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The Canadian Productivity Review

The Impact of Leased and Rented Assets on Industry Productivity Measurement

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Economic Analysis Division

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- | | |
|----------------|--|
| . | not available for any reference period |
| .. | not available for a specific reference period |
| ... | not applicable |
| 0 | true zero or a value rounded to zero |
| 0 ^s | value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded |
| P | preliminary |
| r | revised |
| X | suppressed to meet the confidentiality requirements of the <i>Statistics Act</i> |
| E | use with caution |
| F | too unreliable to be published |
| * | significantly different from reference category ($p < 0.05$) |

The Impact of Leased and Rented Assets on Industry Productivity Measurement

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The Canadian Productivity Review

The Canadian Productivity Review is a series of applied studies that address issues involving the measurement, explanation, and improvement of productivity. Themes covered in the review include, but are not limited to, economic performance, capital formation, labour, prices, environment, trade, and efficiency at both national and provincial levels. *The Canadian Productivity Review* publishes empirical research, at different levels of aggregation, based on growth accounting, econometrics, index numbers, and mathematical programming. The empirical research illustrates the application of theory and techniques to relevant public policy issues.

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The level of uncertainty will depend on several factors: the nature of the functional form used in the multivariate analysis; the type of econometric technique employed; the appropriateness of the statistical assumptions embedded in the model or technique; the comprehensiveness of the variables included in the analysis; and the accuracy of the data utilized. The peer group review process is meant to ensure that the papers in the series have followed accepted standards, in order to minimize problems in each of these areas.

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Abstract

Leasing offers firms the possibility to acquire the right to use capital assets under terms that differ from those prevailing through other financial instruments. The recording of leased assets in the Canadian System of National Accounts is ownership-based rather than user-based. The separation of capital ownership, in particular legal ownership, from the use of capital assets poses challenges to productivity measurement. To obtain consistent productivity measures at an industry level, leased and rented capital assets must be reallocated from owners' accounts to users' accounts. By using the *General Index of Financial Information (GIFI)* corporate balance sheets and detailed input-output tables, this paper tests the robustness of existing practices of data collection on leased and rented capital. The results show that financial and operating leases are commonly used for capital acquisition in many services-producing industries and that estimates of multifactor productivity growth in some of these industries is affected—sometimes substantially—by the existing treatment of leased and rented capital.

Executive summary

Leasing is an important means of gaining access to assets, of obtaining finance, and of reducing a lessee's exposure to the risks inherent to asset ownership. A lease can be either a financial lease (capital lease) or an operating lease (capital rental). A financial lease is one where the legal owner of an asset (lessor) passes the economic ownership to the user of the asset (lessee), who then accepts the operating risks and receives the economic benefits from using the asset in a productive activity. Under an operating lease, the lessor is both the legal owner and the economic owner of the asset leased (rented), bearing the operating risks and receiving the economic benefits from the asset. The lessor transfers only the right to use the asset to the lessee.

The use of leased or rented capital presents challenges to productivity measurement. In order to yield meaningful productivity estimates, outputs and inputs should be measured consistently such that the reported inputs are actually utilized to produce the reported output. Contrary to the case for purchased capital, legal owners and users of leased or rented capital are not always the same, and this may lead to inconsistent estimates of capital input with respect to the output produced. However, even when the two are consistent by some standards, those standards may impact the results of studies of productivity.

The System of National Accounts 2008 recommends reporting capital assets acquired under both financial and operating leases according to economic ownership, which involves allocating leased operating capital to the industry of the lessor and leased financial capital to the industry of the lessee. The investment data used in the Canadian System of National Accounts (CSNA) and the Canadian Productivity Accounts (CPA) is collected by the Capital and Repair Expenditures Survey (CAPEX). However, the CAPEX questionnaire asks the lessor, not the lessee, to report capital assets under financial leases, whereas this is not consistent with business and national accounting rules for financial leases. For the purpose of analyzing productivity of Canadian industries, CAPEX investment data must be adjusted by reallocating capital acquired under financial leases to the industry of the lessee. In most cases, this adjustment is not applied in the CNSA and CPA due to data limitations. As a result, current measures of capital assets may be underestimated for industries using significant quantities of capital acquired via financial leases, while they may be overestimated for industries that lease significant quantities of capital via financial leases to other industries. This inaccurate distribution of capital inputs across industries may have an impact on measures of industry productivity.

Operating leases raise different issues in terms of industry productivity measurement. Rental payments of capital under operating leases are treated as purchases of services and then recorded as intermediate expenses in the CSNA for the industry acquiring leased capital via an operating lease. This can have a major impact on the ratio of intermediate consumption to value added and the distribution of value added across industries. For instance, an industry will have higher capital income and value added when the capital it utilizes for production is owned rather than rented although it should not since the amount of capital input provided in production processes and the output produced should be invariant to the way capital is acquired.

As an exploratory project, this paper tests the robustness of existing practices of data collection on leased and rented capital and examines their impact on industry productivity growth. For this purpose, this paper uses *General Index of Financial Information (GIFI)* corporate balance sheets and detailed input-output tables to reallocate leased and rented capital across industries. The estimating results show that financial and operating leases are commonly used for capital acquisition in many services-producing industries and that estimates of multifactor productivity growth in some of these industries is affected—sometimes substantially—by the existing treatment of leased and rented capital.

1 Introduction

This paper reviews the existing practices of compiling leased and rented physical capital investment in the Canadian System of National Accounts (CSNA), examines the size and industry distribution of leased and rented capital assets in the Canadian business sector, and proposes adjustments from the perspective of the use of capital for productivity measurement.

Firms often choose to lease or rent buildings, vehicles, machinery and equipment rather than purchase them, in part because leases offer more flexibility to lessees in terms of adjusting to changes in technology and capacity needs. Decisions to lease or rent, rather than purchase, such assets may also be influenced by factors quite unrelated to the technology of production, such as taxation, availability of finance, or consequences for the balance sheet.

Business accounting standards and the System of National Accounts (SNA) 2008 make a distinction between financial (capital) leases and operating leases based on economic ownership. A financial lease is one where the legal owner of an asset (lessor) passes the economic ownership to the user of the asset (lessee), who then accepts the operating risks and receives the economic benefits from using the asset in a productive activity. For example, a financial lease could be a contract under which a lessor leases a building for a long period of time to a lessee, with an option for the lessee to buy the building at a preferred rate at the end of the lease. Under an operating lease, the lessor is both the legal owner and the economic owner of the asset leased (rented), bearing the operating risks and receiving the economic benefits from the asset. The lessor transfers only the right to use the asset to the lessee. For example, a lease involving a building could be classified as an operating lease if its duration is short compared to the life duration of the building and if the lessor remains responsible for major maintenance and repairs.

The use of leased or rented capital presents challenges to productivity measurement. The SNA 2008 recommends reporting capital acquired under a financial lease or operating lease according to economic ownership—that is, allocating capital acquired under an operating lease to the lessor and capital acquired under a financial lease to the lessee. In order to provide meaningful productivity estimates, outputs and inputs should be measured consistently such that the reported inputs are actually utilized to produce the reported output. Contrary to the case for purchased capital, legal owners and users of leased or rented capital are not always the same, and this may lead to inconsistent estimates of capital input with respect to the output produced. However, even when the two are consistent by some standards, those standards may impact the results of studies of productivity.

The CSNA and the Canadian Productivity Accounts (CPA) use the investment data collected by the Capital and Repair Expenditures Survey (CAPEX) to estimate capital stock and capital input at various industry levels. However, the CAPEX questionnaire collects capital acquisition under financial leases by the lessor only. This is not consistent with business and national accounting rules for financial leases. For the purpose of analyzing the productivity of Canadian industries, CAPEX investment data must be adjusted by reallocating capital acquired under financial leases according to economic ownership.¹ There has been no generalized adjustment made so far in the CSNA to reflect the economic ownership of assets acquired under a financial lease, as a result of lack of information.² Therefore, current measures of capital assets in the CSNA may be underestimated for industries using significant quantities of capital acquired via financial leases, while they may be overestimated for industries that lease significant quantities of capital via

1. The current reporting of assets acquired under leases under CAPEX suits other needs, such as analyses of wealth based on legal ownership.

2. Two adjustments are made in the CSNA in order to link assets acquired under financial leases to the lessee. Personal expenditures on motor vehicle leases are treated as purchases by the households sector, with corresponding decrease in investment in the financial industries. An upward adjustment is also made to the investment level of the transportation industry for leases of imported aircraft.

financial leases to other industries. This inaccurate distribution of capital inputs across industries may have an impact on measures of industry productivity.

Operating leases raise different issues in terms of industry productivity measurement. Rental payments of capital under operating leases are treated as purchases of services and then recorded as intermediate expenses in the CSNA for the industry acquiring leased capital via an operating lease. As a result, business decisions to rent capital under an operating lease, rather than purchase it, can have a significant impact on the ratio of intermediate consumption to value added and the distribution of value added across industries. For instance, an industry will have higher capital income and value added when the capital it utilizes for production is owned rather than rented. This is because, under the current accounting rules, most of the costs associated with the use of owned capital are not recorded as intermediate consumption. They would be if the capital were leased under an operating lease. The consumption of fixed capital forms part of gross value added while interest costs, both actual and implicit, have to be met out of the net operating surplus. Only the costs of the materials needed for maintenance and repairs appear under intermediate consumption. Consequently, how capital employed for production is obtained would have an impact on the measured productivity using the CSNA data although it should not since the amount of capital input provided in the production process and the output produced are invariant to the way capital is acquired. Capital actually applied to the production process is not recognized for operating leases but is recognized for financial leases. This may be important for cross-country comparisons when the intensity of leasing varies across countries. A country with active leasing industries will have less value added reported in industries that use leased capital than do other countries where leasing markets are less utilized. It will also lead to the impression of differences in capital intensity that do not exist.³

In this study, data from the *General Index of Financial Information (GIFI)* and detailed input-output tables are used in order to examine the size and industry distribution of leased and rented capital in the Canadian business sector. A procedure is proposed in order to adjust for industry use of leased and rented capital in the measurement of multifactor productivity growth that allows for consistency and for the recognition of the amount of capital services actually employed in the production process.

This paper is organized as follows. Section 2 provides an overview of accounting standards for leases and of the literature on the use of leases. Data sources employed in this study are presented in Section 3. Section 4 and Section 5 outline the correction procedures that will be employed to calculate new multifactor productivity growth estimates that correct present estimates for financial leases and operating leases, respectively.

2 Accounting and economic benefits of leases

Generally, a lease is defined as an agreement whereby the lessor conveys to the lessee the right to use an asset for an agreed period of time in return for a payment or series of payments. This general definition does not fully reflect the diversity of leases that exists in the business world. In Canada, the conditions used to classify leases into various categories are defined by the Canadian Generally Accepted Accounting Principles (GAAP) for the years prior to 2011.⁴ Leases are usually divided into two broad categories: financial (capital) leases and operating leases. Canadian GAAP (CPA of Canada 2014) define a financial (capital) lease as "a lease that, from the

-
3. The present practice recognizes that rental activity is a valuable service—and places the value added into a special industry (Finance, Insurance, and Real Estate [FIRE]) when the lease is an operating lease and into the industry where the asset is employed (combined with other factors) when the activity is conducted via a financial lease. Implicitly, then, in the latter case, the output of the industry consists of both output activity (for example, automobile production) and leasing activity. This rationale is rarely addressed when it comes to the derivation of price indices by creating a weighted average of the output of both the physical outputs and the financial self-provided services.
 4. International Financial Reporting Standards (IFRS) are effective starting in the year 2011, whereas this analysis focuses on data up to 2010.

point of view of the lessee, transfers substantially all the benefits and risks incident to ownership of property to the lessee." (Paragraph 3065.03 (a)). An operating lease, on the other hand, is defined as "a lease in which the lessor does not transfer substantially all the benefits and risks incident to ownership of property." (Paragraph 3065.03 (d)). Risks may include losses from idle capacity, technological obsolescence, or variations in returns due to changing economic conditions, while rewards may include operating profit over the asset's economic life, appreciation in the value of the asset, or the realization of a residual value.

The GAAP specify that from the point of view of the lessee, all risks or benefits would be substantially transferred at the inception of the lease if any of the following four conditions is met:

1. There is a reasonable assurance that ownership will be transferred to the lessee during the lease term.
2. The lease contains a bargaining purchase option.
3. The lease term covers a major portion (75% or more) of an asset's economic life.
4. The discounted value of net minimum lease payments covers substantially all of the asset's fair value. The lessor is then assured of recovering the investment in the leased property and of earning a return on the investment as a result of the lease agreement. The present value of minimum lease payments (excluding executor costs) is usually equal to 90% or more of the fair value of the leased property at the inception of the lease.

From the point of view of the lessor, risks and rewards would normally be transferred when all of the following conditions are met at the inception of the lease:

5. Any of conditions 1 to 4 is met.
6. The credit risk associated with the lease is normal when compared to the risk of collection of similar receivables.
7. The amounts of any non-reimbursable costs likely to be incurred by the lessor under the lease can be reasonably estimated.

Changes in estimates (of economic life, for example) or in circumstances (default by the lessee, for example) do not trigger a reclassification of a lease.

2.1 Accounting issues

Financial leases are divided in two categories: sales-type leases and direct financing leases. In a sales-type lease, the lessor is usually a manufacturer or a dealer and the fair value of the leased property at the inception of the lease is greater or less than its carrying amount, thus giving rise to a profit or loss to the lessor. In a direct financing lease, the lessor is usually neither a dealer nor a manufacturer, and the fair value of the leased property is equal to its carrying amount.

Assets leased under financial leases are reported separately on the lessee's balance sheet in order to distinguish the assets that the enterprise owns from those that it only has the right to use. The gross amount of assets under financial leases and related accumulated amortization must be disclosed.

Financial leases must be reported as an acquisition of an asset and an assumption of an obligation on the lessee's balance sheet. The asset value and the amount of the obligation are recorded at the beginning of the lease term and are equal to the present value of the minimum

lease payments excluding executory costs.⁵ Lease payments are allocated to a reduction of the obligation, interest expense, and any related executory costs.

The capitalized value of a depreciable asset under a financial lease should be amortized over the period of expected use, on a basis that is consistent with the lessee's depreciation policy for other similar fixed assets. If the lease contains terms that allow ownership to pass to the lessee or a bargain purchase option, the period of amortization is equal to the economic life of the asset. Otherwise, the property is amortized over the lease term.

Operating leases are declared as rental expenses on the lessee's income statement. Since most operating leases are short-term, they normally must be expensed on a straight-line basis over the lease term even if payments do not flow on a straight-line basis.

Direct financing or sales-type leases create a long-term receivable, although the lessor may also hold an interest in the residual value of an asset under lease. As a consequence, the net investment in the lease is considered to be separate from other assets and disclosed separately.

The lessor's net investment in the lease includes (a) the minimum lease payments receivable less executory costs and related profits, plus (b) any unguaranteed residual value of the leased property accruing to the lessor, less (c) unearned finance income remaining to be allocated to income over the lease term.

2.2 Classification issues

The Canadian standards for accounting for leases are similar to those prevailing in the United Kingdom and the United States. Those standards were established in the 1970s and mandated the capitalization of financial leases. Imhoff and Thomas (1988) reported a sharp decline of financial leases as a source of financing after the introduction of the requirements for their capitalization in 1976 in the United States. This is compatible with the argument that companies would prefer treating leases off balance sheet in order to avoid debt covenant violations⁶, which would have a negative effect on the incentive compensation of managers. Responding to the requirement to recognize financial leases on the balance sheet, managers substituted financial leases into operating leases by structuring new lease contract terms in such a way as to avoid capitalization on the balance sheet.⁷

Discussions arose among academics, data users, and accounting standards setters regarding whether a binary categorization of leases may end up with different accounting treatments of two leases that are economically similar. The International Accounting Standards Board (IASB), with the help of a working group including representatives of standard-setting bodies from Australia, Canada, New Zealand, the United Kingdom, and the United States, published a report in 1996 that reviewed existing accounting standards of leases.⁸ While acknowledging that the standards implemented in the 1970s represented an improvement in the quality of information available, the review highlighted concerns that the existing accounting standards at that time failed to properly recognize assets and liabilities arising from operating leases. The report highlighted the possibility that standards were being circumvented with leases being structured to only marginally meet the conditions allowing them to be classified as operating leases.⁹ A subsequent report from the IASB in 2000 proposed a new approach for the categorization of leases based on the right-to-use an

5. Executory costs are costs related to the operation of the leased property (for example, insurance, maintenance costs, and property taxes).

6. A debt covenant is a contract clause that may allow a lessor to repossess an asset should the lessee fail to meet specific financial conditions.

7. Imhoff and Thomas 1988.

8. McGregor 1996.

9. McGregor 1996, p. 9.

asset.¹⁰ IASB initiated in 2006 a consultation on the implementation of new accounting standards for leases. The implementation of these new standards is still ongoing.

Users of financial data are aware of the shortcomings of the existing accounting standards regarding the treatment of operating leases and have applied different restatement methods to capitalize them, i.e., to replace rental expenses by amortization and interest expenses; this affects the measurement of investment returns. Durocher (2008) analyzed the capitalization of operating leases for the 100 largest public companies (by revenue) in Canada using company-specific assumptions (interest rate, life of assets, tax rate). He found that, among 68 firms about whose operating leases in 2002 and 2003 there was sufficient information, the median effect of correcting for amortized leased assets was a 2.6% increase in total assets, while the median effect of the present value of minimum lease payments was a 6.0% increase in total liabilities. Capitalizing operating leases leads to the recognition of important additional assets and liabilities on the balance sheets of the Canadian companies analyzed and would have a significant impact on the debt-to-asset ratio, especially for firms in merchandising and lodging industries.¹¹

2.3 Economic benefits to leasing

Leases represent a significant source of financing for the acquisition of assets. Table 1 shows that lessors of commercial and industrial machinery and equipment (offering either capital or operating leases) generated \$6.7 billion in operating revenues in 2008 and maintained double-digit operating profit rates in the 2000 decade.¹² Data coming from financial statements attached to the tax returns of Canadian corporate businesses show that tangible assets under financial leases represented between 2.5% and 3.0% of tangible capital stock from 2000 to 2008¹³ (Table 2). These estimates should be considered as a lower bound of the share of assets that are either leased or rented, for two reasons: these estimates do not include assets leased under an operating lease; and they do not take into account assets that have been initially leased under a financial lease and subsequently acquired by the lessee.

10. Nailor and Lennard 2000.

11. Industry classification corresponds to the Toronto Stock Exchange industry classification.

12. Operating revenues declined in 2009, but operating profits rate remained above 10%. Data on lessors of automotive equipment rental and leasing (North American Industry Classification System [NAICS] 5321) are not included in these figures as a significant share of their revenues comes from non-business entities (e.g. households, governments). Data on revenues and profits of lessors of commercial real estate (NAICS 5311) are not readily available.

13. The corporate business sector is defined as all businesses filing a T2 tax return, excluding those that come under NAICS 61, 62, and 91. This definition is consistent with the definition of business sector used in stock estimates derived from CAPEX (CANSIM table 031-0002).

Table 1
Commercial and industrial machinery and equipment rental and leasing
(NAICS industry 5324)

	2000	2002	2004	2006	2008
Operating revenues (millions of dollars)	5,297.0	5,733.0	5,334.1	6,013.2	6,742.4
Operating profit rate (percent)	26.3	17.6	12.3	14.6	12.3

Note: NAICS: North American Industry Classification System.

Sources: Statistics Canada, Annual Survey of Service Industries: Commercial and Industrial Machinery Equipment Rental and Leasing, and CANSIM table 352-0009.

Table 2
Tangible capital stock and capital leases in corporate tax returns, business sector

	2000	2002	2004	2006	2008
	millions of dollars ¹				
Tangible capital stock	1,238,349	1,295,808	1,430,013	1,721,920	1,796,925
Capital under financial leases	31,335	38,896	42,234	47,939	52,258
	percent				
Capital under financial leases (percent of tangible capital stock)	2.5	3.0	3.0	2.8	2.9

1. Book value.

Note: Authors' compilation.

Source: Canada Revenue Agency, *General Index of Financial Information (GIFI)*.

In the literature on measuring the cost of capital, Modigliani and Miller (1958) demonstrated that, in a perfect capital market, the real operating cash flow from buying or renting an asset would be invariant to the ownership of the asset.¹⁴ Subsequent research on the reasons behind the decision to lease as opposed to buy has then focused on market imperfections such as taxes, differences in information, and agency costs (Myers 2001). Research on tax-related incentives has shown that the present value of tax savings is thought to be important when a high-tax lessor has an opportunity to take advantage of depreciation and interest deductions that do not benefit a low-tax lessee to the same extent.¹⁵ Tax benefits not available to the lessor may also be available to the lessee—e.g., in some jurisdictions, the cost of owned land is not deductible for tax purposes, but the full deductibility of lease payments makes them effectively deductible to the lessee. Investment tax credits—reductions to taxes payable based on a percentage of the cost of capital assets acquired during the year—are also provided to owners.

14. In the Modigliani-Miller context 'perfect capital market' means that the capital market is competitive, frictionless, and complete. A capital market is complete when the risk characteristics of every security issued by the firm can be matched by purchase of another existing security or portfolio, or can be offset by dynamic trading strategies (Myers 2001).

15. Myers et al. (1976); and Miller and Upton (1976).

Andrew and Gilstad (2005, p. 1) claimed that the previous literature on leasing presents a "failure to seriously consider the differences that exist between the financial characteristics of the lessor and the lessee beyond tax rates." They suggest that, when the lessors' cost of borrowing is lower than that of lessees, both parties may benefit from leasing if the lessor is willing to share the difference.¹⁶ As stated in Andrew and Gilstad (2005), other factors may also influence leasing decisions. These include, but are not restricted to, acquisition costs,¹⁷ residual value realization,¹⁸ and maintenance and operating costs of specialized equipment.¹⁹

Recent academic literature has put the emphasis on the nontax determinants of the decision to lease or buy. Eisfeldt and Rampini (2009) argued that, in the context of the United States, allocating ownership to the financial agent strengthens the financier's claim by facilitating repossession in case of bankruptcy and that this allows the financier to extend more credit.²⁰ Lin et al. (2013) found that financially constrained firms prefer leasing over buying, using firm-specific indicators of financial constraints, including low internal funds, high variability of internal funds, high market-to-book ratio, low asset tangibility, and small size.²¹ They also found that the substitutability between leasing and financing varies with financial constraints: as internal funds fall, firms that are most constrained tend to increase leasing and decrease borrowing while firms that are less constrained tend to decrease leasing and increase borrowing. Rampini and Viswanathan (2012) observed that severely constrained firms find it optimal to lease all their tangible capital and that leasing enables firms to grow faster.

2.4 System of National Accounts recommendations

The definitions of 'operating lease' and 'financial lease' embedded in the SNA are similar to the business accounting standards. According to the SNA 2008, a financial lease is one where the lessor, as legal owner of an asset, passes the economic ownership to the lessee, who then accepts the operating risks and receives the economic benefits from using the asset in a productive activity, and an operating lease is one where the legal owner is also the economic owner and accepts the operating risks and receives the economic benefits from the asset by using it in a productive activity.

The SNA 1993 and the SNA 2008 both provide guidelines for reporting leased and rented capital assets. With respect to financial leases, capital goods purchased under a financial lease should be allocated to the industry of the lessee (user) rather than to that of the lessor (owner) because financial leasing is not itself a process of production: it is rather an alternative financing method used to acquire buildings, machinery and equipment. A distinguishing characteristic of financial leases is that all the risks and rewards of ownership are, *de facto*, transferred from the legal owner (the lessor) to the user (the lessee) of the capital good.

16. The authors argue that the cost of borrowing of lessors is indeed lower than that of lessees. However, this observation is based on a small sample of firms from a voluntary survey conducted for the Equipment Leasing Association.

17. A frequent purchaser (lessor) may be able to acquire assets at lower cost on average than can an infrequent purchaser (lessee), as a result of accumulated knowledge and experience on the quality and capability of an asset.

18. A lessor usually has developed market for the sale or re-lease of used assets and generally realizes higher residual values than can be obtained by an end user (lessee).

19. Proper maintenance and skilled operators may achieve higher output per unit of assets and realize higher residual value. There are cases where the lessor can provide all or parts of the maintenance or operating expenses for a total cost lower than the lessee can provide alone, and achieve the same or better output.

20. Under Chapter 11 of the United States Bankruptcy Code, the lessee must either assume the lease or reject the lease, and must return the asset. In contrast, the collateral that secures the claim of a secured lender is subject to automatic stay and is protected from recovery or foreclosure.

21. Lin et al. argue that the market-to-book ratio can be used as a proxy for the growth option in a firm's investment opportunity set. In a high-growth firm, the conflict of interest between debt holders and stockholders may lead to a problem of underinvestment. One way to alleviate this problem would be to reduce the amount of debt in the capital structure or to use financing that has high-priority claims such as leasing or secured debt.

Under an operating lease, it is the responsibility of the legal owner to provide any necessary repair and maintenance of the asset; hence, the asset remains on the balance sheet of the lessor. According to the SNA 2008, the payments made under an operating lease are referred to as rentals and are recorded as payments for a service. The service provided by the lessor goes beyond the mere provision of the asset. It includes other elements such as convenience and security. Such service can be important to the user because he/she may not have the necessary expertise or facilities to maintain and service the equipment properly.

3 Data

Statistics Canada produces its estimates of capital stock by using investment data from CAPEX and applying the Perpetual Inventory Method (PIM). The target population of CAPEX includes all Canadian businesses. In contrast to business accounting standards and SNA recommendations, CAPEX requires respondents to report assets according to their legal ownership.

Consequently, the industry capital stock derived from CAPEX investment data without any adjustment for financially leased capital is based on legal ownership rather than economic ownership. In consequence, relative to the value added from this type of lease calculated for output, capital stock employed for production estimated from CAPEX would be overestimated in the lessor industries and underestimated in the lessee industries when financial leases are employed. For a measure of industry productivity that accords with the assignment of value added from these leases, financially leased capital needs to be reallocated across industries according to the use of capital provided under financial leases. CAPEX itself provides no information for such an adjustment.

According to the business accounting standards, financially leased capital needs to be reported in the lessee's balance sheet. For this purpose, the GIFI is used.

3.1 *The General Index of Financial Information (GIFI): A brief introduction*

The GIFI is a report that Canadian corporations must include along with their T2 tax returns that provides information reflecting the contents of their financial statements. All corporations are required to file a T2 tax return for every tax year, even when there is no tax payable. The only exception is corporations that were registered charities throughout the tax year. Insurance corporations also do not use the GIFI to report their financial statements but continue to submit paper copies of their financial statements with their T2 tax returns. The Tax Data Division of Statistics Canada imputes values for the insurance industry in the GIFI electronic files.

Two types of business entities covered in CAPEX are not covered in the GIFI: unincorporated businesses and government business enterprises (GBEs). Evidence suggests that the unincorporated sector generated \$93 billion in gross domestic product (GDP) in 2005, or 9.4% of GDP (Rispoli 2009). At an aggregate industry level, this level of GDP stood between the GDP of the wholesale industry (\$66 billion) and the GDP of the mining and oil and gas extraction industry (\$111 billion). However, data on the capital structure of unincorporated businesses are not available (Table 3).

Fixed assets held by GBEs accounted for 8.1% of capital stock of the business sector in CAPEX (as per the CAPEX definition²²) in 2008. GBEs hold significant fixed assets in several industries, such as utilities, transportation, finance, wholesale, and retail.

22. The business sector breakdown available in CANSIM tables is defined as all NAICS industries excluding 61, 62, and 91. Other definitions of business sector are possible.

Table 3
Value of tangible capital stock in GIFI and CAPEX, business sector

	2000	2002	2004	2006	2008
	millions of dollars				
CAPEX excluding intellectual property products	1,830,826	1,969,368	2,047,869	2,293,798	2,648,078
GIFI firms	1,238,349	1,295,808	1,430,013	1,721,920	1,796,925
Government business enterprises	159,584	173,184	182,966	199,137	214,406
Unincorporated businesses

... not applicable

Notes: CAPEX: Capital and Repair Expenditures Survey. Authors' compilation.

Sources: Statistics Canada, CANSIM tables 031-0002, 385-0030 and 385-0031; and Canada Revenue Agency, *General Index of Financial Information (GIFI)*.

The GIFI provides detailed information about the assets and liabilities of Canadian companies, including specific fields for the values of capital leases and their related amortization. However, the reporting of assets acquired under financial leases in these specific fields is voluntary. Only a few aggregates are mandatory in the GIFI. The GIFI structure also provides generic categories to classify an asset when a respondent cannot find an appropriate specific category. However, there are no generic categories that would accommodate capital leases. Therefore, should a respondent not be able to report a capital lease in a specific category, it would likely be included only in the 'total assets' mandatory aggregate and in no other specific categories. For the purposes of this paper, it is assumed that businesses having capital leases report them in the appropriate fields.

Table 4
GIFI variables for tangible capital acquired under financial leases

GIFI variable code	Description
Leased-out	
L1069	Lease receivable
L1070	Allowance for doubtful amounts contained in leases receivable
Leased-in	
L1910	Capital leases—Buildings
L1911	Accumulated amortization of capital leases—Buildings
L1912	Capital leases—Equipment
L1913	Accumulated amortization of capital leases—Equipment
L1914	Capital leases—Vehicles
L1915	Accumulated amortization of capital leases—Vehicles
L1916	Capital leases—Others
L1917	Accumulated amortization of capital leases—Others
L1918	Leasehold improvements
L1919	Accumulated amortization of leasehold improvements
Total tangible capital	
L2008	Total stock of tangible capital asset
L2009	Total accumulated amortization of tangible capital assets

Source: Canada Revenue Agency, *General Index of Financial Information (GIFI)*.

GIFI balance sheets have information on financial leases booked from the lessor's perspective. Long-term leases receivable are combined with other long-term assets, and the two cannot be separated. However, information on current leases receivable (L1069), together with an allowance for doubtful amounts contained in leases receivable (L1070), is available (see Table 4) and will be used in the correction procedure for financial leases presented in Section 4.

3.2 Rental variables in the input-output tables

Detailed input-output tables provide information on rental commodities that can be used for the adjustment of operating leases. The Canadian input-output framework includes five rental commodities related to the use of capital under operating leases (see Table 5). Estimates of industry rental revenues and rental expenses of these commodities in the input-output tables are based on relevant industry surveys and T1 and T2 tax files.

Table 5
Input-output commodities on capital rental

Input-Output Commodity Classification code (W level)	Description
5594	Non-residential rent
5752	Rental and leasing of computers and related equipment (hardware only)
5520	Rental and leasing of office equipment, except computer equipment
5770	Rental and leasing of automotive equipment
5792	Rental and leasing of commercial and industrial machinery and equipment, except computer equipment

Source: Statistics Canada, *Hierarchical Structure of the Input-Output Commodity Classification*.

Finally, the study uses the data from the GIFI and from the input-output tables to correct industry multifactor productivity growth estimates for financial and operating leases. The multifactor productivity estimates come from the CPA.²³ CPA data include variables on industry real and nominal value added, labour income and labour input, and capital input.

The correction procedures for financial and operating leases are presented in Sections 4 and 5, respectively.

4 Correcting for capital under financial leases

This section introduces a procedure to calculate adjustments for financial leases from GIFI data and then apply this adjustment in order to correct multifactor productivity growth estimates found in the CPA.

At any point of time, it is assumed that the value of capital used in an industry is equal to the value of its legally owned capital adjusted by adding the value of capital it leases in (as a lessee) and deducting the value of capital it leases out (as a lessor) under financial leases. Let i and t be indexes for industry and time, $V(K_{it}^{LEGAL})$ and $V(K_{it}^{ECON})$ be the net value of capital stock recorded based on legal ownership and economic ownership, $V(K_{it}^{IN})$ be the net value of stock of financially leased-in capital, and $V(K_{it}^{OUT})$ be the net stock of financially leased-out capital. The resulting identity is the following:

$$V(K_{it}^{ECON}) \equiv V(K_{it}^{LEGAL}) + V(K_{it}^{IN}) - V(K_{it}^{OUT}). \quad (1)$$

The adjusting factor for financial leases is defined as the ratio of the net value of leased-in capital to the economically owned capital, i.e.,

$$\alpha_{it} = \left((V(K_{it}^{IN}) - V(K_{it}^{OUT})) / V(K_{it}^{ECON}) \right). \quad (2)$$

23. Statistics Canada, Canadian Productivity Accounts and CANSIM table 383-0021.

The ratio derived from Equation (2) is applied using GIFI data (α_{it}) in order to adjust the existing industry capital stock derived from the CAPEX data (K_{it}). It is assumed that applying the adjustment α_{it} to the existing data has no price effect on industry capital stock, which is equivalent to assuming that the industry composition of capital assets remains unchanged.²⁴ The net capital stock by industry adjusted for financial leases is estimated as

$$\tilde{K}_{it} = K_{it}^{LEGAL} / (1 - \alpha_{it}). \quad (3)$$

Existing capital input (Z_{it}) also needs to be adjusted in order to re-estimate industry multifactor productivity growth. Adjusting capital input for financial leases requires information on leased capital by asset type. This information is not available in the GIFI for leased-out capital. To overcome the problem, the study assumes that the ratio of capital stock to capital input remains unchanged before and after the adjustment. On the basis of this assumption, capital input is adjusted using the same factor, i.e.,

$$\tilde{Z}_{it} = Z_{it} / (1 - \alpha_{it}). \quad (4)$$

Under a financial lease, the lessee is entitled to the rewards, and is responsible for all expenses, associated with the use of the leased capital. This implies that whether capital is financially leased or owned has no impact on corporate reports of operating revenues and expenses. Therefore, the labour income share in industry value added (w_{it}) remains unchanged, and the adjusted industry multifactor productivity growth becomes

$$\begin{aligned} \Delta \ln(MFP_{it}) &= \Delta \ln(MFP_{it}) - (1 - \bar{w}_{it}) \Delta \ln(\tilde{Z}_{it} / Z_{it}) = \Delta \ln(MFP_{it}) + (1 - \bar{w}_{it}) \Delta \ln(1 - \alpha_{it}), \\ \text{where } \bar{w}_{it} &\equiv \frac{w_{it} + w_{it-1}}{2}. \end{aligned} \quad (5)$$

The adjustments for financial leases calculated in Equations (3) and (4) increase capital in lessee-dominant industries and hence decrease the multifactor productivity level in these industries. The impact is opposite to that in the lessor-dominant industries. How the industry multifactor productivity growth is affected depends on the change over time in the importance of financial leases. The adjusted multifactor productivity growth will be higher in an industry when the share of capital obtained under a financial lease in the total capital employed for production in the industry becomes smaller.

The rate of return on capital by industry changes after correcting for financial leases. Defining the gross rate of return on capital (Γ_{it}) as the ratio of capital income (Y_{it}^K) to nominal capital stock ($P_{it}^K K_{it}$) yields

$$\tilde{\Gamma}_{it} = \frac{Y_{it}^K}{P_{it}^K \tilde{K}_{it}} = \frac{Y_{it}^K}{P_{it}^K K_{it} / (1 - \alpha_{it})} = (1 - \alpha_{it}) \frac{Y_{it}^K}{P_{it}^K K_{it}} = (1 - \alpha_{it}) \Gamma_{it}. \quad (6)$$

Equation (6) implies that the gross rate of return on capital will increase for the lessor-dominant industries and decrease for the lessee-dominant industries after adjustment for financial leases.

The GIFI elements related to financial leases are used to calculate industry aggregate leased-in capital stock net of amortization:

24. This simplification may or may not be appropriate but is required given that a detailed breakdown of industry capital structure by type of assets is not readily available for this analysis.

$$\begin{aligned}
K_{it}^{ECON} &= \sum_j (L2008_{jt} - L2009_{jt}) \\
K_{it}^{IN} &= \sum_j (L1910 + L1912 + L1914 + L1916 + L1918)_{jt} \\
&\quad - \sum_j (L1911 + L1913 + L1915 + L1917 + L1919)_{jt} \\
&\quad \forall j(\text{firm}) \in i(\text{industry}).
\end{aligned} \tag{7}$$

The GIFI balance sheets do not have information on leased-out capital by industry. The current leases receivable net of the allowance for doubtful amounts gives the current due (CD_{it}) of lease payments from the lessee in industry i at time t , i.e.,

$$CD_{it} = \sum_j (L1069_{jt} - L1070_{jt}), \quad \forall j(\text{firm}) \in i(\text{industry}). \tag{8}$$

The current leases receivable in the GIFI include personal use of capital goods under financial leases such as leases for household appliances and motor vehicles. Household appliance manufacturing (NAICS 3352) is dropped, and leases receivable from the motor vehicle manufacturing industry (NAICS 3361) are adjusted by the share of non-personal use of motor vehicles in order to exclude capital leased to households.²⁵

It is assumed that the duration structure of lease receivables is the same across industries, and that total capital leased from GIFI firms to non-GIFI firms and from non-GIFI firms to GIFI firms is balanced. Therefore,

$$\frac{CD_{it}}{\sum_i CD_{it}} = \frac{K_{it}^{OUT}}{\sum_i K_{it}^{OUT}} \Rightarrow K_{it}^{OUT} = \frac{CD_{it}}{\sum_i CD_{it}} \sum_i K_{it}^{OUT}. \tag{9}$$

It is also assumed that total capital leased from GIFI firms to non-GIFI firms and from non-GIFI firms to GIFI firms is balanced, i.e.,

$$\sum_i K_{it}^{OUT} = \sum_i K_{it}^{IN}. \tag{10}$$

Substituting (10) into (9) gives

$$K_{it}^{OUT} = \frac{CD_{it}}{\sum_i CD_{it}} \sum_i K_{it}^{IN}. \tag{11}$$

Substituting results from (7) and (11) into (2) yields the adjusting factor for financial leases (α_{it}). Public sector entities are excluded from this calculation.

4.1 Empirical results

Table 6 gives the estimated adjusting factor for financial leases for the business sector industries over the 2000-to-2008 period. It is noteworthy that financial leases may not be fully adjusted when applying this factor for CAPEX-based capital stock estimates. The capital assets that are originally acquired under a financial lease and have not been fully worn out would not be reported as leased capital in the GIFI if they are fully paid off. In this case, the remaining value of these assets is still included in the CAPEX-derived capital stock of the lending industry.

25. The study estimates from final demand tables that the share of leases receivable coming from the business sector stands at between 15% and 25% of leases receivable in this industry from 2000 to 2010, depending on the year.

Table 6**Adjustment factor¹ for financial leases, 2000 to 2008**

Industry (NAICS code)	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean
	percent									
Agriculture (11)	0.7	0.7	0.7	0.6	0.6	0.7	0.8	0.6	0.7	0.7
Mining (21)	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Utilities (22)	0.6	0.5	0.4	0.4	0.5	0.4	0.2	0.1	0.1	0.4
Construction (23)	1.3	1.3	1.3	1.3	1.4	1.7	1.0	1.2	1.4	1.3
Manufacturing (31, 32, 33)	1.0	0.4	0.3	0.4	0.3	0.4	0.9	1.3	0.7	0.6
Wholesale trade (41)	4.6	4.7	3.9	2.7	2.9	3.0	3.8	5.4	7.1	4.2
Retail trade (44, 45)	16.1	15.3	14.7	14.3	13.1	13.4	13.4	13.4	13.1	14.1
Transportation (48, 49)	2.3	3.6	3.0	3.1	3.4	3.7	3.8	3.7	3.4	3.3
Information (51)	2.3	2.3	3.9	2	2.2	1.9	2.2	2.3	2.6	2.4
FIRE (52, 53, 55)	-8.1	-7.8	-8.7	-8.5	-7.9	-8	-8.2	-7.7	-8.4	-8.1
Professional services (54)	1.3	2.4	9.7	9.6	4.2	4.5	4.5	4.8	4.7	5.1
Administrative (56)	6.8	5.8	4.9	4.7	4.1	3.3	3.3	3.9	3.7	4.5
Arts, entertainment (71)	4.0	3.7	4.5	4.6	4.8	4.2	4.5	4.2	7.1	4.6
Accommodation, food (72)	7.4	8.4	8.0	8.6	9.0	9.6	9.9	10.1	10.9	9.1
Other private (61, 62, 81)	5.3	5.2	4.6	5.8	6.2	6.2	7.2	6.9	7.1	6.1

1. Refers to the alpha defined by Equation (2).

Notes: FIRE: finance, insurance, and real estate; NAICS: North American Industry Classification System. Authors' compilation.

Source: Canada Revenue Agency, *General Index of Financial Information (GIFI)*.

Several observations are in order. First, the finance, insurance, and real estate (FIRE) industry is the only industry with net lending. Over the 2000-to-2008 period, net lease-out capital accounted for more than 8.0% of the total capital employed in the FIRE industry on average, and this share was stable over time. Second, acquiring capital assets under financial leases is not a widespread practice in goods-producing industries. The ratio of the net leased-in capital to the total capital employed averaged 0.7% in agriculture,²⁶ 0.2% in mining, 0.4% in utilities, 1.3% in construction, and 0.6% in manufacturing. Third, businesses in the services-producing industries rely more heavily on leased capital, especially those in retail trade and those in accommodation and food. Net leased-in capital accounted for more than 14% of the total capital employed in retailing and for more than 9.0% of the total capital employed in accommodation and food. Fourth, many services-producing industries experienced an increasing tendency to use capital acquired under financial leases. For instance, the share of the net leased-in capital increased by 3.5 percentage points in accommodation and food, and by 3.4 percentage points in professional services, over the 2000-to-2008 period.

Equation 6 shows that the adjusting factor (α) is equal to the percent change in the rate of return on capital. For instance, Table 6 suggests that the average rate of return on capital decreases by 14.1% in retail trade and by 9.1% in accommodation and food, and increases by 8.1% in FIRE.

The estimated adjusting factor for financial leases is incorporated into Equation (5) to recalculate industry multifactor productivity growth. The results are shown in Table 7. On average over the 2000-to-2008 period, multifactor productivity growth changes in most services-producing industries but remains almost unchanged in the goods-producing industries. The amount and the direction of the adjustment in the industry multifactor productivity growth are related to the change in the relative importance of financial leases to the capital employed in each industry. For instance, the ratio of capital assets under financial leases to total capital employed increased from 4.6% in 2000 to 7.1% in 2008 for wholesale but decreased from 16.1% in 2000 to 13.1% in 2008 for retail;

26. This takes into account only the incorporated part of agriculture. Incorporated farms represent less than 20% of the total number of farms. More than 50% of farms are operated by sole proprietors, the rest consisting of farms operated by partnerships (Statistics Canada 2012).

accordingly, adjusting for financial leases led to a 0.14-percentage-point decrease and a 0.12-percentage-point increase in multifactor productivity growth for these two industries, respectively.

Table 7
Impact of financial leases on annual MFP growth, business industries,
2000 to 2008

Industry (NAICS code)	Unadjusted MFP growth	Adjusted MFP growth	Difference	Average nominal GDP share
	percent	percent	percentage points	percent
Agriculture (11)	2.87	2.87	0.00	2.65
Mining (21)	-6.15	-6.15	0.00	9.81
Utilities (22)	1.25	1.29	0.05	3.16
Construction (23)	-0.15	-0.15	0.00	8.02
Manufacturing (31, 32, 33)	-0.52	-0.50	0.02	20.33
Wholesale trade (41)	1.74	1.61	-0.14	6.81
Retail trade (44, 45)	1.35	1.47	0.12	7.53
Transportation (48, 49)	-0.32	-0.36	-0.05	6.10
Information (51)	2.36	2.35	-0.01	4.57
FIRE (52, 53, 55)	0.13	0.15	0.02	10.71
Professional services (54)	-0.21	-0.27	-0.06	6.51
Administrative (56)	-0.81	-0.72	0.09	3.39
Arts, entertainment (71)	-1.19	-1.30	-0.11	1.02
Accommodation, food (72)	-0.18	-0.28	-0.11	3.16
Other private (61, 62, 81)	-1.31	-1.38	-0.07	6.25

Notes: FIRE: finance, insurance, and real estate; GDP: gross domestic product; MFP: multifactor productivity; NAICS: North American Industry Classification System. Authors' calculations.

Sources: Statistics Canada, Canadian Productivity Accounts; Canada Revenue Agency, *General Index of Financial Information (GIFI)*.

Applying the correction for financial leases may lead to a change in the bottom-up estimate of aggregate multifactor productivity growth because of changes in the industry share of capital (Table 7). Such impact is expected to be small. Over the 2000-to-2008 period, the correction for financial leases leads to an increase of 0.05 percentage points per year (from -0.52% to -0.47%) in aggregate multifactor productivity growth (bottom-up).

5 Correcting for capital under operating leases

A different adjustment is introduced in this section. This adjustment makes changes to the conventional multifactor productivity estimates in order to reallocate assets used under an operating lease from the owning industry to the using industry. Under an operating lease, the user (lessee) pays the owner (lessor) a fee in exchange of the right to the use those specified capital assets. In practice, capital assets under operating leases remain in the owners' balance sheets, and the rental payments and revenues of capital assets under operating leases are correctly reported in the income statements of both the lessee and lessor as a part of their production expenses and revenues, respectively. Consequently, from the users' perspective, the operating profits would be lower if the capital used for production were rented rather than owned. For output and input to be fully lined up with each other for the purposes of this exploration, rental revenues

and payments with respect to rented capital must be re-categorized or reallocated from users' perspective.²⁷

The rental payments of capital under operating leases correspond to the lessee's user cost of the rented capital. For productivity to be measured consistently with capital in the industry of use, the rental payments must be deducted from the lessee's production expenses and added to his or her operating profits, and the rental revenues must be deducted from the lessor's income. At an aggregate level in the total economy, there is no change in overall operating surplus.

Let t and i be time and industry indexes. The net rental expenses (R^Δ) of an industry at a point in time is the difference between its rental expenses (R^E) and rental revenues (R^R), i.e.,

$$R_{it}^\Delta = R_{it}^E - R_{it}^R. \quad (12)$$

A positive (negative) net rental expense of an industry at a point of time implies that the industry at that time has more (less) capital rented in than rented out, so that the capital stock and capital income of the industry should be adjusted up (down) to reflect the actual use of capital and the corresponding capital income in the industry.

Let Y be the value added, Y^L be the labour income, and Y^K be the capital income for an industry. Let variables with a hat be operating-lease-adjusted variables. For an industry, its value added and capital income will increase by the amount of the net rental expenses after adjustment for operating leases, i.e.,

$$\begin{aligned} \hat{Y}_{it} &= Y_{it} + R_{it}^\Delta \\ \hat{Y}_{it}^K &= Y_{it}^K + R_{it}^\Delta \\ \hat{Y}_{it}^L &= Y_{it}^L. \end{aligned} \quad (13)$$

The adjusting factors for value added and capital income for operating leases are defined as

$$\beta_{it} \equiv R_{it}^\Delta / Y_{it}, \quad \gamma_{it} \equiv R_{it}^\Delta / Y_{it}^K. \quad (14)$$

The adjusted labour income share becomes

$$\hat{w}_{it} \equiv \frac{\hat{Y}_{it}^L}{\hat{Y}_{it}} = \frac{Y_{it}^L}{(1 + \beta_{it})Y_{it}} = \frac{w_{it}}{1 + \beta_{it}}. \quad (15)$$

In estimating the real variables required for re-estimating multifactor productivity growth at an industry level, let Z_{it} be capital input of owned capital and Z_{it}^Δ be capital input of rented capital. Assume that owned and rented capital are indifferent in terms of capital service provided

27. The payments for operating leases actually cover several components: 1) the user cost of capital; 2) the cost of the lessor for providing the leasing service; 3) financial charges of the lessor and 4) profit margin of the lessor. Due to lack of data, we treat all rental payments as user costs of capital. Overadjustment may be an issue and needs to be assessed whenever data is readily available.

(measured by capital income) per unit of capital input. In other words, the implicit price index of capital input is equalized for owned and rented capital.²⁸ That is,

$$\frac{R_{it}^{\Delta}}{Z_{it}^{\Delta}} = \frac{Y_{it}^K}{Z_{it}} \Rightarrow Z_{it}^{\Delta} = \frac{R_{it}^{\Delta}}{Y_{it}^K} Z_{it} = \gamma_{it} Z_{it}. \quad (16)$$

For simplicity, it is assumed that capital input is additive. Consequently, the adjusted capital input for operating leases becomes

$$\hat{Z}_{it} = Z_{it} + Z_{it}^{\Delta} = (1 + \gamma_{it}) Z_{it}. \quad (17)$$

Similarly, the adjusted real industry value added becomes

$$\hat{Q}_{it} = Q_{it} + \Delta R_{it} / P_{it}^Y = Q_{it} + \Delta R_{it} / (Y_{it} / Q_{it}) = Q_{it} (1 + \beta_{it}). \quad (18)$$

Note that the labour input (L) remains unchanged after adjustment for operating leases. The adjusted multifactor productivity growth can then be calculated as

$$\Delta \ln(MFP_{it}) = \Delta \ln(\hat{Q}_{it}) - \hat{w}_{it} \Delta \ln(L_{it}) - (1 - \hat{w}_{it}) \Delta \ln(\hat{Z}_{it}) \quad (19)$$

where $\hat{w}_{it} \equiv \frac{\hat{w}_{it} + \hat{w}_{it-1}}{2}$.

5.1 Empirical results

The rental expense and the rental revenue of an industry are obtained by summing the inputs and outputs of these five commodities based on the W-level input-output tables. The share of the net rental expenses in nominal value added (β) and the share of the net rental expenses in capital income (γ) for each industry are then calculated. The results are shown in Table 8 and Table 9.

Several observations are noteworthy. First, the FIRE industry is the major source of capital rented under operating leases. The net rental income received in the industry accounted for about 26% of its value added and about 48% of its capital income on average over the 1997-to-2008 period. Second, utilities and wholesale trade are the two other industries that have more rental income than rental expenses, although by a smaller margin. The shares of the net rental income in value added and capital income were 2.0% and 2.7% for the utilities sector, and 1.8% and 5.6% for wholesale trade, respectively. Third, acquiring capital goods through operating leases is more intensive in services-producing industries than in goods-producing industries. After adjustment for operating leases, the industry value added and capital income would, on the high end, increase by 9.4% and 41% in administrative services, respectively, and by 8.6% and 47% in professional

28. Dealing with the net rental payments here is equivalent to treating the rent-in and rent-out capital symmetrically; i.e., within an industry, both capital added corresponding to the rental payments and capital deducted corresponding to the rental revenue are based on the rate of return on capital in this industry. Under this assumption, the rate of return on capital remains unchanged after the adjustment for operating leases. However, this method may lead to imbalance between imputed rent-in and rent-out capital. For example, Industry A pays an amount to Industry B for capital rental. The adjustment made in this study is to add capital to Industry A according to the rate of return on capital in Industry A and to deduct capital from Industry B according to the rate of return on capital in Industry B. Rates of return on capital are usually different across industries; consequently, the amount added to Industry A and the amount deducted from Industry B are not the same. Ideally, it should be assumed that capital used in an industry for production, either owned or rented, earns the same rate of return; in this way, rent-in capital can be imputed and then reallocated to lessor industries on the basis of bilateral rental flows. Given the lack of data on bilateral rental flows between industries, on rental flows to and from the non-business sector, and on international rental flows, this approach cannot be implemented.

services, respectively; on the low end, the increases were 1.6% and 3.7% in manufacturing, and 2.1% and 2.7% in mining.

The two adjusting factors are then used to adjust industry multifactor productivity growth for operating leases. The results are shown in Table 10. The adjustment of multifactor productivity growth for operating leases is substantial in some industries (mainly the services-producing industries) but insignificant in other industries (mainly the goods-producing industries). The average annual multifactor productivity growth over the 1997-to-2008 period is raised by 0.33 percentage points per year (from -0.15% to 0.18%) in FIRE and by 0.1 percentage point per year (from -1.92% to 2.02%) in retail trade; meanwhile, it is reduced by 0.3 percentage points per year (from -1.49% to -1.79%) in other private services and by 0.24 percentage points per year (from 0.16% to -0.08%) in professional services. Again, the impact on the bottom-up estimate of the aggregate multifactor productivity growth is small. Over 1997-to-2008 period, the correction for operating leases leads to an increase of 0.03 percentage points per year (from 0.09% to 0.12%) in the aggregate multifactor productivity growth (bottom-up).

Table 8
Share of net rental expense in value added, 1997 to 2008

Industry (NAICS code)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean
	percent												
Agriculture (11)	1.18	1.18	2.03	3.23	3.10	3.26	3.80	3.62	4.10	4.08	3.72	3.17	3.04
Mining (21)	3.26	4.11	3.39	1.93	1.99	2.02	1.70	1.56	1.30	1.26	1.12	1.01	2.05
Utilities (22)	-1.71	-1.40	-1.69	-1.69	-1.90	-1.97	-1.64	-2.04	-2.15	-2.30	-2.59	-2.97	-2.00
Construction (23)	3.31	3.43	3.96	3.75	3.69	3.31	3.55	3.47	3.70	3.65	3.36	3.60	3.56
Manufacturing (31, 32, 33)	1.63	1.49	1.24	1.36	1.18	1.62	1.69	1.51	1.62	1.77	1.80	1.88	1.57
Wholesale trade (41)	-3.13	-2.40	-1.85	-1.95	-2.00	-2.13	-1.99	-1.92	-1.24	-1.16	-0.87	-1.13	-1.81
Retail trade (44, 45)	7.69	7.90	7.59	6.68	6.44	4.97	4.12	4.59	4.65	4.75	4.58	4.60	5.72
Transportation (48, 49)	6.97	7.68	8.08	8.57	8.22	7.10	7.24	7.67	6.37	5.97	5.93	6.31	7.18
Information (51)	3.11	3.95	4.04	4.15	4.47	3.77	3.84	3.48	3.68	3.95	4.22	4.42	3.92
FIRE (52, 53, 55)	-26.24	-26.62	-28.15	-28.40	-27.91	-26.70	-25.93	-25.81	-25.64	-25.53	-24.97	-25.65	-26.46
Professional services (54)	8.28	8.46	9.81	9.34	9.59	9.10	8.20	8.24	8.17	8.10	7.93	7.85	8.59
Administrative (56)	9.36	9.13	10.44	11.30	11.00	10.45	9.46	9.20	8.62	8.39	7.73	7.53	9.38
Arts, entertainment (71)	6.52	4.69	5.51	5.82	6.31	5.92	5.96	6.48	5.74	5.63	6.40	6.21	5.93
Accommodation, food (72)	8.22	9.26	8.09	8.79	8.78	7.88	7.18	6.89	6.73	7.20	6.95	6.85	7.73
Other private (61, 62, 81)	6.99	8.03	8.33	8.00	7.59	7.37	7.32	7.74	7.67	7.45	7.49	7.39	7.62

Notes: FIRE: finance, insurance, and real estate; NAICS: North American Industry Classification System. Authors' calculations.

Sources: Statistics Canada, input-output tables and Canadian Productivity Accounts.

Table 9
Share of net rental expense in capital income, 1997 to 2008

Industry (NAICS code)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean
	percent												
Agriculture (11)	2.02	1.96	3.49	5.63	5.38	5.47	6.55	6.02	7.37	7.54	6.53	4.80	5.23
Mining (21)	4.54	6.27	4.60	2.32	2.48	2.58	2.06	1.87	1.53	1.52	1.37	1.19	2.70
Utilities (22)	-2.21	-1.84	-2.22	-2.21	-2.48	-2.58	-2.15	-2.78	-2.88	-3.16	-3.47	-3.99	-2.66
Construction (23)	19.62	20.89	23.08	22.01	18.59	15.34	15.19	13.66	14.09	14.52	13.21	14.09	17.03
Manufacturing (31, 32, 33)	3.78	3.42	2.64	2.80	2.55	3.57	3.93	3.56	4.03	4.47	4.53	4.77	3.67
Wholesale trade (41)	-10.10	-7.86	-6.03	-6.52	-6.67	-6.92	-5.90	-5.43	-3.44	-3.05	-2.28	-3.13	-5.61
Retail trade (44, 45)	38.98	40.70	36.04	30.70	25.71	18.63	14.68	16.50	16.09	16.33	15.00	15.18	23.71
Transportation (48, 49)	20.37	23.49	24.96	26.71	24.60	21.30	20.68	22.96	18.08	16.77	17.00	18.35	21.27
Information (51)	5.69	7.55	8.15	8.82	9.30	7.54	7.53	6.63	6.95	7.43	8.04	8.50	7.68
FIRE (52, 53, 55)	-47.25	-47.57	-50.26	-52.78	-51.16	-48.77	-46.80	-47.07	-47.21	-47.01	-46.01	-47.00	-48.24
Professional services (54)	40.63	44.82	54.88	55.04	61.23	52.59	45.19	44.23	43.89	41.01	40.65	41.33	47.12
Administrative (56)	38.13	40.10	49.13	53.58	48.71	44.06	39.38	38.20	35.62	36.26	33.89	34.86	40.99
Arts, entertainment (71)	21.25	18.81	22.26	23.10	25.05	22.83	22.88	24.55	21.35	19.92	23.32	22.91	22.35
Accommodation, food (72)	36.61	41.36	35.20	40.87	40.21	34.91	31.51	30.15	29.40	33.72	32.94	33.45	35.03
Other private (61, 62, 81)	23.42	27.03	27.56	26.82	25.11	23.96	23.54	24.39	24.67	23.26	23.62	23.64	24.75

Notes: FIRE: finance, insurance, and real estate; NAICS: North American Industry Classification System. Authors' calculations.

Sources: Statistics Canada, input-output tables and Canadian Productivity Accounts.

Table 10
Impact of operating leases on annual MFP growth, business industries,
1997 to 2008

Industry (NAICS code)	Unadjusted MFP growth	Adjusted MFP growth	Difference	Average nominal GDP share
	percent	percent	percentage points	percent
Agriculture (11)	3.45	3.45	0.00	2.65
Mining (21)	-4.71	-4.69	0.02	9.81
Utilities (22)	1.21	1.21	0.00	3.16
Construction (23)	0.75	0.83	0.08	8.02
Manufacturing (31, 32, 33)	0.76	0.74	-0.02	20.33
Wholesale trade (41)	2.25	2.26	0.01	6.81
Retail trade (44, 45)	1.92	2.02	0.10	7.53
Transportation (48, 49)	-0.37	-0.46	-0.09	6.10
Information (51)	1.83	1.81	-0.02	4.57
FIRE (52, 53, 55)	-0.15	0.18	0.33	10.71
Professional services (54)	0.16	-0.08	-0.24	6.51
Administrative (56)	0.07	0.10	0.03	3.39
Arts, entertainment (71)	-0.88	-0.97	-0.09	1.02
Accommodation, food (72)	0.50	0.56	0.07	3.16
Other private (61, 62, 81)	-1.49	-1.79	-0.31	6.25

Notes: FIRE: finance, insurance, and real estate; GDP: gross domestic product; MFP: multifactor productivity; NAICS: North American Industry Classification System. Authors' calculations.

Sources: Statistics Canada, input-output tables and Canadian Productivity Accounts.

6 Conclusion

Firms often lease or rent, rather than purchase, capital assets employed in production. Both business and national accounting standards recommend that the income accruing from, and the amount of the capital assets under, financial leases be recorded on users' accounts and that, under operating leases, these be recorded on owners' accounts. This asymmetric treatment between financial and operating leases creates a challenge for those exercises in productivity measurement that would like to treat all capital assets consistently and place them in the industry where they are directly used in the production process.

In the CSNA, the treatment of capital assets under operating leases follows international standards. However, the amount of capital assets under financial leases is recorded on owners' accounts because CAPEX, the source data for the capital stock estimation in the CSNA, asks that all leased capital be reported by owners. For consistency, in order for changes in the application of capital to be consistent with income treatment in the SNA, these financial assets must be transferred to the industry of use. If, in addition, a consistent treatment of all leases is desired, the capital assets under both financial and operating leases must be reallocated from the lending industries to industries that actually use them for production, and all income derived there from needs to be allocated to the industry in which capital is used in production.

This paper is an exploratory project to test the robustness of existing practices of data collection on leased and rented capital. It uses the GIFI corporate balance sheets and detailed input-output tables to reallocate leased and rented capital across industries. The results show that financial and operating leases are commonly used for capital acquisition by Canadian businesses during the 2000-to-2008 period. Many services-producing industries acquire capital through leases, and estimates of multifactor productivity growth in some of these industries are affected—sometimes substantially—by the existing treatment of leased and rented capital.

The impact of the adjustment for operating leases on multifactor productivity growth estimates in some individual industries is particularly noteworthy. The average annual growth rate of multifactor productivity for the FIRE industry increases by 0.33 percentage points during this period, while it decreases by 0.24 percentage points for professional services. The share of net rental expenses on value added and capital income is negative for FIRE, wholesale trade and utilities industries, suggesting that these industries are net lessors of capital. In the case of FIRE industries, the magnitude of net rental expenses represents almost half of the magnitude of its capital income. This is consistent with the view that financial industries have the financial capacity to acquire assets and provide users in other industries with the possibility of using those assets under flexible terms. On the other hand, net rental expenses represent between a third and half of capital income on average for administrative services, professional services and accommodation and food industries, suggesting that these industries use significant amounts of rented capital.

The most significant impact of the adjustment for financial leases on multifactor productivity growth estimates for the 2000-to-2008 period shows up in wholesale and retail trade industries, with a decrease of 0.14 percentage points in the average annual multifactor productivity growth rate for the former and an increase of 0.12 percentage points for the latter.

The magnitude of these changes on estimates of average annual multifactor productivity growth by industry may seem small at first glance but their compounded effect over several years is multiplicative and may provide a different assessment of productivity growth in the long-run. Analyzing capital movements between lessors and lessees taking into account changes in the capital structure by asset type and industry could provide more refined estimates of the impact of leased and rented capital on multifactor productivity growth.

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