Statistics Canada
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Canada's Natural Resource Wealth

UNECE Expert Group on National Accounts

Statistics Canada

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Overview

- **Natural Resources: how (and why) we value them**
- **Integration with the National Balance Sheet**
- **Methodology for quarterly estimates**

First, the why…

"Conventional economic aggregates generated through national accounting, such as GDP, do not reflect the extent to which production and consumption activities may be using up environmental assets and limiting the capacity for these assets to generate ecosystem services in the future."

-The Economics of Ecosystems and Biodiversity: Guidance Manual for Countries (2013)

Now the how…

According to the UN System of Environmental-Economic Accounting 2012 (SEEA):

5.109 …no values for the asset itself, in situ*, are available.*

5.110 In this situation, the discounted value of future returns approach, commonly referred to as the Net Present Value approach – or NPV – uses projections of the future rate of extraction of the asset together with projections of its price to generate a time series of expected returns. Typically these projections are based on the history of returns earned from the use of the environmental asset. Assuming that returns earned in the current period are worth more to the extractor than returns earned in the future, the stream of expected returns is discounted to reflect the value a buyer would be prepared to pay for the asset in the current period.

Resource value: Resource rent

$$RR = TR - C - (r_c K + \delta)$$

where:

RR = resource rent (annual)

TR = total annual revenue

C = annual non-capital extraction cost (excluding taxes)

δ = annual depreciation

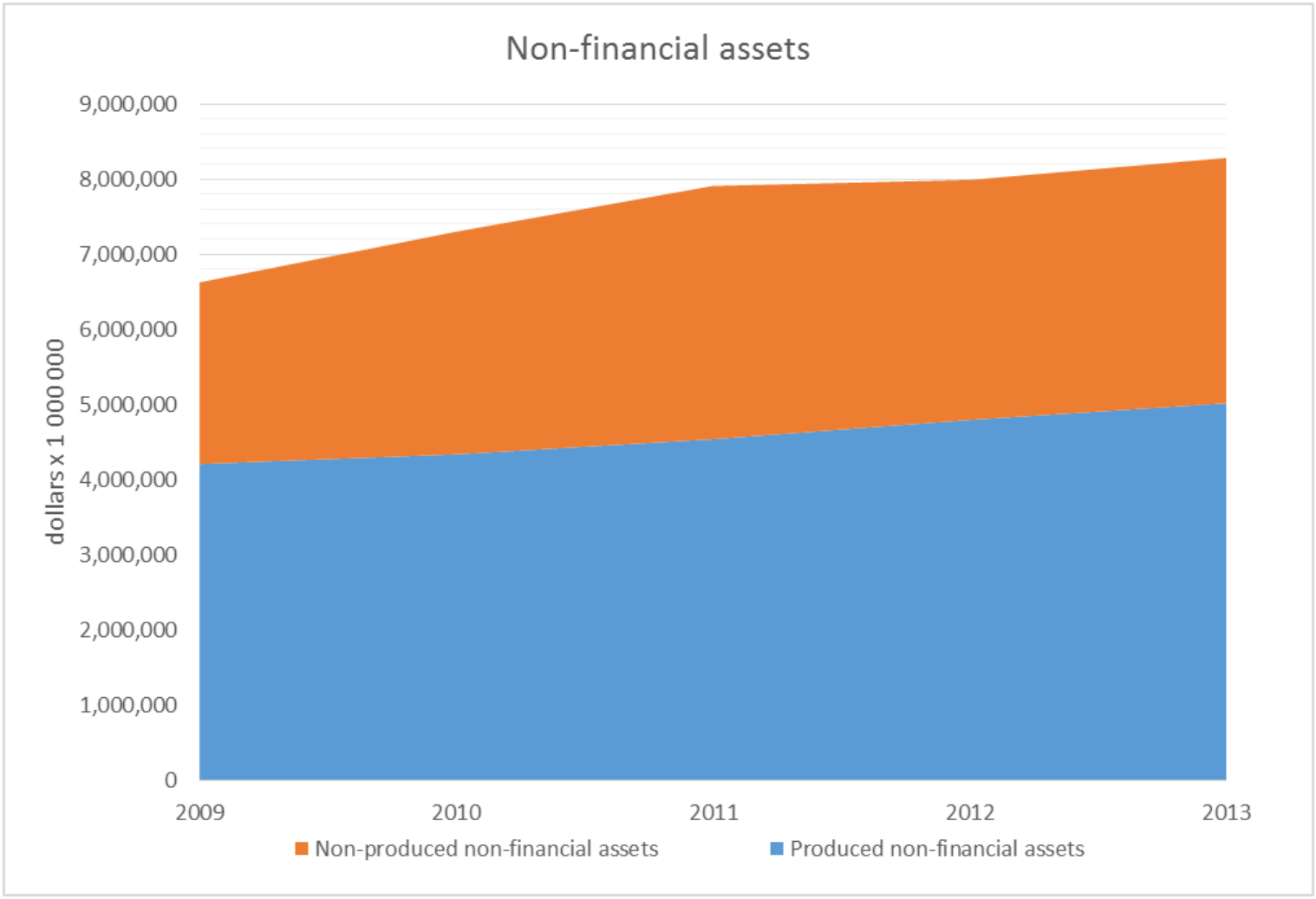
$r_c K$ = return to produced capital

Resource value: Net present value

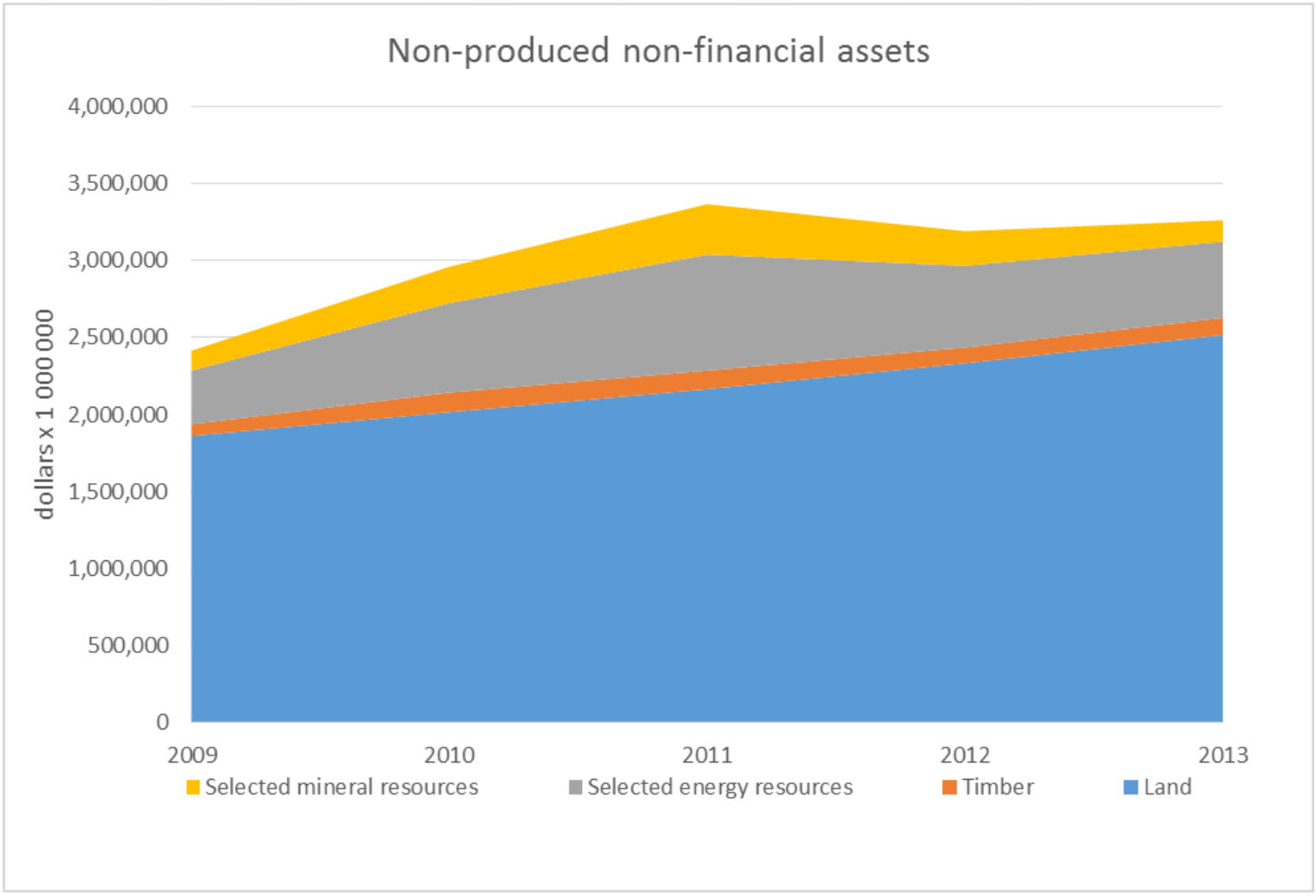
$$NPV = \sum_{t=1}^{T} \frac{RR_1}{(1+r_i)^t}$$

where:
RR_1=resource rent of year 1
T= reserve life, i.e. Closing stock ÷ extraction
r_i= discount rate

How much are we talking, here?



How much are we talking, here?



Let's go Quarterly!

Why?

Natural resources are considered non-produced non-financial (tangible) assets in the United Nations System of National Accounts (2008 SNA) and should be included in the calculation of national wealth and sectoral net worth. Basically, we're supposed to do it.

The problems…

We have no quarterly natural resource asset values.

The quarterly balance sheet is sectored, so who gets what?

All we need are the variables… (and a way to sector)

$$RR = TR - C - (r_c K + \delta)$$

$$NPV = \sum_{t=1}^{T} \frac{RR_1}{(1 + r_i)^t}$$

Resource value: quarterly projectors

Revenue

- Quarterly price and quantity data can be used to allocate annual historical sales revenues across quarters
- Forward projection of revenues are based on price and quantity indicators for the current and previous periods

Calculating quarterly revenue

$$\begin{bmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \\ \omega_4 \end{bmatrix} = \begin{bmatrix} \frac{tr_1}{tr_T} \\ \frac{tr_2}{tr_T} \\ \frac{tr_3}{tr_T} \\ \frac{tr_4}{tr_T} \end{bmatrix} \quad and \quad \begin{bmatrix} TR_1^E \\ TR_2^E \\ TR_3^E \\ TR_4^E \end{bmatrix} = \begin{bmatrix} \omega_1 * TR^A \\ \omega_2 * TR^A \\ \omega_3 * TR^A \\ \omega_4 * TR^A \end{bmatrix} \qquad (Eq.3a)$$

Where:

ω_i = weights used to distribute annual (benchmark) survey revenue data by quarter, i.e., where $\sum_{i=1}^{4} \omega_i = 1$

tr_i = constructed quarterly sales revenue for the *i*th quarter, based on quarterly price and quantity data, i.e., $tr_i = p_i * q_i$ [27]

tr_T = the sum of constructed quarterly revenue over 4 quarters, i.e. $tr_T = \sum_{i=1}^{4} tr_i$

TR^A = reported sales revenue from *annual* survey sources[28]

TR_i^E = estimated total revenue for *i*th quarter, where $\sum_{i=1}^{4} TR_i^E = TR^A$

$$RR = TR - C - (r_c K + \delta)$$

Projecting quarterly revenue

$$TR_t^E = TR_{t-1}^E\left(\frac{p_t}{p_{t-1}} * \frac{q_t}{q_{t-1}}\right) = TR_{t-1}^E\left(\frac{tr_t}{tr_{t-1}}\right)$$

Where:

p_t , q_t = quarterly indicators of price and quantity for the current period

p_{t-1} , q_{t-1} = quarterly indicators of price and quantity for the previous period

$$RR = TR - C - (r_c K + \delta)$$

Resource value: quarterly projectors

Costs

- Quarterly wage rate and output data can be used to allocate annual historical labour cost across quarters
- Forward projection of cost are based on wage rate and output indicators for the current and previous periods
  - A similar approach is used for other costs (e.g. raw materials, electricity)
  - Capital costs: depreciation allocated with quarterly investment data, return to capital based on bond rate

Calculating quarterly costs (labour)

$$\begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} = \begin{bmatrix} \frac{Q_1}{Q_T} \\ \frac{Q_2}{Q_T} \\ \frac{Q_3}{Q_T} \\ \frac{Q_4}{Q_T} \end{bmatrix}; \quad \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} = \begin{bmatrix} \frac{W_1}{W_T} \\ \frac{W_2}{W_T} \\ \frac{W_3}{W_T} \\ \frac{W_4}{W_T} \end{bmatrix}; \quad \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \end{bmatrix} = \begin{bmatrix} \theta\alpha_1 + (1-\theta)\beta_1 \\ \theta\alpha_2 + (1-\theta)\beta_2 \\ \theta\alpha_3 + (1-\theta)\beta_3 \\ \theta\alpha_4 + (1-\theta)\beta_4 \end{bmatrix}; \quad \begin{bmatrix} C_1^E \\ C_2^E \\ C_3^E \\ C_4^E \end{bmatrix} = \begin{bmatrix} \gamma_1 * C^A \\ \gamma_2 * C^A \\ \gamma_3 * C^A \\ \gamma_4 * C^A \end{bmatrix}$$

$$\sum_{i=1}^{4} \alpha_i = 1 \qquad \sum_{i=1}^{4} \beta_i = 1 \qquad \sum_{i=1}^{4} \gamma_i = 1$$

Where:

α_1, α_2, α_3, and α_4 are quarterly output ratios,

β_i are wage rate ratios,

θ=weight (assumed 0.5)[31]

γ = weighted average of α and β

Q_1, Q_2, Q_3, and Q4 = production in each quarter

Q_T = sum of quarterly production values, i.e. $Q_T = \sum_{i=1}^{4} Q_i$

W_1= hourly wage rates from quarterly sources

W_T= sum of hourly wage rates from quarterly sources, i.e. $W_T = \sum_{i=1}^{4} W_i$

C_1^E =estimated labour cost in quarter 1;

C^A = labour cost from annual (benchmark) survey sources

$$RR = TR - C - (r_c K + \delta)$$

Calculating other quarterly costs

- **Quarterly other operating costs**

- A similar approach is also used for interpolation and forward projections of other cost components of rent such as electricity and raw materials costs; *e.g.,* where hourly electricity rate is used in place of wage rate (W). Data for material inputs are estimated using price indexes and gross domestic product.

$$RR = TR - C - (r_c K + \delta)$$

Projecting quarterly costs (labour)

$$C_t^E = C_{t-1}^E \left(\frac{W_t}{W_{t-1}} * \frac{Q_t}{Q_{t-1}} \right)$$

$$RR = TR - C - (r_c K + \delta)$$

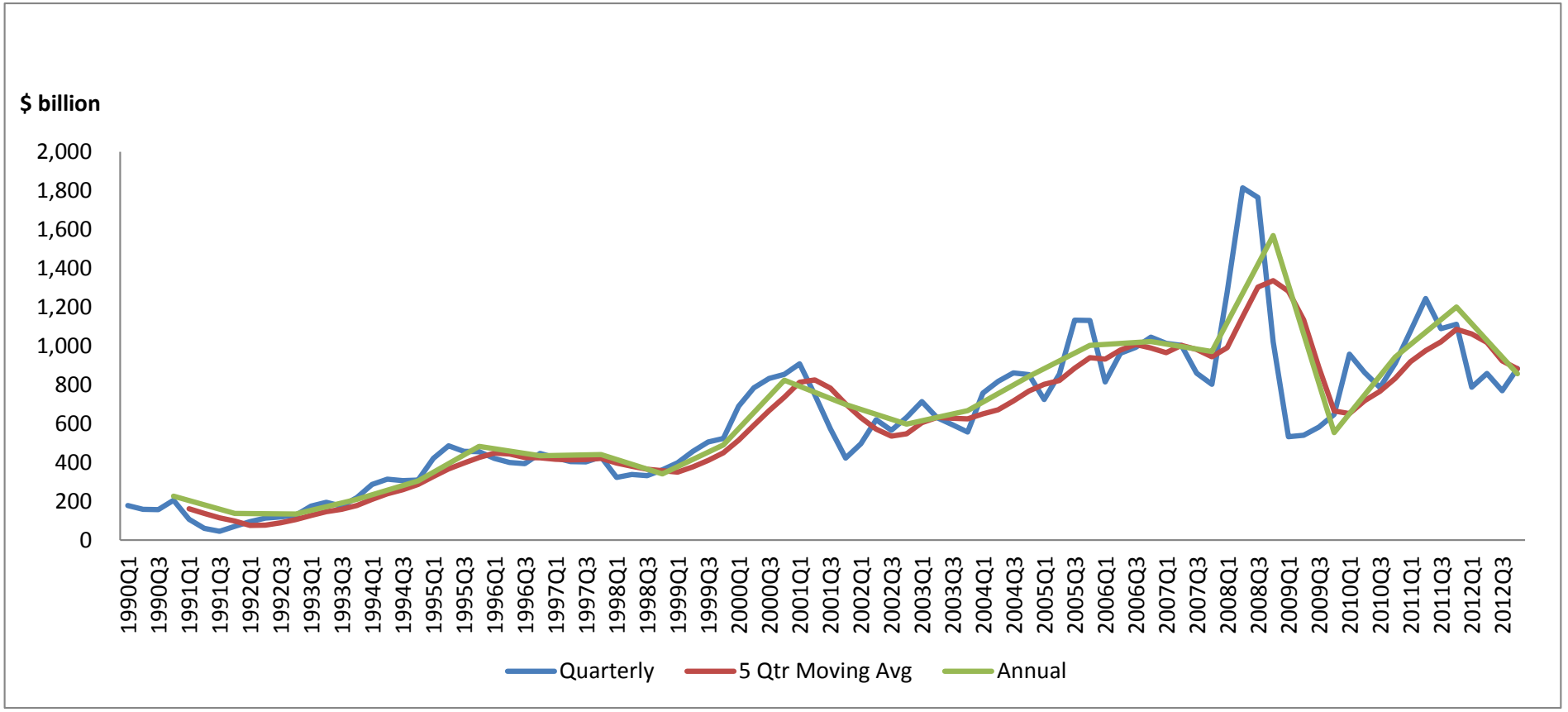
Calculating depreciation and return to capital

- **Quarterly capital costs**

- There are two components of capital cost that need to be accounted for in the calculation of resource rent: depreciation (δ) and the return to fixed capital ($r_k K$).
  - For the former, the perpetual inventory method is used to generate estimates of (geometric) depreciation. While these capital stock and depreciation data are not estimated on a quarterly basis at Statistics Canada, a quarterly investment data series is used to allocate them by quarter.
  - With respect to calculating a return to fixed capital, an often contentious issue is the selection of an appropriate rate of return (r_k) to apply to fixed capital stock (K). For these estimates, an internationally accepted rate based on the 5-year bond rate from the Bank of Canada is used.

$$RR = TR - C - (r_c K + \delta)$$

We have the quarterly values, on to sectoring…



Conflicting international guidance…

- SNA 2008 suggests the allocation of in situ resource value to the owner (government), with royalty payments of the extractor shown as rent for both natural timber and subsoil assets.

- SEEA 2012 suggests splitting the value of mineral and energy resources between the two owners based on their share of the future stream of resource rent.

Considerations: Governments

- Governments **do not** account for natural resource stocks in their financial statements
  - Therefore, the SNA 2008 recommendation to allocate to government is at odds with IMF-based government financial statistics
- Governments **do** account for selected income flows resulting from economic activity associated with the use of natural resources
  - Not all benefits accrue to government, but the income they do receive implies an underlying asset

Considerations: Corporations

- Corporations **do** account for natural resource stocks in their financial statements (intangible extraction rights)
- Since revenue accrues from harvest/extraction, they are economic owners
  - If the resources are allocated to government, there is no asset in the corporate sector to reflect this income flow
- Resource price changes will affect the value of corporate shares on markets: to better reflect this reality, we need a link to the asset in the corporate sector balance sheet in the SNA

The solution.

- Statistics Canada will use the SEEA 2012 suggestions on the sectoring, however…
- The proposed solution is to define sectoral claims on the physical resource stock as **intangible assets** (they are claims on the underlying resources)
- Why? Because you can't meaningfully split the tangible asset.

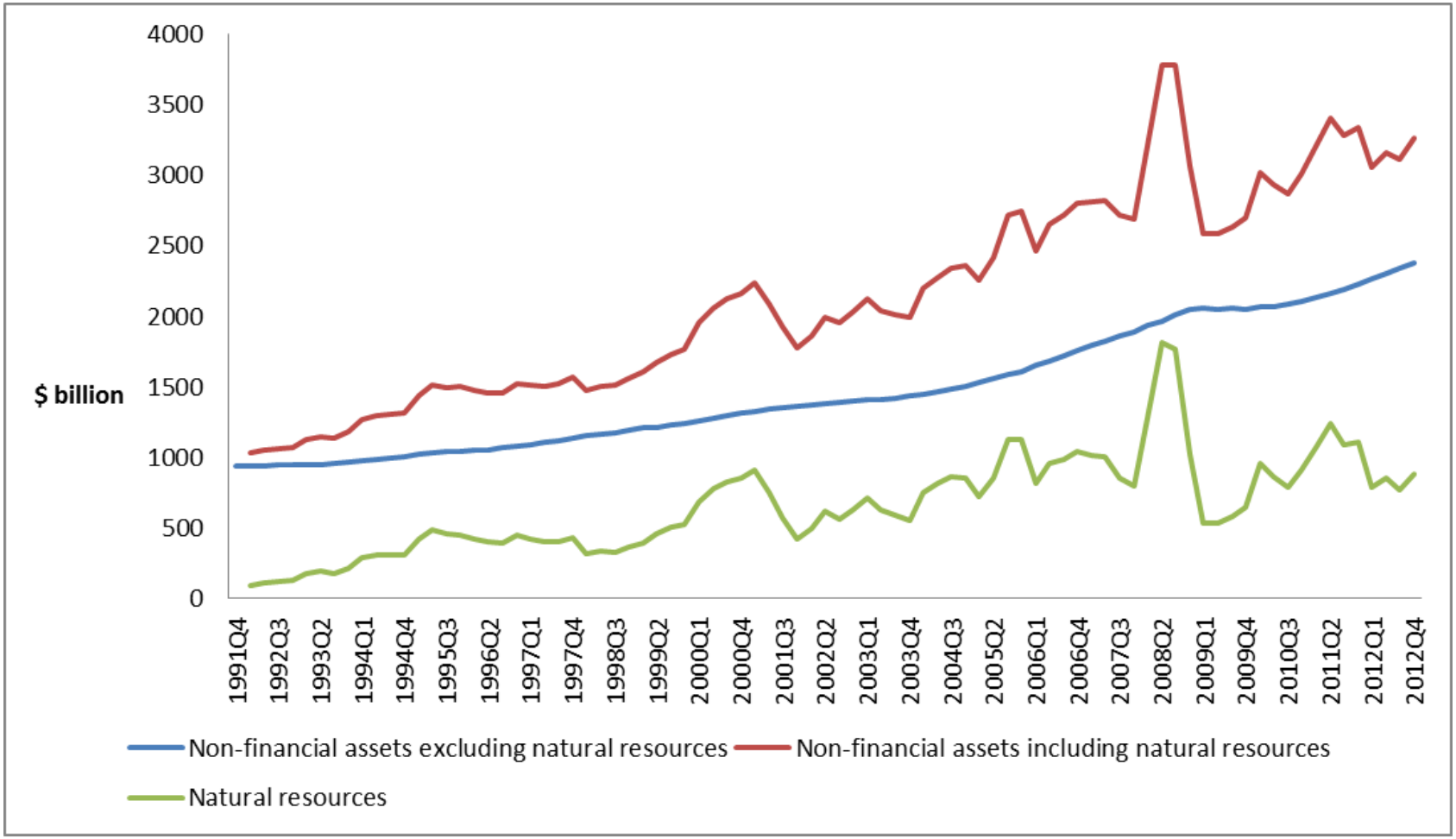
Sectoring of net present value

- Government share
  - Based on expected revenue stream (*i.e.* royalties and special taxes)
- Corporate share
  - Calculated as the residual

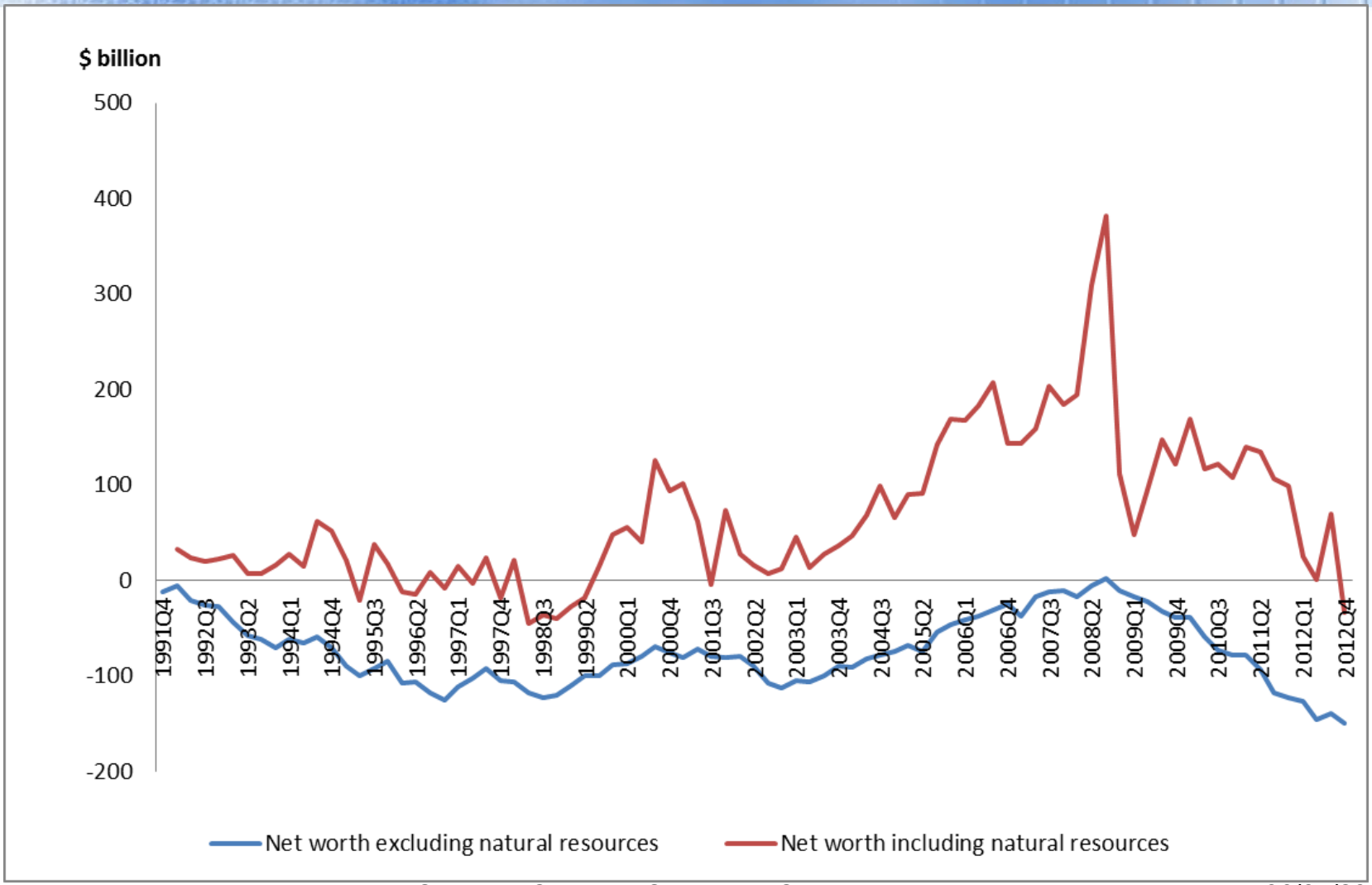
So what does that mean?

NBSA sectors/assets	Households	Corporations	Government	Reclassification from sector accounts to National Wealth	Consolidated National balance sheet (CNBS)
Total assets	4500	6300	400		
Non-financial assets		4300	400		National Wealth: 4700
Produced assets		3300			3300
Non-produced assets			400		
Tangible natural resources NR				+1400	1400
Intangible assets related to NR		1000 (derived)	400 (calculated)	-1400	
Financial assets	4500	200			
Liabilities and net worth	4500	6300			
Debt		3000			
Equity at market value		3500			
Sectoral net worth (residual corporate net worth in the corporate sector)	4500	**-200**	**400**		**National Net Worth: 4700** (equals sum of domestic sectors' net worth)
MEMO ITEM					
Corporate net worth as a net asset value		3300			

What's it look like? (corporate)



What's it look like? (government)



What does this mean for users?

The Daily

In the news	Indicators	Releases by subject
Special interest	Release schedule	Information

National balance sheet and financial flow accounts, third quarter 2015

Text | CANSIM tables | Related information | Release schedule | Previous release | PDF (336 KB)

Released: 2015-12-14

National wealth declines as the value of natural resource wealth falls

National wealth, or the total value of non-financial assets in the Canadian economy, declined $190.4 billion to $9,205 billion at the end of the third quarter. This was mainly attributable to a $285.4 billion decrease in the value of natural resource wealth as energy prices fell in the quarter. The value of residential real estate rose by $48.7 billion.

Offsetting some of the decline in national wealth, Canada's net international asset position increased $61.0 billion in the third quarter to $287.9 billion. The advance in the net foreign asset position in the quarter was led by the depreciation of the Canadian dollar, which increased the value of international assets and decreased the value of international liabilities. Most of the assets are denominated in foreign currencies compared with about half of the liabilities.

National net worth declined 1.3% or $129.4 billion from the second quarter to $9,493 billion at the end of the third quarter. By comparison, national net worth excluding natural resources increased 1.7% from the second quarter as the value of real estate and Canada's net international investment position advanced. On a per capita basis, national net worth decreased 1.7% to $263,800.

2 of 2 | Pause

National net worth

$9.5 trillion

Third quarter 2015

-1.3%

(quarterly change)

Source(s): CANSIM table 378-0121.