.

Consider any point (F, P) on the demand schedule for freight (figure 2.4). Revenue at this point is the product of price P and quantity F . Consider now an incremental change in price, lowering it from P to $P - \Delta P$. The loss in freight revenue on the original amount sold is approximately $\Delta P F$ while the gain in gross revenue on the additional amount sold is approximately $P \Delta F$. The change in revenue R from freight alone is

$$\Delta R(\text{freight}) = -\Delta P \cdot F + P \Delta F.$$

Figure 2.4

The freight market with fraction k
of land held by the railway

(This, of course, is the formula for the differential of a product PF where ΔP is the absolute value of the decrease in price.) The marginal revenue schedule for such infinitely small changes in price is shown in the diagram, lying below the demand schedule and with a steeper slope. (See Annex II for a note on the relationship between demand schedules and their marginal revenue schedules.).

Consider now the case where the railway owns the fraction k of the land affected by freight prices. The same fraction k of the landowners' surplus associated with the demand schedule accrues to the railway. The loss of revenue associated with a decrease in the price of freight F already sold is partly offset by the increase in land values captured by the railway. Thus, when price falls by ΔP , the loss of revenue on the inframarginal units is approximately $(1-k)\Delta P.F$ while the gain in revenue from additional sales ΔF is approximately $P\Delta F$, as before. The change in revenue from all sources therefore is

$$\Delta R = -(1-k)\Delta P.F. + P\Delta F.$$

Where the railway owns none of the land ($k=0$) marginal revenue is the familiar $-\Delta P F + P \Delta F$; where the railway owns all the land ($k=1$) the change in revenue is $P \Delta F$. Marginal revenue ($\Delta R / \Delta F$) is then equal to price, the marginal revenue schedule is coincident with the demand schedule, and total revenue is the area under the demand curve.

An alternative form for the marginal revenue schedule is derived as follows:

$$\Delta R = (1-k) \Delta P \cdot F + P \Delta F$$

$$\Delta R / \Delta Q = (1-k) (\Delta P / \Delta F) F + P$$

$$MR = P ((1-k)/n + 1)$$

where n is the price elasticity of demand.

For the extreme values of k :

$$MR = P (1/n + 1) \text{ for } k=0;$$

and

$$MR = P \quad \text{for } k=1$$

In the general case the marginal revenue schedule $P((1-k)/n + 1)$ lies between the usual freight-only marginal revenue curve and the demand curve, approaching the latter as the fraction of land owned increases.

Incidentally, where the demand schedule is a straight line it can be shown⁵ that the marginal revenue from both land and freight is a vertically weighted average of the demand schedule and the marginal revenue from freight only, as in figure 2.5. The marginal revenue schedule for land and freight intersects the vertical distance between the demand and conventional marginal revenue lines in the ratio $(1-k): k$ respectively. It is tempting to assume that this relationship holds for any demand curve, but it does not.⁶

It can be seen that the more land is owned by the railway, the further to the right will be the intersection of the marginal revenue and marginal cost curves. If the railway owns all the land, the profit-maximizing price will be at the competitive level, equal to marginal cost. Over time, as the railway sells its land the reduced proportion owned results in an incentive

Figure 2.5

Marginal revenue for straight-line demand
where the railway owns proportion k of land

to shift towards the simple monopoly price, an incentive which will be anticipated by buyers when we allow for more than one period.⁷

Before analysing the more-than-one-period model a formal proof of the single period model is given.

(v) The optimal freight rate: a formal proof⁸

Revenue from sales of freight alone is the product of price $P(F)$ and quantity F . Additional revenue accruing to landowners is the surplus below the derived demand for freight and above its price.

$$\text{Revenue to landowners} = \int_0^F P(F) dF - PF \quad (1)$$

The railway which owns the fraction k of the land acquires that same fraction of the surplus (equation 1) plus the direct revenue $P(F) \cdot F$ from the freight. If cost is $C(F)$ then profits can be written

$$\begin{aligned} \pi &= k \left(\int_0^F P(F) dF - P(F)F \right) + P(F)F - C(F) \\ &= k \int_0^F P(F) dF + (1-k)P(F)F - C(F) \end{aligned}$$

Maximum profits are achieved where $d\pi/dF = 0$

$$\begin{aligned}
 d\pi/dF &= .kP(F) + (1-k)[P(F) + FdP(F)/dF] \\
 &\quad - dC(F)/dF \\
 &= .0
 \end{aligned}$$

Therefore

$$\begin{aligned}
 dC/dF &= P(F) + (1-k)F dP(F)/dF \\
 &= P(F)(1 + (1-k)/n) \quad (2)
 \end{aligned}$$

where n is the elasticity of demand $(dF/dP)/(F/P)$.

The left hand side of equation (2) is marginal cost, while the right hand side is marginal revenue from all sources. As before we see that the railway owning no land ($k=0$) maximizes its profits where

$$\text{marginal cost} = P(F)(1+1/n)$$

and the railway owning all the land ($k=1$) where

$$\text{marginal cost} = P(F)$$

which is the same as the competitive outcome (and the outcome for the perfectly discriminating monopolist).

Because the railway only owned part of the affected land (about sixteen out of every thirty six sections in a township),⁹ only part of the potential welfare loss due to monopoly (the shaded area in figure 2.2) is recovered.

More than one period

(i) Elements of the theory

When we extend the model to more than one period several complications arise. The first comes from the observation made earlier: that as the land is sold, the railway's 'optimal' freight rate increases until, when it owns no land, its profit-maximizing freight rate is the simple monopoly price. The catch here is that potential buyers fully anticipate this change. They expect to be exploited eventually. They expect that land values will fall as the freight rate rises, and because of this, the railway is not able to capture the full potential value of the land. However low the current freight rate is, the present value of the land is limited by the expected high freight rates of the future. Since such high future freight rates reduce the value of the land in the initial periods and by more than the gain in freight

revenues (because of the consequent dead weight loss), it is to the railway's own advantage to prevent itself from following its later, post-sale, interest in raising freight rates.¹⁰

The Crow's Nest Pass Agreement did exactly that. It put a perpetual ceiling on settlers' freight rates--eastbound grain and flour and westbound settlers' requirements.¹¹ It was a guarantee to settlers that the rates on both their output and their material inputs would not be raised beyond that level, eliminating not so much the risk of future monopoly rates but the certainty of such rates after the Railway had disposed of the bulk of its lands. Indeed, by the 1920s when most of its land had been sold, the CPR was pressing for the Agreement to be cancelled.

An alternative solution to the cheating problem would have been to retain ownership of the land, renting it instead of selling it. The CPR did not pursue this policy and rented land only in a minor way, for grazing rights and this mainly on lands reserved for the Railway but not yet earned. The renting solution would probably not have worked because of the uncertainty associated with tenant arrangements, settlers likely having a

strong preference for ownership which would give them the exclusive rights over the improvements they made to the land.

In looking for a change in the value of land following the Crow's Nest Pass Agreement, I would predict an increase in excess of the value due simply to the specified reduction in rates. Other things being equal,¹² the rates would have increased beyond the 1897 level. The ceiling has more significance than the reduction. (A rough and, unfortunately, incomplete estimate of the welfare gain realised by the 1897 rate changes is given in Annex III.)

In the static single-period model, all land is instantly accessible to the settler. Over more than one period, the timing of land sales becomes critical. When sales are spread over a number of years, the volume of land sold affects freight revenue. Unsold land (or rather uncultivated land) meant foregone freight revenue. The Railway making profit on its freight (because it did not own all the land) had an incentive to settle land earlier than would a landowner who did not also have an interest in freight revenues or a railway which owned all the affected land. It will be seen that

the Railway would therefore attach cultivation requirements to at least some of its land sales and, since acceleration of settlement was costly, compensate the buyer by offering such land at a lower price than was available to speculators.

Finally, another important aspect of the model in more than one period is that the stock of land, at least of accessible land, is not fixed. The Railway produced land by building track to make existing land accessible, bringing it within the extensive margin. (See Lewis and Robinson [1983] for an analysis of the optimal timing of branch line construction..)

Another complication, whatever the period of the model is the effect of location, to be introduced in the next section. Implicitly one aspect of location has already been accounted for--distance from the market affects values through the freight rate. But rail costs are not the only component of transportation costs. The length of haul to the railway itself affects land values. So far, the spatial heterogeneity of land has been ignored.

(ii) Introducing location: the effect of distance on land values

Distance from the market affects the net revenue to the landowner to the extent that output and some inputs must be transported. Land closer to the market has a higher value than more distant land and this difference in the "quality" has to be incorporated into the analysis of supply and demand.

The particular effect of distance on value depends on the nature of the production function. Fixed proportions, with fixed output per acre, leads to a profile of land values dropping off linearly with distance. A different profile is to be expected if substitution among inputs allows the closer land to be farmed more intensively. The relationship between distance of haul and land values is examined below. (See also Annex IV for the effects of freight rates on the intensity of use of other inputs.)

(a) Fixed factor proportions and haulage costs

If land and labour are combined in fixed proportions, the result is a constant yield per acre cultivated. Assuming that haulage costs per unit of output

are a linear function of the haulage distance, the farm gate price decreases linearly with distance from the track. Net revenue of land cultivated at a distance d is given by

$$\text{Net Revenue} = ([P - hd] Q - wB) A$$

where A is the amount of land employed, B is the fixed amount of labour applied to an acre of land, w the wage rate, Q the output per acre, P the railhead price, and h the haulage cost per unit of distance. Since we have fixed proportions, output is proportional to labour input and we can rewrite the net revenue as

$$\text{Net Revenue} = ([P - cw - hd] Q) A$$

where $c = B/Q$, and Q is the constant output per acre. All coefficients are parameters except d , so that the value of land will be a linear function of distance from the track, decreasing to zero at a distance of $d = (P - cw)/h$ which is the extensive margin where the price is equal to variable costs of production and haulage.

(b) Variable factor proportions and haulage costs

Under variable proportions, land closest to the track will be farmed more intensively (i.e. more labour will be applied per unit of land) than more distant land because of the higher farm gate price. The marginal revenue product of labour will be equated to the wage rate at a lower marginal physical product, which is to say relatively more labour is employed. Since output per acre will decline with distance, haulage costs per acre will increase less than proportionally with distance. At the same time gross revenues fall off with distance making it unclear whether net revenues decrease more or less than proportionally.

The problem of finding land values as a function of distance simplifies into expressing land value as a function of the farm gate price. We have again

$$V = (P - hd)Q - wB$$

where V is the net revenue of land. Using Shepherd's lemma

$$\partial V / \partial d = -hQ < 0$$

we find that net revenue, and therefore land values, decline with distance d .

"employing" additional settlers on its lands to the degree that the marginal cost of bidding up the wage rate in the first period is equal to the marginal decrease in costs (discounted to the first period) in the next and all subsequent periods.

This effect increases the degree to which the Railway possessing monopsony power under-produces land. It restrains the amount of settlers employed (by producing less land) not only because of their immediate impact on wage rates, but also because waiting reduces labour costs.

Incidentally it should be noted that the two-period model illustrated in figure 2.7 needs to be amended to be applied to more periods. While the demand for land services is expressed as an annual flow, the marginal costs of production is a once and for all cost.

The Railway acts at another margin, with an opposite effect on the timing of its production of land. I now allow for the influence of freight profits. It has already been seen that the Railway would charge freight rates above the competitive level because it did not own all the land whose value was affected by these rates (k

It is assumed for simplicity that the relevant haulage distance is the shortest distance to the track (which assumes loading may take place anywhere along the track) and that in any particular region the price at the railway is uniform (which is the same as assuming freight rates are uniform). This implies that bands of land at each distance are of equal area, given that distance is varied in equal increments. (See Annex VI for the array of land when the relevant distance is to a single point, the loading station.)

The problem now is to determine the total demand for land faced by the Railway, given that land values vary systematically with distance as well as with quantity supplied at any distance.

There are two dimensions to land which affect its value: quantity and distance. The demand for land at a given distance slopes downwards either because of diminishing returns or increasing labour costs. (See Annex I.) The demand for any quantity of land shifts downwards as the distance of that land increases, because of haulage costs. Therefore there is an array of individual demand schedules which exist simultaneously, each for the demand for land at a different distance d_i . (See figure

2.6). For ease of illustration distances are taken in discrete amounts rather than continuously varying. Here demand schedules at a given distance are shown as straight lines, consistent with linear haulage costs and fixed proportions. In the more general case, they are curved. Land is supplied as a joint product, each mile of railway track simultaneously adding a band of land whose "quality" varies according to its distance from the track, this quality running through the whole spectrum of immediately adjacent land to land possibly at and beyond the extensive margin.¹³ Forty-eight square miles of this band (24 miles on either side of the track) would lie within the Railway Belt, of which the Canadian Pacific owned the fraction k , roughly $16/36$.

The total demand faced by the railway can therefore be represented by the vertical sum of all the demand schedules for each quality (distance) of land in a 48 mile wide belt multiplied by the fraction owned by the railway. Individual demand schedules are truncated at zero, since land more distant than the extensive margin does not have a negative value. This gives rise to discontinuities in the aggregate demand at each quantity where an individual demand schedule cuts the horizontal axis.

Figure 2.6

Demand for land: aggregate and at discrete distances

(a_i = demand for land services at distance i)

(In the analysis here, demand for land may be interpreted either as the annual demand for land services, in which case the 'price' is the annual rental value of the land, or as the demand for the stock of land, in which case price is the sale price, equal to the present value of the expected annual returns.)

The "joint product" nature of land is illustrated in figure 2.6. The demand schedules for land at distances d_i ($i=0, \dots, 3$) are shown as a_i . Since land at all distances is simultaneously supplied when the Railway builds track, the total price which can be realised is the (vertical) sum of the prices for the land at each distance, as shown in the aggregate demand schedule. (Individual prices or quantities supplied have to first be weighted by the fraction k .)

For example (in figure 2.6), if the Railway supplies an amount of its own land Q comprised of $Q/4$ at each distance (say by building one mile of track), this will realise a price P equal to the sum of P_0 , P_1 , P_2 , and P_3 (P_3 being zero since land at $i = 3$ is outside the extensive margin). Thus for any length of track, an array of prices exists to clear the market of all land within the extensive margin, a set of prices which would

allow all the land to be sold without creating an excess supply or demand for land at any distance. The market-clearing array would leave no gaps of unsold land within the extensive margin.

In this example, when quantity Q is supplied, land at d_3 lies outside the extensive margin. This margin does not depend simply on the economic variables which determine the position of the individual demand schedules, but also on the total quantity of land available. With more track, other things being equal, the average value of all existing land falls, because of the rising supply of labour, and the extensive margin shifts closer to the track.

The multi-period model: the demand and supply of land over time

Moving to more than one period, we allow for the possibility that land can be produced (or made accessible) by building track. Figure 2.7 shows a two period model where AB is the annual demand for land services -- a 'flow' demand. Initially I assume this is constant through the two periods, which means that the supply of labour is unchanged. In the first instance I consider

Figure 2.7

Demand for land services with production possible in second period

that the railway which produces land by building track maximizes net revenues from land alone. These assumptions will be gradually relaxed.

L_1 is the stock of land in the first period. Additional land can be produced at marginal cost MC in the second period. The marginal revenue from production in the second period is shown as MR . The profit-maximizing output of land ($L_2 - L_1$) in the second period increases the available stock to L_2 .

Land L_1 available in the first period produces an annual return of P_1 in the first period and P_2 in the second. Land not produced until the second period produces an annual return of P_2 at that time. This could have been sold in advance to a speculator for P_2 discounted to the first period, a price lower than the price of L_1 by the amount of the real returns accruing to L_1 in the first period. Thus land bought to be cultivated immediately sells at a higher price than the land bought speculatively, but appreciates at a lower rate to the degree that its expected return includes real output. The speculative land is expected to appreciate at the rate of interest up to the point where it is brought under cultivation.

Figure 2.8

Short (S_2) and longer (S_3) run supply of labour and wage rates paid by monopsonist

Figure 2.9

Effect of short and longer run elasticity of labour supply on the annual returns to land

I now relax the constant demand-constant labour supply assumption by introducing adjustment in the labour market. The supply of labour is more elastic in the second period than in the first, given the longer time to adjust. Figure 2.8 illustrates the effect of a change in elasticity over time, showing the short and longer run schedules for the labour supply, and, in figure 2.9, the corresponding shifts in the annual demand for land services, for, say, periods 2 and 3.

With no change in elasticity, L_2 is the railway's optimal stock of land at the end of the second period. Allowing for the adjustment of labour, postponing some production of land to the following (third) period realises a higher return but at a later date. The return is higher because the price will rise since labour costs will fall. (An additional benefit, not allowed for here, is that long run costs of producing land may also be lower, production taking place over two periods instead of one.) The Railway will adjust its production of land so that the marginal benefit from postponing production is zero, reducing production in one period to the point where the immediate net revenue foregone is equal to the discounted increase in net revenue to be gained in the following period. The Railway postpones

"employing" additional settlers on its lands to the degree that the marginal cost of bidding up the wage rate in the first period is equal to the marginal decrease in costs (discounted to the first period) in the next and all subsequent periods.

This effect increases the degree to which the Railway possessing monopsony power under-produces land. It restrains the amount of settlers employed (by producing less land) not only because of their immediate impact on wage rates, but also because waiting reduces labour costs.

Incidentally it should be noted that the two-period model illustrated in figure 2.7 needs to be amended to be applied to more periods. While the demand for land services is expressed as an annual flow, the marginal costs of production is a once and for all cost.

The Railway acts at another margin, with an opposite effect on the timing of its production of land. I now allow for the influence of freight profits. It has already been seen that the Railway would charge freight rates above the competitive level because it did not own all the land whose value was affected by these rates (k

less than one). The demand schedule AB in figure 2.7 already accounts for the effect of freight rates on land values but does not show the freight profits accruing to the Railway. All cultivated land generates additional profits to the Railway, not shown in the marginal revenue schedule here. Producing an additional increment of land beyond L_2 depresses the direct returns to land below P_2 , the rental price which maximizes the net returns from new land alone, but, at the same time, increases profits from freight because more freight is demanded at the given freight rate, a rate which exceeds marginal cost of transportation services. The Railway will therefore produce additional land, in excess of L_2 , to the degree that the marginal loss in rents on land is equal to the marginal increase in profits on the extra freight demanded to service that land.

Thus the joint-ownership of the railway monopoly and some but not all of the land, results in an incentive to accelerate the production of land through railway construction. Given the amount of land already produced in one period, L_1 , more will be produced in the second period than would be produced by a landowner with the same degree of monopsony power, but no revenues from freights. Had the Railway owned all the land, this in-

centive to accelerate settlement would not have existed as additional demand for freight would not increase profits (although there could be an inframarginal effect on producer's surplus if marginal cost increased with quantity supplied).

The incentive to produce land early to gain freight profits is independent of monopoly power in the land or labour markets. Even with competitive conditions in the "purchase" of labour, profits on freight would have led the Railway to produce more land earlier.¹⁴

It will be seen later that early production of land was not the only way the Railway would choose to accelerate settlement. Production of land within the extensive margin occurs jointly with production of land beyond that margin. In the timing of settlement section below, the incentive to settle land which lies outside the extensive margin (defined in terms of its immediate, not long run, returns) will be considered. This, it will be seen, is linked to the pricing policy of the Canadian Pacific.

2

More than one period: the administered price

I have shown how an array of prices will clear the market of land. In the fixed stock, single period, no-adjustment-costs model, there is apparently nothing to be gained by failing to differentiate land quality by price.¹⁵ Nevertheless the Canadian Pacific tended to vary its administered prices very little and often charged a single price apparently for a wide range of land quality, especially in the early years. With this in mind, the purpose of this section is to examine the consequences of charging a single uniform price for land whose value varies.

The demand for land at various distances is illustrated in figure 2.10, again with the assumption that there are equal amounts Q of land at each distance.¹⁶

To dispose of a fixed stock Q of land of each quality, prices P_0 , P_1 , and P_2 will be charged. All land within the extensive margin will be sold. If however all land is offered at a single price, say P_1 , then all the land at d_1 , and closer is sold. An excess demand for land exists at d_0 , and an excess supply at d_2 , where only an amount Q_2 will be taken.

Figure 2.10

Demand for land: The case of a single administered price P_1 when amount Q is supplied

All the land whose value exceeded the administered price would be sold. The "overpriced" land within the extensive margin would remain unsold. It would simply be priced out of the market. While this is not efficient in the single period case, it may be rational when we take into account adjustment costs and freight revenue over time.

Allowing for variable proportions, the most valuable (closest) land produces the greatest yield and therefore the greatest demand for freight. If only some of the accessible land is to be sold, then the Railway would prefer to sell the best land. But why charge less than the value of the land? And why not sell all the land? To answer these questions I have to consider the timing of settlement.

(v) The timing of settlement¹⁷

If exclusive property rights had been established over all land (and neglecting for the moment the effects on freight revenue), settlement would have occurred at the socially optimal time, when the net present value of land was maximized.

Homesteaders could not wait till the optimal time for cultivation--to wait was to lose the land. The Dominion's policy of more or less giving the land away led to a scramble to establish rights over the land. This resulted in premature settlement with all the expected rents' being dissipated through too-early cultivation, early to the point where the expected net present value was equal to the price paid, ten dollars a quarter section.

Furthermore it was not only the free homesteads which led to a rent-dissipating scramble. Land grants to the early colonization railways led to a "frenzy of railway projection", "labyrinths of railway land grants".

The technique of the "colonization railway" became the most promising contrivance yet devised for getting lands cheap and in large quantities from the government. This desperate rivalry for land grants, beginning with premature incorporation and a mad scramble for eligible land reserves and passing through all the conventional stages of broken contracts and rival interests undermining and countermining each other's concessions from the government, filled a whole decade with turmoil and controversy.

(Martin, 1938: 277)

For the Railway, the pertinent issue was not when to sell but when to settle. Had it sold all the land in the first period, control of the timing of culti-

vation would have been lost. But why would the Railway wish to accelerate settlement? Could the buyer not be relied on to cultivate at the optimal time? As was described earlier the difference of opinion between the Railway and other owners on the optimal timing of cultivation arises from the difference between freight rates and marginal cost. Had all the land been owned by the Railway, there would have been no difference of opinion—the cost of freight would have been internalized. Freight would have been priced at marginal cost and the decision on when to begin cultivation would have been made with actual costs perceived by the decision-maker.

Since the Railway did not own all the land, and since it could not legally discriminate between homesteaders and purchasers of its own land, we have seen that it would charge all settlers a freight rate above marginal cost. I have already show how the production of land through railway construction is accelerated because of the profits earned on freight. This earlier supply of accessible land encouraged additional settlement at an earlier date with no coercion to cultivate necessary, simply by bringing more land (more than L_2 in figure 2.7) into the economically feasible region. Here, however, I

am considering an additional impetus to settlement through conditional contracts of sale, in order to bring into cultivation land which, in terms of its immediate annual returns, lies outside the extensive margin because of high short run labour costs. Postponement of cultivation would be profitable for the buyer free to choose his optimal time to cultivate but the railway would prefer an earlier date of settlement because of the resulting extra freight profits. e

It was therefore in the Railway's private interest to settle its lands 'prematurely', that is to say before the time which would maximize the present value of the returns to the land itself. While such premature settlement reduced the potential value of the land, the Railway would have been willing to forego some potential land rents in order to generate additional freight profits. A tradeoff existed between the marginal reduction in land value, due to earlier cultivation, and the marginal increase in freight profits due to the corresponding increase in the demand for freight in the earlier period.

Figure 2.11 illustrates the effect of early settlement on the net returns to the land. If net returns of cultivated land are first negative (because of

Figure 2.11

Annual returns to cultivating land

high labour costs) and grow as in the profile shown, the settler will choose to begin cultivation when net returns become positive, at point A. The Railway, in order to earn additional profits by increasing the demand for freight by accelerating settlement to, say, point B, would have to compensate the settler constrained to begin cultivation at B for the losses he incurs in the period B to A, equivalent to the shaded area.

The Railway would have been prepared to pay anyone to settle earlier in the vicinity of its own lines, regardless of who sold them the land. However attempts to bribe buyers of land from other companies to cultivate earlier would not have been easily enforceable. There was no problem with homesteaders. The Dominion itself enforced cultivation conditions on the homesteader. The Railway therefore had an interest in encouraging settlers to take up homesteads apart from their potential as future buyers of its own land (although all homesteads were not exclusively served by CPR lines so the CPR was not the only railway to benefit). On its own lands failure to cultivate was penalized by making rebates or a preferential price conditional on such cultivation.

The degree to which land was priced below its potential value depended on the degree to which settlement was to be accelerated. All settlers faced adjustment costs in taking up a new home in the West. The costs, however, would increase if settlement were to occur faster or sooner. The supply of settlers (which is the supply of labour to be applied to the land) would be inelastic in the short run with the "price" of a settler increasing as more were demanded in any period. Thus the more who were to be encouraged to come, and the earlier they were to come, the higher the compensation they required to offset their extra costs.

The Dominion accelerated settlement by giving its lands away, dissipating all the land rents, and even this did not achieve immediate occupation of all homesteads. The Railway encouraged settlement by charging less than the land's potential value, dissipating land rents only to the degree that net revenue was increased from land and freight combined. With increasing costs of accelerating settlement, it would not choose to settle all its land in the first period.

At the same time, the tradeoff between realizing the maximum value from its lands and the consequent loss of freight profits due to later cultivation implies

that the Railway would prefer not to sell to speculators, at the prices speculators were willing to pay (a speculator being a buyer who does not intend to cultivate immediately). Sales to speculators might take place, (and the theory predicts at a higher price than charged the bona fide settler) once the margin for increasing net profits through accelerating settlement had been exhausted. Nevertheless the maximum potential value of unsold land can always be realised later, while if it is sold the Railway loses the option of stimulating its earlier settlement and increasing net total revenues from both land and freight. If this last effect, the value of keeping its options open, is significant, we would only expect to see intentional sales to speculators at times when the Railway was finding it especially costly to raise capital.

Incidentally, moral hazard led the CPR in effect to withdraw from the market some lands not yet serviced by its lines, lands which could only have been sold to speculators. Buyers would rightly expect the Railway's incentive to build lines into an area to be maintained only while it owned the land, but to be reduced as soon as it sold the land. Expecting this change in probability of the land's ever being serviced reduced

its price below its potential value. Therefore, it was more profitable for the Railway to hold the land off the market (or to price it out of the market) until it had built the lines it planned and could realise the land's full potential value.

The existence of monopoly profits on freight combined with increasing costs of accelerating settlement though dissipation of land rents shows that it would be rational not to adjust prices to clear the market of all land within the extensive margin. There remains, however, the question why administered prices were apparently relatively insensitive to differences in the land the CPR did sell. A single price had the advantage that sales would be ranked in time according to value, those lands yielding the largest demand for freight selling first.

Nevertheless it would still appear to be worthwhile to differentiate by price among those lands which the Railway intended to sell. Also, while it was rational to set an array of prices which left some land unsold, the theory does not predict that there would be pockets of land left unsold within the margin of settlement. Where there was differentiation by price, bands of unsold

land existed between lands of differently priced sold land.¹⁸ The theory has no explanation for this, perhaps because land has been assumed to be homogeneous except for the characteristic of distance. Variations in soil quality may be the reason behind these pockets of unsold land, obscuring the location of the extensive margin for heterogeneous land. Where there was no differentiation by price (in the early eighties, for example) the "thinness" of the margin of new settlement may mean that there was no difference in quality of the land purchased at the flat rate.

(vi) Advertising

Pricing policy was a major instrument for encouraging early settlement but this was not the only means for offsetting adjustment costs. The Railway could affect the demand for land by advertising the West, by providing assisted passages for settlers, and by subsidizing passages for harvest labour.¹⁹ We would not expect such colonization expenditures to be aimed solely at its own lands either. Early settlement of the homesteads was recognized as a prerequisite for sales its own lands and served to increase freight profits.²⁰

CONCLUSION

I have shown that ownership of land adjacent to its lines reduced the Canadian Pacific's incentive to charge the full monopoly price for its freight services. Lowering freight profits below the monopoly level reduced freight profits but increased the value of its land so that the wealth from both sources was increased. In order to realise the potential increase in its wealth, however, the Railway had to prevent itself from cheating. While land values are higher when freight rates are lower, the buyer rationally expects the freight rates to rise after he has bought the land. Only by preventing its own opportunistic behaviour at a later date could the Railway realize maximum value from its land and freight.

The Crow's Nest Pass Agreement allowed this end to be achieved. The theory predicts that the ceiling imposed on its freight rates increased the value of the land held by the Railway (and, for that matter, all land within reach of CPR lines).

The fact that the Railway did not own all the affected land leads to a freight rate between the competitive and monopoly levels, so that the Railway

continued to earn some monopoly profits on its transportation services. The theory predicts that this would lead the Railway to encourage early settlement and would be prepared to pay settlers to cultivate earlier than they would otherwise have chosen to. In effect it would buy the right to service early settlers at a profit.

Enforcement problems would lead the Railway to encourage early settlement on its own lands and on the homesteads, rather on lands held by other companies. Settlement on its own lands could be accelerated by charging less for its lands than their maximum potential value, conditional on early cultivation. The theory therefore predicts a preference in its sales policy towards the bona fide settler rather than the speculator and that the prices for land of equivalent quality would be lower for the CPR than for land sold by other land companies at the same time. The difference is likely to be small if any sales by others took place, because demand faced the CPR is likely to be very elastic with respect to price differences. The Railway would be able to divert demand from other companies by a small reduction in price, which is also to say other companies would sell nothing if they maintained a much higher price.

It is also expected that the quality of land sold would tend to decline over time.

The theory has shown that land prices will decline with distance of haulage to the track and with the level of the freight rate, and will increase the greater the availability of labour (the potential purchasers of land). In the next chapter, some of these predictions will be tested against the evidence, the main themes being that the Railway recognized the interdependence of its land and rates policies, that lower freight rates increased land revenues, that early settlement increased its freight profits and that the Crow's Nest Pass Agreement increased the value of Canadian Pacific lands.

ANNEX I

Demand for Productive Services: A reminder that derived demand schedules slope down too.

The demand for land (and for freight) is a demand derived from the demand for wheat in the world market. In this section the properties of the demand for a productive service will be reviewed. (See Stigler, 1966, Chapter 14 for a general treatment.) It will be assumed that wheat is produced by combining land and other factors in variable proportions. (Freight as an input bears a less general relationship being applied in more or less fixed proportions to the output--although presumably quality of freight might be varied--but is still combined in variable proportions in the other inputs). Profit maximization requires that factors be combined in quantities which equate prices (or more strictly combines them so that ratios of marginal products are equated to ratios of the factor prices).

The marginal product curve is a demand curve of sorts since it shows how quantities of inputs change with their price. However it is not a demand curve in the usual sense since it holds quantities of other factors constant, not prices. The demand curve for a productive

service which holds other prices constant will be more elastic than the marginal product curve but will also slope downwards.

The greater elasticity is illustrated in figure 2A.1. AB is the marginal revenue product of the factor whose price is P and quantity used is Q . When the price falls from P_1 to P_2 , with other quantities fixed, the quantity used will be increased from Q_1 to Q_2 to restore the equality between marginal revenue product and price. But now more of this factor is being used than before which will increase the marginal product of the other factors. The quantities of these other factors will therefore also be increased to restore the equality of their marginal revenue products and prices.

This increase in quantities of the other factors will increase the marginal product of the factor illustrated in the diagram for all levels of amounts used: it will shift the marginal product schedule to the right, so that when quantities of all factors have adjusted, an equilibrium will be found at point F where the quantity used at price P_2 is Q_3 , a greater amount than that on the original marginal product curve where other factors were fixed. The derived demand by the in-

Figure 2A.1

The demand for an input

dividual firm for a productive service passes through points DF, a curve with greater elasticity than the marginal product curve: the demand for an input slopes downwards but less steeply than the associated marginal product curve.

A distinction is made here between the demand by the individual firm and the overall demand for that factor by the industry. In a competitive market the individual firm faces prices which are unaffected by its own decisions. For the industry as a whole holding all prices constant is not realistic. Movement along the industry's demand curve is likely to affect prices especially, perhaps, the price of the output. In the case considered here, Canada's total output of wheat was a small proportion of the world production and it will be assumed that such output had no significant influence on the price. A question of interest here is whether the derived demand for land slopes downwards even if the demand it derives from, that for wheat, is perfectly elastic.

Even under these conditions the derived demand would slope down because of the effect of the quantity of land put into production on prices other than the price of wheat, in particular the price of farm labour. This

means that the demand curve for land for the industry would be less elastic than the individual settler's demand curve. The increase in application of other factors following a fall in the price of land would be moderated by the upward pressure on the price of the other factor (labour). Thus the rightward shift of the marginal product curve will be less, if industry wide changes are taken into account. The industry-wide demand curve for land is thus less elastic than the sum of the individual demand curves, but more elastic than the sum of the marginal revenue product curves.

ANNEX II

The relationship between average and marginal revenue

The geometric properties of a marginal revenue schedule are familiar when the demand schedule is a straight line: the same price intercept, half the quantity intercept, and twice the slope. An informal and unscientific survey of economists has revealed to me that when asked how to draw any marginal revenue schedule, some will reply, without hesitation, 'below the demand curve and with twice the slope'.

An example will show that this is not always the case. The hyperbolic demand schedule, which holds total revenue constant, has a horizontal marginal schedule (equal to zero). The slope of one is not twice that of the other.

It is my experience that frequent use of straight line illustrations, while usually simplifying the analysis, can also conceal a lack of generality. For example, the use of a constant marginal cost schedule eliminates the possibility of producers' surplus and should therefore be used with caution in welfare analysis.

In this section, I derive the general properties of a marginal revenue schedule to show that its slope is not always twice that of the demand schedule. This means that the "half the intercept" rule does not apply generally either, which is why my result on the effect of ownership of a fraction of land on the marginal revenue--a weighted average of the usual marginal revenue curve and the demand curve--only applies to the straight line case.

Total revenue R is given by

$$R = P \cdot Q \quad (1)$$

where $P = P(Q)$ is average revenue (the demand curve) and Q the quantity.

Differentiating (1) to get marginal revenue

$$dR/dQ = QdP/dQ + P$$

Differentiating a second time to get the rate of change (slope) of marginal revenue

$$d^2R/dQ^2 = Qd^2P/dQ^2 + 2 \cdot dP/dQ$$

Note that the slope of the demand curve is dP/dQ . The slope of the marginal revenue curve is therefore equal to twice the slope of the demand curve when $d^2P/dQ^2 = 0$, which is the straight line case (constant slope). Since demand curves tend to slope downwards with an increasing slope (decreasingly negative) d^2P/dQ^2 is usually positive, the marginal revenue schedule usually has a slope less than or equal to twice that of the demand curve in absolute terms, the equality occurring for the straight line case.

ANNEX III

The welfare gain resulting from the Crow's Nest Pass rate reductions

A crude measure of part of the welfare gain from moving to the lower rate (given that this rate is still above marginal cost) is given by the area of the triangle of increased consumer's surplus $\frac{1}{2}\Delta P\Delta Q$ which is also $\frac{1}{2}(Q/P)\Delta P^2n$ where ΔP is the change in price P at quantity demanded Q and n is the elasticity of demand, an unknown. (The remaining part of the welfare gain is the corresponding producer's surplus.) As a rough measure of the order of magnitude, I substitute the values prevailing in 1897. The quantity of grain moved by the CPR was 32,528,256 bushels, the Regina to Fort William freight rate 13.8 cents/bushel and the total Crow's Nest Pass reduction was 1.8 cents. Assuming otherwise static conditions, this gives an annual welfare gain of \$44,322n.

I have no way of knowing the value of n the elasticity of demand, but considering the large increase in land sales after 1897 it could be quite big. However it is not possible to attribute the whole of the expansion in sales, and consequently amount of freight demanded, to the change in the freight rate. Other costs were possibly falling at the time, and there may have been a general increase in sales regardless of the Agreement.

The area measured at \$40,000n is an underestimation of the annual gain since the expectation would have been that freight rates otherwise would gradually rise. Furthermore, it does not include additional gains to the Railway in profit made on the additional volume, given that price still lies above marginal cost. (See figure 2A.2.)

Figure 2A.2

Welfare gain from Crow's Nest
Pass rate reduction

ANNEX IV

Effects of prices on relative intensities of use of inputs: the peculiar nature of land and freight as inputs

The usual conditions for profit-maximization in production are that inputs are combined so that their marginal products are proportional to their prices. The constant of proportionality in a competitive market is the price of the output--marginal revenue products being equated to input prices.

At first glance, this would suggest no change in the ratio of inputs when the price of the output changes. However, for land there is a change because the quantity of land at a given location cannot be varied and the rental price (or, rather, the annual value of the land) that the marginal revenue product is equated to is, itself, determined by the price of the output. While an administered price may exist for land, its value is endogenous.

When freight rates go down, the farm gate price of the output goes up. And at the same time the value of the land goes up too, so that relatively less of the land at any location will be combined with labour (that is to say, more labour will be applied to it) in order to maintain the equality of the marginal revenue products and

the (rental) prices (or values) of the inputs. However, as the labour input is increased, the output of a given amount of land increases-- and in this way relatively more of the cheaper freight is combined with land. The marginal product of labour falls with the increase of labour applied to land. Since the ratio of labour to output could have moved either way, we cannot tell whether there has been an increase in the ratio of labour to freight following the fall in the price of freight. Overall, however, there will be more freight, more labour and, as the extensive margin shifts out, more land used, as freight rates fall.

The point being made here is that freight as an input is combined with other inputs, but not in the conventional way that allows substitution between it and other factors. Although the ratio of freight with any other input does vary, we cannot make the usual statement that a fall in its price will increase the amount used relative to all other factors. The way in which the ratio of freight to other inputs will increase is through cultivation at more distant locations. Land at a further distance from the market will be brought into production, increasing the maximum length of haul both on the railway and to the railway.

ANNEX-V

The variation in land values for a Cobb-Douglas production function

In this section, land values will be derived as a function of distance for the special case of a Cobb-Douglas production function

$$Q = aL^x \quad (1)$$

where Q is output per acre and L is labour input per acre. Necessary conditions for maximum profit give

$$PdQ/dL = w \quad (2)$$

where P is the farm gate price at distance d . The farm gate price is given by $P = P_w - f - hd$ where P_w is the world price of wheat, f the freight rate and hd the cost of haulage to the railway.

Applying this condition (2) to equation (1) we get

$$Px a L^{x-1} = w \quad (3)$$

or $PxQ/L = w \quad (4)$

equation (3) gives L as a function of the farm gate price

$$L = [xa P/w]^{1/(1-x)}$$

$$L = [xa(P_0 - hd/w)]^{1/(1-x)}$$

It can be seen that L decreases as d increases to the point where $L = 0 = Q$ at the extensive margin where $P_0 - hd = 0$. The elasticity of labour with respect to the farm gate price is $1/(1-x)$. Substituting for L in (1)

$$Q = aL^x$$

$$= a [xa P/w]^{x/(1-x)}$$

The elasticity of output Q with respect to the net farm gate price is $x/(1-x)$. This means that the higher is x , the elasticity of substitution of labour, the bigger is the response of yield to changes in net farm gate price.

For the single period the value of land can be written

$$V = PQ - wL$$

$$= PaL^x - wL$$

$$= L(PaL^{x-1} - w)$$

substituting for L

$$\begin{aligned}
 V &= (xaP/w)^{1/(1-x)} (Pa [(xaP/w)^{1/(1-x)}]^{x-1} - w) \\
 &= (xaP/w)^{1/(1-x)} (Pa [xaP/w]^{-1} - w) \\
 &= (xaP/w)^{1/(1-x)} (w/x - w) \\
 &= (xaP/w)^{1/(1-x)} w(-x)/x \\
 &= (x/w)x/(1-x) (1-x)^{1/(1-x)} (aP)^{1/(1-x)}
 \end{aligned}$$

The elasticity of value of land with respect to farm gate price is $1/(1-x)$ which is larger, the greater is d , the elasticity of substitution of labour. What does this tell us about the profile of land values as a function of distance? We can see that for the Cobb-Douglas production function land values vary with farm gate price to the power $1/(1-x)$. Since x must be less than one the value of $1/(1-x)$ is greater than one.

$$\begin{aligned}
 \text{Putting } V &= k(P)^{1/(1-x)} \\
 &= k(P_0 - hd)^{1/(1-x)}
 \end{aligned}$$

and differentiating with respect to distance

$$dV/dd = [-hk(P_0 - hd)^{x/(1-x)}] / (1-x)$$

< 0

and, differentiating again,

$$d^2V/dd^2 = [xh^{2k}(P_0-hd)(2x-1)/(1-x)]/(1-x)^2$$

$$> 0$$

Thus, for the Cobb-Douglas production function land values decline as distance increases, but at a declining rate. The profile of land values is convex to the origin, falling to zero at a distance P_0/h from the track, where a sufficient condition for the extensive margin of cultivation is that the price of the output is exhausted by the haulage cost.

ANNEX-VI

The array of land values allowing for discrete loading points

It was assumed, earlier in Chapter 2, that land values are affected by the distance of the land from the track. More realistically, the relevant distance is to the nearest loading station, these being spaced at intervals of about seven or eight miles along the track. Land values therefore depend on the distance from a point, rather than distance from a line. This produces a different array of land values which will be examined here.

Under the distance-to-track assumption, the total supply of land is $48T$ square miles, where T is the length of track in miles. (This assumes that the track is a straight line with no overlapping of the railway belt.) The area $48T$ is composed of equal quantities of land at each distance from the track, from zero to twenty-four miles either side.

Under the distance-to-station assumption, the total area again is the area $48T$ of the railway belt. The best land (at small d) is in smaller quantities than the more distant land, since distances now radiate from points. The quantity of land at each distance is more complex. (See figure 2A.3).²¹

Figure 2A.3

Array of land at various distances
from stations

A, B = stations

If the distance between stations is $2D$, the amount of land at distance d from a station can be seen to increase directly with d up to $d = D$. (The area of the ring of land between d and $d + \Delta d$ is $2\pi d \Delta d$.) Beyond $d = D$, the area increases less rapidly, as the concentric circles around one station increasingly intersect those around the next. A second discontinuity occurs at a distance of twenty-four miles, the width of the Railway Belt on each side of the track. Beyond this distance the concentric circles are truncated at the boundary of the railway belt as well as by the line perpendicular to the back bisecting the distance between stations.

While the relative amounts of land at each distance are more complicated by allowing for the location of stations, it can be seen that the proportions are constant for any loading station. The demand schedules for land at each distance may still be added vertically by first weighting each demand schedule by its share of the total area over the distance (or half the distance) between two stations. The aggregate price of any such slice of the Railway Belt can then be calculated by summing the weighted prices over each value of the distance from zero to a little over 24 miles $\sqrt{(24^2 + D^2)}$ where 24 miles is the depth of the railway belt from the track and $2D$ is the distance between stations.

Footnotes to chapter 2

1. The idea is John McManus's, from a question he poses to his price theory class at Carleton University. Engerman (1972) recognized that freight rates would be lower but did not pursue the idea of increased efficiency.
2. It was perhaps a mistake not to have allowed for inflation.
3. Canadian annual production accounted for less than three per cent of world production before 1900. See footnote 2 and table 3.5 in chapter 3 below.
4. It is not new, the idea that owning land was likely to result in lower freight rates. A C.P.R. official has stated that the value of real estate was the motive behind the Crow's Nest Pass Agreement (see note 6 below).

Engerman (1972) observed that land grants to railways would reduce freight rates. Burstein recognizes an additional interaction between land values and freight--the possibility of a tie-in consistent with the "variable rental hypothesis":

Northern Pacific required that purchasers of land adjacent to its tracks and owned by Northern Pacific agree to ship via Northern Pacific to a greater extent than would probably otherwise would have been the case. It is evident that there is a correlation between the ultimate volume of traffic and the ultimate worth of the land to the purchaser. The tying arrangement achieved the effect of an open-ended lease."

(Burstein, 1960: 72)

The Canadian Pacific had no need of such arrangement as its monopoly position as a railway, gave it a perfect tie-in.

5. For a straight line demand schedule, slope b , price may be written

$$P = a - bF \quad (1)$$

Revenue R_f from freight alone is

$$\begin{aligned} R_f &= R \cdot F \\ &= aF - bF^2 \end{aligned}$$

$$\text{and marginal revenue } MR_f = a - 2bF \quad (2)$$

The revenue R_L from land, accruing to the railway owning the fraction k of affected land is

$$\begin{aligned} R_L &= k \left(\int_0^F P dF - PF \right) \\ &= k \left(\int_0^F P dF - aF + bF^2 \right) \end{aligned}$$

Differentiating to get the marginal revenue MR_L from land

$$\begin{aligned} MR_L &= k (P - a + 2bF) \\ &= kbF \end{aligned}$$

The marginal revenue MR from both land and freight is therefore.

$$\begin{aligned} MR &= MR_f + MR_L \\ &= a - 2bF + kbF \end{aligned} \quad (3)$$

Consider now a line MR' which is the weighted average of the demand curve (1) and the conventional marginal revenue curve (2), the weights being k : $(1-k)$ respectively

$$\begin{aligned} MR' &= [kP + (1-k)MR_f] / (k + 1-k) \\ &= k(a - bF) + (1-k)(a - 2bF) \\ &= ka - kbF + a - 2bF - ka + 2kbF \\ &= a - 2bF + kbF \end{aligned}$$

which is the same as the total marginal revenue schedule (3).

The Railway's marginal revenue, for the straight-line case, thus lies between the demand schedule and the marginal freight revenue schedule, such that the vertical distance between them is cut in the ratio $(1-k):k$, as illustrated in figure 2.5.

6. Annex II shows that the properties of average and marginal revenues exhibited by straight line schedules cannot be extended to the general case.
7. An illustration of the incentive to exploit a monopoly position after the sale of the affected land is given by Professor Alfred Kahn in a footnote to his Ely lecture (Kahn, 1979):

From time to time, we at the New York Public Service Commission found ourselves confronted with requests by small water companies for rate increases in the range of 200 to 300 percent,, which, to our astonishment, our staff testified were necessary to enable them to cover their costs and provide a reasonable return on investment.. It was very difficult to believe, in these cases, that costs had increased by percentages of that order of magnitude during the period in which the then current rates had been in effect. The explanation was not hard to find. While separate legal and accounting entities, the companies in question either were or had been appendages of real estate developers, who got into the water business because most of their customers were unwilling to buy developed lots and houses without an attached water supply. Whatever they earned, they earned not on the water systems as such, but on the combined operation. Now they were proposing to make the water operation compensatory by conventional regulatory standards. It proved fairly simple to explicate the sense of injustice expressed by some of their indignant customers. The price that purchasers had paid for the developed lots or houses must have reflected, explicitly or implicitly, the price they were being charged for water, and certain expectations about its future course. It seems a reasonable assumption that the purchasers had no reason to expect their water rates to go up more than costs. If that assumption is correct, the inference is inescapable that to grant a water company associated with a real estate developer a rate increase by

time of purchase would have involved permitting a double recovery of the original investment - once in the selling prices of the houses, and the second time, by courtesy of the Public Service Commission, in the price of the water itself.

8. Frank Lewis and David Robinson (1983) estimate the value of the Railway's optimal freight rate as close to the actual Crow's Nest Pass rate for an area in Saskatchewan. Their model for the optimal freight rate is similar to my own. The major difference in our assumptions is that the Lewis-Robinson model assumes that all land within the extensive margin (their "feasible" region) is instantaneously settled so that there are no adjustment costs. Their optimal timing of construction for branch lines may be earlier than under the assumptions of positive adjustment costs. Under the assumptions of my own model, costs of branch line construction would remain the same but benefits to the railway would be smaller--only a share of the total benefits produced--which would probably, though not definitely, result in a later date for maximum net present value of construction. (Given that costs mostly occur in the early period and benefits are spread over time, the reduction in level of benefits will likely delay the optimal time and not simply reduce the overall scale of net benefit flow without changing its peaks.)
9. The Railway's right to reject land not "fairly fit for settlement" reduces the average number of sections it owned in any township. The records in my possession of individual sales in the Qu'Appelle Valley show that there were large areas in the Railway belt in which it either owned no land, or did not sell it during the period of study, 1882-1913.
10. This explanation is supported by testimonial from a Canadian Pacific official documented by Currie (1954: 631). Mr. W.B. Lanigan, Freight Traffic Manager, and with the Company since 1884, stated before the Interstate Commerce Commission in 1923, that the main reason for the Crow's Nest Pass Agreement was the increase in the value of the estate.

Currie. (1967, 87) also adds:

Sir William Van Horne....has been credited with enormous vision because he saw that low rates would induce new settlement, increase the volume and the profitability of the Railway's traffic, and enormously enhance the value of the Company's extensive holdings of land.

11. As described in Chapter 1 there was a permanent ceiling on the rates on westbound settlers' requirements as well as eastbound grain. These commodities included inputs into farming such as binder twine, agricultural implements, glass, coal oil, iron (for example horseshoes, nails, pipes), wire, livestock, and green and fresh fruit.
12. Other things being equal include continuation of the Canadian Pacific's monopoly and freedom from rate regulation. The Manitoba Agreement brought rates down a little showing the influence of competition. The Crow Agreement also introduced a loss of freedom from rate regulation. In a sense, competition was a substitute for the Crow's Nest Pass Agreement in constraining monopoly pricing. The advantage of the Canadian Pacific monopoly, combined with the land grants, was that it seduced the Railway into encouraging settlement at the same time as serving to subsidize construction.
13. It seems that the extensive margin may have lain well within the 24-mile Railway Belt. Maps in Chester Martin's Dominion Lands Policy (1938) p. 246, showing accessibility to railways for 1886-1931 are captioned "Accessibility is indicated by means of bands 20 miles wide enveloping the railway lines, 10 miles from a railway representing the economic range for agriculture" (emphasis added). However Martin's maps also show, by 1901, extensive areas occupied beyond 10 miles from a railway, throwing doubt on the limits he puts on the economic range for agriculture.
14. However, without the assumption that the short run labour supply is inelastic, the timing of settlement becomes indeterminate. Other models generate an optimal time to settle the land by assuming, for example, that the world demand for wheat is increasing.

15. Land values vary continuously, but transactions costs preclude such fine-tuning of price. There would still be an array of discretely different prices which would clear the market.
16. In a more realistic model relevant distances are from a point, a loading station, and the areas at each distance increase proportionally with distance, at least at first. The demand schedules would be weighted by this distance before aggregating to get total demand. See Annex VI for an analysis to the relative amounts of land at each distance.
17. See Norrie (1979) for a comprehensive review of the extensive literature on the rate of settlement of the prairie homesteads.
18. The land sales records examined in Chapter 3 showed such gaps.
19. It was in the context of the Railway's bringing harvesters in free that Hedges (1931: 111) observed that the generosity of the company was enlightened self-interest.
20. The CPR Annual Report for 1885 (p.18) states

The Directors have devoted their attention almost entirely to promoting the settlement of the free Government lands within the railway belt and south of it to the International boundary, meantime making little effort to effect sales of its own lands. Until the free homesteads are pretty well taken up and occupied, there cannot be any great quantity of land sold to settlers.

Marr and Percy (1978) introduced Dominion colonization expenditures as a factor in determining the rate of prairie settlement. They did not, however, include similar expenditures by the Canadian Pacific.
21. Frank Lewis (1981) shows a similar array and also takes account of the extra distance required to travel by road.

CHAPTER 3

TESTING THE HYPOTHESIS

A. Introduction

In this chapter some of the predictions of chapter 2 are to be tested against the data, in particular, that the Crow's Nest Pass Agreement had a positive effect on land values, not only by reducing freight rates but also by guaranteeing to settlers that they would not be raised after sales had been made.

This empirical chapter is composed of two parts. In the first, an attempt is made to explain the variation in land prices using cross-sectional data over the period 1882-1912. These data are from individual records of CPR land sales in a single area in Saskatchewan.

In addition to using regression analysis, other casual evidence is gathered from the literature to support the hypothesis that the railway maximized its wealth from land and freight combined and recognized the interdependence between these. In particular the theory's predictions are tested by comparing the land pricing policies of the Railway and the Hudson's Bay Company in

the final section of this chapter. The intention is to evaluate the conventional wisdom among early historians that the Railway was more concerned with revenues from traffic than from land.

B. Testing by regression analysis

I begin with a description of the simplified model to be tested against the data.

(i) The model

The basic model for land value V is

$$V = E \int (R_t - C_t) e^{-it} \quad (1)$$

$$= E_t \sum (R_t - C_t) / (1+i)^t \quad (2)$$

where V is the present value of the stream of revenue R_t net of costs C_t , discounted at a rate of interest i . E is an operator, indicating "the expected value of".

It is assumed that land's only use is in the production of wheat,¹ that the price of wheat is exogenous, determined in the world market,² and that factor inputs are applied in fixed proportions.³

The net income stream $(R - C)$ for any time period can be written

$$R - C = (P_w - f - hd)Q - WL - rK \quad (3)$$

where P_w is the world price of wheat, f is the freight rate, h is the haulage charge per mile to the nearest loading station a distance d away, Q is yield per acre and WL and rK are the costs per acre of labour L and capital K used. The fixed factors assumption implies that Q is independent of L and K , while L and K are fixed for a given quantity of land, as, for example, in a Leontief production function.

(ii) The variables

a) Land values

Observed prices are used as the proxy for land values. This introduces an eccentricity into the estimation analysis because prices were administered by the Canadian Pacific and did not vary much in nominal terms. Quantity, on the other hand, varied a lot. See figures 3.1 and 3.2. The margin at which price was equal to value would vary as value itself varied and we can therefore expect to see a variation in the quality or distance

Figure 3.1
Nominal average annual prices
of CPR land sold (\$/acre)

Source: Hedges

Figure 3.2

Annual CPR land sales (thousands of acres)

Source: Hedges

of the land sold at a given price, as economic conditions changed. However the policy of offering a wide band of land at a single price means that the price observed may underestimate the land's expected value for at least some of the land. Price is thus less than or equal to the value of land sold and varies less than the variable, value, to be explained in the model.

b) The explanatory variables

(i) Expected revenues

Revenue is the product of price and yield. There is therefore a choice between modelling expected revenue itself and the expected components, price and yield. There is no a priori reason to expect wheat prices to change systematically over time. Casual inspection of real wheat prices suggests a downward trend and a great deal of year to year variation. (See figure 3.3 for the variation of real prices over time. The smooth line shows a slight downward trend, estimated by regressing the real price of wheat against time.)⁴

Figure 3.3

Real price of wheat and estimated
time trend (1935-9 cents/bushel)

Yield is likely to be mainly stochastic, dependent on weather, although an increase over time might be expected because of improvements in technology while a decrease over time may occur because of the expansion of the extensive margin. No significant trend was shown by the data.⁵ Figures 3.4 and 3.5 show that both yield and revenue fluctuated considerably from year to year.

Attempts to isolate a systematic relationship for current revenues (or prices) as a function of past values were not successful. A simple expectations model was therefore used in which values in the previous period were assumed to be taken as indicators of future values.

Soil Quality

Data on actual yields are available as annual averages for Saskatchewan (or the part of the Territories which are now Saskatchewan). Expected yields for individual quarter sections depend on soil quality and the data from contract records allow such quality to be identified, at least by the standards of soil quality in the area today. Included, therefore, as an explanatory variable is a measure of the quality of the soil for individual land sales. Quality, like distance, varies with

Figure 3.4
Annual wheat yield, prairie provinces,
(bushels/acre)

Figure 3.5

Real gross revenues (1935-9 dollars/acre)

cross-sectional observation but may also vary over time. However only a single current-day observation is available so the quality variable in the regression analysis is constant over time.

(ii) Costs

As with revenues, I use a naive expectations model in which the lagged real value of cost serves as its expected future value. This approach is used because of the discouraging results for estimating the predicted components of price and revenue for wheat and because such estimation creates its own problem for estimating land values by reducing the determining variables almost to constants. Furthermore data on costs were scanty and it is doubtful that manipulation of these series would add any information.

Freight Rates

Central to this thesis is the interdependence of freight and land policies of the Railway. Freight rates affect land revenues; land prices affect freight revenues. Ideally a simultaneous model of both freight rates and land prices should be estimated. Lacking data

on the determinants of the optimal freight rate (in particular marginal cost of transportation services) I attempt here only to estimate the effect of already determined freight rates on land prices. To avoid the problem of simultaneity, I use past freight rates as an explanatory variable determining current land values.

Freight rates pose a problem for econometric analysis since they did not vary much in nominal terms especially after the Crow's Nest Pass Agreement. (See figure 3.6.) While the ceiling is predicted to have an important effect on land values, in the analysis it is difficult to distinguish the freight rate from the constant term. Even though there was some variation after the Agreement (and more variation when we use real freight rates instead of nominal) it is the stability itself of the ceiling and the limit this puts on expected future freight rates that is important in determining land values. Regression analysis is more suited to identifying the influence of explanatory variables through their variation, not their stability.

In the analysis, nominal freight rates are used as well as real freight rates. Fixed nominal rates may have led turn-of-the-century settlers to expect long run fixed real rates. However, given their experience of

Figure 3.6
Cost of transporting wheat (cents/bushel)

inflation they may have expected gradually increasing real rates. (See figure 3.7 for the price level at this time. For the two decades before 1897, the price level had been falling rather than rising.)

The freight rate used is the rate for wheat from Regina to Fort William-Port Arthur. The area under study is close to Regina and actual freight rates, where known, were within a cent of the Regina rate.

Freight rates, of course, are predicted to have a negative effect on land values, and a once and for all change is predicted following the Crow's Nest Pass Agreement.

Factor Costs

Wages and interest rates are expected to have a negative effect on land values.

Haulage Costs: distance from the track

Land values are predicted to decline with distance from the nearest loading station. With the individual contract data, unlike aggregate annual data on land sales, I can observe the actual distance of the land sold.

Figure 3.7

Price index 1878-1913 (1935-9 = 100)

Source: Urquhart and Buckley, (1965)

Costs of adjustment

In addition to the variables determining long run expected net revenue, the immediate costs of adjustment are likely to influence the price at which land can be sold. Two factors affecting these costs are included here. First, the degree to which neighbouring homesteads are settled, and second, the advertising expenditures of the Dominion and the Railway to encourage colonization.⁶

The two effects are not independent. Advertising aimed ultimately at settling railway lands was directed in the first instance to settling the homesteads:

The C.P.R. immigration agencies, contrary to the general belief, are not employed in securing settlers for C.P.R. lands, but devote their energies towards settling immigrants on government property, the company recognizing the fact that the filling up of the Dominion lands will enhance the value of their own.

(Manitoba Daily Free Press,
June 18, 1886)⁷

The Railway itself recognized the importance of homestead settlement to the demand for its own lands:

The free homestead lands in the railway belt...are already largely taken up, and it cannot be long before there will be a good market for the Company's lands...

(CPR Annual Report for 1885: 18)

and:

The free government lands in the vicinity of the railway are so far absorbed as to encourage your Directors* to believe that the time is at hand when the lands of the Company will not only be readily saleable, but will bring higher prices than in the past.

(CPR Annual Report for 1888: 20)

Hedges (1939: 81) also observes that homestead settlement increased the demand for CPR land:

Higher prices for railway land constituted but one of the benefits resulting from prior occupation of the government lands. Successful farmers...were large buyers of the land of the company.

Martin (1938: 87) gives another source:

In the first years our efforts were more directed to the settlement of the homesteads than to the selling of our own land.

(retired official of the CPR to the Saskatchewan Commission)

Advertising was therefore directed at the free lands first:

... as the most practical and effectual method of giving a value to, and creating a market for, the Company's lands; the Directors have devoted their attention almost entirely to promoting the settlement of the free government lands within the railway belt and south of it, to the International boundary, meantime making little effort to effect sales of its own lands. Until the free homesteads are pretty well taken up and occupied, there cannot be any great quantity of land sold to settlers.

(CPR Annual Report for 1885: 18)

It has been the policy of the company...not to press the sale of its own lands so long as large areas of free government lands should remain in their vicinity, but rather to encourage the settlement of the government lands instead. It is believed that a much better price can be obtained for the railway lands when the free government lands are out of the way, and this belief is justified by the experience of the Land Grant railways in the United States.

(CPR Annual Report for 1887: 18)

Ostensibly promoting homestead settlement was to improve its own land revenues but the theory also predicts that it was in its interest to promote early settlement of any land, free or otherwise, to generate profits on its freight. For this purpose too, it was rational to concentrate on the homesteads, free land being the most desirable for the potential settler.

Expansion was cheaper for homesteaders, in terms of adjustment costs, than it was for immigrants. The more homesteaders there were, the more potential buyers there were with low adjustment costs. These would be more responsive to the Railway's attempts to encourage early settlement of their own lands. Also, the more settled the area (up to a point), the lower the non-pecuniary costs are likely to be for newcomers and homesteaders alike.

The degree to which the area was settled was estimated as the ratio of the stock of net homestead entries to the length of railway track (all companies) opened in the prairies. This gives a measure of the average depth of the area settled by homesteaders. It assumes homesteads were taken as close to the railways as possible (a widening band over time), and that the railways went through the prairies in straight lines such that the bands of settled land on either side of one railway did not overlap others.

Maps in the original edition of Martin's 'Dominion Lands' Policy (1938:246-250) indicate that so-called accessible areas did not overlap much, except in Manitoba, until 1901. By 1911, branch lines extending into Saskatchewan were showing considerable overlap; similarly for Alberta by 1916. However Martin's caption to these maps states that "10 miles [represented] the economic range for agriculture". If we accept that the economic range was wider (and certainly the range of settlement was) then there would have been more overlap and my indicator of depth of settled homesteads increasingly is an underestimate.

Homesteaders were not the only buyers. The perceived costs of adjustment and expected revenues for foreigners were influenced by advertising. Both the Dominion government and the Canadian Pacific Railway spent considerable sums advertising the west.

In the simple model estimated here, lagged annual expenditures were used as the explanatory variable. Since advertising would have a cumulative effect, a stock approach might have been more appropriate with 'old' advertising depreciating. It is assumed that recent advertising affects CPR sales directly and "old" advertising affects sales indirectly through the stock of homesteads.

Liquidity

The liquidity of homesteaders may have affected the timing of their decision to purchase, while the liquidity of the Railway may have influenced the administered price it charged, for a given value of land.

No direct data were available on liquidity. However recent wheat revenues are a proxy for settlers' ability to buy so that prices might be higher (for a

given quality of land) following a good harvest, regardless of the effect of such a harvest on expectations. Similarly, less land would be sold in a year following a poor harvest, given no change in the administered price. Since the best land, at any price, is sold first, it would appear that value had fallen as the location of sales shrank away from the margin that existed before. After a good year more distant land would sell for the same price, so that it would appear that value had risen.

The Canadian Pacific recognized the influence of settlers' liquidity on its own revenues:

Immigration and land sales were seriously affected during the past year by the crop failure of 1889, in the Northwest...

(Annual Report for 1890: 18)

and

The Company's lands are seldom sold to new immigrants, but generally to those who have already established themselves on free homesteads, and who from their improved conditions are able to increase their holdings by the purchase of adjoining railway lands; therefore an unfavourable season in agriculture is sure to be unfavourable as regards land sales.

(Annual Report for 1893: 16)

Low land sales are again attributed to depressed conditions in 1894:

The price of wheat, which was unprecedentedly low ... continued to decline as the year advanced, and the price of nearly all other agricultural products ... likewise declined. The resulting scarcity of money among farmers had a marked effect upon trade and manufactures, and caused a contraction in business throughout nearly all Canada ... made worse by the extraordinary commercial depression in the United States... The land and townsite sales suffered more than anything else [in the Company's business] from the prevailing conditions; indeed the sales almost ceased.

(CPR Annual Report for 1894: 11)

And good harvests had opposite effect:

Meanwhile immigration into this perplexed land had not ceased. The happy crop and high prices of 1888 gave a fillip to migration from Ontario, many going to Regina and Moose Jaw.

(Morton 1938: 86)

The recovery in the prices of farm products, and especially wheat, has given vigour to agricultural development in the Canadian Northwest, and the Directors anticipate a much larger increase in the land sales of the new year.

(CPR Annual Report for 1897: 12)

A poor crop evidently results in less land sold at a given price but does not necessarily affect the prices of sales observed unless the Railway reacts by reducing the price:

At the beginning of last year [1892] the Directors made a considerable reduction in the price of the Company's lands with a view to hastening their sale and cultivation. This policy was remarkably successful: the acreage disposed of during the year was FOUR TIMES greater than in 1891.

(Annual Report for 1892: 17)

Hedges (1939:75) confirms the effect of the Railway's own liquidity in explaining why the CPR deviated from the 1882 regulations which gave more favourable terms to settlers than to land companies:

[The Canadian Northwest Company's] contract with the railway contained no provision requirements with respect to settlement of the land. It paid a fixed price for land irrespective of whether it located settlers on its holdings. The Canadian Pacific regarded its agreement with the land company not as a promise of early colonization of the land but as a means of obtaining the financial assistance it sorely needed at the time.

These factors are not included in the econometric model because of the unavailability of data on the Railway's liquidity and capital needs.

c) The Data

The cross-sectional data are taken from the records of individual contracts for first sales by the CPR, in an area of about forty-two townships in the Qu'Appelle Valley of Saskatchewan. (See figure 3.8 for a sample record and figure 3.9 for the location of individual observations.) Since each contract records price, date of sale, and position of the land by quarter section, it is possible to locate the land and measure its actual dis-

Copy of Figure 3.9

(see insert at back of this thesis
for coloured original)

CANADIAN PACIFIC LAND SALES 1882-1912

tance from the nearest loading station. Soil quality can be identified by using a present day map of soil types for the area. Since the land is all in one area, more things are held equal than is possible for the aggregate data available in published form. (See the annex to this chapter for regression results on aggregate time series data.) The Regina to Fort William freight rate is a good estimate of actual costs of rail transportation for settlers in the Qu'Appelle Valley. Yields are available for Saskatchewan. Climate, too, is held constant, the Qu'Appelle Valley being in the range of 9-10 inches of average summer precipitation.

At the same time individual sales in a single area are vulnerable to local disturbances to settlement. The area included a large corporate 'Bonanza' farm (the Bell Farm), an experimental farm at Indian Head, Indian reservations, and large blocks of land within the Railway Belt either not included in the Railway's allocation or sold before the records in my possession. These make observation of the shifting margin of settlement 'lumpy'.

Soil quality

Soil quality was determined through the description of quality on a current day ARDA (Agricultural and Rural Development Act) map of the area.⁸ Six soil types are identified and a dummy variable was used to distinguish among them. Where a quarter section fell into two or more soil types, one type was recorded, the predominant type by area. Soils in classes 1, 2, 3 and 4 are nowadays described as being considered capable of sustained use for cultivated field crops, while those in classes 5 and 6 are suitable only for perennial forage crops. Most of the land originally owned by the railway in this area falls into the two best categories, classes 1 and 2. Very little of the area is unsuitable for field crops, and this mostly along the steep wooded banks of the Qu'Appelle River. Wheat is now the dominant crop occupying over 70 per cent of the annual cropping acreage.

The Contract Data

The procedure I used to gather information from the data is as follows. (A more detailed description is given in the appendix.)

Each quarter section of land sold was located on a National Topographic System map of the area, and its price and date recorded. Part-quarter sections were rounded to the nearest quarter section. Repeat sales (after a cancellation of a contract) were also recorded. Distances to the nearest loading station were measured to the nearest mile and soil quality was recorded as one of six present day categories.

In each year there were, in general, several sales at the same price, some of which had common soil quality. For all sales in one year at the same price and on the same soil, the only distance which was recorded for regression purposes was that for the land which was furthest from its nearest loading station. The purpose of using a single measurement of distance for a group of sales at the same price and soil quality was to recognize that price must be less than or equal to the expected value of the land. The furthest distance is thus a better measure of the margin where price equals distance than all distances, and the more observations I have at that price, the closer I expect the furthest quarter section to be to its margin.

Thus, not only do I take the furthest distance from the nearest station as the relevant distance, but I have more confidence in the observed price as an indicator of the value of the land at that assumed margin, the more observations I have. I therefore also recorded the number of observations in the same year with the same price and soil quality in order to give more weight to the single price/distance/quality observation I use in the regression analysis.

Instead of including all observations in the regression data,⁹ with 'corrected' distance values, I recorded single values for the multiple observations and weighted the regression equation by the square root of the frequency of observation. The rationale for the square root is to ensure that minimum least squares is preserved. Instead of the equation

$$Y = aX + b + e$$

I use the equation

$$\sqrt{n}Y = \sqrt{n}aX + \sqrt{n}b + u$$

where the disturbance u is equal to $\sqrt{n}e$ and n is the frequency of observation of (Y, X) . The weighted equation magnifies all the values observed by root of n , their

frequency of occurrence. Intuitively this maintains the sum of least squares, since by multiplying individual disturbances by root n , the contribution to the sum of squares will be n times. Multiplying the equation by n would have resulted in each squared disturbance contributing n^2 times to the sum of the squares.¹⁰

The time series data for costs, revenues, advertising expenditures, depth of homestead settlement, interest rates, freight rates, price index, etc. are described in the Appendix.

d) The results

The general specification of the equation tested was

$\text{price}_{it} = f_n (\text{distance}_i, \text{soil quality}_i, \text{freight rate}_{t-1}, \text{wage}_{t-1}, \text{depth of settlement}_t, \text{colonization expenditures}_{t-1}, \text{wheat price}_{t-1}, \text{interest rate}_t, \text{price index}_t, \text{time trend}_t).$

The suffix i indicates a cross-sectional observation made in the year of an individual sale, while the suffix t indicates a time series observation applicable

to all sales in that year. The model was tested by ordinary least squares regression, in log-linear form using real values of all monetary variables and also using nominal values with the influence of the price level unconstrained.

The period of the regression analysis was 1884 to 1912. All equations except the first (table 3.1) were weighted by the square root of the frequency of occurrence of observations as has been described. It can be seen that the weight dramatically increases the apparent goodness of fit.

A sample of the results is shown in tables 3.1 to 3.3. The endogenous variable is the logarithm of the price of land. All variables are real except in equation 7. All explanatory variables were used as logarithms except for the intercept, the dummies and the time trend.

The logarithmic form is not a strict application of the present value model which would require that price be proportional to the difference between expected gross revenue and expected cost, rather than the ratio of these values.

Table 3.1

REGRESSION RESULTS:
ESTIMATED COEFFICIENTS AND t-STATISTICS

156

equation	(1)	(2)	(3)	(4)
<u>variable</u>				
constant	2.45 (32.40)	2.49 (34.90)	2.35 (27.18)	2.95 (0.66)
distance	-0.25 (-6.53)	-0.28 (-9.94)	0.27 (-9.35)	-0.20 (-8.23)
soil quality 2			0.13 (2.58)	0.05 (1.11)
quality 3			0.27 (2.59)	0.12 (1.33)
quality 4			-0.28 (1.19)	-0.13 (-0.64)
quality 5			0.30 (1.84)	0.13 (0.98)
quality 6			0.07 (1.06)	0.07 (1.19)
freight (-1)				-0.73 (-7.50)
wage (-1)				0.24 (0.33)
Price wheat (-1)				0.40 (2.93)
$\bar{R}^2$	0.21	0.93	0.94	0.97

Table 3.2

REGRESSION RESULTS:
ESTIMATES COEFFICIENTS AND t-STATISTICS

equation	(5)	(6)	(7)	(8)
<u>variable</u>				
constant	8.92 (1.15)	8.50 (1.11)	-7.95 (-1.14)	4.81 (0.61)
distance	-0.11 (-4.53)	-0.11 (-4.65)	-0.11 (-4.24)	-0.11 (-4.55)
soil quality 2	0.04 (1.06)	0.05 (1.41)	0.05 (1.42)	0.06 (1.67)
quality 3	0.67 (0.86)	0.06 (0.80)	0.06 (0.71)	0.06 (0.82)
quality 4	-0.01 (-0.06)	0.01 (0.08)	-0.02 (-0.09)	-0.00 (-0.01)
quality 5	0.04 (0.38)	0.05 (0.43)	0.02 (0.15)	0.03 (0.30)
quality 6	0.00 (0.06)	0.00 (0.04)	0.02 (0.41)	0.02 (0.29)
freight (-1)	-0.61 (-4.43)	0.08 (0.26)	-0.47 (-4.55)	0.13 (0.41)
wage (-1)	-0.10 (-0.09)	-0.49 (-0.44)	2.46 (2.38)	-0.11 (-0.10)
depth of homesteads	0.90 (5.37)	0.90 (5.47)	0.49 (2.45)	0.75 (3.99)
Dominion expenditures (-1)	-0.19 (-2.92)	-0.14 (-2.20)	-0.19 (-3.03)	-0.15 (-2.24)
CP expenditures (-1)	0.04 (0.67)	0.01 (0.17)	0.06 (1.08)	0.01 (0.14)
Price wheat (-1)	0.35 (2.76)	0.30 (2.41)	0.26 (2.17)	0.29 (2.34)
time		0.03 (2.38)		0.04 (2.84)
price index			0.17 (0.17)	
interest rate				0.44 (1.67)
<u>R²</u>	0.97	0.97	0.95	0.97

Table 3.3

REGRESSION RESULTS:
ESTIMATED COEFFICIENTS AND t-STATISTICS

equation	(9)	(10)	(11)
<u>variable</u>			
constant	5.06 (0.69)	10.25 (1.30)	10.08 (1.27)
distance	-0.11 (-4.45)	-0.11 (-4.40)	-0.11 (-4.40)
soil 2	0.04 (1.00)	0.03 (0.86)	0.03 (0.87)
3	0.07 (0.83)	0.06 (0.82)	0.06 (0.82)
4	-0.00 (-0.02)	-0.02 (-0.10)	-0.02 (-0.09)
5	0.04 (0.37)	0.04 (0.37)	0.04 (0.38)
6	0.01 (0.15)	0.00 (0.07)	0.00 (0.08)
freight (-1)	-0.56 (-4.59)	-0.71 (-4.80)	-0.71 (-4.70)
wage (-1)	0.45 (0.44)	-0.38 (-0.33)	-0.34 (-0.29)
depth of homesteads	0.84 (4.96)	0.83 (4.91)	0.85 (5.00)
dominion expenditures (-2)	-0.16 (-2.51)	-0.09 (-1.18)	-0.09 (-1.21)
CP expenditures (-1)	0.04 (0.78)	0.01 (0.19)	0.01 (0.24)
Price wheat (-1)	0.32 (2.67)	0.19 (1.31)	0.19 (1.33)
Crow (freight (-1))		-0.04 (-1.68)	
Crow			-0.12 (-1.58)
R^2	0.97	0.97	0.97

Performance of the explanatory variables

Distance to the loading point is an important determinant of land values, with coefficients consistently negative (at about -0.1 to -0.2) and significant. Adding the weighting factor slightly increased the estimate of the elasticity of land values with respect to distance. It was argued earlier that the weighting served to give greater emphasis in the regression to the values of distance likely to be more accurate, and it seems this does improve the explanatory power of distance.

The soil quality variable had unexpected results insofar as they were significant. One would expect consecutive soil grades to be associated with decreasing land values--each dummy to have a negative coefficient of increasing magnitude. Only quality 4, the land now described as "class 4: soils (with) severe limitations that restrict the range of crops or require special conservation practices, or both", consistently had the expected sign in the various experiments (though not significant), and relative magnitudes did not correspond with the hypothesis that value increased with quality. A possible explanation is that quality, as judged now on

the ARDA map was not evident to prospective buyers before the land was broken. (In this case we should expect the soil dummies to be insignificantly different from zero.)

I would assume that the current ARDA soil categories correspond to the latent, if sometimes unknown, quality at the time of settlement. It is possible that quality of some land has changed over time, depending on the treatment it has had in the past hundred years.

Lagged real freight rates were estimated as having a significant negative effect on land values, as predicted by the theory. The elasticity of land values with respect to freight rates was estimated to be in the range of -0.5 and -0.7, indicating that freight costs were a substantial component of a farmer's costs. (Indeed this was so, freight costs being about 18 cents/bushel in the late eighties when the Winnipeg price of wheat varied between about 80 cents to one dollar per bushel. Freight rates fell later, but so did the delivered price of wheat.)

It had been anticipated that the effect of freight rates might be difficult to isolate because of their lack of variability: they were constant over long periods, at least in nominal terms, changing usually in a step function downwards. It was found that the estimated

effect of freight rates was sensitive to the inclusion of a time trend (equations 6 and 8) when freight rates were estimated as having no significant effect.

Equations 10 and 11 show the results of testing for a structural change in 1897, the year of the Crow's Nest Pass Agreement. The equation was tested with a "Crow dummy" both as a coefficient of freight rates and as an intercept dummy. While neither was estimated as significant at the 5 per cent level, the signs are perhaps worth mentioning. The dummy as a coefficient of freight rates, was estimated to have a negative effect suggesting freight rates had an increased negative relationship with land values. The value, however, was estimated as slight, changing the elasticity with respect to freight rates from -0.71 to -0.75 following the Agreement.

The Crow dummy included as an intercept was also negative, though again not significantly different from zero. The negative value suggests that the so-called land boom of this period (post-1897) was not accompanied by higher real prices and perhaps by lower prices (even though the freight rate effect increased prices and, if anything, to an increased degree after 1897).

Past wages were not found to have a significant effect on land values except in equation 7 where nominal values were used and the price index included as a separate, unconstrained influence. Here nominal wages showed a significant positive effect, contrary to the theory. It has been observed elsewhere (Bertram, 1973) that prairie wage rates followed a different pattern from eastern wages rates (used here) and this may explain the poor result.

Interest rates were found to have no significant effect on land values (equation 8).

The depth of settlement of homesteads consistently had a substantial and significant positive effect on land prices, consistent with the theory.

Expenditures on colonization by the Dominion and the Railway did not show the anticipated effects. Dominion expenditures, lagged one or two periods, showed a significant and unexpectedly negative effect. The effect of Railway land expenditures was estimated as positive but not significant. Both results are contrary to the theory and possibly due to inadequate specification, colonization expenditures being likely to have a delayed and cumulative effect on settlement perhaps not captured by recent annual expenditures.

The unexpected results should not be taken as proof that colonization expenditures did not achieve their end. The effect of more distant past expenditures is already embodied in the depth-of-homestead settlement variable, the equation tested here only isolating the effect of very recent advertising.

The results on recent colonization expenditures perhaps is due to two components of influence having opposite effects. Recent advertising likely increases the immediate demand for homesteads, and consequently, the later demand for railway lands. One would expect the general increase in demand for land to influence all land, but at the same time there may be an immediate substitution effect in which demand is diverted towards the free lands and away from the railway lands. This substitution effect is likely to be larger for Dominion expenditures than for the Railway whose relative bias would be towards advertising the railway land, which would account for the difference in the estimated coefficients of the two types of advertising expenditures.

Past real wheat prices were predicted to have a positive effect on land values, both as an indicator of future revenues and through their effect on settlers'

liquidity. Consistent with the theory, the real price of wheat, lagged one period, was found to have a significant positive effect, the estimated elasticity being 0.2 to 0.4.

The inclusion of a time trend (equations 6 and 8) showed a significant upward trend in land values over time. The estimated coefficient for freight rates was sensitive to the inclusion of time, presumably because of the collinearity between these variables, freight rates showing a steady downward trend over time.

Finally, the model was estimated for nominal values (equation 7) with the influence of the price level allowed to be unconstrained. The coefficient estimated for the price level was not significantly different from zero. The other estimates were only slightly affected by the use of nominal values, except for the wage rate. This appeared to have a significant and positive effect, unlike in the other specifications and contrary to the theory.

Conclusion

The regression results were, on the whole, consistent with the predictions of the theory, land values being found to be positively affected by proximity to the railway, decreases in freight rates, past wheat prices and the presence of homesteaders in the area. The estimate for a structural change in the influence of freight rates following the Crow's Nest-Pass Agreement displayed the anticipated negative sign but was not found to be significant. Perhaps the most convincing evidence in support of the hypothesis is the statement made by a CPR official of the time:

In evidence before the Interstate Commerce Commission in 1923, Mr. W.B. Lanigan, Freight Traffic Manager, who had been with the Canadian Pacific since 1884, gave the increase in the value of the estate as the main reason for the Agreement (transcript of evidence, docket 14393, pp. 1627-50).

(Currie, 1954: 631)

Two improvements in the specification of the model could be made. The model estimated here omits the determinants of an endogenous variable, the current freight rate. A simultaneous model of freight rates and land values would be a more complete test of the theoretical model developed in Chapter 2. Secondly, the

process of adjustment has not been specified in a testable form. Price is not the only measure of the success of the Railway's attempts to encourage settlement: quantity is affected too. Inspection of the volume and average prices of land sold (figures 3.1 and 3.2) shows that while prices did not change much after 1897, the quantity sold increased dramatically. Especially with an administered price, we can expect quantities to be sensitive to economic conditions. A dynamic model of CPR land sales is a promising area for further research.

C. A comparison of the lands policies of the Canadian Pacific Railway and the Hudson's Bay Company

"In the ulterior problems of permanent and rapid settlement, the interest of the [Hudson's Bay] Company could scarcely be expected to compare with that of the government or of a pioneering railway. For the Company their chief concern was to sell their lands to the best advantage; and with the sale of the land their interest came to an end. For the railway the traffic of the immigrant - his chattels and his goods in one direction and his wheat in the other - could be relied on to dwarf the initial prices charged for railway land."

(Martin, 1938: 240)

Introduction

The maintained hypothesis is that the Canadian Pacific Railway offered its land for sale at prices below its maximum potential value in order to accelerate settlement and earn freight revenues. The Hudson's Bay Company did not have this incentive, its objective being to maximize the wealth from its land only. The purpose of this section is to compare the land policies of the two companies.

In particular, the evidence offered by the historians will be assessed, the conventional view being that railway land policy was one of low prices.

Background

In 1869 the Hudson's Bay Company agreed to surrender Rupert's Land, estimated in 1863 at one million pounds sterling, to the Dominion in return for three hundred thousand pounds, one-twentieth of the land in the "fertile belt", and a maximum of 50,000 acres around its trading posts. The Dominion Lands Act of 1872 set out the terms for the allocation of the land in the fertile belt, section 8 and three-quarters of section 26 in every township except for every fifth township where the whole of both sections were allocated. The Hudson's Bay lands were therefore of average quality (the "mine run") through the fertile belt and, on average, possibly lower quality than the railway's since the Hudson's Bay Company did not have the same rights of selection.

The Historians' View

The view in the historical literature is that land revenues were of secondary importance to the railway and that CPR land prices were relatively low in order to encourage settlement and increase traffic:

Information which is available suggests that the Canadian Pacific Railway Company sold its lands over the years at prices which were

better designed to encourage occupation and development of the West than to extract the maximum immediate return.

(Fowke 1957:60)

The contribution of the CPR...was to subordinate land sales to traffic, and in the interests of traffic, to settle their own lands as soon as possible at prices substantially lower than market value.

(Martin 1938:398)

Hedges describes the contrasting policy of the Hudson's Bay Company in the following way:

If the West were settled and developed, the Hudson's Bay Company intended to obtain some of the profit...6,313,900 acres passed into the hands of the Hudson's Bay Company. From this area it has enjoyed the unearned increment resulting from the efforts of others. Having little incentive to push the sale of its land, the company largely sat tight in the assurance that land values would surely rise.

(Hedges 1931: 9-10)

These views are based on a comparison of average land prices. Martin (1938:316) states that average prices for Canadian Pacific lands were substantially below school lands (gross average of \$16.85 per acre in Saskatchewan, \$14.40 in Alberta and \$9.77 in Manitoba) and below Hudson's Bay lands (gross average of \$12.10 per acre). These compared with a gross average of \$7.63 per acre for the CPR, or \$8.55 per acre if the irrigation lands are included.

The Historians' View Evaluated

The question raised here is whether lower land prices are confirmation of the subordination of CPR land sales to traffic.

The average prices compared by Martin are the revenues from gross land sales summed over the period 1894 to 1930 and divided by the acreage sold: ("Gross" here means that no allowance is made for cancellations.). This is an unsatisfactory measure for comparison because it neglects changes in the purchasing power of the dollar,¹¹ interest rates, and quality of land. Even allowing for changes in the general price level, an early sale at a lower price could be more profitable, regardless of freight revenue, than a later sale at a higher real price because of the opportunities to reinvest the revenue. A price rising at the rate of discount would leave the land company indifferent to the time of the sale, providing it had no other interest in early settlement.

A more revealing comparison of average prices can be made by taking the future value of land revenues. An ex post comparison is made here by compounding the

revenues from gross land sales for 1893-1930 to the year 1930 and calculating the average future value per acre of land sold by the two companies. The interest rate used for compounding is the current nominal rate on Canadian government bonds (Neufeld, 1972). Revenue is assumed to begin to earn interest in the year following the land sales. The results are shown in table 3.4.

TABLE 3.4

Average Price and Average Value of Revenues from
Gross Land Sales, 1893-1930.

	<u>Hudson's Bay</u>	<u>CPR</u>
gross sales (acres)	4,958,440	16,044,900
total revenues	\$60,013,800	\$153,964,000
average price	\$12.10/acre	\$9.60/acre
value of revenues	\$115,351,000	\$342,891,000
average 1930 value of land sold	\$23.26/acre	\$21.37/acre

Average prices for the two companies differed by 26 per cent, \$12.10 per acre for the Hudson's Bay Company and \$9.60 for the CPR. The difference in the value of the revenues to the two companies was less dramatic. When revenues are compounded to give their value in 1930, the average values of the revenues were \$23.26 per acre and \$21.37 respectively, a difference of 9 per cent. This, rather than average prices, is

consistent with the hypothesis that the CPR priced its land to encourage settlement rather than maximize the wealth from the land alone.¹²

I have already described in chapter 1 how the Railway had a two-price policy for its land, charging bona fide settlers a lower price than speculators or giving rebates for fulfilling cultivation requirements. This price reduction conditional on cultivation follows from the theory presented in Chapter 2. Unfortunately I have been unable to discover the exact details of cultivation requirements attached to land sales contracts. (The Glenbow Institute provided me with copies of the only contracts they could locate, but these were for sales to land companies. I have not explored the nature of the sales contracts made by the Hudson's Bay Company.)

Of particular interest to the ex post comparison is the fact that by 1930 the Hudson's Bay Company still had more than 2,600,000 acres unsold out of its original holding of 6,630,000 acres. At that time, the Railway had only 1,580,793 acres of its main line grant unsold--8.7 per cent of the original grant, net of the 6.793 million acres returned to the government in 1886.¹³

At the present moment we are labouring under certain special disadvantages. In the first place, the Canadian government are now forwarding emigrants to the area and giving them land free. I believe, therefore, as long as that continues, the Hudson's Bay lands are not very saleable."

(Sir Stafford Northcote, governor of the Hudson's Bay Company Proceedings of the General Court of Proprietors, July 1, 1873, quoted in Galbraith, 1951)

We would expect to observe low volumes of sales in any region until the homesteads had been taken. Railway lands would then be sold, to be followed by Hudson's Bay lands in the same area. Average prices observed take no account of this sequence. Hudson's Bay lands would sell at a higher price than the adjacent railway lands had sold earlier (except those sold to speculators) and at a higher price than less desirable railway lands (i.e. lower quality or more distant) at the same time. Thus, any concurrent comparison of prices does not allow for differential quality and such different quality is to be predicted; and any geographical comparison does not allow for different sequence of sales over time. We would expect, therefore, to observe relatively high average prices for Hudson's Bay lands in any single year and few sales in the early years (except to speculators) when homesteads were generally available. The filling up of homesteads (and, later, railway lands) would result in a lag between the sales of

railway lands and the Hudson's Bay lands in similar locations for immediate settlement. Because the net revenue from foregone incremental freight would decline over time as volumes of freight increased, both the lag between sales and the differential in prices for the lands of the two companies would tend to close.

The aggregate price data cannot show the lag between sales of similar quality land although the lower percentage of Hudson's Bay land sold supports this, giving a lower average distance from the railway for the Hudson's Bay Lands at any time. The average prices for gross sales tend to confirm the prediction above. Hudson's Bay land prices were consistently higher than those for CPR lands until 1910. However 1909 and 1910 prices were exceptional, the average price for CPR lands being raised by about \$3/acre because of the inclusion of irrigated lands. During the early 1910s, the differential in prices was relatively low, and from 1918 to 1926 Hudson's Bay prices were below the CPR. (See figures 3.10 and 3.11.)

The relatively high railway land prices in the twenties are consistent with the theory which predicts that the incentive to charge less than the maximum potential value of the land in order to accelerate

Figure 3.10

Annual average prices of land:
Canadian Pacific and the Hudson's Bay

Figure 3.11

Land prices: Canadian Pacific as a
percentage of the Hudson's Bay

settlement would decline as the per unit profit on freight declined. By the twenties, per unit freight profits had likely fallen on two counts: the price level had increased, inflating the costs of transportation while nominal freight rates were fixed by the Crow's Nest Pass limit (though the limit was relaxed for a period because nominal costs were high); and secondly, the capacity of the railway was more fully used than in the nineteenth century, increasing real marginal costs. The incentive to accelerate settlement arose from the existence of monopoly profits, as recognized, implicitly by Hedges (1939: 46):

Railway competition was doubtless a desirable thing, but under such circumstances it did violence to the theory implicit in the system of railway land subsidies--that the railway company receiving the lands would promote settlement as a means of developing traffic for its lines.

The view that the Hudson's Bay Company "sat tight and get every dollar" out of the lands it was possible to obtain" is consistent with the different objectives of the two companies. In general, one would expect nothing to be gained by holding land until its 'value' increased. If such an increase was to be expected from future availability of railway services, for example, additional supply of labour, and density of

settlement, it would be capitalized into the price of the land at an earlier date. Rather "sitting tight" makes sense if it is a matter of waiting till cheaper 'bargain' land is no longer available--the homesteads and the CPR lands priced below their maximum potential value in order to accelerate settlement. Waiting could also be rational if the Hudson's Bay Company had a different rate of discount. However, the Hudson's Bay Company, even with the same rate of discount, would tend only to match CPR land prices for their sales to speculators. Where settlers were purchasing, the Hudson's Bay would not match the prices of the CPR, as long as the Railway was pricing below potential market value, subject to cultivation requirements.

A critical point to be remembered in any comparison of land prices is that freight rates, transportation services, and density of settlement affected the values of all land, whether free homesteads, railway lands or Hudson's Bay lands. It is not an increase in the value that the Hudson's Bay Company waited for, but the chance to realize the maximum potential rents on its own lands, part of which the Railway was sacrificing on its own lands to induce purchasers to settle the railway lands earlier.

In summary, the evidence throws into doubt the historians' view that the CPR subordinated its land sales to traffic revenues (Martin 1938:398), that its "prices were better designed to encourage occupation and development of the West than to extract the maximum immediate return" (Fowke, 1957:60, my emphasis).

It has already been shown that it is a mistake to compare concurrent land prices to establish the extent to which the CPR was sacrificing returns from land in the interests of settlement. On the basis of the evidence, crude though it is, the Railway was giving, on average, a discount of about 9 per cent below the value of the land.

If we also take into account the closer proximity of the Hudson's Bay land (given its slower rate of sales), the discount for land of equal value was less than 9 per cent. (The regression analysis earlier in this chapter confirmed that price was sensitive to distance from the railway.)

While the comparison of land prices for the two companies does confirm the historians' view that CPR prices were relatively low, the real difference in prices for equivalent land (taking into account timing and loca-

tion) proves to be smaller than suggested in the literature. That a difference existed is also predicted by the theory, but it need not have been great. The demand for all land would be sensitive to the absolute price of land, but the demand for CPR land would likely be very elastic with respect to relative prices. A small differential is all that is required to divert demand from competing land companies. At the same time, if the Hudson's Bay expected to sell any land at all, it could not maintain a large difference in its price for land of equivalent quality.

As for the subordination of land sales to traffic, this idea completely neglects the "subordination" of freight rates to land revenues. The evidence of lower relative prices reflects the difference in objectives between the companies -- the difference in prices indicates a preference for early settlement on the part of the railway, but tells us nothing about the effect of CPR freight policy on its land prices, nor on the relative importance of land revenues in its objective function. As the Hudson's Bay lands were affected similarly by freight service and rates, relative prices shed no light on the significance of land revenues in the rate making policy of the Canadian Pacific Railway.

3 3

OF / DE

Annex to Chapter 3Regression analysis using aggregate annual data

Published data on land prices are available only as average annual values of all land sold, although there is some distinction made among lands from different grants. It was expected that the use of the annual time series data for regression analysis might be unsatisfactory because aggregation conceals a predicted systematic decline in the quality of the land sold over time, quality being determined by distance from the track and other characteristics such as climate and soil quality.¹⁴ Furthermore, since average length of haul would increase with time, a single freight rate (say Regina to Fort William) increasingly underestimates freight costs as the land sold becomes more distant from the port of export.

Preliminary tests using aggregate time series data showed serious collinearity problems and disappointing results. The model was tested in log-linear form with the average annual price of CP land sold determined by expected revenues, freight rates, wages, interest

rates, estimated distance from the track, and the stock of homesteads settled. Figure 3.12 shows the endogenous variable, the real price of land.

Expected revenue was estimated by using the predicted value of current revenue, obtained by regressing current revenue on its past three values, actual revenue being calculated as the product of the real price of wheat at Chicago and the average annual yield per acre of wheat in the prairies. The regression results, over the period 1886 to 1913 were:

$$\begin{aligned} R\hat{e}v = & 35.0 - 0.09 \text{ rev}(-1) - 0.50 \text{ rev}(-2) + 0.04 \text{ rev}(-3) \\ & (3.94) \quad (-0.47) \quad (-2.91) \quad (0.27) \end{aligned}$$

$$\bar{R}^2 = 0.18$$

The distance from the track of the land sold was estimated as proportional to the total net stock of land sold from the CP main line and Souris Branch grants (including the irrigated lands) divided by the length of CPR track opened in the prairies. Stock of homesteads was included as a factor expected to increase the demand for CPR land.

Figure 3.12

Average annual prices of CPR
lands sold (1939 \$/acre)

A sample of the regression results is given below. The period of estimation was 1883-1913, omitting 1885, a year in which the price was not reported. The variables are:

PL, Average price of CP land sold annually from the CP main line and Souris grants, excluding irrigated lands;

PW, Price of wheat at Chicago; —

rêv, Expected real revenue, estimated by regressing the product of the real price of wheat and the average yield per acre in the prairies on its previous three values;

F, Freight rate for wheat, Regina to Fort William

H, Net stock of homestead entries

W, Wage rate;

D, Estimated distance of land sold from the track, equal to the net stock of CP land sold divided by the length of CP rail in the prairies;

I, Interest rate;

P, Price index;

T, Time trend dummy; and

CROW, Dummy equal to zero before the Agreement, equal to 1 in 1898 and onwards.

Equation 1 (All values real) .

$$\log \hat{PL}/P = 4.64 + 0.26 \log PW/P + 0.54 \log (F/P)(-1)$$

$$(0.85) \quad (1.13) \quad (1.64)$$

$$+ 1.96 \log H - 1.74 \log W/P - 0.91 \log D$$

$$(7.81) \quad (-1.95) \quad (-4.26)$$

$$\bar{R}^2 = 0.899 \quad F(6,23) = 44.0 \quad D-W = 1.31$$

Equation 2 (Nominal values, price index and time trend)

$$\log \hat{PL} = 3.79 + 0.29 \log PW = 0.52 \log F (-1)$$

$$(2.58) \quad (1.21) \quad (1.52)$$

$$+ 1.99 \log H - 2.87 \log W - 0.81 \log D$$

$$(3.66) \quad (-1.45) \quad (-3.81)$$

$$- 0.07 T + 7.45 \log P$$

$$(-2.19) \quad (0.81)$$

$$\bar{R}^2 = 0.93 \quad F(7,22) = 59.4 \quad D-W = 1.29$$

Equation 3 (Expected revenue, real values, time trend, interest rate)

$$\log \hat{PL}/P = 2.76 + 0.46 \log r\hat{e}v + 0.86 \log (F/P)(-1)$$

$$(0.44) \quad (2.39) \quad (1.46)$$

$$+ 2.11 \log H - 1.96 \log W/P - 0.77 \log D$$

$$(4.18) \quad (-2.04) \quad (-2.73)$$

$$+ 0.15 (\log I) - 0.08 T$$

$$(0.26) \quad (-1.93)$$

$$\bar{R}^2 = 0.92 \quad F(7,20) = 42.6 \quad D-W = 1.72$$

Equation 4 (Testing for the Crow Agreement's effect on
the coefficient of the freight rate)

$$\begin{aligned} \log PL = & 2.93 + 0.40 \log PW + 0.49 \log F(-1) \\ & (0.34) \quad (1.75) \quad (1.57) \\ & - 0.12 \text{ CROW } \log F(-1) + 1.10 \log H - 1.62 \log W \\ & (-2.12) \quad (1.67) \quad (-0.84) \\ & - 0.56 \log D - 0.01 T + 3.68 \log P \\ & (-2.42) \quad (-0.14) \quad (2.69) \\ \bar{R}^2 = & 0.94 \quad F(8,21) = 60.8 \quad D-W = 1.37 \end{aligned}$$

Equation 5 (Testing for the effect of the Agreement on
the intercept)

$$\begin{aligned} \log PL = & 2.50 + 0.39 \log PW + 0.48 \log F(-1) \\ & (0.29) \quad (1.75) \quad (1.54) \\ & + 1.08 \log H - 1.52 \log W - 0.54 \log D \\ & (1.66) \quad (-0.79) \quad (-2.32) \\ & - 0.005 T + 3.65 \log P - 0.31 \text{ CROW} \\ & (-0.11) \quad (2.68) \quad (-2.18) \\ \bar{R}^2 = & 0.94 \quad F(8,21) = 61.4 \quad D-W = 1.36 \end{aligned}$$

Assessment of the results

The results are sensitive to specification. Expected revenue performed better than actual price of wheat though both show the correct sign. As for expected costs, current wages have the expected negative influence on land prices, although the coefficients estimated were not always significant. Freight rates appeared to have a positive influence, contrary to the theory. The Crow dummy reduced the estimated positive effect of the freight rate when included as a coefficient suggesting a higher value of land for a given reduction in freight rates after 1897, but reduced the predicted value of land when included as an intercept suggesting there was a downward shift in the price of land. Interest rates were not found to have a significant effect.

The quality variable, depth of settlement of railway land, worked well, land being more valuable closer to the track. Similarly the influence of the presence of settlers, depth of homesteads settled, had the expected positive effect on land values.

The time trend was estimated as negative. The theory does not predict the net effect of time on land prices: in one direction we expect declining quality over time, in the other a possible reduction in costs due to changing technology.

Tests showed a collinear relationship between the freight rate and the stock of homesteads, making the estimates for their coefficients suspect. When the stock of homesteads was included as an explanatory variable, the sign of the estimated coefficient of the freight rate changed from negative to positive. All specifications showed serial correlation.

Footnotes to Chapter 3

1. In fact livestock and other crops were produced but the main output was wheat.
2. Before the turn of the century, Canadian wheat production was less than three per cent of world production. The proportion rose in the early twentieth century, but did not exceed 6 per cent in the period under study. See table 3.5.
3. Variable proportions would lead to dependence among the explanatory variables, revenues depending on inputs and therefore costs. Also yield would decline with distance from the track as the farm gate price declined.
4. I estimated a slight downward time trend by ordinary least squares over the period 1878 to 1913 to get

$$\log p = \log (1.425) - 0.064t$$

$$(22.5) \quad (-3.09)$$

with $R^2 = 0.20$, where p is the real price of wheat at Chicago, the nominal data being a consistent series assembled by Knick Harley. My results show a different trend from Frank Lewis's (1981) earlier analysis. Lewis used wheat prices at Fort William, source Urquhart and Buckley (1965), to derive Saskatchewan prices, adjusting for the structural changes in the data, and estimating the trend over a later period, starting 1897. He found a slight upward trend over time.

5. Ordinary least squares regression of yield in Saskatchewan against time showed that yield increased from an average of about 16 bushels/acre to about 20 bushels/acre over the period 1883 to 1913, but that the rate of increase estimated was not significantly different from zero:

$$\hat{y} = 14.7 + 0.14t$$

$$(8.1) \quad (1.7)$$

with $R^2 = 0.06$

6. The influence of Dominion colonization expenditures on the rate of prairie settlement has been explored by Marr and Percy (1978). Their study did not include the possible additional effect of Railway colonization expenditures although these were of the same order of magnitude, in the low hundreds of thousands of dollars annually.
7. Cited in Hedges (1939: 80).
8. Map 64/2 - 62L "Soil Capability for Agriculture", part of the Canada Land Inventory series, produced under the Agricultural and Rural Development Act by the Canada Department of Forestry and Rural Development, now under the Department of the Environment.
9. I could have included all observations, with their actual distances to the nearest station. Apart from this yielding a prohibitively large number of observations, it would also give inconsistent estimates because of the implicit error in measurement of the distance at which price is equal to value (or the corresponding error in measurement of the dependent variable price as a proxy for value at the actual distance). Inconsistency is greater, the greater the error of measurement and I can reduce it by substituting the maximum value of distance for all lesser distances in observations whose other values are identical.

Having done this, I could record the group of now identical observations as a single observation in the regression analysis. This sacrifices information on two counts. It fails to give weight to the observations in which I have most confidence, where the estimate of the distance is likely to be a relatively good measure of the margin of cultivation at that price. And secondly it fails to give weight to the frequency of the observations. The observations which have identical values are not to be interpreted as repeat observations: they should be included in the analysis insofar as the cross-sectional data, price, soil quality, and location are each distinct for any sale observed. The time series data (wages, freight rates, etc.) are indeed repeat observations and including all observations gives these more weight for the years where there were more sales. Nevertheless, the skew

in the weight of information on time series data towards the years when sales were frequent does represent the data I have.

10. Weighting the equation is equivalent to the inclusion of all observations in each "cell". The statistics are calculated only on the basis of the number of cells (160 in my regressions). This is similar to the grouping problem in econometrics where averages of groups are recorded in place of all observations originally made. The difference in my own estimation procedure is that no information is lost since all elements of a group are 'identical' (except insofar as I have substituted one value for distance where different distances were observed: the values of all other variables in the group were the same).
11. To give Martin credit, he recognized that "it would be rash to draw too definite conclusions from statistics that were never intended perhaps for such analysis. The figures for sales are for gross sales only ... General price levels in the twentieth century, moreover, are scarcely comparable with the meagre proceeds of land sales during the lean years of the eighties and nineties: much of the rise in the price of land corresponded to the rise in the cost of living and of government..." (Martin 1938: 305 and 309). Nevertheless Martin does go on to take the average prices through the whole period as "certain distinctions in price... traceable clearly enough to indicate distinctions in policy".
12. It should be borne in mind that the values estimated here are only crude measures of the effective discount given to settlers and that it makes no allowance for explicit rebates given to settlers by the CPR for immediate cultivation. Otherwise the comparison is mainly limited by the availability of data on Hudson's Bay sales. I have not been able to correct for cancellations, nor have I included sales prior to 1893. (This was the earliest date for Martin's CPR data.) Furthermore, the 1930 values are an ex post comparison, reflecting actual returns and interest rates rather than the expected values which would have formed policy.
13. Hedges (p. 393) gives acreage unsold from mainline grant as 1,558,527 acres as at December 31, 1937. Annual sales and cancellations are given for years 1921-1937 inclusive (p. 389). Net sales for the

years 1931-37 inclusive can be calculated as 22,266 acres (a total of 809,291 acres sold and 787,025 acres cancelled). This implies land unsold at the end of 1930 was 1,580,793 (acres unsold in 1937 plus net sales 1931-37).

The original mainline grant of 25,000,000 acres was reduced to 18,206,986 acres in 1886 when 6,793,014 acres were returned to the Dominion government. Unsold acreage in 1930 was therefore 8.68 per cent of the original grant net of this transfer.

14. One adjustment has been made for the heterogeneity of land quality, by leaving out the irrigated land sold after 1908. As can be seen from table A2 in the Appendix, irrigated lands had an appreciable effect on the average price received for all lands.

Unfortunately this still leaves a minor structural change in the series for average prices. To 1908 these are for lands from the main line grant and from the Souris Branch grant. When the Canadian Pacific reports the average price for non-irrigated lands, some sales are included from other grants such as the Manitoba South Western. From 1903 to 1908 sales from the M.S.W. grant had been at a lower price than from the CPR grant and had depressed the averages slightly below the price realized on CPR lands.

Table 3.5
Wheat Production and Exports

Crop Year ending in	Canadian Wheat Production (millions of bushels)	Wheat and Wheat flour exports	World wheat production	Exports as % of Canadian production	Canadian production as % of world production
1881	32.3	4.5		13.9	
82	38.0	6.0		15.8	
83	47.8	8.1		16.9	
84	30.8	1.6		5.2	
85	45.4	2.9		6.4	
86	42.7	5.2		12.2	
87	38.2	8.0		20.9	
88	39.0	3.7		9.5	
89	33.0	1.1		3.3	
90	30.8	0.9	2091	2.9	1.5
91	42.2	3.4	2171	8.1	1.9
92	60.7	10.4	2319	17.1	2.6
93	48.2	11.1	2558	23.0	1.9
94	41.3	11.2	2516	27.1	1.6
95	43.2	9.8	2440	22.7	1.8
96	55.7	10.8	2469	19.4	2.3
97	39.6	9.8	2234	24.7	1.8
98	54.4	24.6	3012	45.2	1.8
99	66.5	13.9	2773	20.9	2.4
1900	59.9	20.3	2633	33.9	2.3
1901	55.6	14.8	2900	26.7	1.9
02	88.3	31.0	3118	35.1	2.8
03	97.1	38.8	3273	40.0	3.0
04	81.9	23.9	3144	29.2	2.6
05	71.8	20.6	3309	28.7	2.7
06	107.0	47.3	3493	44.2	3.1
07	135.6	46.5	3189	34.3	4.3
08	93.1	47.6	3171	51.1	2.9
09	112.4	56.7	3625	50.4	3.1
10	166.7	67.8	3576	40.7	4.7
11	132.1	62.4	3570	47.2	3.7
12	231.2	97.6	3857	42.2	6.0
13	224.2	115.7	4088	51.6	5.5

Notes to Table 3.5

Sources: Canadian production and exports from Urquhart and Buckley, series L139 and L145; world production from Mackintosh Table IV p. 14.

Note that both sources give data for Canadian production and exports but they differ significantly.

Since data are for crop years ending in year shown, production is actually for previous calendar year.

APPENDIX: THE DATA

The greatest obstacle is the paucity of data

(Robert W. Fogel)

Introduction

In this appendix I report on some data previously unpublished, some published but previously scattered and not appearing in one place in a complete series, and some published but from obscure sources. Occasionally, I report on errors I have found in published material. In particular an extensive search of the Annual Reports of the Canadian Pacific Railway has revealed some anomalies in the previously published data and it is hoped here to provide historians with a more accurate and complete series of land sales data for the Railway. I also describe here the estimates I have made for use in the regression analysis where data were not available.

A. THE LANDS

(i) Canadian Pacific land sales in the Ou'Appelle Valley

Records of individual land sales contracts made by the Canadian Pacific have been used to gather data on prices and location of all first sales made within an area of 49 townships in the Ou'Appelle Valley, Saskatchewan. The records of these sales are found in the Glenbow Archives in Calgary (Glenbow Archives, Alberta, Canadian Pacific Railway Company Papers BNC212G "Land Sales Records"). Ian Clarke and Lyle Dick, historians with Parks Canada, generously provided me with copies of these records which were used for a study of the W.R. Motherwell National Historic Site at Abernethy. See Dick (1980).

The area of study includes Townships 17 to 23 and Ranges 8 to 14 West of the Second Meridian and is illustrated in figure 3.9 in chapter 3 and reproduced here as figure A1. The map is reproduced by a computer program designed for me by Ted Lyon of Agriculture Canada to locate and plot individual quarter sections. I am grateful to Mr. Lyon for his help and time spent in setting up this program and in plotting the many observations. Forty-nine townships of normal size would

Figure A1

(see insert at back of this thesis for
the original coloured map)

CANADIAN PACIFIC LAND SALES 1882-1912

include 1764 sections of which 784 (16 out of every 36) potentially belong to the railway. The usual unit of sale is a quarter section which could mean about 3000 sales in this area, not allowing for the additional resales of land for which earlier contracts were cancelled.

However, as can be seen in the map, some of the area searched for contracts lies outside the main line belt. Also some land was reserved for other purposes, for example the Bell Farm (a large corporate farm of 64,000 acres, or 100 square miles) and the Indian Head Experimental Farm. A few sections were rejected by the CPR, these mainly being in the region of Fort Qu'Appelle. Lastly, some sales en bloc appear to have been made in the very early years, for which no records appeared in the search at Glenbow.

The black grid in the map shows townships, usually about six miles square. The coloured dots (figure 3.9) are quarter sections for which I have the record of original sales by the CPR. The map also shows the railways passing through the area and the dates on which they were opened. While the Canadian Northern line is outside the 49 townships studied, it is close enough to provide access as the nearest line to some land whose sales were observed and so has been included in the map.

A typical record of an original sale is reproduced in figure 3.8 (chapter 3). Each record shows date of the contract, the name and address of the buyer, the location of the land (corner--NW, NE, SW or SE--of the section, the section, the township and the range numbers), the area, price per acre, total cost, the terms of sale, and the dates and amounts of payments made.

All observations are for sales by the CPR only. Subsequent sales made by settlers or land companies are not recorded although some changes in ownership are recorded where such changes were made before all payments due had been made in full. Nevertheless some quarter sections appear more than once in the records because of cancellations of contracts. In my work, such repeat observations are used since they give additional information on value at different times.

The usual unit of sale was the quarter section, an area of 160 acres which is one quarter of a square mile. Occasionally much smaller areas were sold--for example, one or two acres to a church or school or for right of way³² and these I ignored. My general procedure was to round areas sold to the nearest quarter section and treat each quarter section as a single observation.

All observations appear on the map in figure 3.9. Included among these sales plotted were two large blocks of purchases by land companies and these have been omitted from my empirical work as not typical of individual sales to settlers. These two blocks were an area of 49,951 acres around Indian Head sold in 1882 to the Ontario and Qu'Appelle Land Company, and sales in township 23 (which, incidentally, lies outside the main line belt) which were part of a large sale in 1903 to various individuals apparently on behalf of various land companies--the Dominion American Land Co. Ltd., the Western Canada Settlers Mutual Land Co. Ltd., the Land and Agricultural Co. of Canada, and Union Trust Co.

Sales made on credit were at six per cent interest and usually payable over six and sometimes ten years. However cash sales were usually at a discount, suggesting the price to installment buyers effectively included interest, or a penalty, in addition to the six per cent explicitly paid. Where sales were paid in cash, the price observed was typically about 10% lower than that for sales made in installments. The terms for cash sales were advertised by the CPR in one of its pamphlets Western Canada 1905 (p. 63):

DISCOUNT FOR CASH - If land is paid for in full at time of purchase a reduction from price will be allowed equal to ten per cent on five-sixths of the purchase money.

This is a discount of about 9% on the whole price. To compare prices on the same basis as those for sales made on credit, the prices on the few cash sales among my observations were increased by 9%.

The land in this area is mainly wheat growing land. Over 70 per cent of crop growing land is, nowadays, used for wheat. Soil quality for the land sold was taken from a current-day map, ^{us} as described in chapter 3. Where a quarter section contained soil of different qualities, the quality was recorded as that which covered the largest area.

An exhaustive search of the records at the Glenbow Institute produced records from 1882 to 1912. Initial sales were usually at \$2.50 or \$3.00 per acre. After 1884, there were barely any sales until 1892 when prices ranged between \$3 and \$5, and they remained in this range, with occasional exceptions, until the turn of the century. Prices then began to rise into the \$6-\$10 range in the early nineteen hundreds; \$10-\$15.50 after 1910.

At the same time, land sold was getting more distant from the railway (although not uniformly so, partly because in any year there was usually a variety of prices).

Figure 3.9 shows the pattern of sales over time although it does not show variation in prices.

(ii) Annual land sales by the Canadian Pacific Railway

CPR lands data (table A1) are from the Annual Reports of the Canadian Pacific Railway which can be found at the National Archives and at the library of the federal Department of Transport. Figures in parentheses are calculated from values reported. This series extends previously published data to earlier years. (Hedges' earliest date for an annual price is 1889.)

Sales shown in Table A1 are from the CPR main line grant and the Souris Branch grant. Where figures needed interpretation or estimation the details are given below.

The cumulative total to December 31, 1883 includes 794,240 acres to settlers and 2,837,400 acres to land companies. These figures seem to be gross sales.

Table A1: CANADIAN PACIFIC LAND SALES

203

YEAR*	AREA (Thousands of acres)	AMOUNT (Thousands of dollars)	AVERAGE PRICE \$/acre	CANCELLATIONS (Thousands of acres)
To Dec.31,1883	3,631.640	10,378.899	2.85	(700.037)
1884	798.584	2,409.727	3.075	129.924
1885	(157.399)	NA	NA	285,644
1886	55.937	(183.473)	3.28	280.686
1887	53.803	179.813	(3.34)	21.762
1888	138.001	443.526	3.215	11.300
1889	142.661	494.402	3.465	10.253
1890	73.941	276.586	3.76	4.988
1891	72.674	294.875	4.0575	6.040
1892	230.308	748.618	3.255	8.244
1893	93.184	295.288	3.17	21.341
1894	43.155	131.628	3.05	33.683
1895	55.453	176.950	3.19	99.548
1896	66.624	220.360	3.30	234.744
1897	135.682	431.096	3.18	46.898
1898	242.135	757.792	3.13	33.093
1899	326.280	1016.081	3.14	19.841
1900	197.321	615.966	3.12	19.232
1901	340.058	1047.268	3.08	
1902	1362.852	4442.136	3.26	17.221
1903	2260.731	8473.573	3.75	23.802
1904	857.474	3516.864	4.10	64.347
1905	411.451	2045.800	4.97	33.092
1906	1012.322	6015.060	5.94	97.301
1907	923.252	5496.371	5.95	50.960
1908	130.378	1400.349	10.74	33.957
1909	363.085	4974.017	13.70	34.621
1910	925.260	14021.316	15.15	55.952
1911	628.092	9391.459	14.95	54.006
1912	666.699	10653.198	15.98	59.046
1913	471.756	7433.135	15.76	100.829

* Data for 1884 to 1899 are for calendar years; for 1900, the six months from Jan.1 to June 30,1900; for 1901 onwards for the twelve months ending June 30 of the year indicated.

No cancellations are reported. However cumulative sales to 1884 (reported below) suggest there were cancellations of 700,037 acres to December 31, 1883. Total land sold to the end of 1884 is given in the Annual Report for 1884 as 3,600,263 acres. Net sales for 1884 are gross sales (798,584) less cancellations (129,924), giving 668,660 acres net sales that year. The net acreage sold by December 1883 was therefore 3,600,263 minus 668,660, giving 2,931,603 acres. Cumulative cancellations were therefore 3,631,640 less 2,931,603, or 700,037 acres.

Prior to 1900, years reported were calendar years. The Report for 1900-01 covered the eighteen month period January 1, 1900 to June 30, 1901 and thereafter years reported were the twelve month period to June 30 of that year.

Prior to 1903, land sales from the land grant and those from townsites are reported as separate items in the CPR balance sheets. Only land sales from the land grant are reported in the table here to that date. From 1903, the cumulative value from sales includes townsites as well as the land grant.

Annual Report data for 1887 sales are inconsistent with cumulative totals. The difference in cumulative totals for 1886 and 1887 is 25,481 acres while sales are reported as 53,803 and cancellations as 21,762 giving net sales of 32,041 acres in 1887. The difference in cumulative totals implies gross sales of 47,243 acres.

From 1909 onwards there is a structural change in the data for sales since the more expensive irrigated lands are included. The CPR reports acreage and prices for irrigated lands and the average price of non-irrigated lands as shown in table A2. However this adjusted value includes lands from other grants and so is not strictly comparable with average prices reported here for earlier years. The irrigated lands included some land from the Manitoba South Western grant and the Saskatchewan and Western. However, the gross sales from the Manitoba South Western were small during the years 1909-1913. Therefore the error in using average price for all non-irrigated land as the price for land in the main line and Souris branch grants is probably small.

Land sales data can also be found in the Statistical Year Book of Canada, where they usually correspond to the data in the CPR Annual Reports. An inconsis-

Table A2

**CANADIAN PACIFIC LAND SALES:
IRRIGATED AND NON-IRRIGATED LANDS**

YEAR	AREA (Thousands of acres)	AMOUNT (Thousands of dollars)	AVERAGE PRICE \$/acre	CANCELLATIONS (Thousands of acres)	IRRIGATED LAND		AVERAGE PRICE	
					AREA (Thousands of acres)	PRICE \$/acre	PRICE \$/acre	NON-IRRIGATED LAND \$/acre
1909	363,085	4974.017	13.70	34.621	69,963	24.71	10.96	
1910	925,260	14021.316	15.15	55.952	145,421	26.59	12.78	
1911	628,092	9391.459	14.95	54.006	19,097	33.63	14.11	
1912	666,699	10653.198	15.98	59.046	3,270	44.25	15.80	
1913	471,756	7433.135	15.76	100.829	7,944	48.88	15.20	

tency occurs for the Year Book for 1892 where the CPR is reported to have sold 392,467 acres for \$1,355,687 which is \$3.45 per acre. This does not correspond with the acreage reported by the CPR as 230,308 acres for \$748,618 which is \$3.255 per acre.

A conspicuous error occurs in Urquhart and Buckley (1965), series K80, which is the value of land sales from the Manitoba South Western grant. For 1894 the value is reported as 280.0 thousand dollars. This should be 28.0 thousand dollars. The error has been accurately reproduced from the cited source, Alberta Resources Commission, vol. T(1) Exhibit 28A which is to be found in the Public Archives. The CPR Annual Report for 1894 reports the amount to have been \$28,003.

The user of the Alberta Resources Commission series appearing in Urquhart and Buckley should be aware of some double-counting (or rather, some double-reporting) due to the overlap of fiscal and calendar years around 1900. The 1900 data are for a twelve month period before June 30, 1900 and so, apparently, half of the year's sales for 1899 appear twice, once reported for 1899 itself and secondly as half of the year recorded as 1900 in these series. This overestimate of cumulative

sales over the period 1899-1901 inclusive is confirmed from the CPR data, as roughly half of the sales for 1899, both for the main line grant and the Manitoba South Western.

The Irrigated Lands

The irrigation block was located in Southern Alberta between the Red Deer River in the north and the Bow River in the south, and extending from the east boundary of Range 11 West of the 4th Meridian to the 5th Meridian about 1 mile east of Calgary. Roughly it stretched 180 miles along the main line from Calgary to Medicine Hat.

Most of the land seems to have been taken as part of the balance owing to the Railway for its main line grant. Some of this came from land which had been set aside for the Manitoba and North-Western Railway. Some 100,000 acres seem to have been accepted as owing to the Railway as part of the Manitoba South Western Colonization Grant. It appears from Hedges (1934: 63-66) that the total block granted formed part of the balance of grants due to the CPR for its main line, the Manitoba South Western, and the Saskatchewan and Western.

Hudson's Bay lands in the irrigation belt were bought up by the railway. In the 1911 Annual Report shareholders were told

In order that you might control the entire belt and thus receive the full advantage of your expenditures on irrigation, it was decided to acquire these lands belonging to the Hudson's Bay Company, about 102,174 acres, at the price of \$13.50 per acre. All these lands will be sold at a substantial profit.

In that year the average prices of CPR land sold were \$14.11 for unirrigated land and \$33.63 for the irrigated.

(iii) Hudson's Bay Company land sales

Data for annual gross land sales of the Hudson's Bay Company, by acres and amounts, are given in table A3.

For 1892 to 1899, the data are for calendar years; for 1900 to 1906, fiscal years ending June 30 of the year given; for 1907 nine months ending March 31, 1907; for 1908 onwards, fiscal year ending March 31 of the year given. The data are from the following sources.

1879-82 Galbraith (1951); 1888, 1889, 1892, and 1893 the Canada Year Book; 1894-1906 the Annual Report 1905-6 of the Department of the Interior, xx; and 1907 onwards series R75 and R76, Urquhart and Buckley (1965).

Table A3

LAND SALES BY THE HUDSON'S BAY COMPANY

<u>Year</u>	<u>Acres</u>	<u>Amount \$</u>	<u>Average Price (\$/acre)</u>
Sep.1879-Mar.31,1881	42,256	239,456	5.67
Apr.1,1881-Mar.31,1882	412,095	2,780,142	6.75
1888	22,700	-	-
1889	40,652	-	-
1892	19,700	116,620	5.92
1893	7,908	50,857	6.43
1894	7,526	48,225	6.41
1895	4,431	23,209	5.35
1896	9,299	52,410	5.64
1897	10,784	53,277	4.94
1898	62,000	310,000	5.00
1899	56,875	274,625	4.83
1900	70,196	352,631	5.02
1901	82,308	399,804	4.86
1902	269,577	1,412,332	5.24
1903	330,046	1,939,804	5.88
1904	144,857	879,910	6.07
1905	139,721	865,905	6.20
1906	236,191	1,863,375	7.89
1907	69,200	742,200	10.73
1908	21,200	267,200	12.61
1909	25,400	288,800	11.35
1910	104,400	1,297,500	12.43
1911	267,000	3,747,800	14.04
1912	42,600	808,900	19.01
1913	53,600	1,128,900	21.07

(The Hudson's Bay Company Archivist provided me with unpublished data on land revenues over a wider period of time but was unable to supply acreages, so these data could not be used to calculate average prices.)

The Canada Year Book gives slightly different data from the Department of the Interior, with a discrepancy in the years. For example, what appears in the Department of the Interior's Annual Report as sales for 1894 and 1895 respectively are approximately the same as the sales recorded in the Canada Year Book for the earlier years 1893 and 1894. (See table A4.) Where there is an inconsistency, the data I use are taken from the Department of the Interior.

The Canada Year Book of 1889 provides the information that "The Hudson's Bay Company sold 40,652 acres, being an increase of 17,952 acres". This implies that sales for 1888 were 22,700 acres. Prices are not given.

(iv) HOMESTEADS

The stock of homesteads (table A5) was calculated by accumulating annual net entries (gross entries less cancellations) for all three prairie provinces. The

Table A4HUDSONS' BAY LAND SALES: CONFLICTING SOURCES

Year	Canada Year Book			Annual Report of the Dept. of the Interior (1905-6)	
	Acres	Amount (\$)	Average Price \$/acre	Acres	Amount(\$)
1892	19,700*	116,620	5.92		
1893	7,908	50,857	6.43		
1894	4,427	23,209	5.24	7,526	48,225
1895				4,431	23,209

* farm lands.

Table A5

ANNUAL NET HOMESTEAD ENTRIES

<u>Year</u>	<u>Net Entries</u>
1878	6,016
1879	4,068
1880	2,074
1881	2,753
1882	7,383
1883	6,063
1884	2,419
1885	1,858
1886	1,624
1887	1,047
1888	1,385
1889	2,634
1890	2,683
1891	3,365
1892	4,741
1893	3,948
1894	1,651
1895	1,105
1896	601
1897	50
1898	1,889
1899	4,282
1900	6,231
1901	6,389
1902	11,260
1903	26,055
1904	17,163
1905	19,336
1906	30,124
1907	7,465
1908	14,519
1909	23,975
1910	24,459
1911	22,151
1912	20,219
1913	16,336

data for entries and cancellations are from series K36-41 in Urquhart and Buckley (1965). Preemptions and purchased homesteads were not included.

B. COLONIZATION EXPENDITURES

(i) Dominion expenditures

Dominion expenditures (table A6) on immigration are taken from Canada, Public Accounts for the Fiscal Year Ended March 31, 1916 (Sessional paper No. 2, 7 George V, A. 1917). The years shown in table A6 indicate the end of the fiscal year to which the expenditures belong. There is a discontinuity in the series when the fiscal year was changed so that the figure for 1906-7 (shown as 1907) was for nine months only. For my regression analysis I normalized this figure by increasing it to a twelve month rate, using \$814,933 instead of the reported value of \$611,200.

(ii) Canadian Pacific land expenditures

Land expenditures by the Canadian Pacific (table A7) were taken from the balance sheets appearing in the Company's Annual Reports. The data appear as ac-

Table A6

DOMINION EXPENDITURES ON IMMIGRATION
(dollars)

1878	154,351
1879	186,403
1880	161,213
1881	214,251
1882	215,339
1883	373,957
1884	511,208
1885	423,860
1886	257,354
1887	341,236
1888	244,789
1889	202,499
1890	110,091
1891	181,045
1892	177,604
1893	180,677
1894	202,235
1895	195,652
1896	120,199
1897	127,438
1898	261,194
1899	255,878
1900	434,562
1901	444,729
1902	494,841
1903	642,913
1904	744,788
1905	972,356
1906	842,668
1907*	611,200
1908	1,074,696
1909	979,326
1910	960,676
1911	1,079,129
1912	1,364,999
1913	1,427,111

*Prior to 1906, period of expenditures is the twelve months ending June 30 of the year shown; after 1906, the twelve months ending March 31. The figure for 1907 is for 9 months only.

Table A7

LAND EXPENDITURES BY THE CANADIAN PACIFIC RAILWAY
(dollars)

Year	Total Cumulative Expenditures	Annual Expenditures
1883	813,494	(271,168*)
1884	1,111,947	298,453
1885	1,481,094	369,147
1886	1,672,611	191,517
1887	1,811,368	138,757
1888	1,922,578	111,210
1889	2,076,129	153,551
1890	2,217,283	141,154
1891	2,312,273	94,990
1892	2,411,846	99,573
1893	2,495,839	83,993
1894	2,568,712	72,873
1895	2,634,321	65,609
1896	2,697,832	63,511
1897	2,769,303	71,471
1898	2,872,790	103,487
1899	2,998,631	125,841
1900-1**	3,189,248	190,617
1902	3,490,898	301,650
1903	3,872,352	381,454
1904	4,071,659	199,307
1905	4,353,090	281,431
1906	4,534,244	181,154
1907	4,970,809	436,565
1908	5,303,355	332,546
1909	5,684,218	380,863
1910	7,292,839	1,608,621
1911	9,077,044	1,784,205
1912	10,827,665	1,750,621
1913	12,462,331	1,634,666

* Estimated as a third of total expenditures to 1883

** The figures for 1900-1 are for eighteen months

cumulated total expenditures. Annual expenditures were calculated by taking annual changes in the total.

A discontinuity appears in 1900-01 when the fiscal year was changed. The figure given in the Annual Report applies to an eighteen month period. For regression purposes two thirds of this eighteen month expenditure was applied to both 1900 and 1901 to normalize for twelve month periods.

Occasionally, expenditures were broken down into components, with the value of promotion expenses being given separately. Ideally I would have used promotion expenditures as the variable affecting land prices. However since only the total of all land expenditures was usually given, this was what I used. Only in two years do we know what error this results in. Annual expenditures are given as \$191,517 for 1886 of which \$131,314 was for promotion. For 1887 the figures are \$138,757 and \$110,052 respectively so in these two cases, the error in using total expenditures is an over-estimate of 46 per cent and 26 per cent respectively. Apparently the bias is not systematic.

Expenditures given in the Annual Reports included, variously, "premium of 10 p.c. on bonds taken in payment for lands", "general charges including interest", "expenditures in connection with land sales and promoting immigration and settlement in the N.W.", and "cultivation rebates". These clearly give total expenditures in excess of the amount relating only to promotion.

Also, the expenditure data in the balance sheets did not include expenditures relating to sales of land from the Manitoba South Western grant, this being reported separately from 1896 onwards. I made no attempt to include such expenditures. Possibly promotion expenditures would not have appeared, in any case, in the Manitoba South Western figures.

A further difficulty is that, in some of the later years, land expenditures included expenses relating to the sale of town sites. It was not always made clear whether town sites were included, but in some years (e.g. 1903, 1904, 1907-1913) they were definitely included.

An interesting anomaly occurs in the balance sheet of 1905. Here some \$36 million in land proceeds are "written off" against the cost of railway and equip-

ment. Both sides of the cumulative balance sheet are reduced by \$36,193,521.00. On the assets side from 1905 onwards, returns from land appear to be \$36 million less, by the item deducted as "Amount expended in construction of Railway and Equipment deducted from cost of property". The casual reader is likely therefore to understate the net revenues accruing to the railway from its land grants.

Another source of possible underestimation of land proceeds arises from the treatment of the lands of the Manitoba South Western Railway. The Report for 1887 announces that the Canadian Pacific held 1,309,421 acres of land arising from the purchase of the MSW Railway "among the best and most available in the North-West". Interestingly, revenues from these lands were not to be declared in the accounts for a while..."These lands have not as yet appeared in the accounts of the Company. The net proceeds have been applied to the principal and interest of the lien [on the M.S.W. land] of the Province and will continue to be so applied until it is paid off". Sales that year were \$110,384.

Similarly interest on land grant bonds served to reduce net revenues reported from land sales. Van Horne states in his Report for 1888,

The interest on land grant bonds, while an obligation of the company, is not included in the fixed charges because the interest paid is chargeable against the land grant and will ultimately be returned to the shareholders. The proceeds of land sales, less the expenses of the Land Department, going for the present toward the extinguishment of the debt upon the lands, the arrangement works practically as a sinking fund.

C. RAILWAYS IN OPERATION IN THE PRAIRIES

(i) The Canadian Pacific

Data for the length of CPR track in operation in the prairies (table A8) are taken from Bladen (1932 and 1934). Bladen reports the distance in miles of main line and branch lines by ownership of railway and the dates opened.

Dates opened are not necessarily an accurate indication of dates of the start of operations as lines were sometimes wholly or partly in operation before they were formally opened. Attributing mileage to opening

Table A8

RAILWAYS IN OPERATION: I CANADIAN PACIFIC

Length of CPR track opened in Manitoba and
the Northwest Territories in miles

Year	Annual	Cumulative Total	Year	Annual	Cumulative Total
1880	92.1		1901	1.5	2014.21
1881	0		1902	20	2034.21
1882	14.1		1903	0	2034.21
1883	124	1293.4**	1904	201.53	2235.74
1884	0	1295.7**	1905	55.5	2291.24
1885*	1065.5	1295.7	1906	34.03	2325.27
1886	0	1295.7	1907	15.2	2340.47
1887	0	1295.7	1908	73	2413.47
1888	0	1295.7	1909	578.94	2992.41
1889	0	1295.7	1910	76.9	3069.31
1890	0	1295.7	1911	246.9	3316.21
1891	0	1295.7	1912	295.8	3612.01
1892	277.71	1573.41	1913	435.5	4047.51
1893	160.1	1733.51	1914	936.29	4983.80
1894	0	1733.51	1915	159.2	5143.0
1895	0	1733.51			
1896	0	1733.51			
1897	0	1733.51			
1898	105.5	1839.01			
1899	18	1857.01			
1900	155.7	2012.71			

* The entry shown for 1885 is the whole of the main line within the region. Some of this applies to earlier years of track opened.

** Cumulative totals before 1885 are estimated. See accompanying text.

dates causes more lumpiness in the data for cumulative totals opened than would have been evident in total track in operation.

In recording CPR track in the prairies, I have identified lines in Alberta, Saskatchewan and Manitoba which Bladen reports as being owned by the CPR. Omitted are lines which were leased or taken over by the CPR after their opening date, which were listed by Bladen as being owned by other companies. Whether this omission is important in the influence on CPR land values depends on whether the lines ran through areas of the CPR land grant, or whether the CPR was free, after acquiring the lines, to choose adjacent land as earned in the CPR grant.

Some land was acquired through taking over lines -- for example ownership of the Manitoba South Western Colonization Railway gave the CPR the rights to the MSW land grant. (However these lands were not included in calculating the average price of land sold.)

Where Bladen reports mileage for branch lines running between points in and outside the prairies I have estimated the length of track within the prairies. For

example, for the 251.5 mile long line between Macleod, in the N.W. Territories and Kootenay Landing in B.C., I estimated that 50 miles lay within the Territories.

CPR branch lines are reported in Bladen for 1880 onwards. The main line, however, is simply reported as 1,459 miles from Nepigon to St. Stephen (summit of the Rocky Mountains) in operation by June 24, 1884, which includes mileage in British Columbia and Ontario. A breakdown of main line constructed could be compiled by date of opening from other sources, in particular Van Horne's Road by Omer Lavallée (1974). However for my purposes it is sufficient to use the mileage of main line lying within the prairies which was known to be operating in 1885.

The Department of the Interior (Annual Report for 1897, p. 34, for example) reports that the CPR main line between the eastern boundary of Manitoba, 1½ miles west of Ingolf, to Hector, the eastern boundary of British Columbia, extended for 1065.5 miles. George Stephen, president of the CPR, stated on 13 June, 1885 in his Annual Report for 1884 that:

the rails are now laid to a point near the summit of the Selkirks, forming a continuous rail connection from Montreal westward for a distance of nearly 2,500 miles.

Therefore the whole of the intermediate component lying in the prairies must have been open at that date.

Inspection of Van Horne's Road shows the section between Medicine Hat and Stephen (just 2.3 miles east of Hector) to have been opened on December 3, 1883. This is the latest opening date shown in the genealogy of the main line between Port Arthur and Stephen so it seems that there was a continuous line of 1063.2 miles in operation between the B.C. border and the Lakehead by the end of 1883.

Cumulative totals are therefore projected back to 1883 and 1884 as 1293.4 miles and 1295.7 miles respectively, which assumes all the 1065.5 miles of main line were open in 1884, and 1063.2 miles in 1883.

(ii) All railways

Estimates of all railways opened in the prairies (Table A9) were provided by Michael Percy. These

Table A9

RAILWAYS IN OPERATION: II ALL RAILWAYS

Length of railways opened in the Prairies, in miles

	<u>Railways Opened Annually</u>	<u>Accumulated Total in Operation</u>
1878	85.0	85
1879	0	85
1880	182.1	267
1881	100.0	367
1882	514.1	881
1883	650.4	1532
1884	0	1532
1885	109.5	1641
1886	211.6	1853
1887	0	1853
1888	115.3	1968
1889	64.6	2033
1890	440.1	2473
1891	278.8	2751
1892	357.7	3109
1893	160.1	3269
1894	0	3269
1895	0	3269
1896	0	3269
1897	123.6	3393
1898	200.9	3594
1899	128.0	3722
1900	592.3	4314
1901	91.5	4406
1902	67.0	4473
1903	111.0	4584
1904	245.0	4829
1905	651.0	5480
1906	781.0	6261
1907	426.0	6687
1908	93.0	6780
1909	642.0	7422
1910	484.0	7906
1911	440.0	8346
1912	1090.0	9436
1913	1685.0	11121

are data used in Marr and Percy (1978) and the sources are given as follows:

1878-1900: Bladen (1932, 1934); Glazebrook (1938). The addition in railroad mileage in any year is the amount which Bladen noted as opening in that year, with the following exceptions: 85 miles from Selkirk to Emerson, Manitoba, is allocated to 1878 (Glazebrook, 261); approximately 90 miles from Selkirk to the Ontario border is allocated to 1880 (ibid); approximately 1000 miles from Winnipeg to Yellowhead Pass is allocated as follows: 1881 -100 miles, 1882 -- 450 miles. 1883--450 miles (Glazebrook, 274-5).

1901-08: p. xxviii 3 George V A.1913 Vol. XLVII No. 8 (Annual Report of the Department of the Interior).

1909-13: p. xxxi 4 George V A.1914 (Annual Report of the Department of the Interior).

D. Freight Rates on Grain, Regina to Fort William

Canadian Pacific freight rates on grain, Regina to Fort William, are given in table A10. The sources are as follows:

1886-1913: These data in cents/100 lb were provided by the CPR Archives and correspond with the rates in cents/bushel reported in Mackintosh (1935, table V, p. 284).

1884: Innis (1971:178) reports the rate from Regina to Port Arthur to have been reduced to 40c/100 lb on January 5, 1884, as a special east-bound grain rate.

1883: In the "Annual Statement of the Honorable Sir Charles Tupper Minister of Railways" delivered in the House of Commons, May 4, 1883, Canadian Pacific freight rates for various distances are compared with those of American lines. The CPR freight rate on grain ("special class 1") is reported as 49 cents/100 lb. for a distance of 800 miles. It is assumed that this rate also applied between Regina and Port Arthur, a distance of 792 miles, in 1883.

1882: Innis (p. 176) reports a new higher tariff to have been introduced on March 23, 1883. According to Innis, the Winnipeg Board of Trade objected to the new rate of 1883 which were on average 59% above the old rates. The percentage change varied among classes of freight and probably also among haulage distances. However, as a rough approximation, I estimate 1882 rates as 31 cents/100 lb, (49 cents being 159% of 30.8 cents).

Table A10: CPR FREIGHT RATES FOR WHEAT, REGINA TO FORT WILLIAM ²²⁸

	<u>Cents/100 lbs.</u>	<u>Cents/Bushel</u>
1882	31.0*	18.6
1883	49.0*	29.4
1884	40.0	24.0
1885	35.0*	21.0*
1886	33.0	19.8
1887	30.0	18.0
1888	30.0	18.0
1889	30.0	18.0
1890	30.0	18.0
1891	29.0	17.4
1892	29.0	17.4
1893	23.0	13.8
1894	23.0	13.8
1895	23.0	13.8
1896	23.0	13.8
1897	23.0	13.8
1898	21.5	12.9
1899	20.0	12.0
1900	20.0	12.0
1901	20.0	12.0
1902	20.0	12.0
1903	18.0	10.8
1904	18.0	10.8
1905	18.0	10.8
1906	18.0	10.8
1907	18.0	10.8
1908	18.0	10.8
1909	18.0	10.8
1910	18.0	10.8
1911	18.0	10.8
1912	18.0	10.8
1913	18.0	10.8

* estimated

1885: No sources were found for the freight rate for 1885. However the CPR Annual Reports give average revenue per ton mile for freight. Normally the CPR reported a breakdown of freight volumes and revenues by type of freight. Ideally I would have used average revenue for grain freight but the breakdown was not reported for 1885 because CPR records for that year were destroyed by fire. I therefore used averages for all freight revenue, 1.45 cents/ton mile, 1.20 cents/ton mile and 1.10 cents/ton miles for the years 1884, 1885 and 1886 respectively. Assuming the freight rate for 1885 lay between the values 40 cents/100 lb and 33 cents/100 lb. for 1884 and 1886 in the same proportion as average revenues from those years, the grain freight rate for 1885 is estimated, as 35 cents/100 lb, or 21 cents/bushel.

While I am informed by the CPR Archivist, Omer Lavallée, that Abernethy lies in the same rate 'block' as Regina, it seems that early freight rates were slightly lower for the Qu'Appelle Valley. Grain Statistics 1914 (4 George V., A. 1914, Sessional Paper No. 10d) p. 194 gives wheat rates to Fort William as 17 cents/100 lb from Abernethy, Indian Head, and Qu'Appelle, and 18 cents/100 lb from Regina.

E. WHEAT

(i) Prices

In a model intended to isolate the effect of freight rates on land values, it is critical that wheat prices be taken at a single location in the world market.

Data on wheat prices appear in Urquhart and Buckley (1965), series L98, and in Mackintosh (1935), table IV, Appendix A. However neither series is consistent. Although the Urquhart series is labelled No. 1 Northern at Fort William, this and the Mackintosh series are for a mixture of grades of wheat and at different markets (Winnipeg and Toronto, for example). These prices are therefore unsuitable for my purposes.

Fortunately, a consistent series is now available. Knick Harley (1980) has compiled wheat prices at various locations for the period 1850-1913. I have used his Chicago series, No. 2 spring wheat, crop year ending June 30, as shown in table A11.

Table All

WHEAT PRICES, NO.2 Spring, at Chicago, in
gold dollars/Bushels

1878	1.08
1879	0.89
1880	1.10
1881	0.99
1882	1.28
1883	1.06
1884	0.93
1885	0.79
1886	0.82
1887	0.78
1888	0.77
1889	0.96
1890	0.81
1891	0.97
1892	0.89
1893	0.73
1894	0.60
1895	0.56
1896	0.61
1897	0.69
1898	0.92
1899	0.70
1900	0.68
1901	0.73
1902	0.72
1903	0.74
1904	0.86
1905	1.08
1906	0.84
1907	0.77
1908	0.95
1909	1.08
1910	1.09
1911	0.94
1912	0.98
1913	0.91

(ii) Yields

Wheat yields are available in several sources: for example, the Canada Year Book, Annual Reports of the Department of the Interior, and the Canadian Pacific Railway's The Western Provinces of Canada. My own data (table A12) are from Strange (1954) which gives the most complete series I could find with a breakdown by province. The series is not strictly complete--some figures, not available from official sources, have been estimated by the Searle Grain Company, the publisher of the book.

F. WAGES

The wage rate (table A13) is intended to capture the labour costs of producing wheat in the prairies.

The long run approach would be to take the opportunity cost of labour (the settler's labour) as the wage rate elsewhere in his alternative occupation. However I chose to take the cost of farm labour in the West, given that most purchasers of Canadian Pacific lands had already opted for farming in the prairies by taking a homestead.

Table A12

WHEAT YIELDS (bushels/acre)

	Saskatchewan*	Prairie Provinces
1883	18.0	21.5
1884	18.0	19.8
1885	17.1	20.2
1886	15.0	15.3
1887	16.0	26.5
1888	18.0	14.2
1889	10.0	11.3
1890	15.7	19.1
1891	23.0	25.0
1892	15.0	16.3
1893	14.0	15.3
1894	8.0	15.4
1895	17.0	26.0
1896	22.0	15.9
1897	17.0	14.7
1898	18.01	17.2
1899	19.02	17.0
1900	9.75	9.1
1901	24.9	25.1
1902	22.3	25.1
1903	19.1	17.1
1904	17.5	16.6
1905	23.1	23.7
1906	21.4	23.0
1907	13.5	14.8
1908	14.5	16.3
1909	23.1	21.4
1910	15.8	14.0
1911	20.8	20.9
1912	19.2	20.4
1913	21.3	20.9

* Prior to 1905, the split up of the N.W.T. between Alberta and Saskatchewan was estimated by the Searle Company.

Table A13

WAGES (DOLLARS PER YEAR)

1882	249
1883	264
1884	257
1885	253
1886	251
1887	250
1888	251
1889	249
1890	253
1891	257
1892	253
1893	255
1894	247
1895	246
1896	243
1897	236
1898	246
1899	243
1900	248
1901	263
1902	268
1903	274
1904	291
1905	296
1906	298
1907	308
1908	315
1909	321
1910	332
1911	326
1912	337
1913	347

Unfortunately data on wage rates are scarce and no continuous series could be found to cover the whole period 1882-1912. Ideally I would have compiled a series of wage rates, say for Saskatchewan. However what data there are are vague--rates for harvesting, threshing, etc., with and without board, and varying, as one would expect, according to the season.

Instead, therefore, I took the Ontario farm labour rate as a proxy. Series L348 in Urquhart and Buckley (1965) gives annual rates without board for 1882-1906 and 1908. (Rates in this period varied between \$230 and \$300 per year, about \$100 less with board.)

After 1906 a series was constructed using the general wage index series DI from Urquhart and Buckley, with the 1906 value of Ontario farm wages as the base.

G. INTEREST RATES

The interest rate (table A14) is the annual percentage yield on Canada bonds, taken from Neufeld (1972, 562-3). This series is, however, incomplete, with years 1914-1918 missing. For these years I used the corporate bond rate less 0.7 percentage points, this being

Table A14

INTEREST RATES (PER CENT)

1878	4.70
1879	4.45
1880	4.35
1881	4.20
1882	4.20
1883	4.15
1884	4.15
1885	4.10
1886	3.90
1887	3.95
1888	3.60
1889	3.50
1890	3.80
1891	4.00
1892	3.90
1893	3.60
1894	3.45
1895	3.25
1896	3.15
1897	2.80
1898	2.90
1899	3.00
1900	3.00
1901	3.00
1902	2.95
1903	3.05
1904	3.20
1905	3.10
1906	3.15
1907	3.25
1908	3.30
1909	3.50
1910	3.55
1911	3.55
1912	3.65
1913	4.10

roughly the difference between the two series in the immediately following years when both series were available.

H. PRICE INDEX

All nominal values were converted to real values using the general wholesale price index (excluding gold), basis 1935-39 = 100, series J34, in Orquhart and Buckley (1965). (See table A15.)

Table A15

PRICE INDEX (1935-9 = 100)

1878	68.0
1879	65.5
1880	71.8
1881	72.4
1882	72.5
1883	70.2
1884	67.0
1885	63.3
1886	62.3
1887	63.7
1888	66.2
1889	66.1
1890	67.1
1891	67.1
1892	62.3
1893	63.2
1894	59.1
1895	57.9
1896	55.9
1897	56.8
1898	59.4
1899	60.6
1900	62.4
1901	63.7
1902	66.6
1903	67.5
1904	68.3
1905	70.4
1906	70.7
1907	76.4
1908	76.3
1909	77.6
1910	78.5
1911	81.1
1912	85.2
1913	83.4

References

Bertram, Gordon W. (1973) The relevance of the wheat boom in Canadian economic growth. Canadian Journal of Economics, VI No.4.

Bladen, M.L. (1932) Construction of railways in Canada to the year 1885. Contributions to Canadian Economics V, 43-60.

Bladen, M.L. (1934) Construction of railways in Canada, part II: from 1885 to 1931. Contributions to Canadian Economics VII, 61-107.

Burstein, M.L. (1960) A theory of full-line forcing. Northwestern University Law Review 55, 62-95.

Canada, Department of the Interior (1934) Alberta Resources Commission 1934 T Vol. I Exhibit 28A. (Public Archives, Manuscript Division RG15 vol. 29).

Canadian Pacific Railway (various years) Annual Reports.

Canadian Pacific Railway (1905) "Western Canada 1905" (pamphlet).

Currie, A.W. (1954) Economics of Canadian Transportation, (Toronto: University of Toronto Press).

Currie, A.W. (1967) Canadian Transportation Economics. (University of Toronto Press).

Dick, Lyle (1980) W.R. Motherwell National Historic Site: a settlement and economic history of the Abernethy district, 1880-1920. (Winnipeg: Parks Canada).

Engerman, Stanley L. (1972) Some economic issues relating to railroad subsidies and the evaluation of land grants. Journal of Economic History, 32, 443-63.

England, Robert (1936) The colonization of Western Canada. (London, P.S. King and Son).

Fowke, Vernon C. (1957) The National Policy and the wheat economy (Toronto: University of Toronto Press), reprinted 1973.

Galbraith, John S. (1951) Land policies of the Hudson's Bay Company, 1870-1913. Canadian Historical Review, XXXII, no. 1, 1-21.

Glazebrook G.P. de T. (1938) A history of transportation in Canada (Toronto: Ryerson Press).

Harley C.K. (1980) Transportation, the world wheat trade and the Kuznets cycle, 1850-1913. Explorations in Economic History 17, No.3.

Hedges, James B. (1939) Building the Canadian West: the land and colonization policies of the Canadian Pacific Railway (New York: Russell and Russell).

Innis, Harold A. (1971) A history of the Canadian Pacific Railway with a foreword by Peter George (Newton Abbot: David and Charles), first published 1923.

Kahn, Alfred E. (1979) Applications of economics to an imperfect world. American Economic Review Papers and Proceedings, 1-13.

Lavallée, Omer (1974) Van Horne's Road.

Lewis, Frank D. (1981) Farm settlement on the Canadian prairies, 1898 to 1911. Journal of Economic History, 41, 517-25.

Lewis, Frank D. and Robinson, David R. (1983) The timing of railway construction on the Canadian prairies. Canadian Journal of Economics (forthcoming).

MacGibbon, D.A. (1917) Railway rates and the Canadian Railway Commission. (Houghton Mifflin Co.).

Mackintosh, W.A. (1935) Economic problems of the prairie provinces, vol. IV of Canadian frontiers of settlement, edited by W.A. Mackintosh and W.L.G. Joerg (Toronto: Macmillan of Canada).

Marr, William and Percy, Michael (1978) The government and the rate of prairie settlement. Canadian Journal of Economics XI no.4, 757-767

Martin, Chester (1938) "Dominion Lands" policy, vol II, part II, of Canadian frontiers of settlement, edited by W.A. Mackintosh and W.L.G. Joerg. (Toronto: Macmillan of Canada).

Morton, Arthur S. (1938) History of prairie settlement, vol II, part I, of Canadian frontiers of settlement, edited by W.A. Mackintosh and W.L.G. Joerg (Toronto: Macmillan of Canada).

Neufeld, E.P. (1972) The financial system of Canada (Toronto: Macmillan of Canada).

Norrie, K.H. (1975) The rate of settlement of the Canadian prairies; 1870-1911. Journal of Economic History 35 no.2, 410-427

Norrie, Kenneth H. (1979) The National Policy and the rate of prairie settlement: a review. Journal of Canadian Studies 14 No.3, 63-76

Regehr, T.D. (1976) The Canadian Northern Railway: pioneer road of the northern prairies, 1895-1918. (Toronto, Macmillan of Canada):

Sanford, Barrie (1977) McCulloch's Wonder: the story of the Kettle Valley Railway. (Vancouver, Whitecap Books).

Stigler, George J. (1966) Theory of price. 3rd edition (London: Macmillan).

Strange, H.G.L. (1954) A short history of prairie agriculture. (Searle Grain Co.).

Urquhart, M.C. and Buckley, K.A.H. (1965) Historical Statistics of Canada. (Toronto: Macmillan of Canada).

Figure 3.9

CANADIAN PACIFIC LAND SALES 1882-1912

Thesis
Ph. D.
1984
W64

1 of 8

- ★ Canadian Pacific Mainline (1882)
- ★ Canadian Pacific (1904-5)
- ▽ Grand Trunk Pacific (1907)
- ▽ Canadian Northern (1908)
- 1882 - 1889
- 1890 - 1898
- 1899 - 1902
- 1903 - 1912
- Boundary of Mainline Grant

END

2	9	H	1	0	H	8	5
---	---	---	---	---	---	---	---

FIN