

Canada's Natural Resource Reserve Index

Gabriel Gagnon

London Group Meeting, Dublin 2018



100

STATISTICS CANADA
ONE HUNDRED YEARS AND COUNTING

STATISTIQUE CANADA
CENT ANS BIEN COMPTÉS

Contents

- Introduction
 - Rationale for a natural resource reserve index (NRRI)
- Status / Background
 - Contrast—natural resource assets (NRA), land and produced assets
 - Previous studies
- Methodology used
 - Formula chosen
- Findings
 - Reserve index linked to wealth
- Limitations
 - NRRI, Rent, and NRA volatility
- Proposal
- Conclusions



Why a reserve index?

: to sum changes in physical stocks

- Tracking physical reserves require an index because:
 - Reserves are measured using different units
 - The relative value changes over time—resource prices fluctuate
- The reserve index:
 - Sums all changes—discovery, depletion, value—in one number
 - Supplements the natural resource assets (NRA) estimate in the national balance sheet accounts (NBSA).



Non-renewable NRA

: included in the reserve index

Energy resource	Physical stock (q)
Natural gas Conventional oil Oil sands	Cubic metres
Coal	Tonnes
Mineral resource	Physical stock (q)
Gold Nickel Copper Lead Iron Molybdenum Uranium Potash	Tonnes
Diamonds	Carats



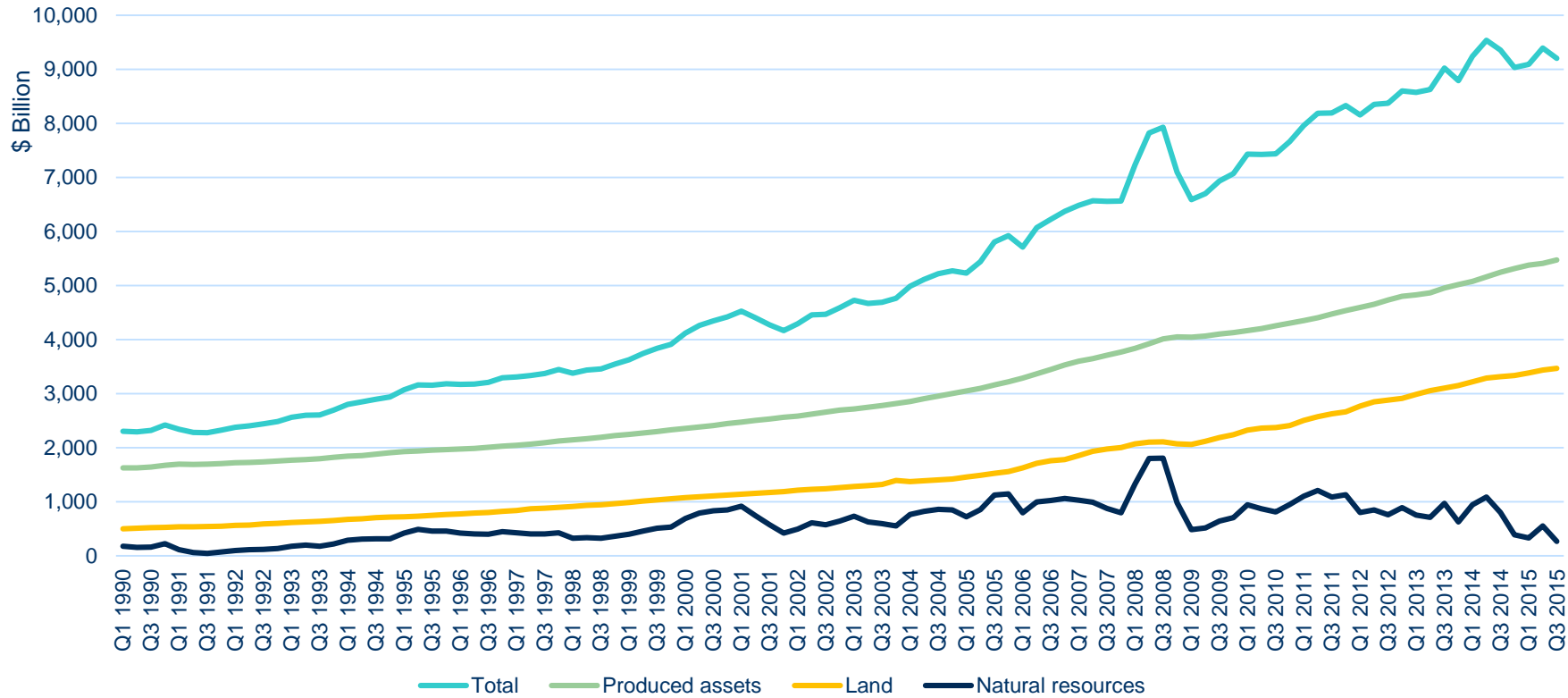
Status / Background

- Statistics Canada publishes annual physical and monetary accounts of natural resources in Canada
 - adhere to international standards as outlined in the SEEA
 - include energy, minerals and timber
- Statistics Canada also publishes natural resources quarterly in the National Balance Sheet (NBS).
 - Inclusion of natural resource asset accounts (NRAA) in the NBS reflects a more complete picture of Canada's wealth.
- The SNA 2008 recommended inclusion of natural resource assets (NRA)—the in situ value of remaining resource stocks—in the national balance sheet accounts (NBSA).
- Statistics Canada developed a method of generating quarterly sectored NRA, and has formally integrated NRA with land and produced assets in the NBSA.



Canada's non-financial assets

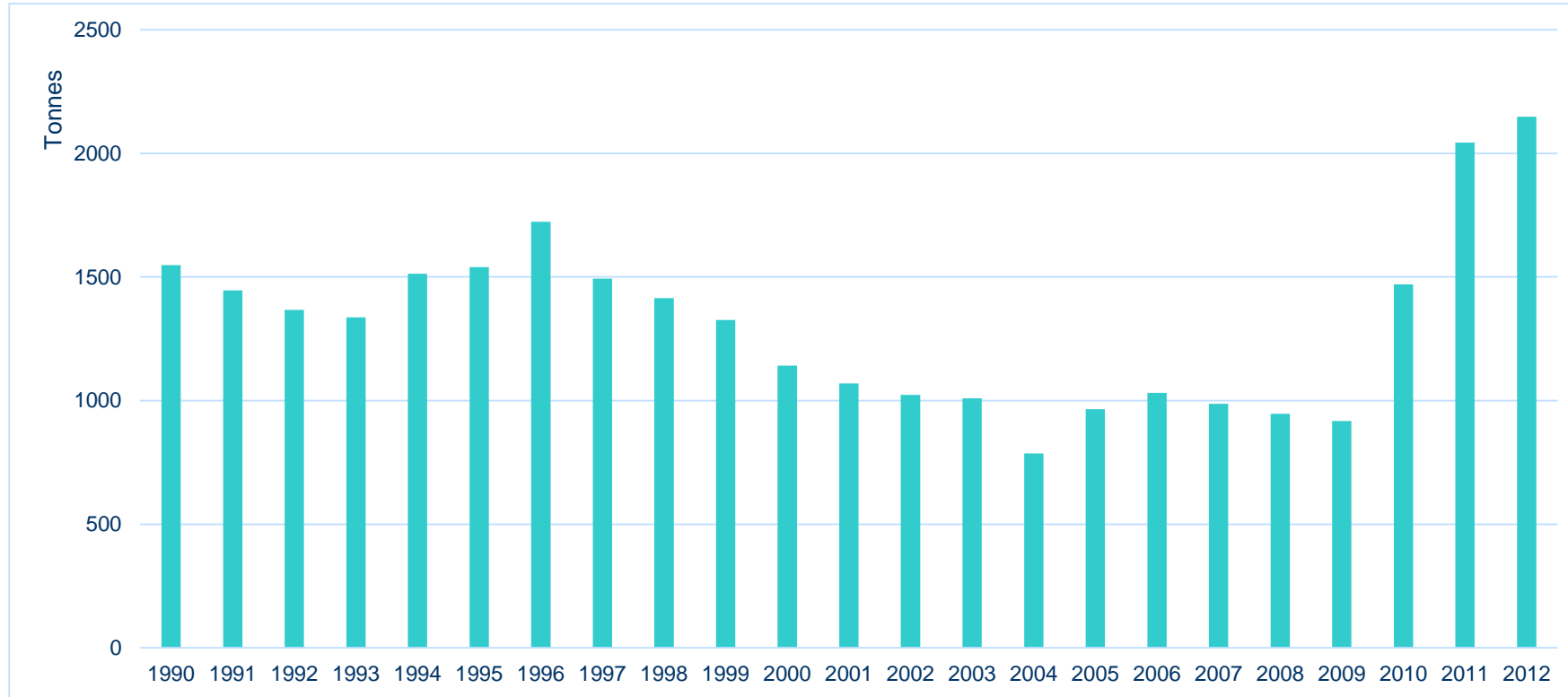
:\$ value of physical stocks, NRA highly volatile



Source: Statistics Canada, table 36-10-0580-01

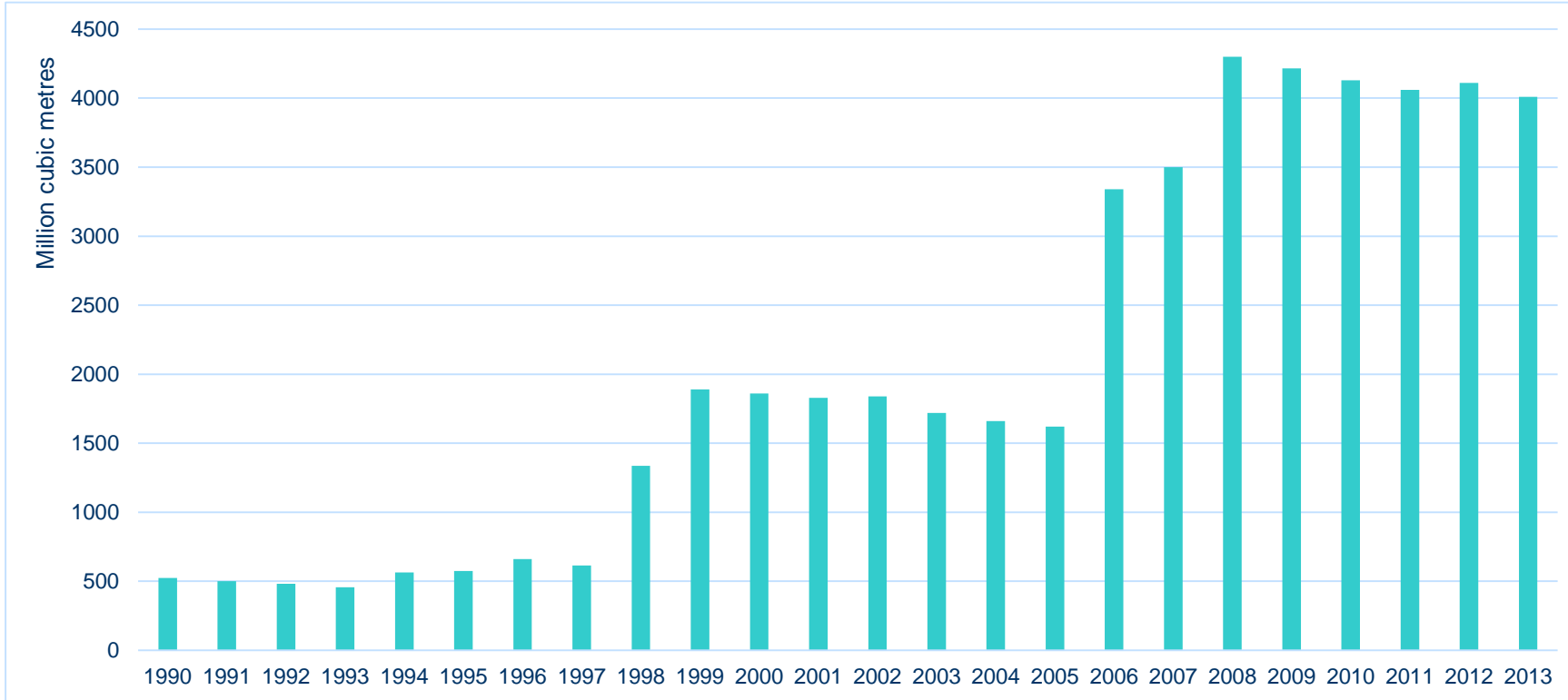
Proven and probable gold reserves

: = closing stock + discovery - extraction



Source: Statistics Canada, table 38-10-0007-01

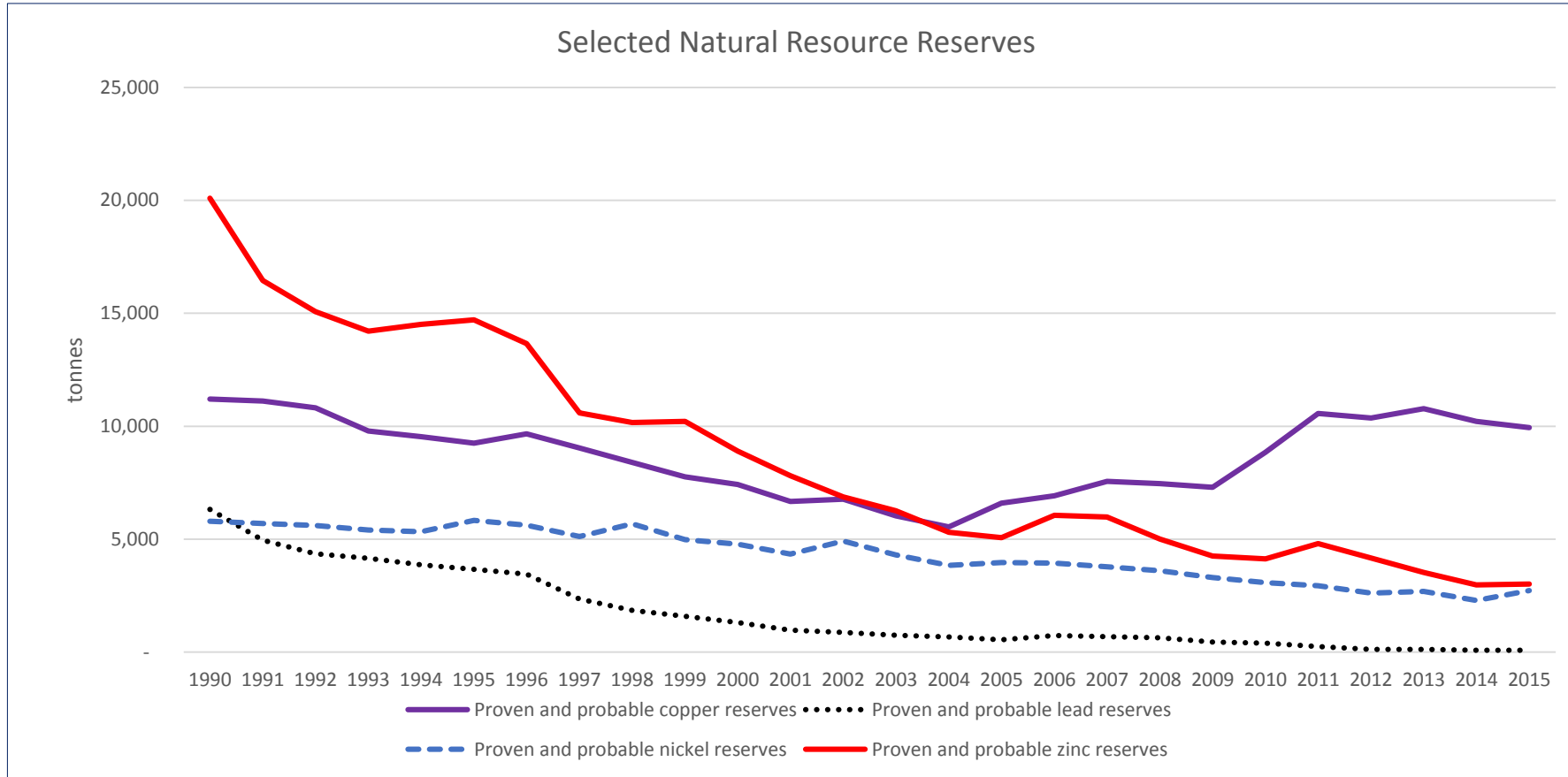
Established crude bitumen (oil sands) reserves : discovery exceeded extractions



Source: Statistics Canada, table 38-10-0007-01

Physical stocks of selected minerals

: reserves of copper, lead, nickel and zinc



Source: Statistics Canada, table 38-10-0007-01

Status / Background

: Previous studies on natural resource index are limited

- In 2001, the Australian Bureau of Statistics (ABS) introduced an experimental national balance sheet that excluded the effects of price change.
- Around the same time Netherlands created a set of natural capital indicators based on a 0-to-100 scale that incorporated both the size and quality of ecosystems.
- The approaches taken by the two countries are quite different and serve different purposes.
- This remainder of this talk presents a natural resource reserve index (NRRI) for Canada and links it with monetary wealth.



Methodology

- A wide variety of index number formulas with a sound micro-economic underpinning are regularly used to track prices and volumes of goods and services.
- The natural resource reserve index (NRRI) was calculated using Laspeyres, Paasche, and Fisher formulas.
- Canadian System of National Accounts selected the chained Fisher index because of its superiority over other indexes.



Fisher volume index

: an ideal index formula

$$Q_{uc}^F = \sqrt{Q_{uc}^L \times Q_{uc}^P} = \sqrt{\frac{\sum \left[\frac{q_t}{q_{t-1}} \right] V_{t-1}}{\sum V_{t-1}} \times \frac{\sum V_t}{\sum \left[\frac{q_{t-1}}{q_t} \right] V_t}}$$

$$Q_{t/1}^{CF} = \prod_{y=1}^t Q_{y/y-1}^{UCF}$$



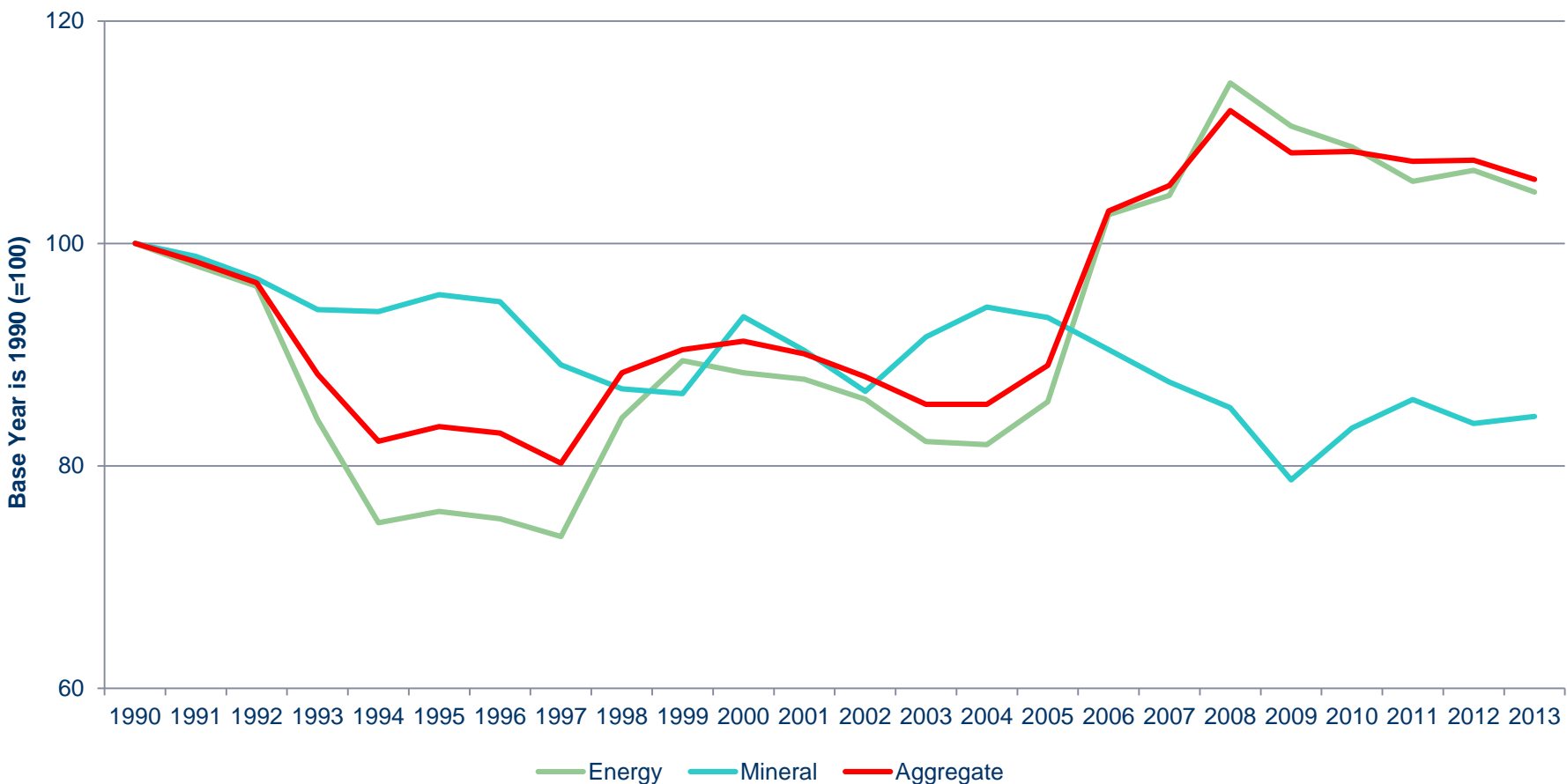
Findings

- Natural assets in the national balance sheet accounts stem from timber, energy, and mineral resources
- Physical stocks of 13 types of energy and mineral resources and their monetary values are applied to estimate Canada's non-renewable NRRI
- The following two figures present:
 - the aggregate natural resource reserve index and its two major components
 - the relative shares of energy and mineral resource wealth
- The reserve index is used to shed more light on fluctuations in monetary wealth.



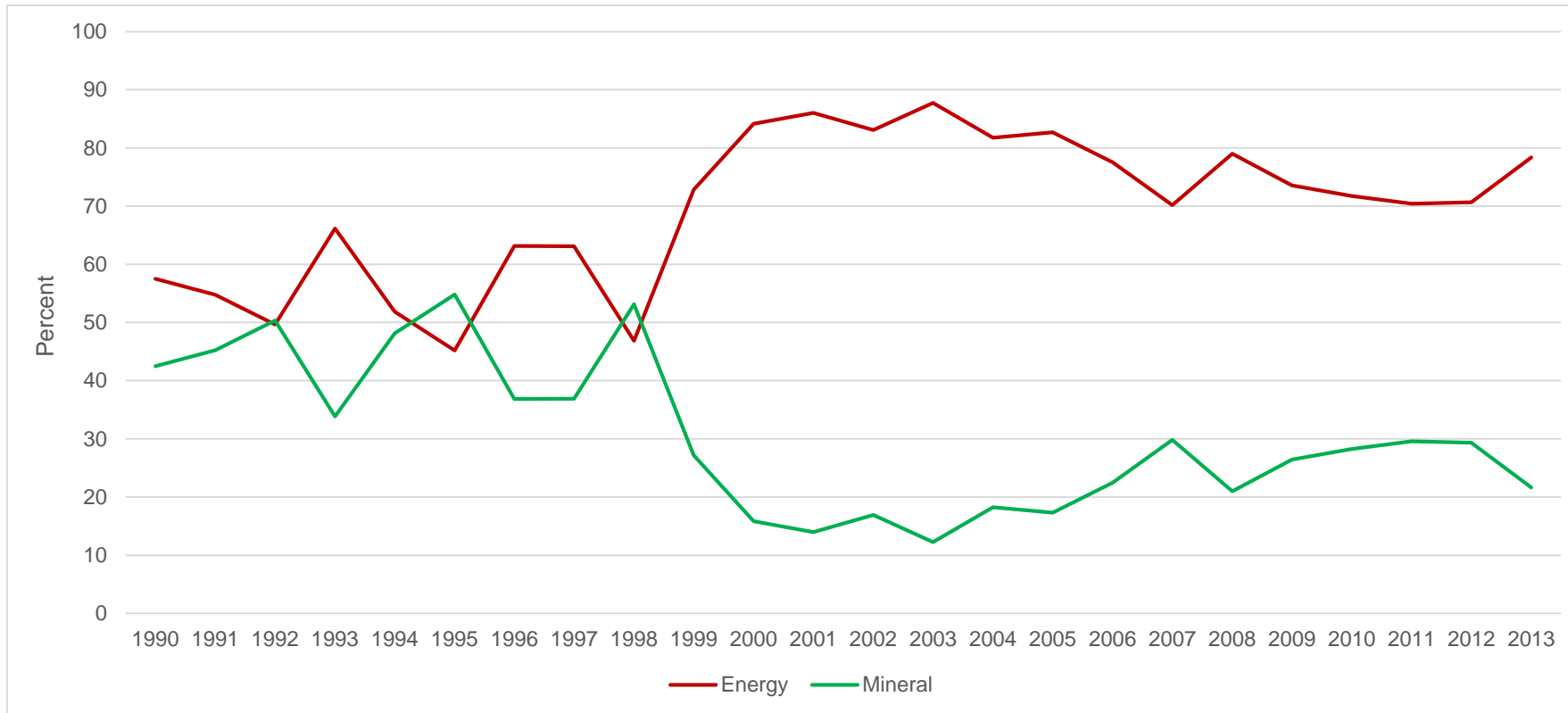
Natural resource reserve index

: with 1990 as the base year



Relative share of energy and mineral resource wealth

: energy resources dominant since 2000



Decomposition of wealth (W)

: physical stock (S) and net price (p)

$$W = S * p$$

$$\ln W = \ln S + \ln p$$

$$\frac{d \ln W}{dt} = \frac{d \ln S}{dt} + \frac{d \ln p}{dt}$$

$$\frac{1}{W} \frac{dW}{dt} = \frac{1}{S} \frac{dS}{dt} + \frac{1}{p} \frac{dp}{dt}$$

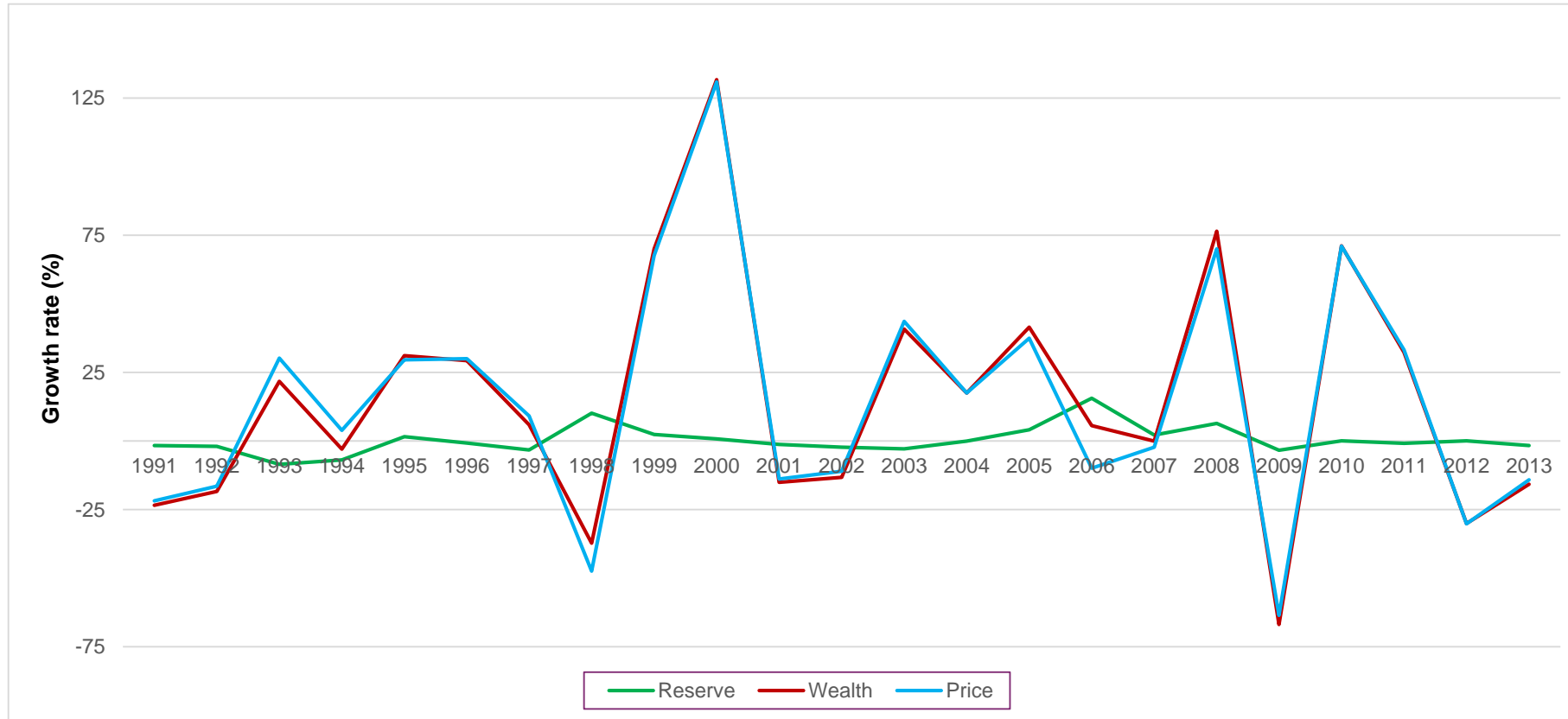
$$\frac{\dot{W}}{W} = \frac{\dot{S}}{S} + \frac{\dot{p}}{p}$$



100

Growth in reserve, wealth and price

: reserve index relatively stable




Limitations

1. The significance of the index is more relevant when the natural resource measured is finite.
2. The interpretation of the index needs to be further clarified.
3. The index is limited to countries that have the physical and monetary accounts already set up.
4. Tracking natural resources in an aggregate manner may overshadow the behavior of each resource.
5. This index could be interpreted by some countries as a way to significantly increase wealth by exploiting identified resources, however the accounts are meant to be used as a sustainable indicator through an environmental lens.



Proposal



V	Asset accounts	133
5.1	Introduction	133
5.2	Environmental assets in the SEEA Central Framework	134
5.2.1	Introduction	134
5.2.2	Scope of environmental assets	134
5.2.3	Valuation of environmental assets	137
5.3	The structure of asset accounts	139
5.3.1	Introduction	139
5.3.2	Conceptual form of the physical asset account	139
5.3.3	Conceptual form of the monetary asset account	143
	5.3.4 Conceptual form of the natural resource reserve index	

Conclusion

- In 2015, NBSA integrated NRA with land, produced assets
<http://www.statcan.gc.ca/daily-quotidien/151214/dq151214a-eng.htm?HPA>
- Land and produced assets seldom decline
- But NRA could be highly volatile
 - Inherent due to changes in reserves
 - Price changes amplify fluctuations
- The reserve index enhances interpretation of the NRA
- In conjunction with human capital and produced capital, can be used as an indicator of sustainable development
- Can also be used for designing sustainable development strategies

- Comments/questions?



THANK YOU!

For more information,
please visit

www.statcan.gc.ca

MERCI!

Pour de plus amples renseignements,
visitez le

www.statcan.gc.ca



#StatCan100

