

Unearthing the Full Economic Impact of Canada's Natural Resources

What are they? How important are they?

Philip Cross

May 2015

16.6%

Directly contributed to Canada's GDP

Nearly

14%

of Canada's jobs

Nearly

2/3

of spending in business investment and exports



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In 2010 natural resource industries directly contributed

\$260 billion

to Canada's GDP

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Resource-based manufacturing
represented

46.2%

of all manufacturing output
in 2010

Executive Summary

How important are Canada's abundant natural resources to the nation's economy? Are we too reliant on "hewing wood" and "drawing water", as media pundits often fret? What about price fluctuations in commodities? And what are the benefits Canada derives from its resources in terms of employment, business investment, and exports?

To answer these vital questions it is necessary to understand what natural resources are, and there has been surprisingly little agreement on this seemingly basic point. This paper attempts to answer the question with greater rigour than has been attempted in the past, which will help reveal how important resources are to the larger economy.

What are resources?

Resource-based industries of course include primary extractive and agricultural industries (agriculture, forestry, fishing, and mining) although there has been some disagreement even over this definition in previous studies. More difficult is determining which downstream industries should be included.

This paper proposes a definition which includes all of the primary industries, including utilities. It then adds industries that rely on resources for greater than 17 percent of their inputs, which includes such sectors as primary metal manufacturing, pulp and paper manufacturing, and pipeline transport.

How important are they?

In 2010, the most recent year figures are available, **natural-resource industries directly contributed \$260 billion or 16.6 percent of GDP**, with mining and oil and gas leading the way. Resource-based manufacturing represented 46.2 percent of all manufacturing output in 2010.

The production of natural resources affects all industries in Canada. For example, by simulating a 10 percent increase in GDP in natural resources production we see **that each dollar of increased resource output generates \$2.32 of economy-wide GDP**. Indeed, the indirect and induced impacts are larger outside the resource sector than within it. Growth in the natural resource sector is particularly beneficial to the services sector. This close interrelationship between services (mostly produced in large urban areas) and resources (mostly produced in remote rural areas) is not appreciated enough by most analysts. Business and financial services and transportation all see a sizeable increase in demand as output grows in the resource sector.

Employment

Resources contribute slightly less to total employment than to output, reflecting the capital intensive nature of most of these industries, with about **14 percent of workers** employed in the resource sector.

There has been surprisingly little agreement on what natural resources are.

Business investment

Natural resources have become the dominant force in business investment in Canada, particularly the energy sector. In 2013 they accounted for **\$144.5 billion or 61 percent of all business investment** in plant and equipment, up from 38.2 percent in 1999.

Exports

The trend for exports is almost the same as for business investment – a reflection of how earnings from exports are used to fund new investments. Natural resources exports totalled \$308.4 billion in 2014, or 58.3% of all merchandise exports up from a low of 39% in 2000.

Recessions in resources are different

Cyclical downturns in the resource sector are fundamentally different than in other sectors, such as manufacturing or housing, because prices absorb most of the adjustment in resources while output bears the brunt in most other sectors. During the 2008/2009 recession for example, manufacturing output fell by 17.6 percent while prices rose 0.6 percent. However, the resources sector adjusts to lower demand primarily through lower prices and profits, not production cuts. Already one can see this response occurring for oil output in 2015. Despite sharply lower prices, **oil output so far in the first quarter of 2015 rose 4.4 percent from a year earlier**. The effect of slumping commodity prices, especially for oil, is to reduce investment, which shows up with a considerable lag.

Canada is heavily dependent on resources, and it's a good thing, too

Applying the definition proposed by this paper it becomes clear that resources are important

contributors to GDP growth and jobs, and absolutely vital to investment and exports, where they account for two-thirds of all spending. Since business investment has leaned so heavily in developing our natural-resource base in recent years, resources are destined to play a key role in Canada's economy for decades to come.

Natural resources are destined to play a key role in Canada's economy for decades to come.

The growth of natural resources has been integral to the transformation and growth of manufacturing in Canada, contrary to fears of Dutch disease affecting the sector. The resource economy has extensive linkages with other industries, notably commercial services in large cities. There is no conflict between rural and urban or extraction and manufacturing, contrary to the tone of much media commentary.

Nor is there reason to believe the recent slump in commodity prices, which has been mild compared with some downturns in the past, marks the end of the long-term upward trend of output in resource-based industries. Only by embracing our rich endowment and history of natural resources will Canada extract their full value.

Sommaire Exécutif

Comment l'abondance de ressources naturelles au Canada profite-t-elle à son économie? Sommes-nous trop tributaires des « coupeurs du bois » et des « porteurs d'eau », comme le prétendent souvent les chroniqueurs? Que penser des fluctuations des prix des produits de base? Et quels avantages le Canada tire-t-il de ses ressources en ce qui a trait à l'emploi, aux investissements des entreprises et aux exportations?

Pour répondre à ces questions cruciales, il faut comprendre ce qu'est une ressource naturelle et, étonnamment, sur ce point essentiel, il n'y a pas consensus. Dans cet article, on tente de trouver réponse à ces questions avec plus de rigueur qu'on ne l'a fait jusqu'à maintenant, ce qui pourrait aider à comprendre l'importance des ressources dans une grande économie.

Comment définit-on les ressources?

Les industries axées sur les ressources comprennent bien sûr les industries agricoles et les industries d'extraction primaire (agriculture, forêts, pêche et exploitation minière), bien qu'on ne s'entende même pas sur cette définition dans les études antérieures. Il est plus difficile de déterminer quelles industries en aval devraient être incluses.

Dans cet article, on propose une définition qui inclut toutes les industries primaires, y compris les services publics. On ajoute ensuite les industries dont plus de 17 % des intrants sont des ressources, ce qui comprend des secteurs comme ceux des métaux de première transformation, des pâtes et papiers et du transport par pipeline.

Quelle est l'importance des ressources?

En 2010, l'année la plus récente pour laquelle on dispose de données, **les industries axées sur les ressources naturelles ont directement injecté 260 milliards de dollars dans le PIB (ou 16,6 % de celui-ci)**, l'exploitation minière et le pétrole et le gaz étant venus en tête. La fabrication axée sur les ressources représentait 46,2 % de la production manufacturière totale en 2010.

La production de ressources naturelles se répercute sur toutes les industries au Canada. Par exemple, en simulant une augmentation de 10 % du PIB dans la production de ressources naturelles, nous observons que **chaque dollar dépensé génère 2,32 dollars de PIB à l'échelle de l'économie**. En effet, les répercussions indirectes et induites sont plus grandes à l'extérieur qu'à l'intérieur du secteur des ressources naturelles. La croissance dans le secteur des ressources naturelles est particulièrement profitable pour le secteur des services. Cette relation étroite entre les services (principalement dans les grandes régions urbaines) et les ressources (pour la plupart dans des zones rurales éloignées) n'est pas suffisamment reconnue par les analystes. Les services aux entreprises, les finances et le transport affichent tous une augmentation importante de la demande au fur et à mesure que la production augmente dans le secteur des ressources.

Emploi

Les ressources contribuent un peu moins à l'emploi total qu'à la production, ce qui reflète la nature capitalistique de la plupart de ces industries. Quelque **14 % des travailleurs** travaillent dans le secteur des ressources.

Étonnamment, il n'y a pas consensus sur ce qu'est une ressource naturelle.

Investissements des entreprises

Les ressources naturelles sont devenues le moteur des investissements des entreprises au Canada, en particulier le secteur de l'énergie. En 2013, ces investissements représentaient **144,5 milliards de dollars, soit 61 % des investissements des entreprises en usines et en matériel**, en hausse par rapport à 38,2 % en 1999.

Exportations

La tendance des exportations est presque identique à celle des investissements des entreprises, ce qui traduit le fait que les recettes tirées des exportations sont utilisées pour financer de nouveaux investissements. En 2014, les exportations de ressources naturelles totalisaient 308,4 milliards de dollars, soit 58,3 % de toutes les exportations de marchandises, en hausse par rapport au creux de 39 % atteint en 2000.

Les récessions que connaissent les ressources sont différentes

Les ralentissements cycliques dans le secteur des ressources naturelles sont fondamentalement différents de ceux d'autres secteurs, comme ceux de la fabrication ou de la construction de logements, parce que dans le secteur des ressources, les prix absorbent la plus grande partie de l'ajustement, contrairement à la plupart des autres secteurs où c'est la production qui subit les contrecoups de la baisse de la demande. Au cours de la récession de 2008-2009 par exemple, la production manufacturière a baissé de 17,6 % pendant que les prix augmentaient de 0,6 %. Toutefois, le secteur des ressources s'ajuste à une plus faible demande principalement au moyen de baisses des prix et

des bénéfiques. Sa production n'est pas réduite. Déjà, on observe cette évolution de la production pétrolière en 2015. Malgré une chute marquée des prix, **selon les données dont on dispose pour le premier trimestre de 2015, la production de pétrole a augmenté de 4,4 % par rapport à un an plus tôt**. Les baisses des prix des produits de base, du pétrole en particulier, se répercutent sur les investissements avec un retard considérable.

Le Canada est fortement tributaire des ressources et c'est très bien ainsi

L'application de la définition proposée dans le présent document révèle que les ressources sont des éléments importants de la croissance du PIB et de l'emploi et qu'elles sont absolument vitales aux investissements et aux exportations. Elles représentent les deux tiers de toutes les dépenses. L'investissement des entreprises s'est tellement appuyé sur le développement de notre base de

Les ressources naturelles sont destinées à jouer un rôle clé dans l'économie canadienne pour encore des décennies.

ressources naturelles au cours des dernières années que celles-ci sont destinées à jouer un rôle clé dans l'économie canadienne pour encore des décennies.

La croissance des ressources naturelles a été partie intégrante de la transformation et de la croissance du secteur de la fabrication au Canada, contrairement à ce que disaient ceux qui craignaient que le syndrome hollandais s'abatte sur le secteur. L'économie des ressources possède

de nombreux liens avec d'autres industries, notamment celles des services aux entreprises dans les grandes villes. Rien n'oppose les régions rurales et urbaines ou bien l'extraction et la fabrication, à l'inverse de ce qu'affirment dans leurs commentaires certains médias.

Et il n'y a aucune raison de croire que le récent effondrement des prix des produits de base, qui a été limité en comparaison de certains ralentissements dans le passé, marque la fin de la tendance à la hausse à long terme de la production dans les industries axées sur les ressources. C'est seulement en assumant son riche héritage et l'histoire de ses ressources naturelles que le Canada pourra pleinement s'épanouir.

Introduction

The role of natural-resource staples in Canada's economic development has been called the most important theme in writings about Canada's economic history (Easterbrook and Watkins 1967, xii). Indeed, the staples theory is our leading contribution to the field of economic history and development. William A. Mackintosh (1923) pioneered the study of staples such as fur, grain, and timber in Canadian economic history,¹ while Harold Innis (1930) elaborated their full impact on our economic, social, and political development.

The staples theory addresses exports of natural resources and their ripple effect in helping other industries develop. Rather than the adversarial relationship between natural resources and manufacturing popularized by the idea of "Dutch disease,"² the staples theory portrays manufacturing as a natural extension of resource extraction. In fact, Nobel Laureate Douglass North (1958) maintained that in Canada and the US "the opening up and development of new areas capable of producing primary goods in demand in existing markets induced the growth of industrialisation" (74). As well, a growing market for staples encouraged demand for other manufactured goods, such as the iron, steel, and transportation equipment that the railroad network needed to expand in response to the Prairie wheat boom in the early 20th century. Trade in staples also boosted incomes and therefore consumer spending, encouraging the growth of manufacturing industries such as clothing. Overall, natural resources have been a major driver of Canada's growing prosperity over the long-term, despite its cyclical ups and downs (which are actually less pronounced than for other industries such as auto assemblies, high tech manufacturing, and housing).³ The faster growth of export than import prices, led by commodities, boosted real incomes by 18 percent since Confederation, according to a study by Statistics Canada (Baldwin and Macdonald 2012).

Natural resources have been a major driver of Canada's growing prosperity over the long-term.

Economists in the US, unlike their Canadian counterparts, have not been apologetic about the role natural resources played in the economic development of their country, perhaps because the US cut its colonial ties to Britain much earlier than did Canada and they are less sensitive to the superficial connection between staples and colonial status.⁴ North applied the theory that "the prime requisite of colonial prosperity is the colonial staple" (Buckley 1958, 439) to the United States, notably the plantation staples of tobacco and cotton in the South, and agriculture and timber in the Midwest (North 1961). Tobacco sustained the first colony in Virginia in the early 17th century (Gordon 2004, 15). Lumber from northern Michigan fuelled the growth of Detroit, which "became the shipbuilding capital of the United States" before the development of the auto industry (Binelli 2013, 47). The first significant migration of people to California was triggered by the 1848 Gold Rush (Gordon 2004, 181). The Erie Canal allowed natural resources from the US Midwest to be shipped cheaply to New York, turning it "into the greatest boom town the world has ever known" (109). Chicago's meat-packing industry made it "the hog butcher to the world" in the late 19th century.

This paper is organized in two parts. The first looks at how previous attempts to define natural resource industries have lacked consistency and analytical rigour. This paper proposes a methodology to define resource industries using data from Statistics Canada's input/output tables that provide a solution to the question of which industries outside the primary sector are dependent on resources

as inputs. Using this definition, the second part of the paper explores the importance of natural resources to Canada’s economy in terms of output (including indirect links to other sectors, notably services), employment, business investment, and exports. It also reviews how the business cycle in the resource sector differs from other industries.

PART I

What Are Natural-Resource Staples?

Staples are “agricultural and extractive resources, not requiring elaborate processing and finding a large portion of their market in international trade” (Bertram 1967, 75).

How to define the sector?

While there is universal acknowledgement of the importance of staples to Canada’s development and that staples are rooted in our abundant endowment of natural resources, there is no consensus on the specific industries included in a definition of natural resources. Almost all of the definitions that have been proposed are taxonomic, but the classifications are without an over-riding explanation or rationale. There is not even agreement on whether all the primary industries (agriculture, forestry, fishing,⁵ and mining) should be included. Several studies include electric power generation alongside the primary sector, since in most parts of Canada it is clearly based on water resources.

However, by far the most disagreement surrounds whether to include downstream manufacturing activities that are based on processing natural resources, such as wood, pulp and paper, and smelting and refining. Some studies extend the definition of resource-based industries into the service sector, including industries such as pipelines and wholesaling. As a result, virtually every study on the

There is no agreed-upon metric of the role that natural resources play in Canada’s economic development.

importance of natural resources to Canada’s economy uses a different definition of natural resources, and therefore comes to a different conclusion. There is no agreed-upon metric of the role that natural resources play in Canada’s economic development. Proponents of the resource sector use a broad definition; critics of excessive reliance on resources for growth want a more restrictive definition (although using a broader definition would more easily support

their argument that our dependence on resources is too great). The result confuses, not edifies, public debate on the subject.

Table 1 summarizes the ways 11 organizations in Canada and abroad define natural resources.

The most striking feature is the almost total lack of agreement on what constitutes resource industries. There is even disagreement on whether primary industries such as agriculture, forestry, and fishing should be included – the TD Bank (2006, 2) excludes agriculture and fishing, as does the Centre for the Study of Living Standards (Sharpe and Guilbaud 2005, 6)⁶ and the National Bank (Pinsonneault 2013). The Bank of Canada (Duguay 2006) left out forestry and utilities from its definition of resources.

Table 1 Organizations disagree on how to define the resource sector

	National Bank (2013)	Bank of Canada (2006)	TD Bank (2006)	Statistics Canada (2012)	CSLS (2005)	Dept of Finance (1991)	Conference Board (1984)	Macdonald Royal Commission (1985)	OECD (1993)	US Census Bureau (2001)	Moody's Analytics (1998)	Total
Primary												
Agriculture		x		x		x	x	x	x	x	x	8
Forestry	x		x	x	x	x	x	x	x	x	x	10
Fishing		x		x		x	x	x	x	x	x	8
Mining	x	x	x	x	x	x	x	x	x	x	x	11
Utilities	x		x	x	x	x		x				6
Manufacturing												
Food				x			x		x		x	4
Tobacco							x		x		x	3
Wood	x	x	x	x	x	x	x		x	x	x	10
Pulp and paper	x	x	x	x	x	x	x		x	x	x	10
Primary metals	x	x	x	x	x		x		x		x	8
Petroleum refining	x	x	x	x	x	x	x		x		x	9
Chemicals		x	x									2
Non-metallic minerals	x		x		x				x			4
Metal fabricating	x		x		x							3
Services												
Pipelines	x		x			x						3

Opinions diverge even more on which industries outside the primary sector should be included. Six of the organizations include utilities. The Conference Board waffled, recognizing that the “hydraulic generation of electricity appears to qualify as a resource industry,” but eventually excluded utilities because coal-fired power plants “are too far removed from the raw resource” (Gusen 1984, 6). Now that all Ontario’s coal-fired plants are closed, revisiting this question might lead the Conference Board to a different conclusion, and demonstrate how applying a standard can yield different results over time as technology and institutions change.

The lack of consensus in defining resource industries is most pronounced for manufacturing industries that process natural resources. There is widespread agreement (in 10 out of 11 definitions) that the wood and pulp and paper industries should be included in natural resources. These are the only manufacturers the Conference Board and the US Census Bureau (2001) count as resources. The Macdonald Royal Commission (1985) was alone in excluding wood and pulp and paper from

resources, because it excluded all manufacturers.⁷ A majority of studies include primary metals and petroleum refining in the resource sector. Four organizations embrace manufacturers of non-metallic minerals in resources. Three organizations extend the definition of resources to food processing, including a Statistics Canada study (which did not have a precise definition of resources but included processed foods, such as bacon and cheese, in the export commodities it studied; see Macdonald and Baldwin 2012). Three studies include metal fabricating, although Canada's leading expert on the auto industry, Dennis DesRosiers, maintains that some metal fabricating industries should be treated as part of the auto industry and not resources. Only two institutions propose that chemicals be included, while the Conference Board, the OECD (1993, 84), and Moody's Analytics (Burt 1998) are the only organizations that include tobacco manufacturing in resources. Services are largely ignored when studying natural resources, with only the TD Bank, the National Bank, and the Department of Finance (1991, 42) including pipeline transport in their definition of resources.

The different definitions of the resource sector are important for our understanding of its importance to the Canadian economy. Depending on the definition, the size of the resource sector varies between 9.8 percent and 14.9 percent of GDP. The narrowest definitions of the resource sector come from organizations outside of Canada, with the US Census Bureau at 9.8 percent, the OECD at 10.8 percent, and Moody's Analytics at 11.0 percent (equalled by the Conference Board of Canada). Canadian government organizations dominate the mid-range, with estimates of 11.3 percent from the Macdonald

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Royal Commission, 11.7 percent from the Bank of Canada, 13.2 percent from the Department of Finance, as well as 13.4 percent from the CSLS. Chartered banks are at the high end, with 13.8 percent the National Bank's estimate, 14.8 the Toronto-Dominion Bank's estimate, and then Statistics Canada at 14.9 percent.

Nor is table 1 an exhaustive review. Some definitions are based on bureaucratic structure.

Natural Resources Canada defines resources as mining, forestry, utilities, and pipelines. It excludes agriculture and fishing with no justification, but probably because these resources have their own federal departments. A definition based on ministerial organization is not one to be taken seriously (Natural Resources Canada 2012). The Alberta Chamber of Resources (ACR) defines resources as forestry, mining, utilities, pipelines, and chemicals. The Chamber's primary focus has been mining, dating back to its origins as the Edmonton Chamber of Mines in 1936 (it changed its mandate to cover resources beyond mining in 2001) (Mansell and Staples 2011). It offers no reason to exclude agriculture and fishing other than that fishing is not important to Alberta and farming is not organized around the corporate structure that warrants a seat at the ACR table.

The definition of natural resources not only varies among organizations, it also varies within an organization over time. Statistics Canada provides the best example. The 2012 Statistics Canada definition of natural resources cited in table 1 is its most recent study. It encompasses the primary sector, utilities, and manufacturers of food, wood, paper, primary metals, and refined petroleum. However, a 2011 Statistics Canada report (Alasia and Hardie) on natural resources included the primary sector and related wholesalers, utilities, as well as manufacturers of food, leather, tobacco, wood, paper, primary metals, fabricated metals, non-metallic minerals, and refined petroleum. A 2008 Statistics Canada report (Cross) defined resources as the primary sector, utilities, and manufacturers of wood, paper, primary metals, and refined petroleum. Exports are a complicating element because Statistics Canada's data on international trade use a commodity- not an industry-based definition. This is particularly relevant to the 2012 Statistics Canada study and the Bank of Canada's 2006 analysis, which focused on exports of natural resources, not their output or employment.

The wide range of definitions of natural resources reflects that several of these studies analysed the resource sector as a tool to study wider topics, such as free trade, innovation, or the terms of trade. The definition of resources itself was not the goal, and therefore was not done rigorously. Most of the time, researchers include industries in resources on little more than intuition or a whim, rarely attempting to justify why some industries were included and others excluded. Until now, no study has compared these definitions and noted their inconsistency.

Which industries to include?

The debate about which manufacturers are part of the resource sector goes back to at least the 1950s. The Rowell-Sirois Royal Commission coined the phrase “primary manufacturers” to capture industries that processed the output of extractive natural resources (Fullerton and Hampson 1957). Primary manufacturing is the final step in staples production, as they “involve either relatively minor processing of domestic resources . . . or those highly capital-intensive and often extremely complex industries which produce industrial materials from our basic natural resources for sale mainly in export markets” (3). Sawmills are an example of the former; pulp and paper and smelting and refining of non-ferrous metals are examples of the latter.

In contrast, secondary manufacturing is characterized by “a higher degree of processing, greater dependence upon domestic markets and reliance on both foreign and domestic inputs” (Bertram 1967, 79–80). Examples range from transportation equipment, textiles, clothing, and electrical products to more complex transformations of resources, such as iron and steel, petroleum refining, and food manufacturing that are mostly destined for the domestic market. Bertram estimated that primary manufacturing accounted for about one-third and secondary manufacturing the other two-thirds of manufacturing in Canada in the first half of the twentieth century (85).

The disparity about which industries to include in resources results from an arbitrary and subjective approach.

How to classify them?

As clarified above, the disparity among analysts about which industries to include in resources results from their arbitrary and subjective approach to the question of what defines natural-resource industries. This points to the usefulness of applying a more rigorous classification system to the definition. As outlined by O’Connor (1974), designing a classification system involves determining its purpose, whether an industry belongs (the criterion), the level of detail involved (its depth), and its consistency.

This paper’s purpose in classifying natural resources is to account fully for the direct importance of resources in Canada’s economy. The staples theory of economic development itself is not of interest; therefore this paper does not distinguish between primary and secondary manufacturing based on the orientation to export or domestic markets (as the Rowell-Sirois Commission report did). It is the inputs into the production process that matter, not the destination of the output. A baker selling bread locally is resource-based in the same way as a meat packer that exports beef because both are primarily based on the existence of a large agricultural industry in Canada.

The first choice is to define what to include in the primary sector. The next is whether to limit resources to the primary sector or extend them downstream to operations in manufacturing and even services. What is important for both is the degree to which an industry uses natural resources

in its production process. For industries beyond the primary sector, this can be examined rigorously through their purchases of resources as inputs. However, this approach is not useful within the primary sector, since it produces (not purchases) its natural resources. This implies that the entire primary sector has to be the starting point in defining resources.

Immediately, some analysts disagree as to whether all primary industries should be included. Some argue that agriculture is distinct from natural resources that are extracted (such as forestry or mining) because humans harvest what they have sown, not what the planet grew in its natural state. For example, crops like wheat are not native to the prairies but planted by humans.⁸ This view, mostly a legalistic one, holds that natural-resource industries must extract or purify a natural resource with minimal creation of the commodity by humans (Frisman 2003). Statistics Canada's Labour Force Survey, for example, differentiates between agriculture and natural resources.

Arguments that some primary industries are not natural-resource industries if the resource does not exist in a "native" state have become increasingly irrelevant due to technological change. Human interventions are becoming as important in forestry, fishing, and mining as they always have been in

The debate about which manufacturers are part of the resource sector goes back to at least the 1950s.

agriculture. Humans have planted much of the forests harvested in Canada, often with a view to eventually harvesting them in logging operations (although measuring the contribution of man versus nature is impossible in practice).⁹ In mining, new technologies, such as hydraulic fracking of oil and gas, show that producers are no longer just skimming oil in its crude state from open pit mines (as in the early days of recovering oil), but are intervening with a mixture of water and chemicals without which the oil and gas

could not be extracted. More broadly, as one financier noted, "Canada's mining and oil wealth is not just minerals dug from the ground. It is the management, geologists, engineers, drillers, workers and investment bankers who staff companies headquartered in Canada that operate across the world" (Don Coxe, quoted in Wentz 2012). Similarly, aquaculture (Crowley 2013) and fur farms increasingly dominate fishing and trapping. The reasoning that humans play a key role in creating wealth from resources extends back to the 18th century, when Adam Smith observed that humans "have entirely changed the whole face of the globe, have turned the rude forests of nature into agreeable and fertile plains, and made the trackless and barren ocean a new fund of subsistence . . . The earth by these labours of mankind has been obliged to redouble her natural fertility" (quoted in Simpson 2013, 15). As a practical matter, it would be impossible to measure what portion of natural-resource output was made possible by the efforts of humans versus what was extracted in a "natural" state.

Within manufacturing, arguments have been made as far back as the 1950s that complexity matters just as much as the amount of processing: lumber meets the criterion of simple processing, but furniture manufacturing does not. The problem with this approach to defining resources beyond the primary sector is that it leaves too much discretion to the researcher, resulting in the wide and often contradictory definitions detailed in table 1. It also does not address that the complexity of production changes with technological advances. Smelting and refining metals, for example, was regarded as simple in the mid-20th century; now they can be customized¹⁰ to the output of individual ore bodies.¹¹

Methodology for the Paper

This paper proposes to resolve the question of classifying resources outside the primary sector by using statistics on inputs rather than subjective evaluations of which industries are resource-based or of the complexity of processing. The input/output accounts that Statistics Canada produces are detailed and highly accurate records of the inputs each industry purchases from other industries based on tax data. Therefore, it is relatively easy to measure the inputs every industry buys from the primary sector or from other resource-based manufacturers.

The criterion to define resource-based industries beyond the primary sector is the share of total inputs bought from all primary industries and utilities, not just one industry within the primary sector. This allows for an industry to depend on more than one resource as a critical part of its production process; smelting and refining of non-ferrous metals require both a source of metal ores and a cheap source of electricity. In the case of aluminum, the metal input (bauxite) does not even exist in Canada; the key resource input is cheap electricity.

It is important to note that using purchased inputs of natural resources only applies outside the primary sector. As stated above, the primary sector and utilities do not purchase resource inputs; they extract resources from their natural state by applying capital and labour. So, for example, utilities only purchase 23 percent of their inputs from the primary sector because the water that hydro-generating plants use is free (after the capital investment of building a dam, which does not count as an input in the input/output accounts).

This paper proposes to classify resources outside the primary sector by using statistics on inputs.

This paper presents the two-digit industry classification for most industries and three-digit for manufacturing and transportation, although the results were initially compiled at the three-digit level. Some of the studies cited above use this finer level of detail beyond manufacturing and transportation. While this level of disaggregation is available for GDP, it is not for employment, business investment, and exports. Therefore, to assess the importance of resources in measures other than GDP, we are constrained to the level of detail available.

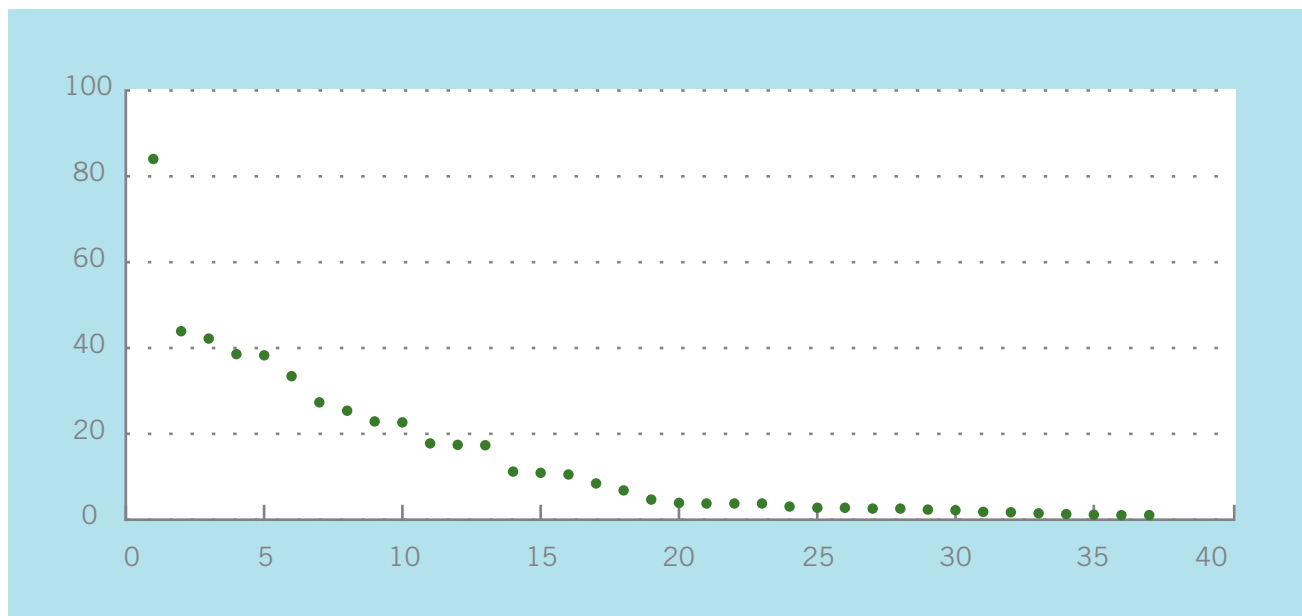
Consistency becomes a problem because some classifications are based on an industry classification (notably for output, employment, and business investment) while others are based on a commodity classification (notably for international trade data). This includes aggregates, such as output and employment, but also sub-components, such as exports and business investment. Since Statistics Canada's classification for exports are based on commodities, not industries, there will not be perfect consistency. This paper uses Industry Canada's trade database, which re-sorts Statistics Canada's commodity trade data into an industry classification consistent with the other data sources. The fact that Statistics Canada does not undertake this conversion suggests that it has misgivings about this approach at a detailed level. However, the Industry Canada results are adequate for the high level of aggregation used in this paper.

Applying a Classification Standard to Define the Sector

Using the methodology outlined above, the definition of the resource sector begins with all the primary industries (agriculture, fishing, forestry, and mining) plus utilities. Industries beyond this first group are counted as resource-based and part of the resource sector if they purchase a significant share of inputs from the primary sector or utilities. All data are in current dollars, and so will fluctuate with commodity prices more than the physical volume of inputs.

Each industry's level of reliance on resource inputs is presented in chart 1 (the underlying data by industry is listed in table 2).

Chart 1 Share of natural resources in inputs, by industry, 2010



Source: CANSIM table 376-0107

Most striking is how easy it is to distinguish industries that use resource inputs extensively from those that hardly use them. Most industries, notably the services sector, use less than 3 percent of their total inputs from the primary sector. At the other end, some industries rely heavily on these inputs, notably petroleum refining (84 percent), wood manufacturers (44 percent), primary metals (38 percent), and chemicals (36 percent).

Table 2 presents the data shown in chart 1 on the intensity of resource input by select industry, excluding most services, which have few resource inputs.

Table 2 Share of resources in total inputs purchased, by industry, 2010

Industry	Percentage
Petroleum and coal product manufacturing	84.0
Wood product manufacturing	43.9
Food manufacturing	42.2
Agriculture	38.6
Primary metal manufacturing	38.3
Forestry	33.4
Mining	27.3
Non-metallic mineral product manufacturing	25.4
Utilities	22.9
Miscellaneous manufacturing	22.7
Chemical manufacturing	17.7
Pulp and paper manufacturing	17.4
Pipeline	17.3
Tobacco manufacturing	11.2
Non-profit	10.9
Construction	10.6
Education	8.4
Accommodation	6.8
Health care	4.6
Plastics and rubber products manufacturing	3.9
Government	3.8
Textile product and clothing manufacturing	3.8
Finance, insurance, and real estate	3.8
Wholesale trade	3.0
Retail trade	2.8
Recreation	2.7
Fabricated metal product manufacturing	2.6
Furniture manufacturing	2.5
Other services	2.3
Transportation and warehousing	2.1
Fishing	1.8
Machinery manufacturing	1.7
Computer, electronic, and electric product manufacturing	1.4
Administration and management	1.3
Professional, scientific, and technical	1.1
Transportation equipment manufacturing	1.0
Information	1.0

The results show that petroleum refining, wood, food, primary metals, and non-metallic minerals are the most resource-based manufacturers. They all purchase between 84 percent and 25 percent of their inputs from primary industries. Miscellaneous manufacturing is next at 23 percent, reflecting the importance of the jewellery industry in this group. However, miscellaneous manufacturing is not allocated to the resource sector because, unlike other manufacturers that produce a similar product over long periods, the industries that comprise it change over time. For example, the importance of jewellery manufacturers in the miscellaneous category (it had the most sales in 2010) could be swamped the following year by rapid gains in another nascent industry. Should the jewellery industry grow enough, it could merit its own industry classification, which would justify inclusion in the resource sector.

The question, which inevitably involves some arbitrariness, is where to draw the line at which the use of resource inputs becomes “significant.” However, the impact of drawing this line should not be exaggerated. Only eight industries have resource inputs of 10–25 percent, so selecting a threshold does not have a major impact on whether most industries are classified as resource-based.

This paper proposes a threshold of 17 percent, as this group of industries is clearly distinct from the next group at 10–11 percent. Moreover, it seems reasonable to include pipeline transport since this

Petroleum refining, wood, food, primary metals, and non-metallic minerals are the most resource-based manufacturers.

industry is clearly resource-dependent: without the input of crude oil or natural gas, the industry loses its reason to exist.¹² An argument could be made for setting the bar at 11.0 percent to include the tobacco and beverage industry, which has many of the characteristics of a resource-based manufacturer. This paper prefers to keep the threshold at 17 percent, because there is a clear gap between industries using resources for more than 17 percent of inputs and industries using less than 11 percent. But the definition is

arbitrary, and other people may choose to include the tobacco and beverage industry. Either way does not materially affect the results, since output in tobacco and beverages amounts to only 0.4 percent of GDP.

Setting the bar at 17 percent means including chemicals and pulp and paper in the definition, but insisting on another standard (such as one-quarter of inputs must be resource-based) would exclude them. Like pipelines, there are practical grounds to treat chemicals and pulp and paper as resource-based industries. For example, the chemical industry is often located to take advantage of by-products from the oil and gas industry. Similarly, pulp and paper mills are often located near lumber mills, so they can process what would otherwise be wasted by-products from cutting logs. In both cases, the industries buy the by-product of production in other industries, which may depress the market value of these inputs and lower the measured value of resource inputs in the input/output accounts.

The results show that certain manufacturing industries that some analysts have touted as being part of the resource sector clearly do not belong in that category. Fabricated metals purchase only 2.6 percent of their inputs from resources, while machinery buys only 1.7 percent. They are unquestionably not resource-based.

It is interesting to analyse how heavily other industries rely on resources. For example, only 1 percent of the inputs into transportation equipment (mostly motor vehicles) consist of resources. This reflects how buying a car today means that most of the purchasing is invisible to the consumer; the physical presence of the vehicle is trivial compared with the technology embedded in it as well as all the services that go into its design, manufacture, transport to the dealer, marketing, financing, and so on. Even furniture, which many people prize for the warmth a wood piece lends to the living room, only

uses resources for 2.5 percent of its inputs. Rubber and plastics manufacturing, which have the name of a resource in the title, purchase just 3.9 percent of inputs from resources.

To summarize, a consistent definition of natural resources has emerged from this analysis of inputs of resources. In Canada, the natural resource sector is now defined as including:

- agriculture,
- forestry,
- fishing and trapping,
- mining, and
- utilities;

as well as manufacturers of

- wood products,
- food,
- primary metals,
- non-metallic minerals,
- chemicals,
- pulp and paper, and
- petroleum and coal products;

and

- pipeline transport.

Certain manufacturing industries that some analysts included as part of the resource sector clearly do not belong in that category.

With this definition, we can now explore rigorously the importance of natural resources to Canada's total GDP and employment, as well as on key sectors such as business investment, profits, and exports.

Part II

How Important are Natural-Resource Staples to Canada's Economy?

This section reviews the role of natural resources in total output, employment, business investment, and exports. It also highlights some of the major resource industries that contributed to trends in the importance of resources over time, especially the primary sector and resource-based manufacturers.

GDP

In 2010 (the last year for which current dollar GDP figures were available by industry), the natural-resource industries listed above directly contributed \$260 billion or 16.6 percent to Canada's GDP. The resource sector was as large as \$308 billion, or 19.9 percent of total GDP, at the height of the resource boom in 2008. However, the historical record is abbreviated due to the ongoing historical revision of the National Accounts currently being undertaken by Statistics Canada.

Of the 16.6 percent of GDP directly attributable to resource industries, 11.3 percentage points originated in the primary industries and utilities. Another 4.9 percentage points came from resource-based manufacturing. The remaining 0.4 percentage points reflected output in the pipeline industry, which performs the valuable service of transporting oil and gas to market. The 16.6 percent share of GDP exceeds any of the definitions displayed in table 1 largely because none of these proposed definitions included all three of the largest resource-based manufacturers (food, primary metals, and chemicals).

Within the primary sector and utilities, mining (including oil and gas) accounted for 65 percent of its total output of \$176.6 billion (table 3).

Table 3: Primary industries and utilities account for the lion's share of GDP in resource-based industries, 2010, millions of dollars

Total GDP	\$1,564,105
Agriculture, forestry, fishing	\$23,785
Mining	\$114,686
Utilities	\$38,114
Manufacturing of:	
- food	\$22,046
- wood	\$6809
- paper	\$8519
- petroleum	\$7701
- chemicals	\$15,676
- non-metallic minerals	\$5768
- primary metals	\$10,672
Pipeline transport	\$6589
Total resource-based GDP	\$260,365

Source: Statistics Canada, Table 379-0029 – *Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), annual (dollars)*, CANSIM.

The oil and gas industry generated three-quarters of the income earned. The \$77.2 billion of resource-based manufacturing output is led by about 30 percent each in energy-based manufacturers¹³ and the food industry. The remainder reflects contributions of 20 percent each from forestry- and mining-based manufacturing.¹⁴ Resource-based manufacturing represented 46.2 percent of all manufacturing output.

It is important to understand that the production of natural resources affects all industries in Canada. This is summarized in a simulation of a 10 percent increase in GDP in natural resource industries using Statistics Canada's input/output model of the economy. This model captures all the direct impacts of boosting resource production by 10 percent, the indirect impact of increased resource output requiring more inputs from other industries, and the induced impact of more consumer spending as a result of higher incomes generated by both the direct and indirect effects.¹⁵

The results show that every dollar of increased resource output generates \$2.32 of economy-wide GDP, a way of saying its multiplier is 2.32. The direct impact of the 10 percent "shock" to resource output is to boost output in the resource sector by \$24.9 billion.¹⁶ However, total GDP rises by \$57.9 billion, because of the indirect benefit of resource industries buying \$22.4 billion of inputs from other industries required to boost their production and the \$10.5 billion of spending induced by higher incomes. Moreover, the indirect and induced impacts are larger outside the resource sector than within resources, at \$19.7 billion versus \$12.1 billion.

Every dollar of increased resource output generates \$2.32 of economy-wide GDP.

The large number of inputs the resource sector requires is mostly from the services sector. This close interrelationship between services (mostly produced in large urban areas) and resources (mostly produced in remote rural areas) is not appreciated enough by most analysts. In the simulation, resources purchase \$6.8 billion more of financial services, which include everything from raising capital to finance expansion to the need to process more transfers of money. Business services record an increase of \$3.2 billion, reflecting the need for everything from more accounting services to lawyers to draw up legal documents to engineers needed to design larger mine projects. Transportation also sees a sizeable increase in demand for its services, as the increased output of resources has to be carried to market, mostly by rail, ship, and truck (most resources are too bulky for air transport). Wholesalers register a \$2.0 billion increase in revenues as a result of the increased flow of goods. Retailers post a \$1.7 billion gain in output, mostly as a result of higher sales to workers earning higher incomes in both the resource sector and the related services just noted.

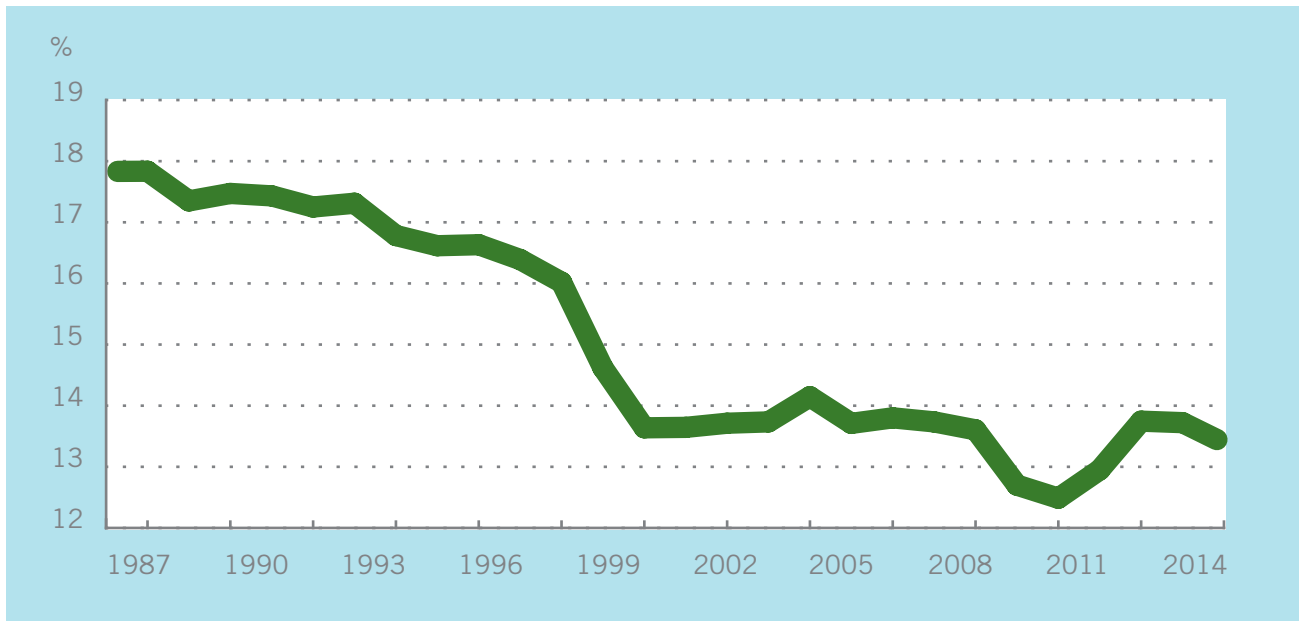
It is noteworthy that very little of the inputs required by resource producers are from the public sector, as public administration, education, and health care output rises a total of \$1.1 billion. It is quite conceivable that governments, flush with royalties and taxes from the resource sector, would choose to spend more, but this political decision cannot be captured by any model. The input/output model only includes the output of the public sector that is required as a technical necessity to meet the demands for more resource output.

There are several reasons why the multiplier for resource industries is high at 2.32 (the multiplier for manufacturing is 2.05, while several services are below 2.0, such as information and culture, finance, and health care). They outsource a great deal of their service inputs, such as finance, transportation, and business services. The jobs created in the resource sector are very high paying, which leads to more demand for consumer services such as retailers, recreation, hotels, and restaurants. And natural resources import very few of their inputs; while output in Canada rises by \$57.9 billion, imports increase by only \$16.9 billion, of which \$15.0 billion were for intermediate inputs (mostly used by manufacturers).

Employment

Natural resources contribute slightly less to total employment than to output, reflecting the capital-intensive nature of most of these industries. In 2013, 304,200 people were employed in natural-resource industries in Canada, nearly one-third more than in 1987.¹⁷ Chart 2 shows the share of natural resources in employment over the last 28 years.

Chart 2 Share of natural resources in employment, 1987–2014



Source: Statistics Canada, Labour Force Survey

Still, the share of employment in natural resources fell from 17.8 percent in 1987 to 13.6 percent in the 1990s, as most resource industries struggled with low prices. The share of resource jobs remained at about 14 percent during the boom of the last decade, except for a brief dip during the 2009 recession.

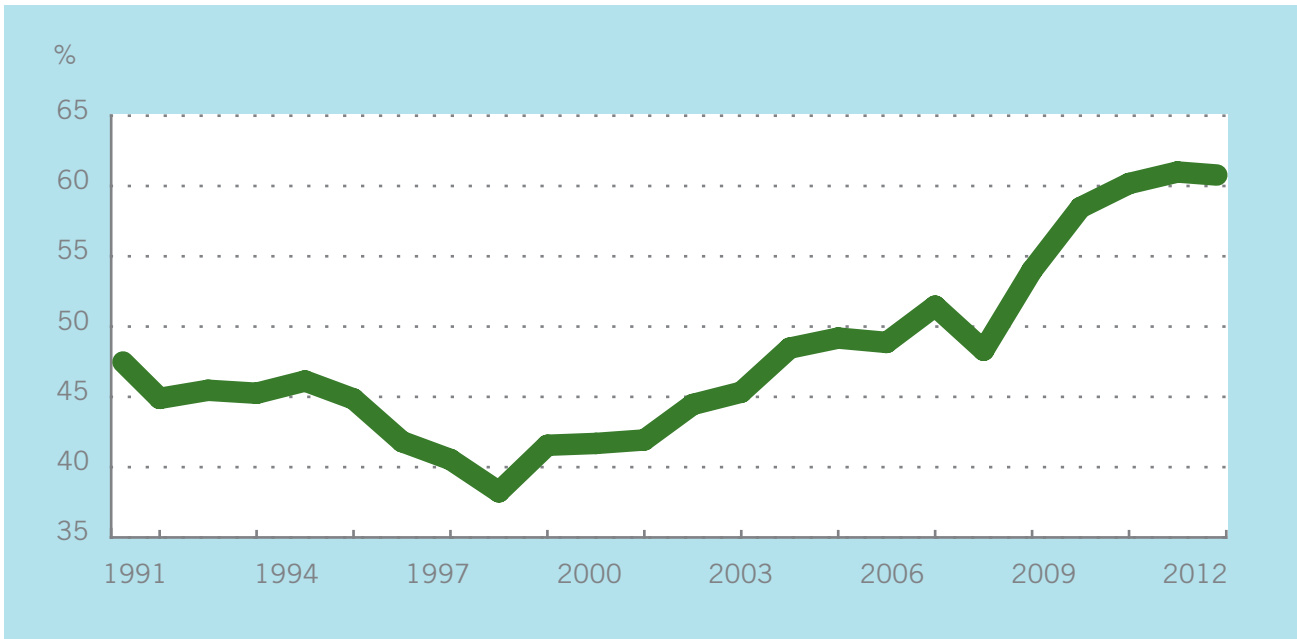
Natural resources contribute slightly less to total employment than to output.

However, major shifts in employment have taken place within the natural-resource industries. Agriculture has posted a steady decline in employment from over 400,000 in the early 1990s to just 282,000 in 2013, as farms continue to mechanize. Conversely, after declines in the 1980s and 1990s, employment in forestry, fishing, and mining soared from 263,000 in 1999 to 373,000 in 2014. Most of this increase reflects growth in the mining industry, especially oil and gas. Employment in resource-based manufacturing industries edged up from 50,000 in 1987 to 60,000 in 2014. The share of resource-based manufacturers in all factory jobs fell from 54.3 percent to 41.3 percent over this period, mostly because they could not keep pace with the rapid growth of the machinery and metal fabricating industries.

Business investment

While their capital-intensity keeps the number of jobs in these industries low, natural resources have become the dominant force in business investment in Canada (see chart 3).

Chart 3 Share of natural resources in business investment, 1991–2012



Source: Statistics Canada, Cansim Table 029-0005

In 2013, they accounted for \$144.5 billion, or 61.0 percent, of all business investment in plant and equipment¹⁸ from a low of 38.2 percent in 1999 when investment shifted from resources to high tech and other manufacturing. Investment in resources fell steadily in the 1990s, from 48.3 percent of total capital spending in 1991. It returned to this relative importance by 2007, and since then has become the almost exclusive source of investment growth in the economy, pushing its share to record highs.

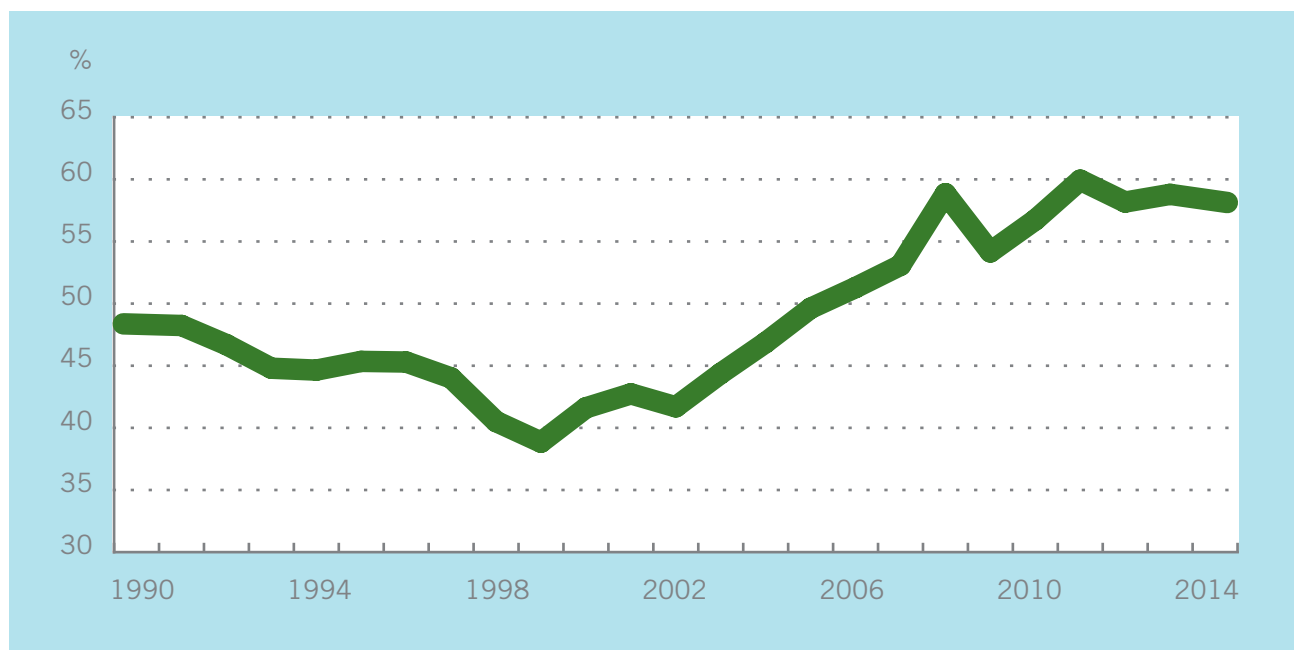
However, investment is not booming in all natural resources. Most of the recent growth has been concentrated in energy investment, which accounted for 79.6 percent of all investment in resources in 2013.¹⁹ In fact, investment in many other resource industries, notably wood, paper, chemical, and non-metallic mineral industries, was less than half its recent highs. Investment remains at relatively high levels in agriculture, metal mining, and primary metals.

Natural resources have become the dominant force in business investment in Canada.

Exports

The relative importance and trend of natural resources within exports is almost the same as for business investment – a reflection of how earnings from exports are used to fund new investments (see chart 4).

Chart 4 Share of natural resources in exports, 1990–2014



Source: Statistics Canada, Table 376-0107 – *Balance of international payments, current account, goods*, CANSIM.

In 2014, natural-resource exports totalled \$308.4 billion, equivalent to 58.3 percent of all merchandise exports.²⁰ In 1992, that figure fell from 48 percent to a low of 39 percent in 2000, before beginning the boom that added 20 percentage points to their share in a little over a decade.

Recessions in the resource sector

Of course, the sharp drop in commodity prices in the past year, especially for crude oil, naturally raises the question of how cutbacks in the resource sector will affect Canada's economy. To understand that

Cyclical downturns in the resource sector are fundamentally different than in other sectors.

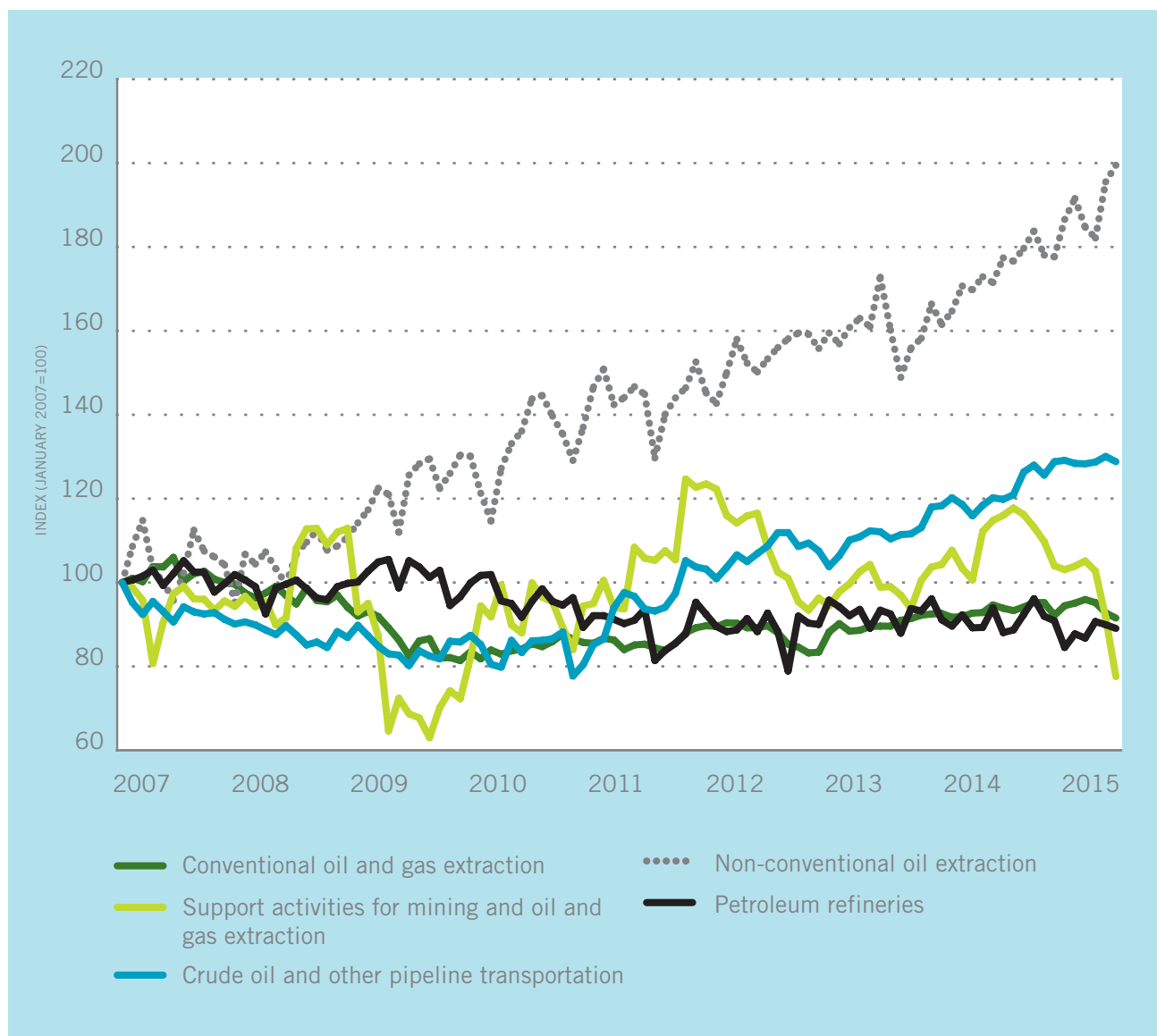
question, it is worth noting that cyclical downturns in the resource sector are fundamentally different than in other sectors, such as manufacturing or housing.

Downturns in the manufacturing industry, for example, are largely met with lower output rather than price cuts. For example, in the 2008/2009 recession, manufacturing output fell by 17.6 percent while prices rose 0.6 percent. However, the resource sector adjusts to lower demand

primarily through lower prices and profits, not production cuts. Faced with plunging oil prices in 2008/2009, producers lowered crude oil output by only 1.1 percent (largely because production in

the oilsands rose 18 percent).²¹ This partly reflects the capital-intensive nature of its operations. Once the initial investment has been made, especially in mining operations, the marginal cost of keeping the mine running is relatively small. As one industry observer remarked of oilsands plants, “once you switch them on, you never switch them off.” Already one can see this response occurring for oil output in 2015. Despite sharply lower prices, oil output in the first quarter of 2015 rose 4.4 percent from a year earlier, again mostly due to increases for crude bitumen.

Chart 5: Gross domestic product, by selected industries



Source: Statistics Canada, CANSIM table 379-0031

The effect of slumping commodity prices, especially for oil, is to reduce investment, which shows up in lower output with a considerable lag. This is why Statistics Canada (Bloskie 1991) found that output in mining often does not begin to fall until 2 or 3 years after a recession hits the rest of the economy. By comparison, the 2009 recession led to a one-third drop in both the current production of autos and investment in the future production of autos. The dynamics of the business cycle in the resource sector often are quite different from the template in the rest of the economy.

Conclusion

Economic historians have long recognized the dominant role natural resources played in Canada's economic development. However, there has been no widely-accepted definition of which specific industries constitute the natural resource sector in Canada. The result has been a bewildering set of answers to the question of how important resources are to our economy. This paper reviewed the many definitions of the natural resource sector and their rationale. It then proposed a new definition founded on the primary sector and utilities. It extended the definition to other sectors based on statistics that used the output of the primary sector and utilities extensively in their inputs.

Applying the new definition shows that natural resources play a significant role in Canada's economy. In recent years, resources have accounted for 17 percent of Canada's GDP, and nearly 14 percent of all jobs. These data reflect the direct impact of output and employment within those industries. A simulation involving the input/output model developed by Statistics Canada showed

that every dollar of higher output in resources boosts overall GDP by \$2.32, a reflection of its extensive linkages with other industries, notably commercial services in large cities.

Resources account for 17 percent of Canada's GDP, and nearly 14 percent of all jobs.

As important as resources are to productivity and jobs, they are primordial in business investment and exports, where they account for nearly two-thirds of all spending. The two are closely related, as earnings from exports drive more investment to develop resources. The energy

sector, notably oil and gas, has been particularly important in driving this dynamic in recent years. Since business investment has been heavily oriented to developing our natural-resource base in recent years, resources are destined to play a key role in Canada's economy for decades to come.

There are few reasons to regard the growth of the resource sector as a threat to other industries, notably manufacturing, as promulgated by the Dutch disease model. Nor is there reason to believe the recent slump in commodity prices, which has been mild compared with some downturns in the past, marks the end of their long-term upward trend.

The growth of natural resources has been integral to the transformation and growth of Canada's economy, including the shift of manufacturing to resource-based industries and the growing demand from capital spending in resources for capital goods. Only by embracing our rich endowment and history of natural resources will Canadians extract their full value.

About the Author



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- . *Table 029-0012 – Capital and repair expenditures, industry sectors 48-49, transportation and warehousing, annual (dollars)*, CANSIM.
- . *Table 282-0087 – Labour force survey estimates (LFS), by sex and age group, seasonally adjusted and unadjusted, monthly (persons unless otherwise noted)*, CANSIM.
- . *Table 304-0014 – Manufacturers' sales, inventories, orders and inventory to sales ratios, by North American Industry Classification System (NAICS), Canada, monthly (dollars unless otherwise noted)*, CANSIM.
- . *Table 329-0077 – Industrial product price indexes, by North American Industry Classification System (NAICS), monthly (index, 2010=100)*, CANSIM.
- . *Table 376-0107 – Balance of international payments, current account, goods*, CANSIM.
- . *Table 379-0029 – Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), annual (dollars)*, CANSIM.
- . *Table 379-0031 – Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), monthly (dollars)*, CANSIM.
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Endnotes

- 1 The first reference to the staple theory is made in William A. Mackintosh, 1923, “Economic Factors in Canadian History.” *Canadian Historical Review* 4 (March).
- 2 The hypothesis is that booming resource exports boost the exchange rate, reducing the competitiveness of manufacturing. See Philip Cross, 2013, “Dutch Disease, Canadian Cure: How Manufacturers Adapted to the High Dollar.” Macdonald-Laurier Institute (January).
- 3 For a discussion of how resources have enriched Canada, see Philip Cross, 2013, “Six Myths Surrounding the Development of Canada’s Natural Resources.” Macdonald-Laurier Institute (May).
- 4 Indeed, Mackintosh’s point in his 1923 article was that Canadian historians had too much of a “constitutional bias” in their studies and did not devote enough thought to basic questions of geography and economics (1).
- 5 Technically, Statistics Canada classifies forestry, fishing, and hunting as one industry. For brevity, this article refers to this industry as forestry and fishing, since they account for by far the largest portion of output.
- 6 In footnote 15 Sharpe and Guilbaud (2005) explicitly say that the primary industry “differs from the definition of the natural resource sector used in the text” (45).
- 7 The Macdonald Royal Commission (1985) excluded all manufacturing industries from its analysis of natural resources and the Canadian economy, although it acknowledged that resources had important backward linkages to industries supplying the resource sector with capital goods, and forward linkages to manufacturers that process the output of resources (409). This narrow definition may reflect the Commission’s preoccupation with free trade, which encouraged a bias to study manufacturing separately from natural resources since the impact of free trade would be much greater on manufacturers (most resource products already had easy access to the US market).
- 8 The *New World Encyclopedia* states clearly that “Agriculture is not considered a natural resource industry” (Swarts 2013).
- 9 Seventy percent of Canada’s forests have never been harvested, according to the Conference Board of Canada (2012).
- 10 An example of the customization of refiners is in Paul Brent, 2011, “Vale’s Massive Newfoundland Nickel Refinery Takes Shape,” *Canadian Mining Journal*.
- 11 Similarly, the insistence in the Rowell-Sirois report that resource staples export their output does not allow for the export orientation of industries to change over time. The most obvious example is autos, which began supplying only the domestic market, but now exports nearly all its output.
- 12 Resources are a small share of the inputs that pipeline companies purchase partly because pipelines are so capital intensive, but capital is not counted directly as an input in the input/output system. This feature is apparent in other capital-intensive resource industries, such as metal ore mining and electric utilities, but these are already included in the resource sector by definition.

- 13 Energy-based manufacturers are petroleum refining and chemicals.
- 14 The forestry-based manufacturers are wood and pulp and paper; metals-based are primary metals and non-metallic minerals.
- 15 This simulation is the same as the one used by Philip Cross, 2014, “High Impact: The Importance of Natural Resources to the Economy of British Columbia.” Resource Works Society, Report #1, (April). That report has a more detailed description of the input/output model.
- 16 The results are for 2009, the last year available when the model simulation was run on February 2, 2015, and therefore are slightly different from table 3 which uses data for 2010.
- 17 Employment data come from the Statistics Canada Labour Force Survey, CANSIM Table 282-0087. This survey was used since the Survey of Employment, Payrolls and Hours does not cover agriculture.
- 18 Sources: Statistics Canada CANSIM Tables 029-0012, 029-0005, and 029-0009.
- 19 The energy sector includes capital spending by the oil and gas industry, support to the oil and gas industry, utilities, petroleum refining, and pipeline transport.
- 20 Trade data is from Statistics Canada CANSIM Table 376-0107.
- 21 The data in this section come from Statistics Canada CANSIM Tables 304-0014, 329-0077, and 379-0031.

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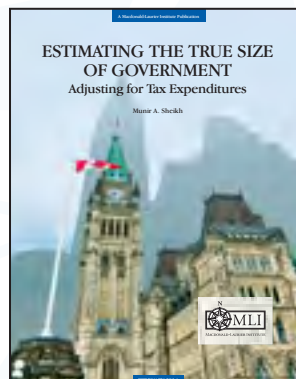
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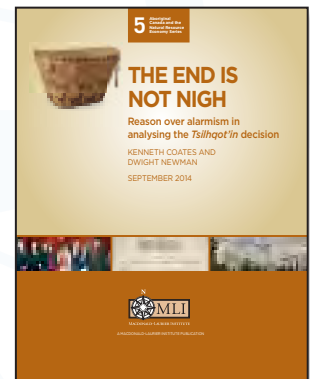
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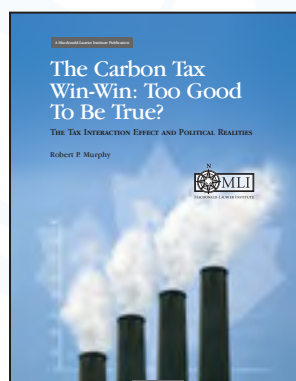
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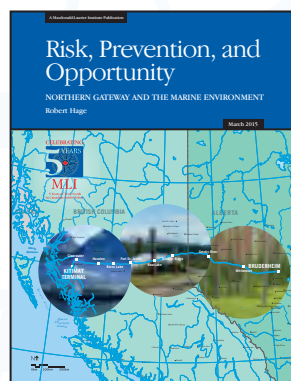
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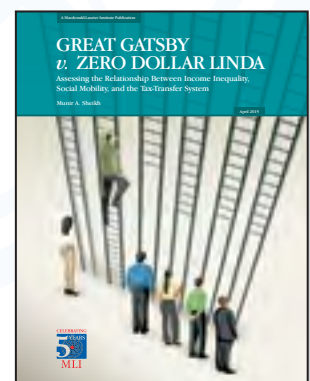
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