DEPRECIATION AND WELFARE DIVERGENCE: AN EMPIRICAL ANALYSIS OF SECTORAL NET DOMESTIC PRODUCTIVITY GROWTH

by

Paul Chung
B.A. (Honours), Simon Fraser University, 2005

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

In the
Department
of
Economics

SIMON FRASER UNIVERSITY

Fall 2007

APPROVAL

Name: **Paul Chung**

Degree: **Master of Arts**

Title of Project: **Depreciation and Welfare Divergence: An Empirical Analysis of Sectoral Net Domestic Productivity Growth**

Examining Committee:

Chair: David Andolfatto
Professor, Department of Economics

Richard Harris
Senior Supervisor
Professor, Department of Economics

David Jacks
Supervisor
Assistant Professor, Department of Economics

Krishna Pendakur
Supervisor
Associate Professor, Department of Economics

Clyde Reed
Internal Examiner
Professor, Department of Economics

Date Defended/Approved: September 18, 2007

ABSTRACT

In this paper, welfare growth is estimated according to net domestic product (NDP)-based labour productivity growth across industries and sectors in Canada and the United States for the period of 1987 to 2003. Analyses of the growth in aggregate and per hour gross output, depreciation, and net output are undertaken. The results indicate that welfare gains were overestimated by gross domestic product (GDP)-based labour productivity growth. Moreover, the rapid rise of depreciation limited welfare gains, as an increasing amount of gross output was allocated toward capital maintenance.

Keywords: labor productivity; depreciation; welfare; net domestic product

Subject Terms: Labor Productivity – Canada; Information Technology – Economic Aspects – Canada

To Mom, Dad, and Alice

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to my senior supervisor, Professor Richard Harris, for sharing his knowledge and research expertise with me. His guidance and encouragement were invaluable to the preparation of this project.

My sincere thanks to Professor David Jacks and Professor Krishna Pendakur for their feedback. Their detailed and constructive comments were greatly appreciated.

I am grateful to Ms. Laura Nielson for her extraordinary efforts in arranging my defense.

I wish to thank all my classmates, students, teachers, and neighbours at SFU for making my time here an unforgettable experience.

I owe special thanks to my family and friends for their unconditional support and encouragement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

The rise in living standards is conventionally measured by the growth of labour productivity that is based on gross domestic product (GDP). Yet this is contrary to the economics literature, which regards net domestic product (NDP) – GDP minus depreciation – as the appropriate measure of welfare. It follows that welfare gains ought to be based on NDP growth. Indeed, if NDP is the correct measure, then the true rate of welfare increases could be overestimated whenever GDP exceeds NDP growth. The objective of this paper is thus to calculate welfare gains according to NDP-based labour productivity growth for all industries in Canada and the United States (U.S.) for the period of 1987-2003.

This paper advances the empirical efforts of Baker (2006) and Spant (2003) in calculating welfare from NDP. Like Baker, this paper uses NDP per hour growth to assess the rise in living standards. But whereas Baker examines welfare at the national level, this study looks at industries and sectors to determine where depreciation and welfare growth were the most outstanding, and compares the extent of GDP-NDP growth differentials. Furthermore, policy implications are considered.

The constraints of this study must be acknowledged. First of all, achieving consistency across countries and industries is challenging and not always possible, as Canada and the U.S. employ different industry classification schemes. Secondly, there is limited empirical research on the relationships

between depreciation, output, and asset composition – all of which could have greatly aided the policy analysis of depreciation.[1] What is known is that depreciation varies positively with capital and information and communications technology (ICT) investment. Finally, this study focuses primarily on the calculation of NDP-based labour productivity growth, leaving the intricacies of regression analysis for another study.

The paper is organized as follows. There is a literature review of the theoretical development of NDP and the relevance of depreciation in the modern economy, followed by a discussion of the empirical strategy of data collection, data concordance, and statistical methodology. The results are then analyzed, and discussions of welfare overestimation, the effect of depreciation on welfare, and policy implications are undertaken. Finally, the paper concludes with a summary of the results.

[1] Empirical research on depreciation typically focus on estimating depreciation rates using capital stock and investment levels. Fraumeni (1997), Statistics Canada (2002), and Gittleman, Raa, and Wolff (2005) are examples.

CHAPTER 2: LITERATURE REVIEW

2.1 Theoretical Foundations of Net Domestic Product

GDP has long been used to measure welfare, although the theoretical literature favours NDP. The evolution of this preference began with Hicks (1974) and extends to Solow [Romer 1996], Samuelson (1968), and finally Weitzman (1976). This section outlines the development of NDP as the ideal measure of welfare.

Hicks (1974) motivates the discussion of welfare by arguing that income is "the maximum amount of money which the individual can spend this week and still expect to be able to spend the same amount in real terms in each ensuing week." This definition is significant because it defines welfare and its measurement. Ideally, income should account for consumption in all time periods, but without the certainty of future prices, this would only be an unreliable aggregate of consumption expectations. Regardless, Hicks recognizes the intertemporal nature of income, concluding that the sum of consumption and investment equals welfare, as investment represents future consumption.

Solow's famous growth model advances Hicks's development and highlights the importance of capital maintenance [Romer 1996]. Here, capital investment is critical to output and consumption growth, and hence to rising living standards. A breakeven level of investment is introduced to maintain current consumption per worker against capital depreciation, population growth, and

technological progress. For instance, if the net capital investment per worker falls below the combined rate of depreciation, population, and technology growth, productivity will decline over time and reduce the economy to a lower steady-state level of output per worker. Consequently, there will be a lower level of consumption per worker. All else equal, a rise in the capital depreciation rate will lead to a reduction in individual welfare. Solow essentially reinforces Hicks by demonstrating that welfare consists not only of current consumption, but also the ability to maintain the current productivity level.

While Samuelson (1968) agrees with Hicks on consumption's role, there is disagreement over the matter of investment. Investment, Samuelson argues, is meaningful only in terms of future consumption, implying that a more appropriate measure of welfare is one that produces a discounted stream of present and future consumption. Effectively, Samuelson characterizes the consumption optimization problem, whereby lifetime consumption is maximized subject to the constraints of the investment choice set.

Subsequently, Weitzman (1976) produces a tractable measure of welfare by showing that net national product is equivalent to the solution of Samuelson's consumption optimization problem. The consumption optimization problem is characterized by:

$$\int C(t)e^{-rt}dt \text{ subject to } (C(t), dK/dt) \in S(K(t)) \text{ and } K(0) = K_0$$

where C is consumption, K is capital, S is savings, and dK/dt is capital investment less capital depreciation. Accordingly, net national product is characterized by:

$$NNP = Y(K, p) = \max C+pI \text{ subject to } (C(t), I(t)) \in S(K(t)) \text{ and } K(0) = K_0$$

where Y is output, p is price level, and I is net investment. Weitzman reveals that net national product (NNP) is functionally equivalent to the Hamiltonian of the optimization problem. Whereas the Hamiltonian represents the theoretical formulation of welfare, NNP is its statistical counterpart. Depreciation must be taken into account because it embodies the opportunity cost of holding older, less productive capital and the deterioration of future productive capacity [Gittleman 2004].[2] While NNP is espoused by Weitzman, NDP is the net output correlate to GDP, and is widely supported as a feasible alternative [Hartwick 1990; Hulten 1992; Brekke 1994; Spant 2003; Baker 2006; Oulton 2006].[3]

2.2 The Divergence of GDP and NDP

The convenient and oft-used equivalence of GDP-based labour productivity (GDP-LP) growth with welfare gains is inaccurate but has generally been reliable. It is inaccurate because welfare gains ought to be based on NDP-based labour productivity (NDP-LP) growth. However, this equivalence is reliable as long as NDP grows proportionally with GDP. Once GDP exceeds NDP growth, then welfare gains will be overestimated.

The latter decades of the twentieth century saw increasing amounts of income allocated toward capital maintenance, expanding the divergence

[2] This cost is known in the economics literature as "the vintage effect". Wolff (1996) claims that this effect is responsible for two-fifths of the post-1970s productivity decline in North America, Western Europe, and Japan.

[3] NNP variants have also been formulated for exhaustible (natural) resources [Hartwick 1990; Weitzman 1997].

between GDP and NDP growth. Spant (2003) produces evidence of this divergence across OECD countries. In particular, the U.S. quadrupled its 1970s average annual GDP-NDP growth differential from one-tenth- to nearly one-half of a percentage point by the 1990s. In the late-1990s alone, the average annual growth differential among sixteen OECD countries was 0.15 percentage points, or approximately five-percent of their NDP growth. In Canada, the differential was also 0.15 percentage points, yet this represented nearly thirty-seven percent of its NDP growth. The rise in OECD growth differentials coincided with an increase in their average annual depreciation share of GDP from 13.85% to 14.60%.

The GDP-NDP divergence has subsequently produced a divergence in GDP-LP and NDP-LP growth. Baker (2006) adjusts U.S. GDP-LP for inflation and depreciation to reveal a widening growth gap that began in the 1960s. The 1960s differential of 0.14 percentage points ballooned into a 1990s differential of 1.01 percentage points. This provides evidence of the exaggeration of the true rate of welfare gains. Likewise, since Canada underwent depreciation growth similar to that of the U.S., Canadian welfare growth must also have been overestimated.

2.3 The Dual Impact of ICT

Information and communications technology (ICT) was fundamental to the productivity surge in the 1990s, and is arguably the primary engine of economic growth today [Oliner and Sichel 2000; Rao and Tang 2001; Stiroh 2001; Sharpe 2004]. In the 1990s, ICT capital investment grew at average annual rates of 13.07% in Canada and 14.55% in the U.S. [Sharpe 2005]. This investment

accounted for 0.96 percentage points of the 2.57% annual average American GDP-LP growth, and 0.35 percentage points of the 1.4% growth in Canada during this period [Oliner and Sichel 2000].[4] Between 1981 and 1999, ICT contributed 0.50 percentage points to Canada's 2.90% average annual output growth, and 0.50 percentage points to the 3.60% growth in the U.S. The impact of ICT was clearly substantial.

Yet ICT employment is a double-edged sword. Although ICT contributes heavily to productivity, it depreciates faster than most other capital assets (see table 2.1). Studies on ICT capital show that their services lives vary from one to seven years, average 1.7 to 3.3 years, and have annual depreciation rates of thirty- to fifty-percent [Fraumeni 1997; Statistics Canada 2002; Dunn et al. 2004]. Compare this to the average service life of 6.3 years for all other types of capital assets. Among ICT assets, software depreciate the fastest, followed by computer equipment, then communications technology. In general, ICT capital necessitate more frequent replacement and larger allocations of income toward maintenance than in the past.

Table 2.1 Average service life (years) of capital, Statistics Canada.

Capital Asset	Service Life
Computer Hardware	1.7
Computer-assisted Production	3.3
Computer-assisted Communications	3.1
All Other Assets	6.3

[4] In comparison, non-ICT capital contributed only 0.14 percentage points to the 2.57% U.S. productivity growth in the late-1990s.

One should expect a difference in productivity and depreciation growth between Canada and the U.S. because they differ in ICT investment and employment. The U.S. invests more in ICT capital and research and development, and holds a different composition of ICT assets than Canada [Rao and Tang 2001]. In addition, Canada has a smaller ICT-producing sector, a slower productivity response to ICT investment, and thus lower productivity growth in its ICT-intensive industries. Canada's ICT investment shares of GDP and total investment are only 68.5% and 62% of those in the U.S., respectively. Canadian per worker levels of ICT investment and ICT capital stock are only half as much as U.S. levels. Whereas the U.S. prefers to invest in communications technology, Canada invests more heavily in computers, which depreciate faster than communications. Simultaneously, the U.S. workforce is more computer-literate and educated than Canada's. As a result of these differences, it is conceivable for the U.S. to experience greater productivity growth, while maintaining lower rates of depreciation.

CHAPTER 3: EMPIRICAL STRATEGY

The empirical objective of this paper is to produce comparable growth rates of GDP per hour (GDP-H), depreciation per hour (D-H), and NDP per hour (NDP-H) for all industries in Canada and the U.S. This requires the assembly of variables and statistics using industry-level GDP, depreciation, hours worked, and capital stock. Moreover, this requires the construction and concordance of multiple data sets. The variables include GDP-H, NDP-H, D-H, and the share ratios of depreciation to capital (D-K) and NDP (D-NDP). The statistics are the average annual growth rates of the mentioned variables. Prior to producing these statistics, however, the industries from all data sets must conform to a common industry classification scheme.

3.1 Data Sources

Four groups of data are used to produce the variables. These data are industry-level gross output, depreciation, hours worked, net capital stock, and capital and output price indexes (see table 3.1). Canadian data come from the Canadian Socio-economic Information Management System (CANSIM) and are organized according to the North American Industry Classification System (NAICS). U.S. data come from the U.S. Bureau of Economic Analysis (BEA) and are organized according to the Standard Industrial Classification (SIC) system. Hours worked data for both countries come from the Groningen Growth and

Development Centre (GGDC) and are organized according to the International Standard of Industrial Classification of All Economic Activities (ISIC) system.

Table 3.1 Characteristics of collected data

Data	Source	Classification	Real
GDP	CANSIM	NAICS	Yes
Depreciation	CANSIM	NAICS	Yes
Net Capital	CANSIM	NAICS	Yes
Hours Worked	GGDC	ISIC	-
Value Added	BEA	SIC	No
CCCA	BEA	SIC	No
NCCCA	BEA	SIC	No
Hours Worked	GGDC	GGDC	-
Net Capital	BEA	SIC	No
Price Index – D	BEA	SIC	No
Price Index – K	BEA	SIC	No

Canadian gross output data are GDP measured in constant 1997 dollars, while the corresponding U.S. data are measured in constant 2000 dollars. Both Canadian and U.S. depreciation data are based on geometric rates, but only Canadian depreciation is measured in constant dollars. Total U.S. depreciation (D) is the sum of corporate capital consumption allowance (CCCA) and non-corporate capital consumption allowance (NCCCA) data for each industry and year. Because the U.S. depreciation data are in current dollars, they require deflation to produce real depreciation in constant 2000 dollars by the chain-type price indexes for value-added. Moreover, since NCCCA data are not as comprehensive as CCCA data, not all industries include NCCCA.

The net capital data are based on geometric depreciation rates. As with depreciation, Canadian net capital data are in constant 1997 dollars, whereas

U.S. data require price deflation to produce real net capital. Net capital is deflated by the chain-type quantity indexes for net stock of private fixed assets.

3.2 Data Concordance

Data concordance is necessary for industry consistency across classification schemes and the comparison of growth statistics. This issue arises from the organizational differences between Canada and the U.S., whereby Canadian data are organized according to NAICS, and U.S. data are organized according to SIC. The hours worked data for both countries are organized according to ISIC. In this study, ISIC is the designated common classification scheme, hence all NAICS and SIC data have been made to conform as closely as possible to ISIC industry categories. The final classification is organized roughly at the 3-digit level of the NAICS system (see appendix 1 for a complete listing of industries).

However, concordance does not necessarily exist between all Canadian and U.S. depreciation rates. Although the basis of their methodologies is Hulten and Wykoff (1981), CANSIM and BEA estimated their own capital service lives and depreciation rates, resulting in differences.[5] For instance, BEA depreciates motor vehicles at an annual rate of 16.5%, with a service life of ten years, whereas CANSIM depreciates at 21%, with a service life of just over four years. In general, Canadian depreciation rates are slightly higher than U.S. rates.

[5] A more comprehensive discussion on methodology can be found in Statistics Canada (2002) for Canada, and Fraumeni (1997) for the U.S.

3.3 Variables and Statistics

The data assembled produce three types of variables for each industry: aggregate measures, per hour measures, and share ratios. The aggregate measures include total real values of gross domestic product (GDP), depreciation (D), hours worked (H), and net domestic product (NDP). NDP is the difference between GDP and depreciation.

Per hour measures of GDP, depreciation, and NDP are produced by dividing their aggregate real values by the hours worked. These calculations of per hour measures will henceforth be referred to as the direct method.

The share ratios produced are total real depreciation to total real net capital (D-NDP) and total real net output (D-K).

All of the above variables are used, in turn, to produce growth statistics. The growth statistics are calculated directly by obtaining the average annualized growth rate for a period of time. GDP-H and NDP-H growth are also calculated by logarithmic differentiation. The periods for which growth rates are calculated are 1987-1990, 1990-1995, 1995-2000, 2000-2003, and 1987-2003.

CHAPTER 4: RESULTS

The results are presented in the order of GDP, depreciation, and NDP. The tables organize the average annual industry growth rates by sector, country, and time period. Each period shows the growth rates for the three sectors of the economy – primary (natural resources), secondary (manufacturing), and tertiary (services) – the overall economy, and the ICT-intensive industries (see appendix 1 for industry categorizations).[6]

4.1 Aggregate Gross Domestic Product (GDP)

Canadian and U.S. GDP were similar in both composition and growth pattern (see tables 4.1, 4.2, and 4.3). Their economies were dominated by their tertiary sectors (over 75%), while the primary sectors accounted for less than a tenth of total output (see appendix 2 for all aggregate growth rates by industry). The tertiary sectors had the strongest output growth, with above-average annual growth rates of 2.87% in Canada and 3.47% in the U.S. The tertiary sector industries that grew the most were wholesale trade, professional, scientific, and technical services, and information and culture. While the output composition was stable in Canada, the U.S. saw a shrinking primary sector, whose share was absorbed by the tertiary sector. The manufacturing shares were relatively stable in both countries.

[6] ICT-intensive industries are industries with ICT capital stock to non-residential capital stock ratios greater than that of the private sector [Robidoux 2003].

Table 4.1 Sector shares of gross output (%), Canada and United States.

Gross Output Share	Canada			United States		
	1987 Share	2003 Share	Difference	1987 Share	2003 Share	Difference
Primary	7.33	6.31	-1.01	3.34	2.33	-1.01
Secondary	18.35	18.07	-0.28	15.95	15.47	-0.49
Tertiary	74.32	75.62	1.29	74.88	77.57	2.69

Table 4.2 Average annual GDP growth (%), Canada.

Gross Domestic Product	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	2.11	2.26	1.72	0.88	1.8
Secondary	1.41	2.36	6.33	-1.52	2.66
Tertiary	2.7	1.65	4.06	3.1	2.87
Economy	2.42	1.83	4.33	2.06	2.76
ICT	2.52	2.73	6.52	2.29	3.78

Table 4.3 Average annual GDP growth (%), United States.

Gross Domestic Product	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	1.56	1.03	1.87	-1.31	0.95
Secondary	1.91	3.62	5.42	-0.61	3.05
Tertiary	3.92	2.68	4.62	2.44	3.47
Economy	3.32	2.86	4.54	1.67	3.24
ICT	3.89	2.37	6.06	2.43	3.81

Where the two countries differed was in the magnitude of their GDP growth. Growth in the U.S. was greater in nearly all sectors and periods. The average growth in Canada was 2.76%, whereas the U.S. maintained 3.24%. The U.S. tertiary sector saw 3.47% growth, while in Canada, it was only 2.87%. The exception was the primary sector, which grew twice as much in Canada (1.80%) than in the U.S. (0.95%). The computer and electronic product industry grew by a substantial 6.12% per year in Canada, but an astounding 19.69% in the U.S. At approximately 3.80%, ICT-intensive industries in both countries had the greatest

growth of all. A slump occurred during 2000-2003, reducing gains from the 1995-2000 period by at least two percentage points.

4.2 GDP Per Hour (GDP-H)

For each method, GDP-H growth patterns generally matched those of GDP (see tables 4.4, 4.5, 4.6, and 4.7). There was rising GDP-H growth from 1987 to 2000, after which the U.S. continued its climb from 2.26% (2.51% for the logarithmic method) to 2.65% (2.58%), but Canada faltered sharply from 1.95% (2.18%) to 1.08% (1.11%). Nearly all sectors followed the patterns of their respective countries. Except for the primary sector, U.S. GDP-H consistently surpassed Canadian growth (see appendixes 3 and 4 for all per hour growth rates by industry).

Table 4.4 Average annual GDP-H growth (%), direct method, Canada.

GDP Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	2.42	3.08	3.2	1.81	2.75
Secondary	0.28	4.17	3.74	-1.87	2.14
Tertiary	0.19	0.64	1.45	1.80	1.02
Economy	0.43	1.56	1.95	1.08	1.38
ICT	0.21	2.25	2.75	1.24	1.83

Table 4.5 Average annual GDP-H growth (%), direct method, United States.

GDP Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	1.56	2.58	0.74	-1.53	1.03
Secondary	1.63	3.96	3.75	4.08	3.48
Tertiary	1.42	0.94	2.10	2.38	1.66
Economy	1.49	1.72	2.26	2.65	2.02
ICT	2.32	1.35	3.56	5.10	2.92

Table 4.6 Average annual GDP-H growth (%), logarithmic method, Canada.

GDP Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	2.40	2.96	2.99	1.77	2.43
Secondary	0.29	3.84	4.19	-1.89	2.29
Tertiary	0.20	0.67	1.64	1.87	1.34
Economy	0.46	1.58	2.18	1.11	1.67
ICT	0.22	2.3	3.26	1.28	2.38

Table 4.7 Average annual GDP-H growth, logarithmic method, United States.

GDP Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	1.56	2.40	0.78	-1.54	1.02
Secondary	1.65	3.90	4.04	3.57	3.30
Tertiary	1.53	1.02	2.36	2.38	2.12
Economy	1.57	1.81	2.51	2.58	2.37
ICT	3.89	2.37	6.06	2.43	3.81

However, GDP-H differed from GDP in two respects. First of all, GDP-H growth was generally lower. Compare 1987-2003 Canadian GDP at 2.76% with GDP-H at 1.38% (1.67%), and similarly, 3.24% with 2.02% (2.37%) for the U.S. Secondly, the sectors with high GDP growth did not repeat their performance with GDP-H. For instance, the Canadian tertiary sector had the highest GDP gains (2.87%) despite having the lowest GDP-H growth (1.02% and 1.34%). A similar experience occurred with the U.S. tertiary sector (3.47% GDP versus GDP-H growth of 1.66% and 2.12%).

4.3 Aggregate Depreciation (D)

In 2003, the manufacturing and primary sectors had disproportionately large shares of depreciation compared to their output. For instance, while the Canadian primary sector accounted for 6.31% of GDP, it accounted for 18.34% of depreciation, which was nearly three times its GDP share. The tertiary sectors' depreciation shares underwent a dramatic expansion during 1987-2003, while those of the secondary and primary sectors shrank (see table 4.8). Their shares increased by 11.78 percentage points in Canada and 17.28 percentage points in the U.S.

Table 4.8 Sector shares of depreciation (%), Canada and United States.

Depreciation Share	Canada			United States		
	1987 Share	2003 Share	Difference	1987 Share	2003 Share	Difference
Primary	25.26	18.34	-6.92	7.78	4.41	-3.37
Secondary	20.10	15.24	-4.86	31.51	28.02	-3.49
Tertiary	54.65	66.43	11.78	52.54	69.82	17.28

Depreciation imitated GDP growth in a couple of ways (see tables 4.9 and 4.10). To begin with, the growth rates of the tertiary sectors and the ICT-intensive industries were the highest in both countries. In Canada, depreciation grew at an average annual rate of 5.23% in the tertiary sector, compared to 3.95% for the economy as a whole. In the U.S., tertiary sector depreciation grew at 6.64%, while the depreciation rate for the economy grew at only 4.76%. Furthermore, U.S. depreciation grew faster, with the exceptions of the Canadian primary sector and the ICT-intensive industries.

Table 4.9 Average annual depreciation growth (%), Canada.

Depreciation	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-2.80	-0.49	5.05	5.59	1.89
Secondary	6.34	0.42	3.33	-0.86	2.17
Tertiary	6.75	3.15	6.54	5.03	5.23
Economy	4.41	1.88	5.67	4.14	3.95
ICT	11.35	3.6	9.29	4.15	6.89

Table 4.10 Average annual depreciation growth (%), United States.

Depreciation	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-7.42	5.76	3.85	-2.02	1.11
Secondary	-0.56	3.9	7.02	3.81	3.99
Tertiary	1.5	2.86	6.47	19.26	6.64
Economy	-0.07	2.72	5.5	12.15	4.76
ICT	1.4	2.73	8.86	6.23	5.01

4.4 Depreciation Per Hour (D-H)

Like GDP-H, D-H grew at a slower pace than its aggregate counterpart (see tables 4.11, 4.12, 4.13, and 4.14). Yet D-H exceeded GDP-H, and American D-H was usually higher. Canada experienced D-H growth of 2.56% (3.05%), whereas GDP-H grew by only 1.38% (1.67%). In the U.S., D-H grew by 3.51% (4.07%), surpassing its GDP-H of 3.24% (2.37%). Growth rates rose over successive time periods, coinciding with the patterns of GDP and ICT investment growth. Notice how the tertiary sector was the D-H growth leader in both countries.

Table 4.11 Average annual D-H growth (%), direct method, Canada.

Depreciation Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-2.51	0.30	6.58	6.57	2.84
Secondary	5.15	2.19	0.81	-1.22	1.66
Tertiary	4.14	2.12	3.87	3.71	3.34
Economy	2.39	1.61	3.26	3.14	2.56
ICT	8.84	3.12	5.41	3.09	4.88

Table 4.12 Average annual D-H growth (%), direct method, United States.

Depreciation Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-7.42	7.38	2.70	-2.24	1.19
Secondary	-0.83	4.24	5.33	8.72	4.43
Tertiary	-0.94	1.11	3.90	19.19	4.77
Economy	-1.85	1.58	3.19	13.23	3.51
ICT	-0.13	1.71	6.29	9.00	4.11

Table 4.13 Average annual D-H growth (%), logarithmic method, Canada.

Depreciation Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-2.49	0.29	6.17	6.40	2.51
Secondary	5.32	2.01	0.92	-1.23	1.78
Tertiary	4.45	2.23	4.35	3.85	4.18
Economy	2.53	1.63	3.63	3.23	3.05
ICT	9.41	3.19	6.36	3.18	6.02

Table 4.14 Average annual D-H growth (%), logarithmic method, United States.

Depreciation Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	-7.42	6.91	2.84	-2.25	1.18
Secondary	-0.83	4.18	5.72	7.67	4.21
Tertiary	-1.01	1.21	4.37	19.22	5.81
Economy	-1.95	1.66	3.54	12.90	4.07
ICT	-0.13	1.79	6.99	8.38	4.55

4.5 Aggregate Net Domestic Product (NDP)

Despite the growth of GDP and depreciation, the composition of NDP changed little in either country during 1987-2003 (see table 4.15). They looked similar to those of GDP, where the tertiary sectors dominated and the shares of the other sectors were considerably smaller.

Table 4.15 Sector shares of NDP (%), Canada and United States.

NDP	Canada			United States		
Share	1987 Share	2003 Share	Difference	1987 Share	2003 Share	Difference
Primary	4.96	4.35	-0.61	2.89	2.05	-0.83
Secondary	18.12	18.53	0.41	14.37	13.81	-0.56
Tertiary	76.92	77.12	0.20	77.15	78.60	1.44

In terms of growth, NDP lagged behind GDP, while the tertiary sectors dominated once again (see tables 4.16 and 4.17). In nearly every instance, GDP exceeded NDP growth. Compare the Canadian economy's GDP growth of 2.76% to its NDP growth of 2.58%, or similarly in the U.S., 3.24% to 3.07%. The only exception was Canada's secondary sector, which had GDP growth of 2.66% and NDP growth of 2.73%. In addition, the tertiary sectors had remarkable NDP growth in Canada (2.60%) and the U.S. (3.19%). The ICT-intensive industries also had substantial growth, with 3.42% in Canada and 3.62% in the U.S. Again, the average annual rates of both services and ICT-intensive industries surpassed that of their economies (2.58% and 3.07%, respectively), the primary sector was the only Canadian sector which outperformed its American counterpart.

Table 4.16 Average annual NDP growth (%), Canada.

NDP	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	5.17	3.61	0.13	-1.91	1.75
Secondary	0.65	2.68	6.76	-1.61	2.73
Tertiary	2.30	1.49	3.76	2.84	2.60
Economy	2.15	1.82	4.13	1.73	2.58
ICT	1.66	2.63	6.16	2.02	3.42

Table 4.17 Average annual NDP growth (%), United States.

NDP	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	3.76	0.00	1.33	-1.10	0.90
Secondary	2.44	3.57	5.07	-1.68	2.81
Tertiary	4.09	2.67	4.50	1.01	3.19
Economy	3.66	2.87	4.45	0.55	3.07
ICT	4.23	2.33	5.66	1.81	3.62

4.6 NDP Per Hour (NDP-H)

GDP-H usually exceeded NDP-H growth, but otherwise, their patterns mirrored one another, regardless of whether NDP-H was calculated by the direct or the logarithmic method (see tables 4.18, 4.19, 4.20, and 4.21). According to the direct method, Canadian GDP-H growth was 1.38%, whereas for NDP-H, it was only 1.21%. Likewise, U.S. GDP-H of 2.02% exceeded NDP-H of 1.84%. Again, ICT-intensive industries maintained above-average gains, with 1.48% (1.74%) in Canada and 2.73% (3.05%) in the U.S. U.S. growth was higher in nearly every sector and period, except for the primary sector (although the differences were rarely greater than one percentage point). The period of 1995-2000 saw high welfare gains, during which Canadian and U.S. growth rates reached peaks of 1.76% (1.96%) and 2.17% (2.41%), respectively.

Table 4.18 Average annual NDP-H growth (%), direct method, Canada.

NDP Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	5.49	4.43	1.58	-1.01	2.69
Secondary	-0.47	4.49	4.16	-1.96	2.21
Tertiary	-0.20	0.48	1.16	1.54	0.76
Economy	0.17	1.55	1.76	0.76	1.21
ICT	-0.63	2.15	2.40	0.98	1.48

Table 4.19 Average annual NDP-H growth (%), direct method, United States.

NDP Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	3.76	1.53	0.21	-1.32	0.99
Secondary	2.17	3.90	3.41	2.97	3.25
Tertiary	1.58	0.93	1.97	0.95	1.38
Economy	1.82	1.73	2.17	1.52	1.84
ICT	2.66	1.31	3.17	4.47	2.73

Table 4.20 Average annual NDP-H growth (%), logarithmic method, Canada.

NDP Per Hour	Canada				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	5.11	4.11	1.25	-1.47	2.39
Secondary	-0.53	4.15	4.64	-1.98	2.37
Tertiary	-0.24	0.49	1.29	1.59	0.91
Economy	0.17	1.57	1.96	0.77	1.44
ICT	-0.81	2.19	2.81	0.99	1.74

Table 4.21 Average annual NDP-H growth (%), logarithmic method, United States.

NDP Per Hour	United States				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Primary	3.45	1.27	0.17	-1.31	0.98
Secondary	2.16	3.85	3.65	2.46	3.08
Tertiary	1.70	1.01	2.21	0.25	1.75
Economy	1.90	1.82	2.41	1.14	2.18
ICT	2.78	1.37	3.51	4.08	3.05

CHAPTER 5: ANALYSIS

5.1 The Overestimation of Welfare Growth

If we define a welfare overestimate as the excess of GDP over NDP growth, then in both countries, there were overestimates at both aggregate and per hour levels. GDP consistently exceeded NDP during 1987-2003 for nearly all sectors. The tertiary sectors had the largest overestimates, and Canada had larger overestimates than the U.S.

At the aggregate level, GDP exceeded NDP growth (see tables 5.1 and 5.2). The tertiary sectors had the largest overestimates in their respective countries. For instance, in Canada, the economy-wide overestimate was 6.75%, whereas the tertiary sector had 10.34%. Likewise, in the U.S., the tertiary sector had 8.88%, while the economy had only 5.68%. The U.S. had greater overestimates in the primary and secondary sectors, but Canada had greater overestimates in the tertiary sector, ICT-intensive industries, and the overall economy.

Table 5.1 Aggregate overestimates (%), 1987-2003, Canada.

Aggregate	Canada			
Overestimate	GDP	NDP	Difference	Proportion
Primary	1.80	1.75	0.06	3.36
Secondary	2.66	2.73	-0.07	-2.52
Tertiary	2.87	2.60	0.27	10.34
Economy	2.76	2.58	0.17	6.75
ICT	3.78	3.42	0.36	10.47

Table 5.2 Aggregate overestimates (%), 1987-2003, United States.

Aggregate	United States			
Overestimate	GDP	NDP	Difference	Proportion
Primary	0.95	0.90	0.05	5.00
Secondary	3.05	2.81	0.23	8.19
Tertiary	3.47	3.19	0.28	8.88
Economy	3.24	3.07	0.17	5.68
ICT	3.81	3.62	0.19	5.26

The two NDP-H calculation methods produce overestimate figures that are similar and consistent (see tables 5.3, 5.4, 5.5, and 5.6). There are two significant findings: Canada had larger overestimates than the U.S., and the tertiary sectors' welfare gains were substantially overestimated by GDP-H. The Canadian economy had an NDP-H rate of 1.21% (1.44%), whereas the U.S. had 1.84% (2.18%). All this resulted in a higher average annual welfare overestimate for Canada at 14.27% (15.73%), compared to only 9.35% (8.93%) in the U.S. Furthermore, despite being the largest sectors with the fastest aggregate growth, the tertiary sectors had double-digit welfare overestimates. In Canada, the overestimate was 34.69% (47.03%), while in the U.S., it was 20.16% (21.49%).

Table 5.3 Per hour overestimates (%), direct method, 1987-2003, Canada.

Per Hour	Canada			
Overestimate	GDP	NDP	Difference	Proportion
Primary	2.75	2.69	0.06	2.20
Secondary	2.14	2.21	-0.07	-3.10
Tertiary	1.02	0.76	0.26	34.69
Economy	1.38	1.21	0.17	14.27
ICT	1.83	1.48	0.35	23.75

Table 5.4 Per hour overestimates (%), direct method, 1987-2003, United States.

Per Hour	United States			
Overestimate	GDP	NDP	Difference	Proportion
Primary	1.03	0.99	0.05	4.57
Secondary	3.48	3.25	0.23	7.13
Tertiary	1.66	1.38	0.28	20.16
Economy	2.02	1.84	0.17	9.35
ICT	2.92	2.73	0.19	6.91

Table 5.5 Per hour overestimates (%), logarithmic method, 1987-2003, Canada.

Per Hour	Canada			
Overestimate	GDP	NDP	Difference	Proportion
Primary	2.43	2.39	0.04	1.80
Secondary	2.29	2.37	-0.08	-3.24
Tertiary	1.34	0.91	0.43	47.03
Economy	1.67	1.44	0.23	15.73
ICT	2.38	1.74	0.64	36.84

Table 5.6 Per hour overestimates (%), logarithmic method, 1987-2003, United States.

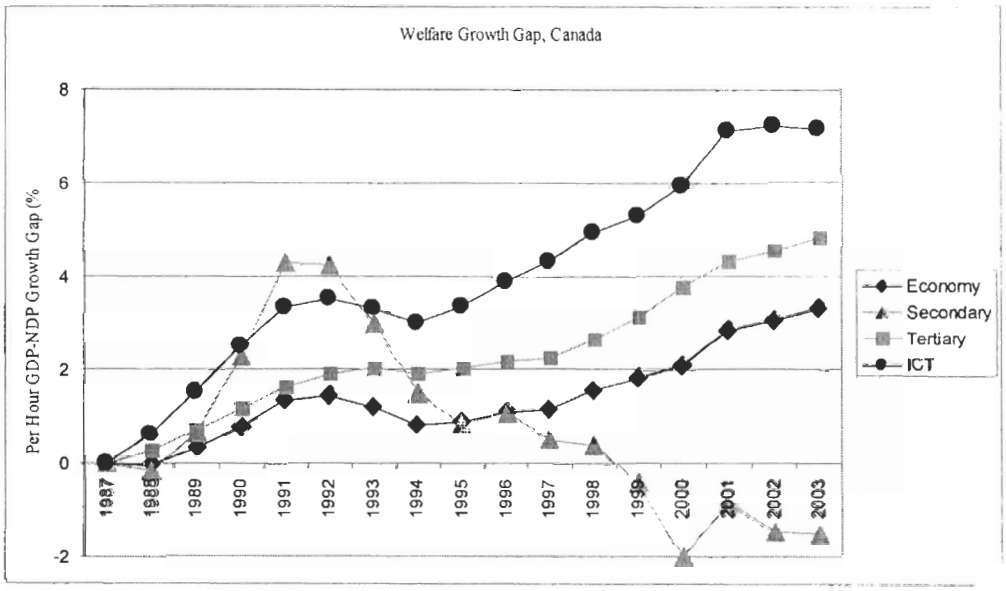
Per Hour	United States			
Overestimate	GDP	NDP	Difference	Proportion
Primary	1.02	0.98	0.04	4.38
Secondary	3.30	3.08	0.22	7.24
Tertiary	2.12	1.75	0.38	21.49
Economy	2.37	2.18	0.19	8.93
ICT	3.81	3.05	0.76	24.84

The gap between GDP-H and NDP-H has been steadily growing since 1987 (see figures 5.1 and 5.2).[7] By 2003, the gap increased to 3.33% in Canada and 3.67% in the U.S. (for all percentages, see appendix 5), and this trend is

[7] The primary sectors are not shown due to their widely erratic patterns.

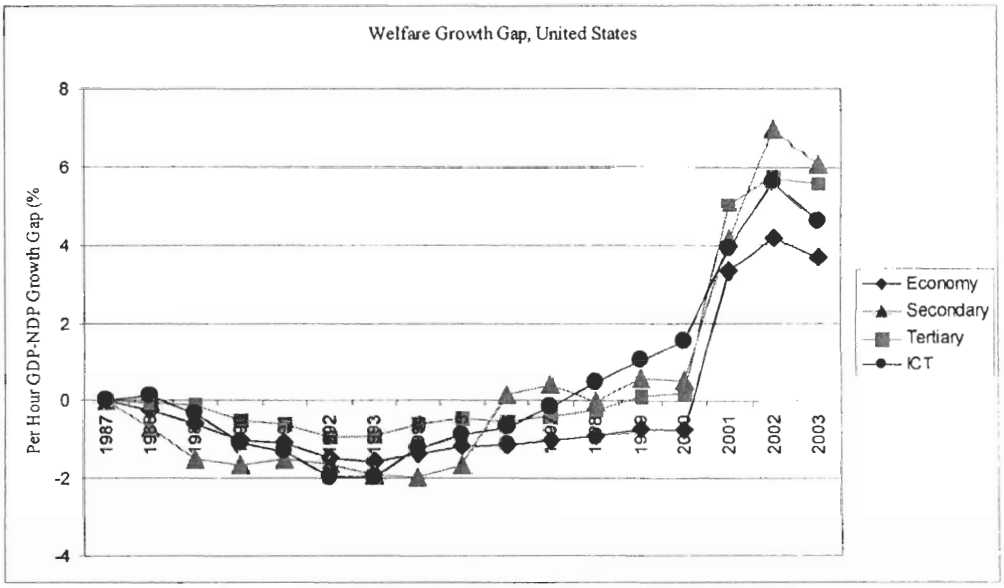
corroborated by the divergence between productivity and real wage growth.[8] However, the countries differed in growth trends and leaders. The gap grew steadily in Canada, but declined in the U.S during the mid-1990s (a period when NDP-H was greater than GDP-H) prior to a dramatic rise in 2001, followed by a dip in 2003. The gap leaders in Canada were the tertiary sector and the ICT-intensive industries. In the U.S., the leaders were the secondary and tertiary sectors.

Figure 5.1 Welfare growth gap (%), direct method, 1987-2003, Canada.



[8] The divergence began in the early 1980s, and has been widening ever since. However, Sullivan (1997) partially attributes the gap to changes in the relative prices of goods.

Figure 5.2 Welfare growth gap (%), direct method, 1987-2003, United States.



5.2 The Effect on Welfare Growth

Despite rising depreciation throughout the economy, it is premature to conclude that welfare growth will diminish. The economy's shift towards services, the tertiary sectors' rapid growth in GDP relative to NDP, depreciation's increasing shares of capital and NDP, and the persistence of depreciation during downturns all indicate the arrival of high depreciation. These four developments are remarkable, but it must be remembered that depreciation is not the sole determinant of welfare gains.

Recall that both countries were – and continue to be – dominated by their tertiary sectors. These sectors had the strongest aggregate GDP gains, with average annual growth rates of 2.76% in Canada and 3.24% in the U.S. While GDP composition was stable in Canada, the U.S. saw a shrinking primary sector

whose share was absorbed by the tertiary sector. During 1987-2003, there was clearly a shift towards services that coincided with depreciation growth.

Furthermore, aggregate and per hour depreciation growth consistently outpaced GDP and NDP growth during this time. Not only this, depreciation was substantially larger than output growth, regardless of the method used to calculate NDP. Aggregate depreciation grew at an average annual rate of 3.95% in Canada and 4.76% in the U.S., while aggregate GDP grew at only 2.76% and 3.24%, respectively. Aggregate NDP growth was even lower at 2.58% in Canada and 3.07% in the U.S. At the per hour level, Canada experienced D-H growth of 2.56%, whereas GDP-H and NDP-H grew by only 1.38% (1.67%) and 1.21% (1.44%), respectively (see table 5.7 and 5.8, where GDP-D and NDP-D refer to the direct method, GDP-L and NDP-L refer to the logarithmic method, and D refers to depreciation). Similarly, in the U.S., D-H grew at 3.51%, surpassing GDP-H growth of 2.02% (2.37%) and NDP-H growth of 1.84% (2.18%). In both countries, D-H grew the most in the tertiary sectors. As such, depreciation grew at nearly twice the rate of welfare.

Table 5.7 Per hour growth comparisons (%), 1987-2003, Canada.

Per Hour Growth	Canada				
	GDP-D	GDP-L	NDP-D	NDP-L	D
Primary	2.75	2.43	2.69	2.39	2.84
Secondary	2.14	2.29	2.21	2.37	1.66
Tertiary	1.02	1.34	0.76	0.91	3.34
Economy	1.38	1.67	1.21	1.44	2.56
ICT	1.83	2.38	1.48	1.74	4.88

Table 5.8 Per hour growth comparisons (%), 1987-2003, United States.

Per Hour Growth	United States				
	GDP-D	GDP-L	NDP-D	NDP-L	D
Primary	1.03	1.02	0.99	0.98	1.19
Secondary	3.48	3.30	3.25	3.08	4.43
Tertiary	1.66	2.12	1.38	1.75	4.77
Economy	2.02	2.37	1.84	2.18	3.51
ICT	2.92	3.81	2.73	3.05	4.11

Depreciation, as shares of capital and NDP, grew in both Canada and the U.S., although Canada saw higher rates in all sectors and periods (see tables 5.9 and 5.10). Over the 1987-2003 period, Canadian D-K grew at a rate of 2.02%, whereas American D-K grew at 1.94% (for all depreciation share growth rates by industry, see appendixes 6 and 7). Despite having slightly different depreciation rates between them, the 2003 D-K ratio was 15.30% in Canada and 4.54% in the U.S. Furthermore, Canada had a higher D-NDP ratio at 16.31%, whereas the U.S. had only 13.21%. Regardless of country, there was a steady rise in depreciation shares among all sectors.

Table 5.9 Depreciation shares of capital (%), Canada and United States.

D/K	Canada			United States		
	1987 Ratio	2003 Ratio	Difference	1987 Ratio	2003 Ratio	Difference
Primary	14.16	14.13	-0.03	6.17	4.22	-1.95
Secondary	14.14	18.64	4.50	11.93	16.24	4.31
Tertiary	9.41	15.03	5.61	1.79	3.66	1.87
Economy	11.10	15.30	4.20	3.34	4.54	1.21
ICT	9.38	16.35	6.97	2.35	3.99	1.65

Table 5.10 Depreciation shares of NDP (%), Canada and United States.

D/NDP	Canada			United States		
	1987 Ratio	2003 Ratio	Difference	1987 Ratio	2003 Ratio	Difference
Primary	67.16	68.71	1.55	27.44	28.36	0.91
Secondary	14.63	13.41	-1.22	22.33	26.80	4.46
Tertiary	9.37	14.05	4.68	6.93	11.73	4.80
Economy	13.19	16.31	3.12	10.18	13.21	3.02
ICT	8.91	15.10	6.19	14.30	17.71	3.41

Depreciation growth also appears to be immune to an economic downturn. In the 2000-2003 recession, there was a noticeable drop in average annual aggregate and per hour GDP and NDP increases (see table 5.11). The aggregate GDP and NDP gains were half of those of the 1995-2000 period. In Canada, GDP-H fell from 1.95% in 1995-2000 to 1.08% in 2000-2003, while NDP-H fell from 1.76% to 0.76%. While the U.S. experienced a rise in GDP-H from 2.26% to 2.65%, there was a decline in NDP-H from 2.17% to 1.52%. Remarkably, depreciation maintained its pace throughout this period. In Canada, D-H fell somewhat from 3.26% to 3.14%, whereas the U.S. saw a dramatic leap from 3.19% to 13.23%. The persistence of depreciation suggests that it is a resilient, if not permanent, part of the new economy.

Table 5.11 Aggregate and per hour growth comparisons (%), Canada and United States.

Growth	Canada			United States		
	Pre-2000	Post-2000	Difference	Pre-2000	Post-2000	Difference
GDP	2.92	2.06	-0.86	3.61	1.67	-1.94
NDP	2.78	1.73	-1.04	3.66	0.55	-3.11
D	3.91	4.14	0.24	3.12	12.15	9.03
GDP-H	1.45	1.08	-0.37	1.87	2.65	0.78
NDP-H	1.31	0.76	-0.55	1.92	1.52	-0.40
D-H	2.42	3.14	0.72	1.39	13.23	11.84

While depreciation has been growing, its effect on welfare growth is arguably limited. Reasons include the small magnitude of per hour depreciation relative to output, the limited fraction of capital that is depreciation, and the human capital basis of the service economy. First of all, depreciation levels are simply too small to significantly threaten welfare gains. In 2003, Canadian D-H was $4.81, while NDP-H was $29.54.[9] Moreover, rising depreciation has been more than offset by rising output (that is, one-percent of output is far greater than one-percent of depreciation in dollars). Even with depreciation's high growth rate, its small magnitude prevents it from achieving a magnitude comparable to that of either GDP or NDP. Second, while depreciation shares of capital have grown since 1987, the understanding of depreciation and its relationships with output levels, asset composition, industry composition, and semiconductor prices is limited at best. Finally, although ICT is a critical component of the tertiary sector, it is ultimately human capital that generates the vast majority of value.[10] Overall,

[9] If D-H maintained its average annual growth of 2.56% and NDP-H did not grow at all, it would take at least seventy-two years for D-H to match current NDP-H in Canada.

[10] Arrazola and De Havia (2004) claim that human capital depreciate at annual rates of 1.0% to 1.5%. This is still substantially lower than the rates of most physical capital.

it is far from certain whether depreciation growth will hamper welfare growth in the long run.

5.3 Policy Implications

Higher NDP productivity growth is desirable, but questions surround the appropriate policy action. Should depreciation growth be reduced? Should the policy focus on certain industrial sectors or the economy as a whole? Should the objective be achieved through tax incentives, accounting regulation changes, or government spending? The output growth differential may not even be substantial enough to warrant policy action. Worse yet, how particular industries attained high NDP productivity growth is not entirely understood. Hence, at this stage, it remains uncertain whether policy action is necessary or even benign.

Certain policies can be ruled out, though. Discouraging ICT capital investment is not feasible because it is a cornerstone of the economy. It would be superficial to revise accounting regulations since capital replacement rates would not be affected, and this would result in inefficient investments. What remains is a policy that encourages investment in longer-lived capital assets to slow the rapidity of asset replacement. Unfortunately, it is not known whether longer-lived assets are necessarily the most efficient ones. Indeed, it needs to be reiterated that the relationship between depreciation and gross output productivity remains unclear, and hence too many uncertainties abound to have confidence in any policy at this point.

CHAPTER 6: CONCLUSION

In this study, NDP-H growth was calculated to conform the practice of growth accounting to its theoretical dictates. According to the economics literature, social welfare ought to be measured using NDP, and in turn, NDP-H growth should be used to assess the rise in living standards. Following Baker (2006), NDP-H growth was calculated at the industry- and sector levels for Canada and the U.S. using both direct and logarithmic methods. The results produced were consistent with one another, and it was clear that depreciation was substantially outgrowing both GDP and NDP at the aggregate and per hour levels. However, no definite conclusion could be drawn regarding the fate of future welfare growth.

This study was limited by the reduction of depreciation to an unexamined object. Left unaccounted for were the nature of depreciation – its relationships to output size, asset composition, and industry type – and the specific depreciation rates in each country that accompany the multitude of asset categories. Depreciation was taken as an exogenous entity, treated simply as a detriment to welfare, and hence considerably restricting the analysis. Undoubtedly, this deficiency shall be overcome in future studies that capture more of the essence of depreciation, and apply more robust methods of calculating NDP-H, not only to North American welfare, but to those of Europe and Asia as well.

APPENDICES

Appendix A: Listing of Industries

All Industries
Agriculture, Forestry, Fishing & Hunting
Mining, Oil & Gas
Food, Drink & Tobacco
Textiles
Clothing
Wood Products
Pulp & Paper Products
Printing & Publishing
Petroleum & Coal
Chemical
Plastics & Rubber
Nonmetallic Mineral Products
Primary Metal & Fabricated Metal Products
Machinery
Computer & Electronic Product
Electrical Equipment, Appliance & Component
Transportation Equipment Manufacturing
Furniture and Related Product Manufacturing
Miscellaneous Manufacturing
Utilities
Construction
Wholesale Trade
Retail Trade
Accommodation & Food
Transportation & Warehousing
Information & Culture
Monetary Authorities & Depository Credit Intermediation
Other Finance, Insurance & Real Estate, & Management of Companies
Professional, Scientific & Technical Services
Administrative & Support, Waste Management & Remediation
Education Services
Healthcare & Social Assistance
Other Services

Primary Sector (Natural Resources)
Agriculture, Forestry, Fishing & Hunting
Mining, Oil & Gas

Secondary Sector(Manufacturing)
Food, Drink & Tobacco
Textiles
Clothing
Wood Products
Pulp & Paper Products
Printing & Publishing
Petroleum & Coal
Chemical
Plastics & Rubber
Nonmetallic Mineral Products
Primary Metal & Fabricated Metal Products
Machinery
Computer & Electronic Product
Electrical Equipment, Appliance & Component
Transportation Equipment Manufacturing
Furniture and Related Product Manufacturing
Miscellaneous Manufacturing
Construction

Tertiary Sector(Service)
Wholesale Trade
Retail Trade
Accommodation & Food
Transportation & Warehousing
Information & Culture
Monetary Authorities & Depository Credit Intermediation
Other Finance, Insurance & Real Estate, & Management of Companies
Professional, Scientific & Technical Services
Administrative & Support, Waste Management & Remediation
Education Services
Healthcare & Social Assistance
Other Services
Utilities

ICT-Intensive Industries
Pulp & Paper Products
Printing & Publishing
Machinery
Computer & Electronic Product
Electrical Equipment, Appliance & Component
Transportation Equipment Manufacturing
Furniture and Related Product Manufacturing
Miscellaneous Manufacturing
Wholesale Trade

Retail Trade
Information & Culture
Monetary Authorities & Depository Credit Intermediation
Other Finance, Insurance & Real Estate, & Management of Companies
Professional, Scientific & Technical Services
Administrative & Support, Waste Management & Remediation

Appendix B: Aggregate Growth Rates

Canada	Gross Output					Depreciation					Net Output				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	3.33	-0.01	1.76	-1.89	0.80	-6.37	-3.05	0.99	-0.24	-1.92	6.86	0.78	1.93	-2.26	1.67
Mining, Oil & Gas	1.21	3.90	1.69	2.59	2.46	-1.29	0.42	6.23	6.95	3.08	3.42	6.41	-1.49	-1.58	1.82
Food, Drink & Tobacco	-0.40	1.39	1.74	1.07	1.10	3.67	2.05	3.45	0.05	2.41	-0.77	1.32	1.56	1.18	0.93
Textiles	-4.90	-0.37	4.05	-5.61	-0.89	3.02	0.17	2.33	-5.06	0.36	-5.95	-0.45	4.35	-5.70	-1.06
Clothing	-2.83	-0.67	4.07	-4.39	-0.34	3.34	4.80	3.33	-5.50	2.07	-3.09	-0.87	4.10	-4.35	-0.42
Wood Products	-2.09	-0.23	8.15	1.98	2.38	9.35	2.64	3.49	-2.55	3.13	-3.30	-0.64	8.82	2.50	2.30
Pulp & Paper Products	-1.13	1.71	2.60	-0.54	1.02	14.84	-1.53	-1.95	-5.28	0.48	-7.18	3.40	4.42	0.92	1.18
Printing & Publishing	5.59	-6.11	3.24	0.44	0.13	10.74	6.75	5.05	2.81	6.20	5.23	-7.43	2.95	0.03	-0.54
Petroleum & Coal	7.07	0.28	1.16	4.52	2.59	2.91	-3.31	-1.34	10.74	0.98	18.21	6.30	4.00	-2.34	6.00
Chemical	3.26	2.31	3.31	3.48	3.02	-0.30	-0.67	2.62	-0.57	0.43	4.10	2.92	3.44	4.16	3.53
Plastics & Rubber	0.78	6.66	8.20	2.31	5.18	9.99	2.70	6.59	1.29	4.97	-0.28	7.17	8.38	2.42	5.20
Nonmetallic Mineral Products	-3.19	-3.68	7.80	4.31	1.37	5.78	-3.49	5.36	0.07	1.60	-4.41	-3.71	8.19	4.91	1.34
Primary Metal & Fabricated Metal Products	0.18	1.68	8.52	-0.57	3.05	3.82	-2.45	4.35	-3.66	0.56	-0.57	2.52	9.20	-0.15	3.45
Machinery	3.58	6.48	4.84	-1.95	3.80	4.72	4.19	6.93	-0.96	4.15	3.52	6.62	4.72	-2.01	3.78
Computer & Electronic Product	6.39	9.07	18.24	-15.56	6.12	6.44	1.19	12.57	1.83	5.74	6.39	10.03	18.72	-17.10	6.18
Electrical Equipment, Appliance & Component	-0.41	-3.55	8.91	-9.70	-0.45	4.42	-0.25	5.49	0.40	2.51	-0.71	-3.80	9.17	-10.51	-0.68
Transportation Equipment Manufacturing	6.00	5.33	6.20	-3.33	4.04	7.96	5.19	4.66	0.37	4.61	5.69	5.36	6.44	-3.91	3.95
Furniture and Related Product Manufacturing	-0.71	1.03	12.43	-2.12	3.50	5.01	2.64	14.65	2.83	6.75	-0.90	0.97	12.33	-2.35	3.37
Miscellaneous Manufacturing	3.62	0.98	9.11	3.73	4.10	3.21	5.96	6.66	-2.94	3.93	1.54	0.69	9.27	4.11	4.11
Utilities	-0.73	2.13	1.17	0.90	1.06	1.90	1.96	-0.22	-0.06	0.88	-2.54	2.25	2.15	1.52	1.17
Construction	2.87	-3.98	4.43	4.84	1.51	5.59	2.09	3.80	6.78	4.15	2.75	-4.50	4.47	4.72	1.38
Wholesale Trade	5.35	3.05	6.72	3.91	4.78	6.97	9.63	11.53	6.77	9.17	5.29	2.77	6.44	3.72	4.56
Retail Trade	-0.76	1.43	3.30	5.19	2.29	6.98	8.99	6.23	8.50	7.63	-1.06	1.04	3.10	4.95	2.00
Accommodation & Food	3.48	-1.03	3.29	0.32	1.40	11.16	2.67	0.35	3.52	3.63	3.05	-1.28	3.51	0.10	1.26
Transportation & Warehousing	2.05	2.63	3.99	1.02	2.64	3.17	2.54	7.19	2.49	4.08	1.79	2.65	3.17	0.59	2.26
Information & Culture	7.22	2.09	8.86	4.86	5.65	9.14	6.82	8.02	3.67	7.03	6.75	0.74	9.13	5.24	5.28
Monetary Authorities & Depository Credit Intermediation	4.50	3.68	5.37	2.34	4.11	15.86	-2.16	14.20	4.03	7.22	-0.14	6.40	1.30	1.21	2.57
Other Finance, Insurance & Real Estate, & Management of Companies	-9.58	3.97	5.03	6.79	2.12	11.60	10.85	16.58	4.33	11.48	-9.77	3.86	5.76	6.86	1.97
Professional, Scientific & Technical Services	4.33	2.93	11.71	3.23	5.82	17.87	22.26	25.28	10.69	19.49	4.11	2.34	10.98	2.54	5.34
Administrative & Support, Waste Management & Remediation	7.71	2.21	1.42	5.59	3.62	10.36	8.11	7.39	11.60	8.95	7.65	2.05	1.20	5.42	3.44
Education Services	0.19	1.21	-0.03	1.13	0.61	3.26	4.71	5.17	9.44	5.45	0.02	1.03	-0.43	0.31	0.24
Healthcare & Social Assistance	2.95	1.09	1.16	1.93	1.59	4.73	3.25	6.33	7.44	5.26	2.89	0.92	0.95	1.63	1.42
Other Services	2.33	0.67	7.31	4.21	3.69	8.33	5.75	13.72	9.68	9.42	2.05	0.38	6.84	3.69	3.30

United States	Gross Output					Depreciation					Net Output				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	1.45	-0.41	6.45	2.05	2.50	-3.30	4.87	9.92	3.09	4.48	2.43	-1.51	5.51	1.71	1.99
Mining, Oil & Gas	1.62	1.90	-1.10	-4.18	-0.26	-9.49	6.26	-0.10	-6.93	-1.34	4.65	0.91	-1.37	-3.44	0.05
Food, Drink & Tobacco	0.77	4.53	-2.39	-0.74	0.64	-4.63	-1.41	2.18	3.35	-0.05	1.61	5.24	-2.89	-1.28	0.74
Textiles	2.28	3.65	-0.67	-3.79	0.61	4.96	7.83	-3.48	8.87	3.82	2.01	3.16	-0.31	-5.46	0.20
Clothing	1.09	0.65	-4.44	-9.67	-2.89	2.12	2.68	1.84	4.41	2.63	0.95	0.54	-4.84	-10.96	-3.52
Wood Products	0.10	-2.53	0.65	-1.07	-0.72	1.98	-5.51	-3.60	-2.17	-2.92	-0.28	-1.71	1.31	-0.93	-0.36
Pulp & Paper Products	-0.36	0.57	-0.43	-2.14	-0.43	-2.25	2.03	0.30	4.05	1.05	0.01	0.29	-0.58	-3.56	-0.77
Printing & Publishing	3.29	0.04	0.12	-3.89	-0.09	3.25	-5.37	-1.24	0.60	-1.39	3.30	0.94	0.30	-4.49	0.14
Petroleum & Coal	-14.85	5.00	4.72	5.43	0.95	-26.51	7.85	-4.57	0.79	-4.62	-65.41	42.41	-210.71	17.23	-
Chemical	2.97	1.40	2.10	2.58	2.13	1.02	-0.12	3.64	-0.09	1.26	3.36	1.68	1.82	3.08	2.30
Plastics & Rubber	3.36	5.94	4.98	-1.88	3.65	3.63	7.02	9.20	0.60	5.81	3.34	5.83	4.54	-2.19	3.42
Nonmetallic Mineral Products	3.26	3.27	3.54	-0.37	2.66	3.19	1.02	6.95	6.21	4.22	3.27	3.67	2.93	-1.81	2.32
Primary Metal & Fabricated Metal Products	0.97	3.05	2.52	-4.73	0.89	-2.28	3.21	5.59	4.12	3.03	1.34	3.03	2.19	-5.94	0.71
Machinery	4.77	-0.34	1.09	-5.72	-0.03	1.37	0.26	8.80	-19.86	-1.17	5.51	-0.46	-0.96	-1.86	0.21
Computer & Electronic Product	10.89	18.16	37.33	4.96	19.69	11.43	23.45	34.79	8.44	21.48	10.79	17.02	37.94	4.15	19.30
Electrical Equipment, Appliance & Component	0.72	1.77	1.75	-0.33	1.17	-	-	-	-	-	0.72	1.77	1.75	-15.69	-1.96
Transportation Equipment Manufacturing	-2.49	-0.22	2.67	1.79	0.62	-1.65	6.67	5.85	1.47	3.83	-2.70	-2.31	1.30	1.93	-0.48
Furniture and Related Product Manufacturing	-3.20	2.20	3.75	-1.34	0.97	-5.36	3.66	6.20	-0.03	1.98	-3.08	2.12	3.61	-1.43	0.91
Miscellaneous Manufacturing	9.91	1.99	5.17	0.92	4.22	9.46	-2.68	5.36	27.70	7.32	9.95	2.33	5.15	-1.30	3.90
Utilities	5.31	2.12	1.28	1.95	2.42	2.60	-0.78	-1.59	8.22	1.23	6.38	3.11	2.09	0.24	2.85
Construction	1.63	-0.06	2.99	-1.29	0.97	-1.10	0.52	4.92	4.03	2.16	1.81	-0.08	2.87	-1.66	0.88
Wholesale Trade	2.60	4.32	7.15	3.35	4.68	3.90	10.15	8.38	9.27	8.24	2.50	3.83	7.03	2.68	4.35
Retail Trade	4.67	4.06	6.50	4.33	4.98	1.66	2.43	9.29	3.87	4.65	4.96	4.21	6.26	4.37	5.02
Accommodation & Food	2.22	1.47	3.86	0.85	2.23	-2.50	-1.85	4.58	15.22	2.70	2.49	1.63	3.83	0.22	2.20
Transportation & Warehousing	3.80	5.25	4.44	0.51	3.82	3.16	4.01	6.25	4.79	4.69	3.93	5.48	4.11	-0.38	3.64
Information & Culture	5.29	4.94	8.02	3.05	5.50	2.81	3.36	11.95	14.05	7.84	5.87	5.28	7.16	-0.09	4.94
Monetary Authorities & Depository Credit Intermediation	2.17	-1.12	1.46	7.72	1.92	3.71	1.43	6.89	-33.12	-4.24	1.91	-1.61	0.17	15.07	2.57
Other Finance, Insurance & Real Estate, & Management of Companies	3.53	2.32	5.39	0.15	3.08	0.33	-0.35	6.18	24.26	6.07	4.36	2.92	5.23	-6.86	1.98
Professional, Scientific & Technical Services	6.89	0.77	6.88	0.59	3.82	-0.36	0.94	11.51	-12.84	1.00	7.20	0.76	6.70	1.54	3.93
Administrative & Support, Waste Management & Remediation	7.13	3.90	4.11	1.52	4.11	0.19	2.63	10.62	-22.37	-0.74	7.78	4.00	3.54	3.46	4.45
Education Services	0.77	3.06	2.10	1.98	2.13	-9.58	5.63	9.69	-14.31	-0.18	0.92	3.03	1.98	7.24	2.16
Healthcare & Social Assistance	2.98	1.26	1.26	4.19	2.12	-5.90	-0.70	1.91	9.56	0.95	3.26	1.31	1.24	4.05	2.16
Other Services	3.86	1.11	0.05	0.20	1.12	4.78	3.33	4.82	-47.17	-8.24	3.71	0.75	-0.93	6.54	1.84

Appendix C: Per Hour Growth Rates – Direct Method

Canada	Gross Output Per Hour					Depreciation Per Hour					Net Output Per Hour				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	3.78	1.05	3.48	0.90	2.29	-5.96	-2.02	2.70	2.59	-0.48	7.33	1.84	3.66	0.52	3.17
Mining, Oil & Gas	1.99	3.94	2.49	-1.15	1.98	-1.41	0.45	7.06	3.05	2.60	3.30	6.45	-0.72	-5.17	1.35
Food, Drink & Tobacco	1.08	2.09	1.27	2.70	1.76	5.21	2.76	2.97	1.67	3.07	0.70	2.03	1.09	2.82	1.63
Textiles	-0.52	2.38	3.91	-5.40	0.80	7.76	2.93	2.19	-4.84	2.07	-1.63	2.29	4.18	-5.48	0.62
Clothing	0.72	3.44	1.31	0.88	1.78	7.11	9.13	0.59	-0.28	4.24	0.54	3.23	1.34	0.93	1.70
Wood Products	0.25	-1.13	4.99	4.76	2.11	11.96	1.71	0.47	0.14	2.86	-0.99	-1.54	5.64	5.31	2.03
Pulp & Paper Products	1.09	3.05	4.58	-0.73	2.43	17.43	-0.23	-0.06	-5.46	1.89	-5.09	4.77	6.43	0.73	2.59
Printing & Publishing	2.38	-2.67	1.69	3.08	0.69	7.38	10.66	3.47	5.50	6.79	2.03	-4.04	1.49	2.65	0.02
Petroleum & Coal	6.45	4.10	-2.65	5.64	2.65	2.52	0.37	-5.05	11.93	1.04	17.53	10.36	0.08	-1.29	6.07
Chemical	1.18	4.42	4.44	4.72	3.87	-2.30	1.37	3.74	0.62	1.26	2.01	5.04	4.56	5.41	4.39
Plastics & Rubber	-2.54	5.71	1.58	2.06	2.15	6.37	1.78	0.06	1.04	1.94	-3.56	6.21	1.74	2.17	2.17
Nonmetallic Mineral Products	-1.91	0.17	4.99	5.16	2.18	7.17	0.36	2.61	0.89	2.41	-3.15	0.14	5.37	5.76	2.15
Primary Metal & Fabricated Metal Products	-0.10	3.06	3.19	0.46	2.01	3.54	-1.13	-0.78	-2.67	-0.45	-0.85	3.91	3.83	0.88	2.41
Machinery	4.33	5.79	1.16	-1.04	2.76	5.48	3.52	3.18	-0.04	3.10	4.26	5.93	1.05	-1.11	2.73
Computer & Electronic Product	6.62	9.11	14.87	-13.57	5.68	6.67	1.22	9.36	4.24	5.30	6.62	10.07	15.34	-15.15	5.74
Electrical Equipment, Appliance & Component	1.06	4.00	6.97	-8.46	1.59	5.96	7.54	3.62	1.78	4.92	0.75	3.73	7.24	-9.28	1.66
Transportation Equipment Manufacturing	5.15	4.43	4.79	-2.29	3.38	7.09	4.29	3.27	1.45	3.95	4.84	4.45	5.03	-2.88	3.29
Furniture and Related Product Manufacturing	-0.12	2.82	4.63	-0.68	2.16	5.63	4.46	6.71	4.35	5.36	-0.31	2.75	4.55	-0.91	2.03
Miscellaneous Manufacturing	0.70	4.22	5.95	5.62	4.35	2.28	9.36	3.57	-1.18	4.18	0.62	3.92	6.11	6.01	4.36
Utilities	-5.27	1.28	2.31	-0.12	0.97	-2.77	1.11	0.99	-1.07	-0.10	-7.01	1.40	3.31	0.50	0.18
Construction	-1.61	-1.21	2.09	0.65	0.08	0.99	5.03	1.48	2.52	2.68	-1.73	-1.55	2.13	0.54	-0.05
Wholesale Trade	2.51	1.91	2.68	2.73	2.41	4.08	8.41	7.30	5.55	6.70	2.45	1.62	2.41	2.54	2.19
Retail Trade	-2.73	1.39	2.05	3.18	1.14	4.85	8.86	4.95	6.43	6.42	-3.02	1.01	1.85	2.92	0.85
Accommodation & Food	1.87	-0.97	0.69	-0.22	0.22	9.43	2.73	-2.18	2.96	2.42	1.45	-1.23	0.90	-0.45	0.08
Transportation & Warehousing	0.35	1.72	2.01	1.43	1.50	1.45	1.63	5.15	2.91	2.92	0.09	1.74	1.20	1.00	1.12
Information & Culture	4.66	1.55	6.75	3.57	4.11	6.55	6.25	5.93	2.39	5.47	4.21	0.21	7.02	3.95	3.75
Monetary Authorities & Depository Credit Intermediation	1.88	3.66	2.64	0.94	2.49	12.95	-2.17	11.24	2.60	5.56	-2.65	6.38	-1.52	-0.18	0.98
Other Finance, Insurance & Real Estate & Management of Companies	-11.85	3.17	1.49	3.34	-0.31	8.80	10.00	12.65	0.97	8.83	-12.04	3.07	1.23	3.42	-0.45
Professional, Scientific & Technical Services	-0.17	1.52	3.56	2.66	2.04	12.78	20.59	14.29	10.09	15.12	-0.38	0.94	2.88	1.98	1.49
Administrative & Support, Waste Management & Remediation	2.82	-1.83	-6.49	3.92	-1.42	5.35	3.84	-0.99	9.72	3.65	2.76	-1.98	-6.69	3.65	-1.59
Education Services	-2.08	-1.05	-0.52	1.18	-0.67	0.92	2.36	4.65	9.49	4.10	-2.25	-1.26	-0.92	0.36	-1.04
Healthcare & Social Assistance	0.55	-0.74	-1.35	-0.71	-0.69	2.29	1.47	3.69	4.65	2.91	0.49	-0.82	-1.58	-1.00	-0.85
Other Services	-0.07	-0.50	4.95	1.62	1.65	5.78	4.52	11.21	6.96	7.27	-0.34	-0.78	4.48	1.12	1.28

United States	Gross Output Per Hour					Depreciation Per Hour					Net Output Per Hour				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	1.48	0.40	4.43	1.50	2.05	-3.27	5.72	7.83	2.55	4.02	2.45	-0.71	3.51	1.17	1.54
Mining, Oil & Gas	1.56	5.70	0.61	-3.23	1.61	-9.55	19.22	1.63	-5.99	0.51	4.58	4.68	0.34	-2.48	1.92
Food, Drink & Tobacco	0.82	4.21	-4.01	1.37	0.42	-4.59	-1.71	0.49	5.52	-0.26	1.66	4.92	-4.50	0.82	0.52
Textiles	5.54	3.96	1.86	6.56	4.07	8.30	8.15	-1.03	20.59	7.39	5.26	3.47	2.22	4.71	3.64
Clothing	5.52	3.17	4.11	4.74	4.19	6.68	5.25	10.95	21.06	10.12	5.46	3.06	3.67	3.24	3.73
Wood Products	0.82	-3.61	-0.75	4.32	-0.44	2.72	-6.75	-4.94	3.16	-2.65	0.44	-3.01	-0.10	4.47	-0.08
Pulp & Paper Products	-1.84	1.05	0.74	4.33	1.01	-3.70	2.51	1.48	10.94	2.51	-1.47	0.76	0.59	2.82	0.67
Printing & Publishing	2.90	0.09	-0.32	1.87	0.81	2.86	-5.33	-1.67	6.63	-0.51	2.91	0.99	-0.14	1.23	1.04
Petroleum & Coal	-15.97	7.10	8.30	8.24	2.90	-25.47	10.00	-1.31	3.48	-2.77	-65.96	45.26	-214.49	20.37	-
Chemical	0.50	2.30	2.41	5.25	2.54	-1.40	0.77	3.95	2.51	1.66	0.87	2.58	2.13	5.76	2.70
Plastics & Rubber	2.72	3.93	4.15	5.66	3.72	2.99	4.99	8.33	6.28	5.89	2.70	3.83	3.72	3.33	3.49
Nonmetallic Mineral Products	3.21	3.67	1.63	3.35	2.88	3.14	1.42	4.98	10.18	4.45	3.23	4.08	1.03	1.86	2.54
Primary Metal & Fabricated Metal Products	0.48	3.25	1.13	2.92	2.00	-2.76	3.41	4.06	12.48	4.06	0.84	3.23	0.80	1.62	1.72
Machinery	5.08	-1.10	1.01	3.17	1.49	1.67	-0.51	8.82	-12.31	0.33	5.82	-1.22	-0.95	7.40	1.73
Computer & Electronic Product	12.16	19.43	34.77	20.52	22.78	12.70	24.78	32.28	24.51	24.62	12.05	18.28	35.36	19.39	22.38
Electrical Equipment, Appliance & Component	1.91	3.15	1.05	10.87	3.65	-	-	-	-	-	1.91	3.15	1.05	-6.22	0.45
Transportation Equipment Manufacturing	-1.94	0.89	1.90	8.27	2.01	-1.10	7.85	5.07	7.92	5.26	-2.15	-1.23	0.54	8.45	0.90
Furniture and Related Product Manufacturing	-2.89	2.03	1.99	3.26	1.30	-5.05	3.49	4.39	4.63	2.32	-2.77	1.95	1.84	3.17	1.24
Miscellaneous Manufacturing	9.52	5.94	4.64	4.97	6.01	9.06	1.08	4.84	32.83	9.16	9.56	6.29	4.63	2.66	5.68
Utilities	5.37	4.16	3.21	4.40	4.13	2.66	1.20	0.28	10.83	2.92	6.44	5.16	4.04	2.65	4.57
Construction	-0.11	-0.03	-1.59	-0.57	-0.64	-2.80	0.35	0.26	4.78	0.53	0.06	-0.05	-1.71	-0.95	-0.72
Wholesale Trade	0.76	3.85	5.91	5.17	4.14	2.04	9.65	7.13	11.19	7.68	0.67	3.36	5.79	4.49	3.81
Retail Trade	3.43	3.37	4.33	4.31	3.86	0.46	1.75	7.05	3.85	3.53	3.72	3.51	4.09	4.35	3.89
Accommodation & Food	1.35	-0.03	1.10	0.57	0.69	-3.33	-3.30	1.80	12.91	1.16	1.61	0.13	1.07	-0.06	0.66
Transportation & Warehousing	3.03	3.22	1.85	2.85	2.68	2.39	2.00	3.61	7.24	3.54	3.15	3.45	1.52	1.94	2.50
Information & Culture	6.32	3.45	5.55	7.64	5.42	3.81	1.89	9.39	19.15	7.65	6.90	3.78	4.71	4.36	4.76
Monetary Authorities & Depository Credit Intermediation	1.61	-0.13	-0.73	5.17	0.98	3.14	2.45	4.58	-34.70	-5.12	1.34	-0.62	-1.99	12.54	1.62
Other Finance, Insurance & Real Estate, & Management of Companies	3.00	0.87	2.33	2.81	2.08	-0.18	-1.77	3.09	27.59	5.05	3.83	1.46	2.17	-4.36	1.90
Professional, Scientific & Technical Services	2.37	-1.31	2.08	3.57	1.34	-4.58	-1.14	6.31	-10.61	-1.42	2.55	-1.31	1.91	4.15	1.44
Administrative & Support, Waste Management & Remediation	2.08	-0.77	0.08	3.79	0.87	-4.53	-1.98	6.34	-20.64	-3.83	2.70	-0.67	-0.46	5.77	1.20
Education Services	-1.64	1.15	-0.18	0.25	0.04	-11.74	3.66	7.24	-15.77	-2.22	-1.49	1.12	**-0.30**	**0.51**	**0.07**
Healthcare & Social Assistance	-2.84	-1.65	-0.93	1.08	-1.15	-11.22	-3.55	-9.30	6.29	-2.28	-2.58	-1.61	-0.95	0.95	-1.11
Other Services	-0.52	**-0.92**	-2.39	-1.04	-1.35	0.36	1.25	2.26	-47.82	-10.45	-0.66	-1.28	-3.52	5.22	-0.65

Appendix D: Per Hour Growth Rates – Logarithmic Method

Canada	Gross Output Per Hour					Depreciation Per Hour					Net Output Per Hour				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	3.74	1.00	3.22	0.83	1.87	-5.87	-1.92	2.49	2.39	-0.38	6.76	1.68	3.38	0.45	2.36
Mining, Oil & Gas	1.09	3.93	2.40	-1.29	2.11	-1.41	0.45	6.82	3.39	2.77	3.10	5.99	-1.48	-6.67	1.54
Food, Drink & Tobacco	1.03	2.02	1.30	2.58	1.60	5.00	2.67	3.03	1.59	2.83	0.65	1.96	1.10	2.68	1.46
Textiles	-0.46	2.09	3.93	-5.36	0.62	6.84	2.57	2.20	-4.81	1.63	-1.54	2.00	4.22	-5.44	0.44
Clothing	0.65	2.84	1.49	0.75	1.32	6.43	7.68	0.68	-0.24	3.27	0.47	2.63	1.53	0.79	1.23
Wood Products	0.23	-1.18	5.71	4.41	2.19	11.22	1.79	0.54	0.13	2.96	-1.16	-1.63	6.39	4.89	2.08
Pulp & Paper Products	1.02	2.87	4.20	-0.74	2.01	16.45	-0.22	-0.06	-5.49	1.55	-7.12	4.42	5.77	0.63	2.21
Printing & Publishing	2.60	-2.21	1.82	2.86	0.63	8.04	9.17	3.72	5.11	6.41	2.20	-4.02	1.46	2.46	-0.76
Petroleum & Coal	6.56	3.44	-3.25	5.47	2.63	2.36	0.31	-6.27	11.59	1.03	15.29	8.68	-0.66	-1.86	4.58
Chemical	1.26	4.02	4.22	4.56	3.49	-2.45	1.24	3.56	0.60	1.12	2.06	4.60	4.34	5.20	3.88
Plastics & Rubber	-2.81	5.94	2.14	2.08	3.17	7.00	1.86	0.09	1.05	2.89	-4.08	6.45	2.35	2.18	3.20
Nonmetallic Mineral Products	-1.84	0.14	5.62	5.04	1.95	6.91	0.30	2.96	0.87	2.17	-3.17	0.11	6.00	5.59	1.92
Primary Metal & Fabricated Metal Products	-0.10	2.87	4.04	0.44	2.31	3.57	-1.05	-1.01	-2.59	-0.54	-0.87	3.68	4.76	0.84	2.72
Machinery	4.24	5.96	1.38	-1.02	3.14	5.37	3.63	3.76	-0.04	3.52	4.18	6.11	1.23	-1.08	3.12
Computer & Electronic Product	6.58	9.10	16.61	-12.51	5.94	6.63	1.22	10.56	3.96	5.55	6.58	9.93	17.07	-15.23	5.99
Electrical Equipment, Appliance & Component	1.02	2.81	7.54	-8.09	1.36	5.72	5.40	3.93	1.71	3.73	0.70	2.58	7.80	-9.01	1.13
Transportation Equipment Manufacturing	5.27	4.61	5.09	-2.22	3.66	7.25	4.46	3.48	1.41	4.26	4.95	4.63	5.35	-2.83	3.55
Furniture and Related Product Manufacturing	-0.12	2.59	6.40	-0.65	2.57	5.53	4.11	9.15	4.17	6.18	-0.32	2.53	6.28	-0.89	2.37
Miscellaneous Manufacturing	0.72	3.65	6.78	5.34	4.23	2.34	8.18	4.09	-1.11	4.06	0.64	3.34	6.94	5.67	4.24
Utilities	-6.12	1.33	2.19	-0.12	0.08	-3.20	1.16	0.86	-1.10	-0.12	-8.24	1.47	3.06	0.52	0.22
Construction	-1.85	-1.05	2.33	0.75	0.11	1.13	4.42	1.65	2.84	3.22	-1.99	-1.40	2.37	0.61	-0.12
Wholesale Trade	2.72	2.01	3.21	2.82	3.26	4.42	8.82	8.62	5.74	8.39	2.65	1.65	2.84	2.61	2.84
Retail Trade	-2.91	1.39	2.17	3.36	1.34	5.14	8.87	5.23	6.79	7.20	-3.25	0.91	1.95	3.08	0.75
Accommodation & Food	1.96	-0.96	0.78	-0.23	0.26	9.84	2.73	-2.50	3.01	2.83	1.46	-1.28	1.00	-0.46	0.03
Transportation & Warehousing	0.36	1.79	2.20	1.41	1.75	1.53	1.70	5.62	2.87	3.38	0.09	1.82	1.26	0.97	1.26
Information & Culture	5.00	1.59	7.35	3.70	4.89	7.01	6.40	6.47	2.48	6.40	4.51	-0.08	7.64	4.09	4.35
Monetary Authorities & Depository Credit Intermediation	2.03	3.67	2.99	0.98	3.06	13.86	-2.17	12.50	2.71	6.56	-4.58	5.84	-2.88	-0.28	0.30
Other Finance, Insurance & Real Estate, & Management of Companies	-12.94	3.29	1.76	3.68	-0.46	9.44	10.33	14.48	1.07	10.88	-13.24	3.15	1.34	3.76	-1.09
Professional, Scientific & Technical Services	-0.20	1.62	5.04	2.71	3.35	14.37	21.62	19.01	10.24	19.13	-0.49	0.59	3.89	1.89	-0.51
Administrative & Support, Waste Management & Remediation	3.23	-2.25	-10.57	4.11	-3.71	6.10	4.63	-1.50	10.18	6.45	3.16	-2.49	-11.01	3.81	-4.62
Education Services	-2.24	-1.18	-0.54	1.18	-0.83	0.98	2.63	4.76	9.48	4.77	-2.42	-1.44	-1.00	0.23	-1.51
Healthcare & Social Assistance	0.59	-0.81	-1.54	-0.77	-1.01	2.46	1.60	4.15	5.02	3.87	0.52	-0.90	-1.83	-1.11	-1.33
Other Services	-0.08	-0.53	5.47	1.75	2.18	6.19	4.77	12.27	7.47	8.79	-0.39	-0.87	4.89	1.17	1.38

United States	Gross Output Per Hour					Depreciation Per Hour					Net Output Per Hour				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	1.48	0.38	4.84	1.52	2.18	-3.27	5.52	8.50	2.59	4.24	2.37	-0.82	3.79	1.15	1.56
Mining, Oil & Gas	1.56	4.83	0.56	-3.13	1.23	-9.57	8.76	1.50	-5.81	0.38	4.05	3.80	0.28	-2.39	1.45
Food, Drink & Tobacco	0.82	4.27	-4.39	1.29	0.43	-4.59	-1.74	0.53	5.20	-0.27	1.60	4.93	-5.13	0.74	0.52
Utilities	5.07	3.91	1.64	4.91	2.65	7.61	8.04	-0.91	15.84	5.17	4.80	3.39	1.94	3.27	2.29
Clothing	4.87	2.82	2.75	3.09	1.66	5.91	4.69	7.62	14.39	5.02	4.82	2.72	2.38	1.74	1.36
Wood Products	0.80	-3.88	-0.81	3.70	-0.42	2.66	-7.29	-5.35	2.71	-2.51	0.43	-3.30	-0.19	3.83	-0.13
Pulp & Paper Products	-1.92	1.02	0.70	3.60	0.82	-3.88	2.46	1.40	9.18	2.06	-1.55	0.70	0.54	1.99	0.49
Printing & Publishing	2.93	0.09	-0.33	1.57	0.71	2.89	-5.31	-1.71	5.62	-0.44	2.94	0.84	-0.13	0.98	0.87
Petroleum & Coal	-16.75	6.51	7.18	7.66	2.25	-29.09	9.21	-1.10	3.23	-1.92	-223.83	-264.24	-207.88	18.45	19.61
Chemical	0.53	2.21	2.37	4.88	2.41	-1.51	0.74	3.90	2.33	1.57	0.92	2.48	2.07	5.34	2.56
Plastics & Rubber	2.77	4.29	4.31	3.12	3.69	3.04	5.45	8.62	5.38	5.84	2.75	4.18	3.82	2.83	3.43
Nonmetallic Mineral Products	3.22	3.60	1.78	3.02	2.80	3.15	1.39	5.42	9.21	4.34	3.23	3.98	1.07	1.44	2.46
Primary Metal & Fabricated Metal Products	0.49	3.22	1.21	2.33	1.74	-2.80	3.38	4.33	10.13	3.59	0.82	3.20	0.82	1.04	1.48
Machinery	5.04	-1.15	1.01	2.44	1.20	1.66	-0.53	8.81	-9.08	0.26	5.73	-1.28	-1.51	4.58	1.39
Computer & Electronic Product	11.79	18.69	36.77	14.36	19.83	12.32	23.90	34.19	17.31	21.60	11.69	17.39	37.39	13.52	19.34
Electrical Equipment, Appliance & Component	1.85	2.95	1.08	8.11	2.67	-	-	-	-	-	-	-	-	-	-
Transportation Equipment Manufacturing	-1.91	0.84	1.97	6.96	1.66	-1.08	7.48	5.24	6.67	4.50	-2.12	-1.33	0.39	7.11	0.26
Furniture and Related Product Manufacturing	-2.86	2.04	2.16	2.85	1.24	-5.00	3.52	4.75	4.06	2.22	-2.74	1.96	1.99	2.77	1.18
Miscellaneous Manufacturing	9.61	5.00	4.75	4.44	4.98	9.15	0.90	4.95	29.94	7.81	9.65	5.27	4.74	0.51	4.69
Utilities	5.36	3.79	2.94	4.11	3.37	2.65	1.09	0.26	10.15	2.34	6.39	4.63	3.61	2.31	3.66
Construction	-0.11	-0.03	-2.02	-0.56	-0.83	-2.95	0.35	0.32	4.68	0.68	0.06	-0.05	-2.17	-0.96	-0.95
Wholesale Trade	0.80	3.93	6.22	4.92	4.41	2.16	9.83	7.50	10.68	8.07	0.71	3.35	6.09	4.17	3.93
Retail Trade	3.55	3.48	4.76	4.31	4.39	0.48	1.81	7.72	3.85	4.03	3.84	3.62	4.48	4.35	4.42
Accommodation & Food	1.38	-0.03	1.26	0.58	0.87	-3.42	-3.57	2.05	13.00	1.44	1.64	0.12	1.22	-0.26	0.84
Transportation & Warehousing	3.10	3.53	2.08	2.67	3.10	2.44	2.20	4.06	6.78	4.05	3.22	3.76	1.70	1.72	2.90
Information & Culture	6.15	3.69	6.15	6.76	5.52	3.71	2.02	10.34	17.12	7.78	6.70	4.01	5.13	2.50	4.83
Monetary Authorities & Depository Credit Intermediation	1.63	-0.13	-0.81	5.53	1.12	3.19	2.33	5.06	-39.21	-6.51	1.34	-0.58	-2.50	8.79	1.89
Other Finance, Insurance & Real Estate, & Management of Companies	3.05	0.93	2.68	2.61	2.38	-0.19	-1.90	3.54	25.88	5.63	3.86	1.50	2.49	-11.45	1.14
Professional, Scientific & Technical Services	2.69	-1.45	2.60	3.32	1.89	-5.25	-1.27	7.72	-9.74	-2.21	2.99	-1.46	2.36	3.70	2.01
Administrative & Support, Waste Management & Remediation	2.39	-0.97	0.10	3.56	1.39	-5.28	-2.52	7.54	-18.97	-8.80	3.04	-0.85	-0.66	4.58	1.79
Education Services	-1.77	1.26	-0.20	0.26	0.05	-12.76	4.00	7.99	-16.78	-3.35	-1.62	1.22	-0.36	0.43	0.09
Healthcare & Social Assistance	-3.41	-1.92	-1.04	1.18	-2.06	-13.71	-4.16	-0.33	6.85	-4.49	-3.10	-1.87	-1.06	1.03	-2.01
Other Services	-0.60	-1.02	-2.72	-1.08	-2.08	0.41	1.38	2.54	-52.18	-	-0.76	-1.45	-3.91	1.22	-0.95

Appendix E: Per Hour GDP and NDP Gap Growth Rates

Canada	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Economy	0.00	-0.03	0.34	0.80	1.37	1.46	1.23	0.84	0.90	1.11	1.17	1.58	1.83	2.10	2.86	3.08	3.33
Primary	0.00	-4.33	-5.63	-9.93	-13.52	-15.14	-20.64	-21.36	-20.79	-18.83	-14.89	-13.28	-13.37	-11.41	-2.65	3.13	1.42
Secondary	0.00	-0.16	0.64	2.26	4.28	4.24	2.99	1.50	0.86	1.08	0.50	0.37	-0.40	-2.00	-0.86	-1.47	-1.51
Tertiary	0.00	0.26	0.72	1.16	1.63	1.91	2.03	1.90	2.03	2.16	2.25	2.65	3.13	3.76	4.30	4.54	4.83
ICT	0.00	0.61	1.52	2.52	3.37	3.55	3.32	3.02	3.37	3.90	4.34	4.95	5.31	5.96	7.14	7.27	7.19

United States	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Economy	0.00	-0.24	-0.58	-1.02	-1.09	-1.48	-1.57	-1.38	-1.18	-1.14	-1.02	-0.92	-0.74	-0.77	3.33	4.17	3.67
Primary	0.00	-1.26	-5.31	-6.97	-4.99	-4.73	-3.89	-5.66	-1.56	-5.92	-4.16	7.01	6.80	1.64	2.26	7.89	0.84
Secondary	0.00	-0.71	-1.51	-1.66	-1.49	-1.61	-1.91	-1.96	-1.66	0.15	0.42	-0.03	0.58	0.54	4.15	6.98	6.08
Tertiary	0.00	-0.03	-0.10	-0.49	-0.59	-0.94	-0.91	-0.59	-0.46	-0.52	-0.38	-0.21	0.11	0.22	5.06	5.74	5.58
ICT	0.00	0.12	-0.34	-1.07	-1.32	-1.96	-1.95	-1.21	-0.88	-0.68	-0.15	0.48	1.05	1.52	3.93	5.59	4.58

Appendix F: Depreciation Share of Net Capital Growth Rates

Canada	Depreciation Share of Net Capital				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	-3.78	-1.72	0.57	0.24	-1.03
Mining, Oil & Gas	0.03	-0.67	0.87	0.87	0.23
Food, Drink & Tobacco	0.63	1.97	2.48	0.62	1.62
Textiles	0.82	2.11	2.51	0.26	1.64
Clothing	1.88	2.96	4.48	0.27	2.72
Wood Products	2.27	-0.04	2.19	2.18	1.50
Pulp & Paper Products	1.38	0.87	1.83	0.55	1.21
Printing & Publishing	5.17	6.63	3.30	3.37	4.69
Petroleum & Coal	1.20	1.35	0.03	3.68	1.34
Chemical	-0.03	1.90	0.54	1.97	1.12
Plastics & Rubber	0.87	2.64	2.10	1.60	1.94
Nonmetallic Mineral Products	1.13	0.87	3.14	0.61	1.57
Primary Metal & Fabricated Metal Products	0.11	1.69	2.22	1.86	1.59
Machinery	0.96	2.14	3.29	1.40	2.14
Computer & Electronic Product	2.71	2.00	4.09	5.38	3.41
Electrical Equipment, Appliance & Component	2.06	2.61	1.43	2.83	2.18
Transportation Equipment Manufacturing	3.68	1.28	2.22	0.80	1.93
Furniture and Related Product Manufacturing	3.21	2.18	3.25	2.83	2.83
Miscellaneous Manufacturing	1.63	2.08	5.11	-0.81	2.38
Utilities	0.21	1.14	1.73	0.16	0.96
Construction	0.04	-0.23	-0.13	1.80	0.23
Wholesale Trade	2.15	3.21	4.32	2.20	3.17
Retail Trade	2.25	3.42	2.63	2.99	2.87
Accommodation & Food	2.47	2.33	1.02	1.65	1.82
Transportation & Warehousing	1.46	1.81	3.08	1.78	2.13
Information & Culture	1.88	4.57	4.48	3.06	3.75
Monetary Authorities & Depository Credit Intermediation	5.66	-1.82	1.44	3.38	1.54
Other Finance, Insurance & Real Estate, & Management of Companies	3.63	10.64	15.98	3.01	9.43
Professional, Scientific & Technical Services	6.07	6.30	0.18	4.27	3.93
Administrative & Support, Waste Management & Remediation	4.07	0.17	0.02	2.83	1.34
Education Services	1.60	1.77	3.42	5.06	2.86
Healthcare & Social Assistance	1.87	1.95	3.73	1.29	2.36
Other Services	5.44	1.66	7.94	5.61	5.04
Primary	-1.08	-0.88	0.95	0.93	-0.01
Secondary	1.41	1.67	2.16	1.51	1.74
Tertiary	2.64	1.77	4.24	3.19	2.97
Economy	1.32	1.09	3.21	2.34	2.03
ICT	3.54	2.22	5.26	2.87	3.53

United States	Depreciation Share of Net Capital				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	-6.45	2.23	7.22	0.51	1.72
Mining, Oil & Gas	-14.53	4.43	-5.04	-11.09	-5.27
Food, Drink & Tobacco	-7.90	-3.55	0.29	1.81	-2.22
Textiles	1.19	5.26	-5.27	7.36	1.47
Clothing	-1.34	0.31	-0.35	2.72	0.23
Wood Products	-1.55	-7.70	-5.46	-3.67	-5.12
Pulp & Paper Products	-6.02	-0.12	-1.05	2.85	-1.90
Printing & Publishing	-0.39	-7.32	-2.49	-0.48	-3.27
Petroleum & Coal	-29.25	5.46	-6.20	-0.61	-6.71
Chemical	-2.33	-1.98	2.05	-1.43	-0.70
Plastics & Rubber	-0.23	4.46	7.56	-0.46	3.57
Nonmetallic Mineral Products	-0.29	-1.16	5.06	4.78	2.02
Primary Metal & Fabricated Metal Products	-5.64	1.02	3.91	3.01	0.99
Machinery	-1.81	-1.52	7.47	-20.56	-2.85
Computer & Electronic Product	8.19	21.49	33.05	7.37	19.50
Electrical Equipment, Appliance & Component	-	-	-	-	-
Transportation Equipment Manufacturing	-4.34	4.32	4.29	0.47	1.90
Furniture and Related Product Manufacturing	-8.50	1.31	4.34	-1.27	-0.17
Miscellaneous Manufacturing	6.01	-4.49	3.57	26.19	5.25
Utilities	-1.29	-3.13	-3.33	6.61	-1.09
Construction	-4.43	-2.02	3.74	3.01	0.22
Wholesale Trade	1.10	8.64	8.03	8.26	6.92
Retail Trade	-1.31	0.26	6.41	1.47	2.07
Accommodation & Food	-5.61	-4.15	1.66	10.64	0.00
Transportation & Warehousing	0.06	1.14	4.73	3.11	2.41
Information & Culture	0.30	2.20	11.97	13.54	6.88
Monetary Authorities & Depository Credit Intermediation	0.04	3.21	12.30	-32.93	-2.83
Other Finance, Insurance & Real Estate, & Management of Companies	1.64	-1.69	4.01	18.55	4.28
Professional, Scientific & Technical Services	-1.93	0.44	11.42	-12.45	0.66
Administrative & Support, Waste Management & Remediation	-2.34	0.81	9.13	-23.05	-2.35
Education Services	-12.28	3.18	6.32	-16.44	-2.89
Healthcare & Social Assistance	-8.55	-2.69	-0.42	7.28	-1.33
Other Services	1.55	0.92	1.66	-48.52	-10.74
Primary	-11.64	3.57	-0.19	-5.63	-2.34
Secondary	-3.89	1.81	5.36	2.59	1.95
Tertiary	-0.78	0.83	5.24	15.86	4.57
Economy	-2.96	0.28	2.70	8.75	1.93
ICT	1.73	1.45	7.13	2.18	3.38

Appendix G: Depreciation Share of NDP Growth Rates

Canada	Depreciation Share of NDP				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	-12.38	-3.80	-0.93	2.06	-3.53
Mining, Oil & Gas	-4.55	-5.63	7.84	8.66	1.24
Food, Drink & Tobacco	4.48	0.72	1.86	-1.12	1.42
Textiles	9.55	0.62	-1.91	0.68	1.44
Clothing	6.53	5.71	-0.74	-1.20	2.50
Wood Products	13.08	3.30	-4.90	-4.91	0.81
Pulp & Paper Products	23.73	-4.77	-6.10	-6.14	-0.69
Printing & Publishing	5.24	15.32	2.04	2.78	6.77
Petroleum & Coal	-12.94	-9.05	-5.13	15.39	-4.74
Chemical	-4.23	-3.49	-0.79	-4.54	-2.99
Plastics & Rubber	10.30	-4.17	-1.65	-1.10	-0.22
Nonmetallic Mineral Products	10.66	0.23	-2.61	-4.61	0.26
Primary Metal & Fabricated Metal Products	4.42	-4.85	-4.44	-3.52	-2.79
Machinery	1.17	-2.27	2.11	1.08	0.35
Computer & Electronic Product	0.05	-8.03	-5.18	22.84	-0.41
Electrical Equipment, Appliance & Component	5.17	3.68	-3.37	12.19	3.21
Transportation Equipment Manufacturing	2.15	-0.16	-1.68	4.46	0.64
Furniture and Related Product Manufacturing	5.96	1.66	2.07	5.31	3.26
Miscellaneous Manufacturing	1.64	5.23	-2.39	-6.78	-0.17
Utilities	4.56	-0.28	-2.33	-1.56	-0.28
Construction	2.77	6.68	-0.64	1.97	2.74
Wholesale Trade	1.59	6.68	4.77	2.94	4.41
Retail Trade	8.12	7.78	3.04	3.40	5.51
Accommodation & Food	7.86	4.01	-3.05	3.42	2.34
Transportation & Warehousing	1.56	-0.11	3.90	1.89	1.78
Information & Culture	2.24	6.04	-1.01	-1.50	1.66
Monetary Authorities & Depository Credit Intermediation	16.03	-8.04	12.73	2.79	4.53
Other Finance, Insurance & Real Estate, & Management of Companies	23.69	6.73	11.28	-2.37	9.32
Professional, Scientific & Technical Services	13.21	19.47	11.09	7.95	13.44
Administrative & Support, Waste Management & Remediation	2.51	5.94	6.11	5.86	5.33
Education Services	3.24	3.67	5.62	9.10	5.20
Healthcare & Social Assistance	1.79	2.31	5.35	5.71	3.79
Other Services	6.14	5.35	6.44	5.78	5.92
Primary	-7.58	-3.96	4.92	7.65	0.14
Secondary	5.65	-2.21	-3.21	0.76	-0.54
Tertiary	4.35	1.64	2.68	2.14	2.56
Economy	2.21	0.06	1.48	2.37	1.33
ICT	9.53	0.95	2.94	2.09	3.35

United States	Depreciation Share of NDP				
	1987-1990	1990-1995	1995-2000	2000-2003	1987-2003
Agriculture, Forestry, Fishing & Hunting	-5.59	6.47	4.18	1.36	2.44
Mining, Oil & Gas	-13.51	5.30	1.28	-3.60	-1.39
Food, Drink & Tobacco	-6.15	-6.32	5.22	4.66	-0.78
Textiles	2.89	4.52	-3.18	15.16	3.62
Clothing	1.16	2.13	7.01	17.26	6.16
Wood Products	2.27	-3.86	-4.85	-1.25	-2.57
Pulp & Paper Products	-2.26	1.74	0.89	7.90	1.83
Printing & Publishing	-0.05	-6.25	-1.54	5.33	-1.53
Petroleum & Coal	112.47	-24.27	-186.20	-14.03	-
Chemical	-2.26	-1.77	1.78	-3.07	-1.01
Plastics & Rubber	0.28	1.12	4.45	2.85	2.32
Nonmetallic Mineral Products	-0.08	-2.56	3.91	8.17	1.86
Primary Metal & Fabricated Metal Products	-3.57	0.18	3.24	10.69	2.30
Machinery	-3.92	0.73	9.86	-18.35	-1.38
Computer & Electronic Product	0.57	5.49	-2.28	4.12	1.83
Electrical Equipment, Appliance & Component	-	-	-	-	-
Transportation Equipment Manufacturing	1.08	9.19	4.50	-0.48	4.35
Furniture and Related Product Manufacturing	-2.35	1.52	2.50	1.41	1.07
Miscellaneous Manufacturing	-0.45	-4.90	0.19	29.58	5.29
Utilities	-3.55	-3.77	-3.61	7.96	-1.58
Construction	-2.86	0.40	2.00	5.79	1.26
Wholesale Trade	1.37	6.08	1.27	6.41	3.73
Retail Trade	-3.15	-1.70	2.85	-0.48	-0.35
Accommodation & Food	-4.87	-3.42	0.72	12.97	0.49
Transportation & Warehousing	-0.74	-1.40	2.06	5.20	1.01
Information & Culture	-2.89	-1.82	4.47	14.17	2.76
Monetary Authorities & Depository Credit Intermediation	1.77	3.09	6.70	-41.88	-6.64
Other Finance, Insurance & Real Estate, & Management of Companies	-3.87	-3.18	0.90	33.40	4.01
Professional, Scientific & Technical Services	-7.06	0.17	4.32	-14.15	-2.82
Administrative & Support, Waste Management & Remediation	-7.04	-1.32	6.84	-24.97	-4.98
Education Services	-10.40	2.52	7.56	-16.19	-2.29
Healthcare & Social Assistance	-8.87	-1.98	0.66	5.30	-1.19
Other Services	1.03	2.56	5.77	-50.41	-9.89
Primary	-10.77	5.76	2.48	-0.93	0.21
Secondary	-2.93	0.33	1.86	5.59	1.14
Tertiary	-2.48	0.19	1.89	18.06	3.34
Economy	-3.60	-0.15	1.00	11.53	1.64
ICT	-2.72	0.40	3.03	4.34	1.34

REFERENCE LIST

Arrazola, Maria and Jose De Havia (2004, April). More on the estimation of the human capital depreciation rate. Applied Economics Letters, 11, 145-148.

Baker, Dean (2006, October). A note on distribution and growth. Center for Economic and Policy Research Briefing Paper IB200610B, Centre for Economic Policy and Research. Retrieved October 30, 2006, from http://www.cepr.net/documents/distribution_2006_10.pdf.

Brekke, Kjell Arne (1994). Net national product as a welfare indicator. Scandinavian Journal of Economics, 96, 241-252.

Bureau of Economic Analysis. n.d. Gross-domestic-product-by-industry accounts, Chain-type price indexes for intermediate inputs by industry (2000 = 100) (table). Version updated January 10, 2007. http://www.bea.gov/industry/index.htm (accessed January 21, 2007).

Bureau of Economic Analysis. n.d. Gross-domestic-product-by-industry accounts, Chain-type price indexes for value added by industry (Billions of chained 2000 dollars) (table). Version updated January 10, 2007. http://www.bea.gov/industry/index.htm (accessed January 21, 2007).

Bureau of Economic Analysis. n.d. Gross-domestic-product-by-industry accounts, Real value added by industry (table). Version updated January 10, 2007. http://www.bea.gov/industry/index.htm (accessed January 21, 2007).

Bureau of Economic Analysis. n.d. Table 3.1ES Current-cost net stock of private fixed assets by industry (Billions of dollars; year-end estimates) (table). Version updated August 15, 2006. http://www.bea.gov/national/FA2004/SelectTable.asp#S3 (accessed January 21, 2007).

Bureau of Economic Analysis. n.d. Table 6.13C Noncorporate capital consumption allowances by industry (Millions of dollars) (table). Version updated January 23, 2004. http://www.bea.gov/national/nipaweb/Index.asp (accessed January 26, 2007).

Bureau of Economic Analysis. n.d. Table 6.13D Noncorporate capital consumption allowances by industry (Millions of dollars) (table). Version updated August 2, 2006. http://www.bea.gov/national/nipaweb/Index.asp (accessed January 26, 2007).

Bureau of Economic Analysis. n.d. Table 6.22C Corporate capital consumption allowances by industry (Millions of dollars) (table). Version updated January 23, 2004. http://www.bea.gov/national/nipaweb/Index.asp (accessed January 26, 2007).

Bureau of Economic Analysis. n.d. Table 6.22D Corporate capital consumption allowances by industry (Millions of dollars) (table). Version updated August 2, 2006. http://www.bea.gov/national/nipaweb/Index.asp (accessed January 26, 2007).

Dunn, Wendy E., Mark E. Doms, Stephen D. Oliner, & Daniel E. Sichel (2004, May). How fast do personal computers depreciate? Concepts and new estimates. National Bureau of Economic Research Working Paper No. 10521, National Bureau of Economic Research.

Fraumeni, Barbara M. (1997, July). The measurement of depreciation in the U.S. national income and product accounts. Survey of Current Business, 7-23.

Gittleman, Maury, Thijs ten Raa, Edward N. Wolff (2006, August). The vintage effect in TFP-growth: An analysis of the age structure of capital. Structural Change and Economic Dynamics, 17, 306- 328.

Groningen Growth & Development Centre. n.d. 60-industry database (table). Version updated September 1, 2006. http://www.ggdc.net/index-dseries.html#top (accessed January 21, 2007).

Hartwick, John M. (1990, April). Natural resources, national accounting and economic depreciation. Journal of Public Economics, 43, 291-304.

Hicks, J.R. (1974). Value and capital. Toronto: Oxford University Press.

Hulten, Charles R. (1992). Accounting for the wealth of nations: The net versus gross output controversy and its ramifications. Scandinavian Journal of Economics, 94, Supplement 9-24.

Hulten, Charles R. and Frank C. Wykoff (1981). The measurement of economic depreciation. In Charles R. Hulten (Ed.). Depreciation, inflation, and the taxation of income from capital (pp. 81-125). Washington: The Urban Institute Press.

Oliner, Stephen D. & Daniel E. Sichel (2000, Fall). The resurgence of growth in the late 1990s: Is information technology the story? Journal of Economic Perspectives, 3-22.

Oliner, Stephen D. & Daniel E. Sichel (2003). Information technology and productivity: Where are we now and where are we going? Journal of Policy Modeling, 25, 477-503.

Oulton, Nicholas (2004). Productivity versus welfare; or GDP versus Weitzman's NDP. Review of Income and Wealth, 50, 329-355.

Rao, Someshwar and Jianmin Tang (2001, Fall). The contribution of ICTs to productivity growth in Canada and the United States in the 1990s. International Productivity Monitor, 3-18.

Romer, David (1996). Advanced macroeconomics. Toronto: The McGraw-Hill Companies, Inc.

Samuelson, Paul A. (1968). The evaluation of 'social income': Capital formation and wealth. In F.A. Lutz & D.C. Hague (Eds.). The theory of capital (pp. 32-57). Toronto: MacMillan and Co. Ltd.

Sharpe, Andrew (2004, Fall). Ten productivity puzzles facing researchers. International Productivity Monitor, 15-24.

Sharpe, Andrew (2005, Fall). What explains the Canada-U.S. ICT investment gap? International Productivity Monitor, 21-38.

Spant, Roland (2003, Fall). Why net domestic product should replace gross domestic product as a measure of economic growth. International Productivity Monitor, 39-43.

Statistics Canada. Investment and Capital Stock Division (2001) Investment flows and capital stocks: Methodology. Retrieved January 21, 2007, from http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=2820&lang=en&db=IMDB&dbg=f&adm=8&dis=2.

Statistics Canada (2002). Productivity growth in Canada – 2002 (Catalogue No. 15-204-XIE). Ottawa, ON: Minister of Industry.

Statistics Canada. n.d. Table 31-0002 Flows and stocks of fixed non-residential capital by North American Industry Classification System (NAICS), annually (Dollars) (table). CANSIM (database). Using CHASS (distributor). Version updated January 4, 2007. http://dc1.chass.utoronto.ca.proxy.lib.sfu.ca/cansimdim/English/ (accessed January 21, 2007).

Statistics Canada. n.d. Table 379-0017 Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), annually (Dollars) (table). CANSIM (database). Using CHASS (distributor). Version updated January 4, 2007. http://dc1.chass.utoronto.ca.proxy.lib.sfu.ca/cansimdim/English/ (accessed January 21, 2007).

Stiroh, Kevin J. (2001, Spring). Is IT driving the U.S. Productivity Revival? International Productivity Monitor, 31-36.

Sullivan, David (1997, March) Trends in real wage growth. Chicago Fed Letter, 115, 1-4.

Weitzman, Martin L. (1976). On the welfare significance of national product in dynamic economy. The Quarterly Journal of Economics, 90, 156-162.

Weitzman, Martin L. (1997). Sustainability and technical progress. Scandinavian Journal of Economics, 99, 1-13.

Wolff, Edward N. (1996, December). The productivity slowdown: the culprit at last? American Economic Review, 86, 1239-1252.