

Measuring subsoil natural resources in Australia

Presented by: Paul Roberts



www.abs.gov.au

Defining subsoil assets

- Subsoil natural resources are defined in the 2008 System of National) Accounts as:
- “... *those proven subsoil resources of coal, oil and natural gas, metallic minerals or non-metallic minerals that are economically exploitable given current technology and relative prices.*” (2008SNA, para 12.17)

General valuation principles



- Assets should be valued on the basis on current, observable market prices.
- In the absence of observable market prices, current prices can be approximated by;
 - accumulating and revaluing acquisitions less disposals of the asset in question over its lifetime.
 - the present, or discounted, value of future economic benefits

Economic rents

- SNA 2008 states that:
- *"Suppose that a mining company knows the size of the deposit being mined, the average rate of extraction and the costs of extraction of one unit. After allowing for all intermediate costs, labour and the cost of fixed assets used, what is left must represent the economic rent of the natural resource. By applying this to the expected future extractions, a stream of future income can be estimated and from this, using the techniques already described, a figure for the value of the stock of the resource at any point in time."* (SNA 2008, para.20.47)

Economic rents

- SEEA 2012 states that:
- *"Resource rent is thus derived from standard SNA measures of gross operating surplus by deducting specific subsidies, adding back specific taxes and deducting the user costs of produced assets (itself composed of consumption of fixed capital and the return to produced assets). As noted above, resource rent is composed of depletion and the net return to environmental assets."* (SEEA 2012, para5.120)

Subsoil assets



- The ABS uses the net present value (NPV) approach to value the stock of subsoil assets.
- This involves calculating the value of net income then discounting this value by an appropriate interest rate over the expected life of the asset.
- Normal returns to produced capital are included to cover the cost of risk and uncertainty.
- The discount rate chosen has been aimed at reflecting the cost of capital, or the cost of borrowing, to the mining industry.

Subsoil assets

- Economically demonstrated reserves (EDRs) and production of mineral resources in Australia are published annually by Geoscience Australia in *Australia's Identified Mineral Resources*.
- Mineral extraction costs are provided by a private consulting firm.
- Prices are obtained from a number of publically available resources, including the *Australian Financial Review* and the Bureau of Resources and Energy Economics' quarterly publication *Resources and Energy Statistics*.
- The ASNA uses a five-year lagged average to smooth prices, costs and production.

Extraction costs

- Mineral extraction costs reflects a variety of factors:
 - Ore grade (metal per tonne of ore)
 - Ore quality (impurities, milling characteristics)
 - Reservoir pressure (flow rates of crude oil or gas)
 - Overburden/strip ratio (waste material to ore coal production)
 - Mine or well depth
- Mineral cost components are not itemised sufficiently to identify the ore grade component

Net present value

- Net present value calculation for individual minerals

$$NPV = \frac{(\$P - \$C) * N}{r / (1 - ((1+r)^{-RL}))}$$

Where \$P = price/unit

\$C = cost/unit (incl. normal return to capital)

N = production

r = discount rate

RL = resource life

= economically demonstrated reserves / N

Data requirements

- Recoverable - Economically demonstrated resource
- 5 year lagged moving average of prices at 30 June
- Annual production
- 5 year lagged moving average of production
- 5 year lagged moving average of resource life
- Net present value of asset

Rate of return to capital

- Gross operating surplus is the return to capital
- Can be allocated to both capital (produced assets) and subsoil natural resources
- The return to produced assets is based on a mark up of costs using cost of extraction data, mining industry capital stock and an appropriate discount rate

Issues with NPV



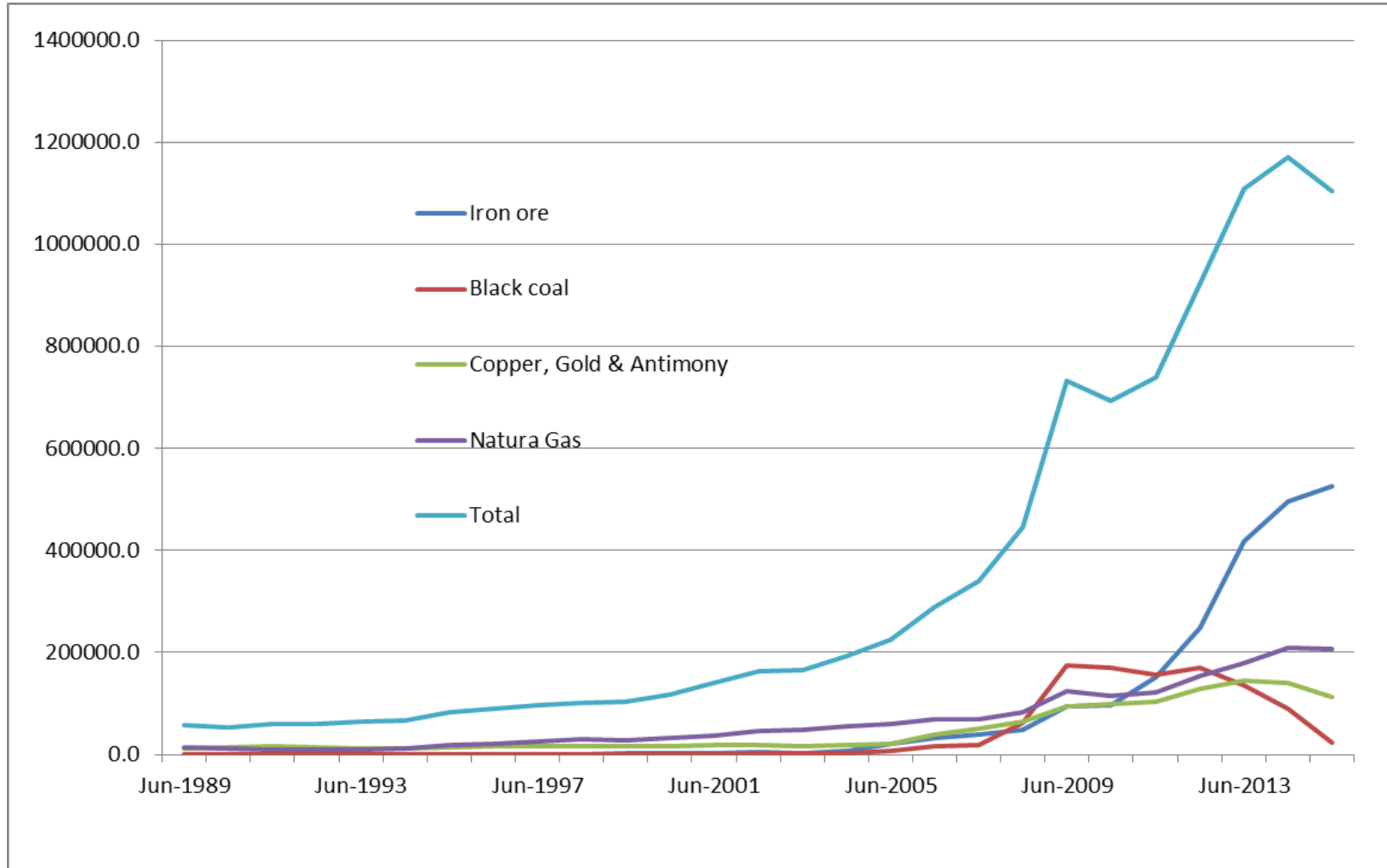
- Future price of products
- Technological developments which will occur during the life of the facility
- True size of the field and any nearby fields
- The performance of the reservoirs to be developed

Current inclusions

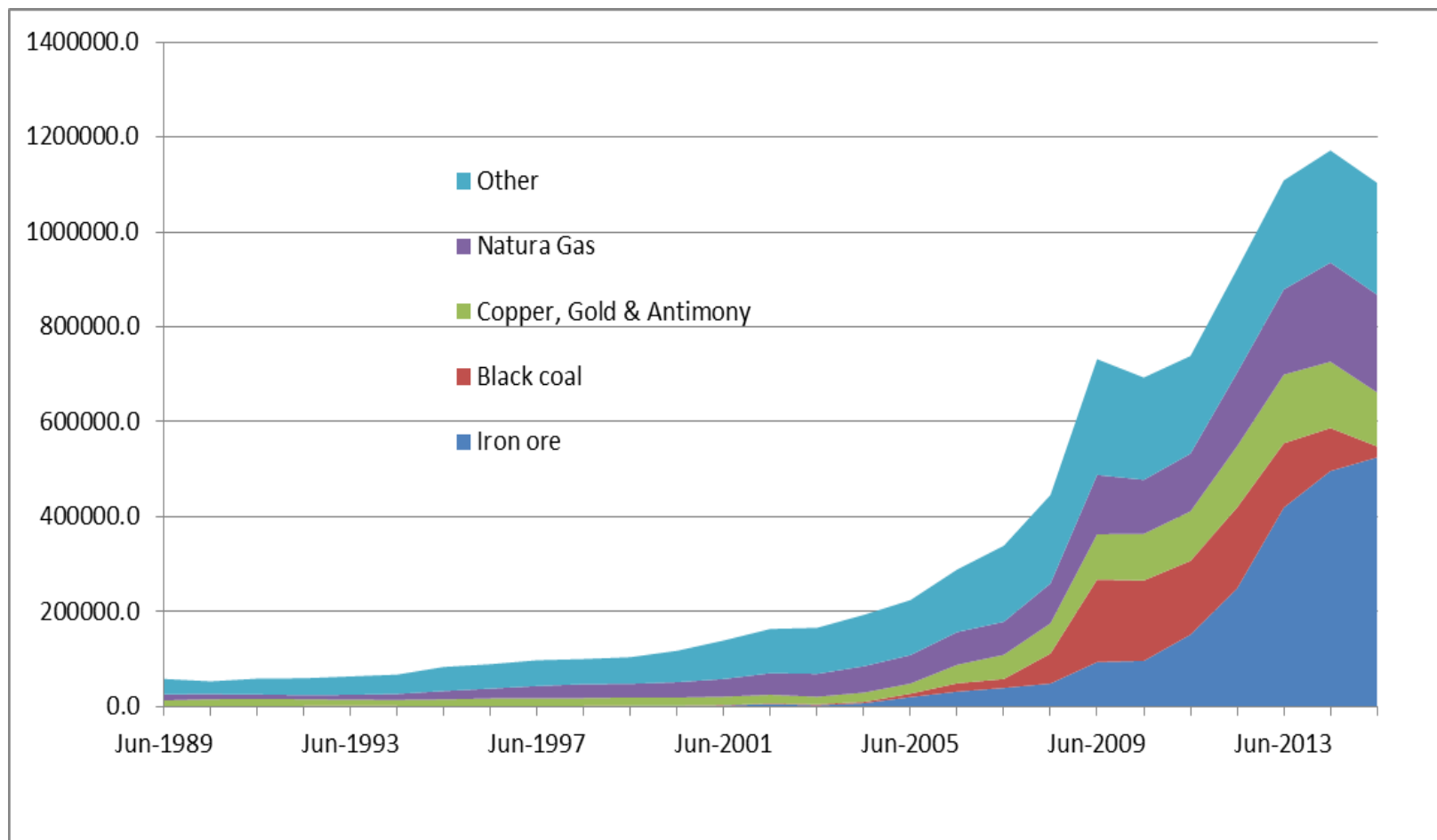


Bauxite	Nickel
Black coal	Platinum
Brown coal	Cobalt
Copper,	Crude oil
Gold	Natural Gas
Antimony	Petroleum - Condensate -
Diamonds	LPG - Naturally occurring
Iron ore	Rare earths (REO, Y203)
Lithium	Tin
Magnesite	Uranium
Mineral sands - Ilmenite	Zinc
Mineral sands - Rutile	Lead
Mineral sands - Zircon	Silver
	Cadmium

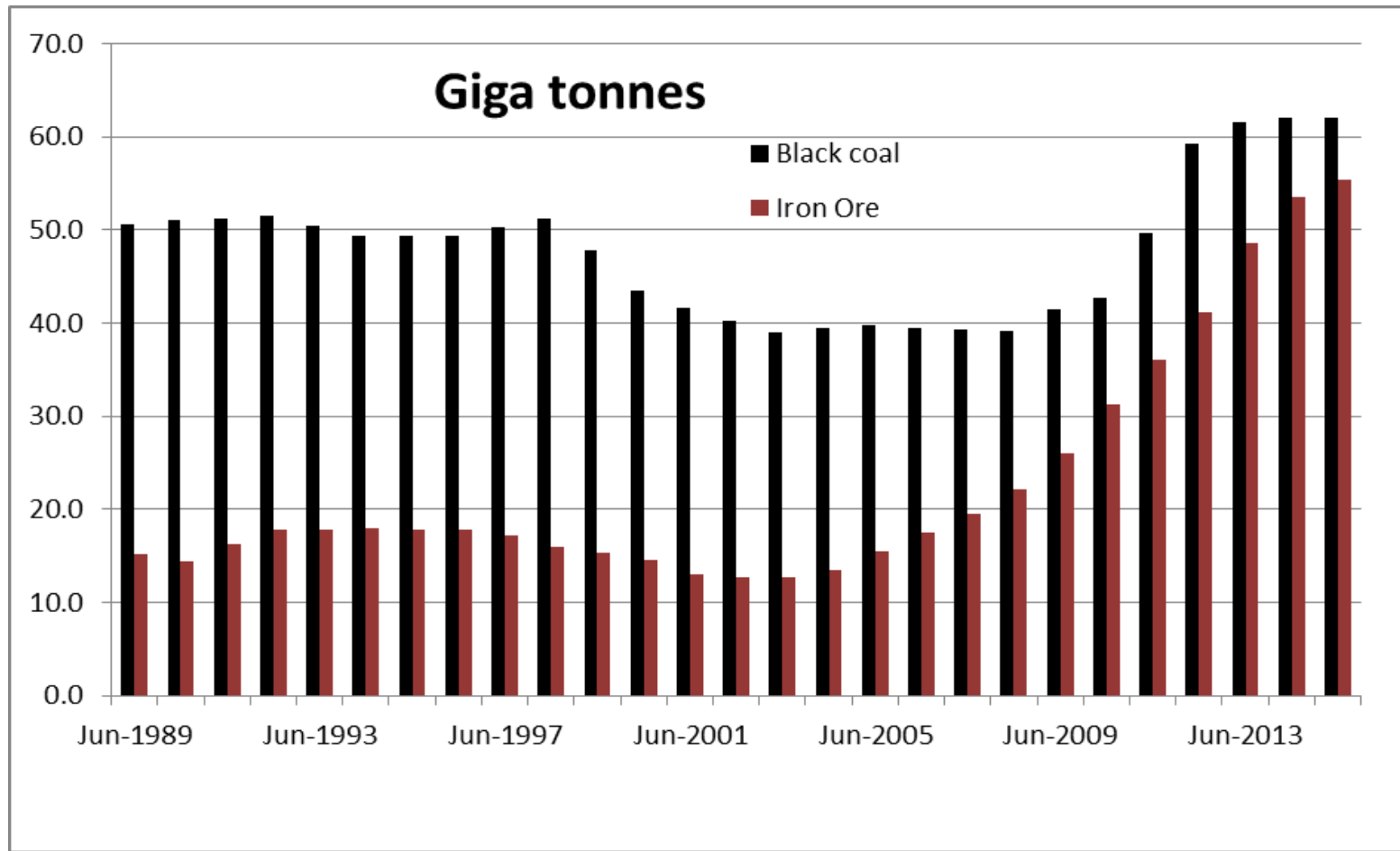
Net present values



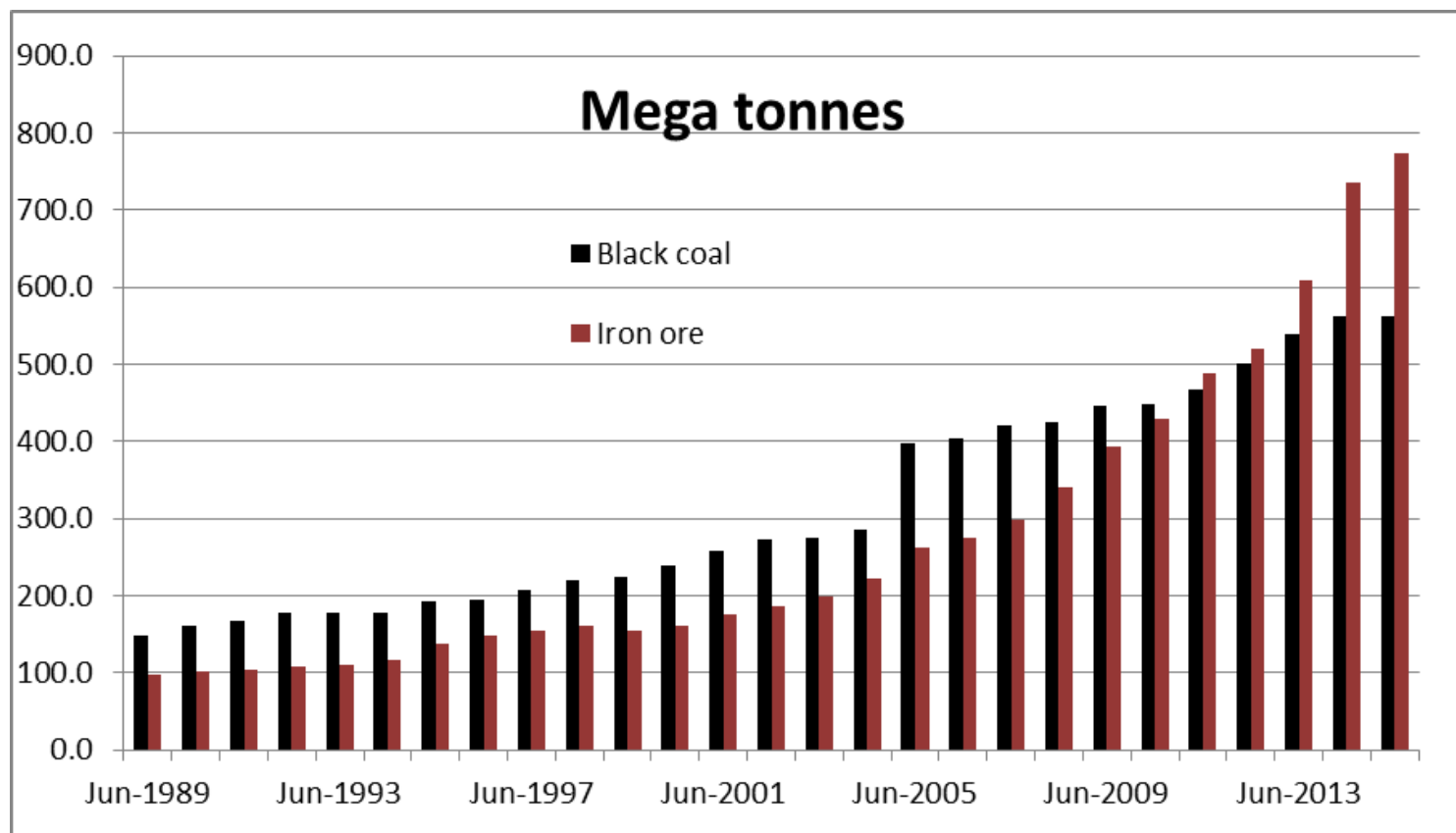
Net present values



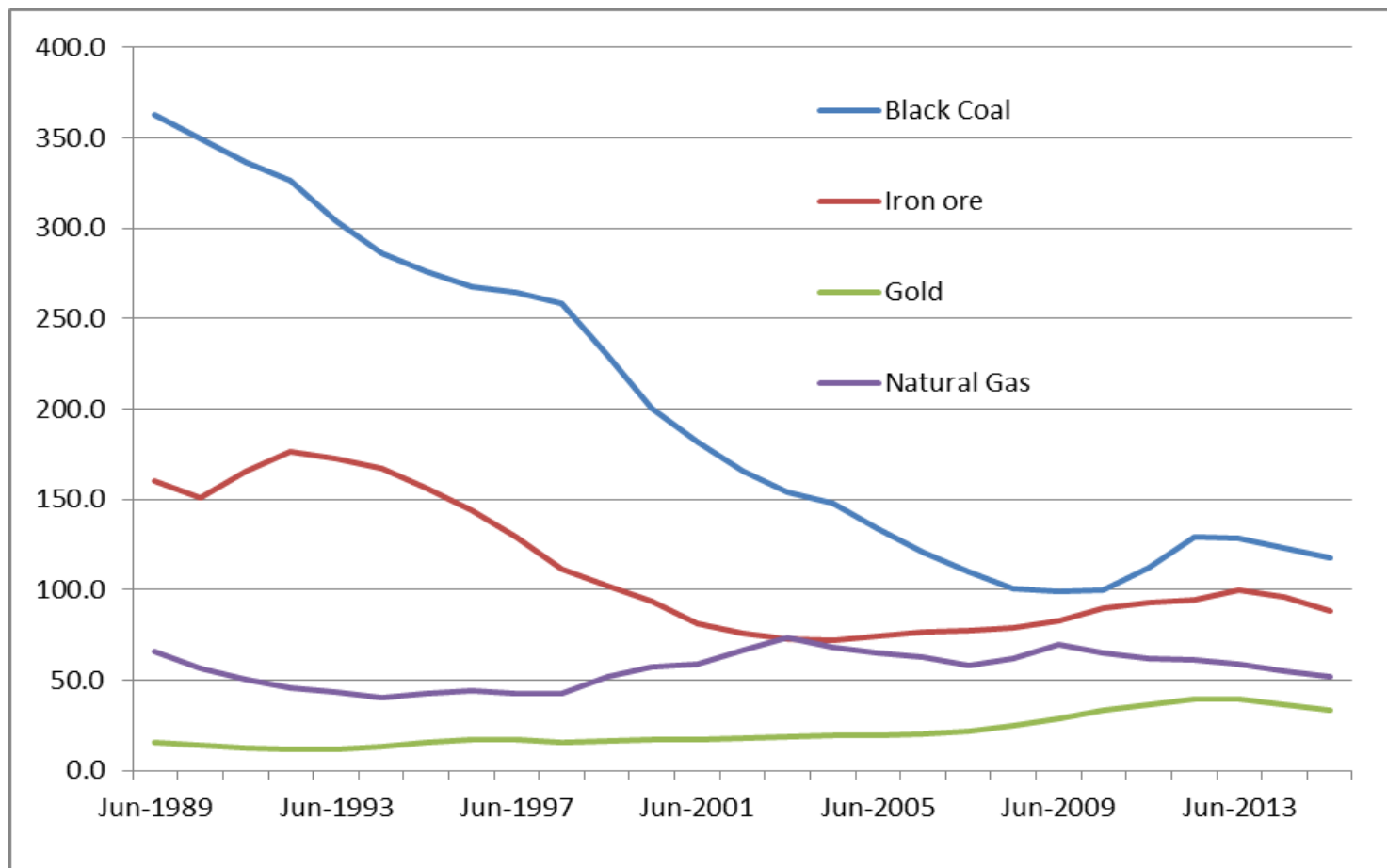
Economic demonstrated resource



Annual production



Average resource life



Questions

- Accounting for Subsoil Mineral Resources (BEA) February 2000
- 5241.0 - Occasional Paper: National Balance Sheets for Australia -- Issues and Experimental Estimates, 1989-92, ABS, March 1995
- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/B5E41C8AF1AD49B8CA25722E001A7F7E?opendocument>