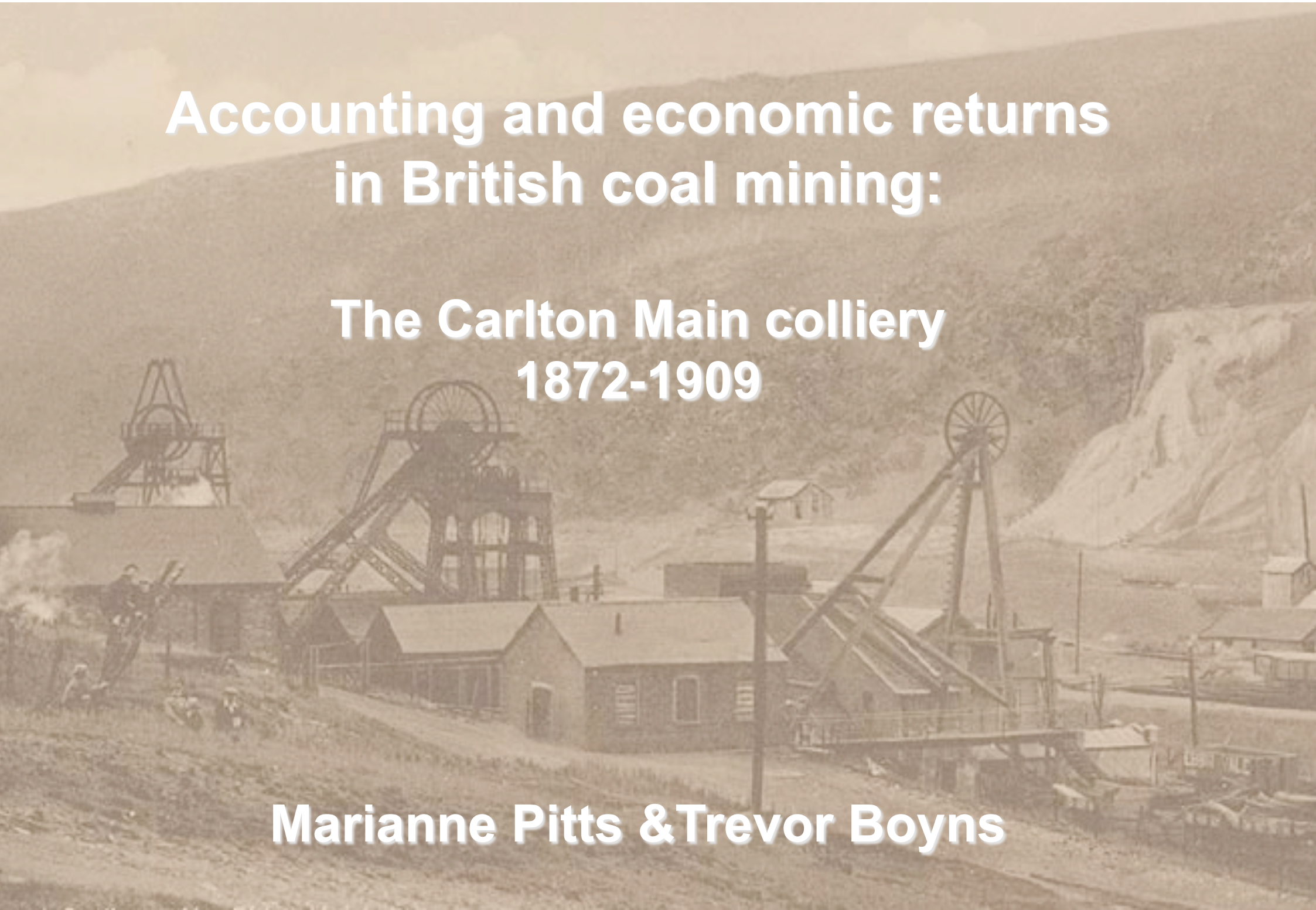

Accounting and economic returns in British coal mining:

The Carlton Main colliery 1872-1909

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Objectives of paper

- To try to assess the validity of past estimates of the rate of return in the late nineteenth century British coal industry

- To examine the efficacy of using accounting rates of return (ARRs) as an indicator of the economic rate of return (IRR) in historical analysis

Basic Approach of Paper

- Consider the theoretical relationship between the ARR and the IRR
- Utilise a combination of published and archival data for the investment in a single colliery – Carlton Main – to estimate both the ARR and the IRR
- Consider the significance of our results for past estimates of the rate of return in the late nineteenth century British coal industry

ARR vs. IRR – (1)

- Kay (1976) – under certain conditions, ARR can provide a consistent estimate of IRR
- Stark (1982) – Kay's conditions are unlikely to hold in the real world; if adjust for real world factors, then ARR is 'not necessarily an acceptable indicator of the true rate of return'
- Peasnell (1982) – since the relationship between ARR and IRR is mathematical, independent of the income measure used or the method of depreciation selected, ARRs 'can be used as a surrogate measures of IRR'

ARR vs. IRR - (2)

- All estimates to date of the rate of return in the late nineteenth century British coal industry have used mean ARRs (sometimes gross, sometimes net of depreciation) – but are these results reliable measures of the economic rate of return?

- Peasnell's result would suggest that the answer is 'YES' for net mean ARRs, but what about gross ARRs?

Previous estimates and contemporary expectations

- 19th century colliery viewers used discount rates of 12%-15% in valuations
- Dron (1928) – 7% to 14% (incl. risk premium) – varying with trade conditions
- Mitchell (1984) – 10.2% gross; 7% net
- Church (1986) – 10-11% gross
- Walters (1977) – south Wales owners expected 20% - 10% interest, 5% redemption and 5% risk premium

Carlton Main Colliery – (1)

- Yorkshire & Derbyshire Coal & Iron Co. Ltd. formed to sink ironstone mines, coal mines and erect blast furnaces - £100,000 nominal capital – on 29 Nov. 1872

- First sod cut re. sinking of Carlton Main colliery on 12 Nov. 1873

- Company never sank ironstone mines or erected blast furnaces (due to collapse of coal and iron boom of 1872-74)

Carlton Main Colliery – (2)

- Coal seam met in July 1876
- Regular coal production began in early 1880s; average production 1890-1908 (ignoring strike year of 1893-4) was 400,000 tons per annum); average employment 1896-1908 was 1,300 men
- Colliery was a relatively large colliery (in 1894 there were 76 collieries employing 1,000 or more men in Britain, 16 of them in Yorkshire)
- In 1900, company acquired Grimethorpe colliery and shortly afterwards commenced sinking Frickley colliery

Calculating the ARR and IRR at Carlton Main colliery – (1)

- Basic source material is company's accounts (profit and loss accounts and balance sheets from 31 March 1878 onwards)

- Archival data (from Directors' minutes and other sources) relating to loans, interest, depreciation, etc.

Calculating the ARR and IRR at Carlton Main colliery – (2)

- Five adjustments were made in order to generate cash flow data from which the IRR could be calculated:
  - (1) assumed that colliery's life began on 1 April 1873 and ended on 31 March 1909 (former date is the date of the first call made on the share capital; production actually stopped in September 1909);
  - (2) assumed that capital expenditure of company after 31 March 1897 was entirely focused on two other collieries, with none on Carlton Main; net contribution to company's profit of Carlton Main was proportionate to its share of output in total company production, 1900-1909;

Calculating the ARR and IRR at Carlton Main colliery – (3)

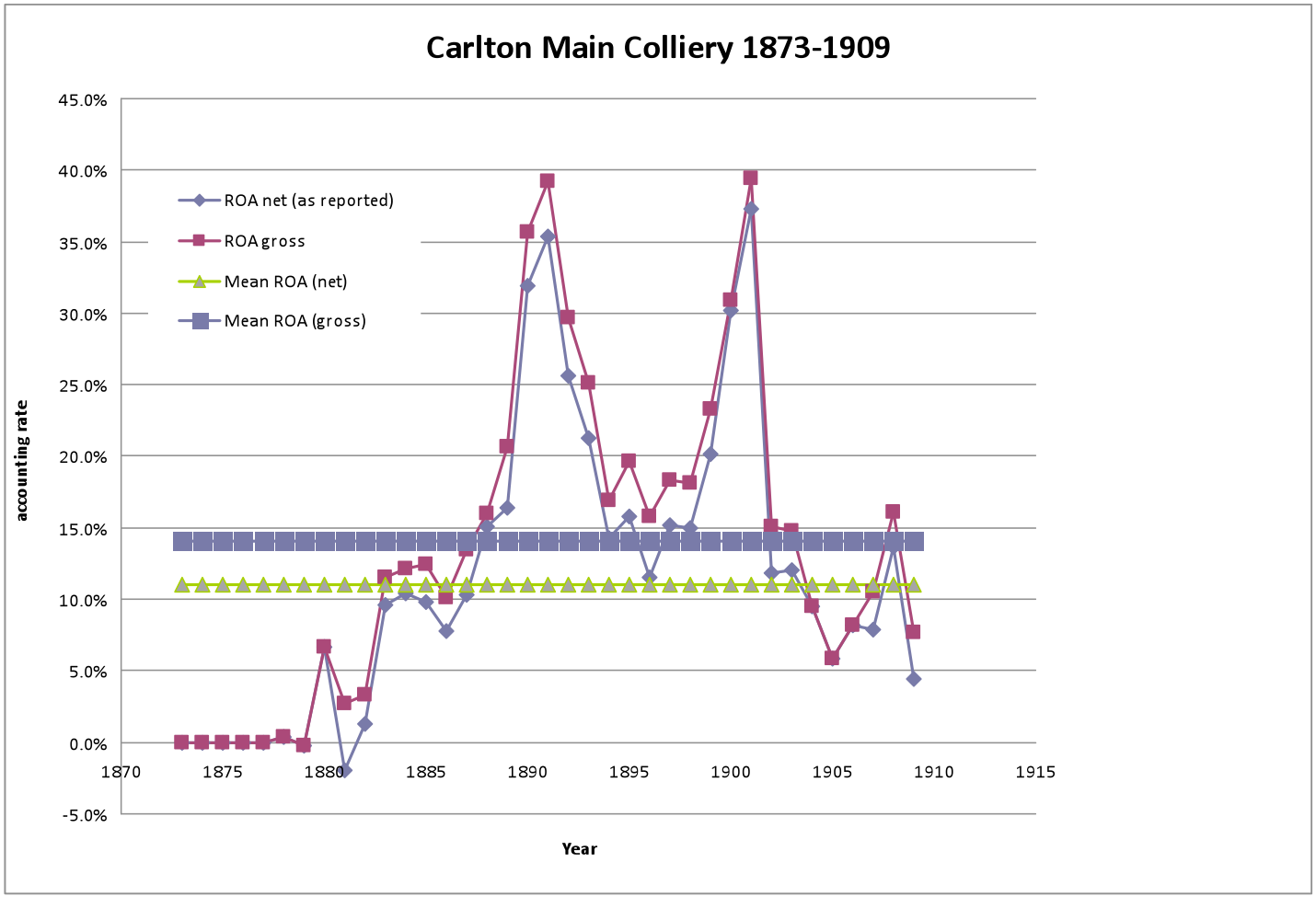
- (3) annual capital expenditure on sinking until 1878 has to be pieced together from archival sources due to lack of any accounts;
- (4) additional depreciation of £2,000 per year has had to be included in net ARR calculations to take account of fact that £60,825 had to be written off the company's assets after closure of the colliery;
- (5) value of equipment transferred from Carlton Main to Grimethorpe colliery on its closure, c.£56K, had to be considered.

Calculating the ARR and IRR at Carlton Main colliery – (4)

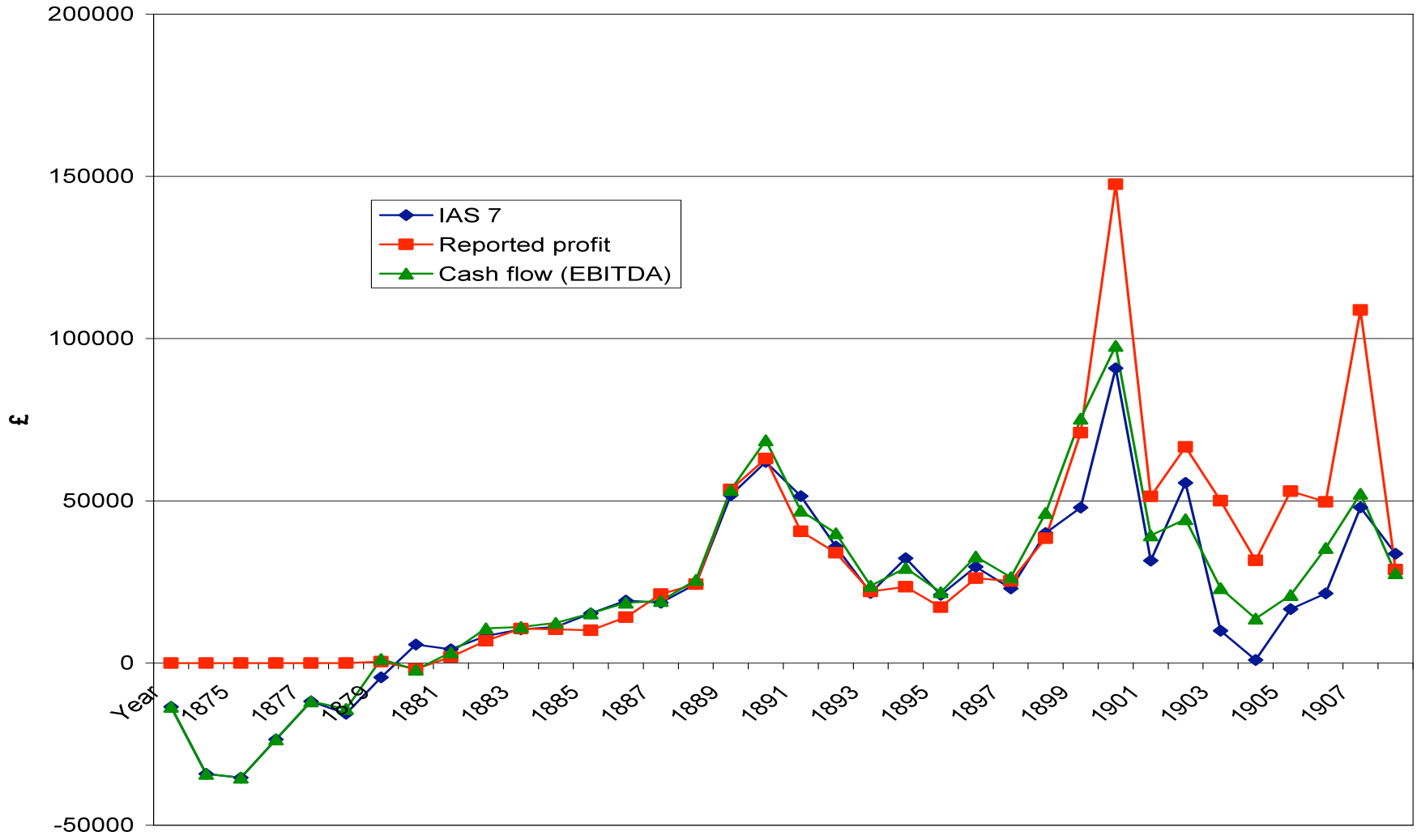
- In respect of some of the adjustments just referred to, we undertook a sensitivity analysis by running our calculations on the basis of assumptions at opposite extremes to one another to see what effect, if any, they had.

- We were surprised that, in the case of many of the adjustments, which assumption was adopted made only a minor difference to the calculated return.

Carlton Main – gross and net ROA



Cash flow (EBITDA & IAS7) and Reported Profit



Carlton Main: the ARR results

Ratio	*1873-1900 Carlton Main colliery only*	*1873-1909 Carlton Main plus apportioned elements*
ROA (net)	10.7	11.0
ROA (gross)	14.1	14.1
ROE (net)	11.0	11.2
ROE (gross)	14.8	14.6

Note: The rate of return for each of the years 1873/74 to 1877/78 has been set at ‘zero’ in the above calculations.

Carlton Main: the IRR results

	Full depreciation Zero breakup	Full Depreciation £56K breakup	No Depreciation post-1900 Zero breakup	No Depreciation post-1900 £56K breakup
Equal expenses (1 April 1875 – 31 March 1878)				
EBITDA(1)	**11.0**	**11.1**	**10.7**	**10.8**
IAS7	**10.5**	**10.6**	**10.2**	**10.3**
Variable expenses (1 April 1875 – 31 March 1878)				
EBITDA(2)	**10.9**	**11.0**	**10.6**	**10.7**
IAS7	**10.4**	**10.5**	**10.1**	**10.2**

Carlton Main – ARR vs. IRR - the main findings

- The IRR calculations suggest an economic rate of return of between 10% and 11%
- The ARR (net) calculations suggest a return of between 10.7% and 11.2%
- The ARR (gross) calculations suggest a return of between 14.1% and 14.8%

Carlton Main – ARR vs. IRR - main conclusion

- Over a long period of time, the average mean ARR is a reliable indicator of the IRR provided that it is calculated net of depreciation; if calculated gross then it will result in a massive over-estimate of the actual return by perhaps 30% or more

Implications of our findings

- Those estimates of the rate of return in the late nineteenth century British coal industry based on mean ARRs are reliable, **BUT** only if calculated net of depreciation. Since many previous estimates have been calculated using gross ARR figures, it can be concluded that they probably overstate the true economic rate of return.