A Half-Century of Stagnation: Labour Productivity in Ontario's Gold Mining Industry

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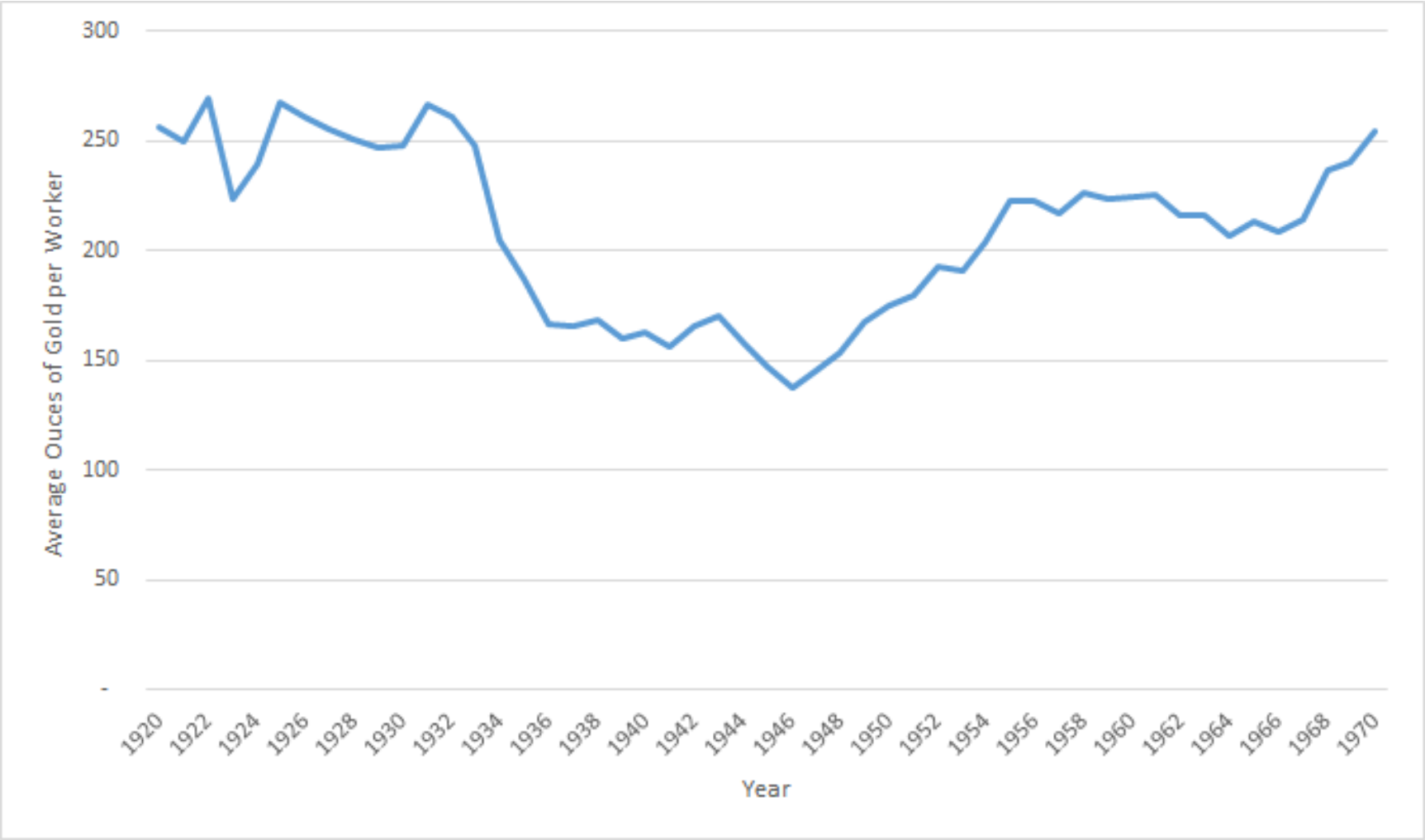
Objective

What caused the large swings in labour productivity observed in Ontario's gold mining sector between 1920 and 1970?

To answer this we complete the following tasks:

- Create a unique mine-level data set which has production, financial, and employment data on Ontario's gold mines.
- Identify important events/policies which caused disruption to the industry.
- Decompose changes in aggregate productivity à la Foster, Haltiwanger, and Krizan (2001) (**FHK**).

Aggregate Labour Productivity (ounces of gold per worker)



Data

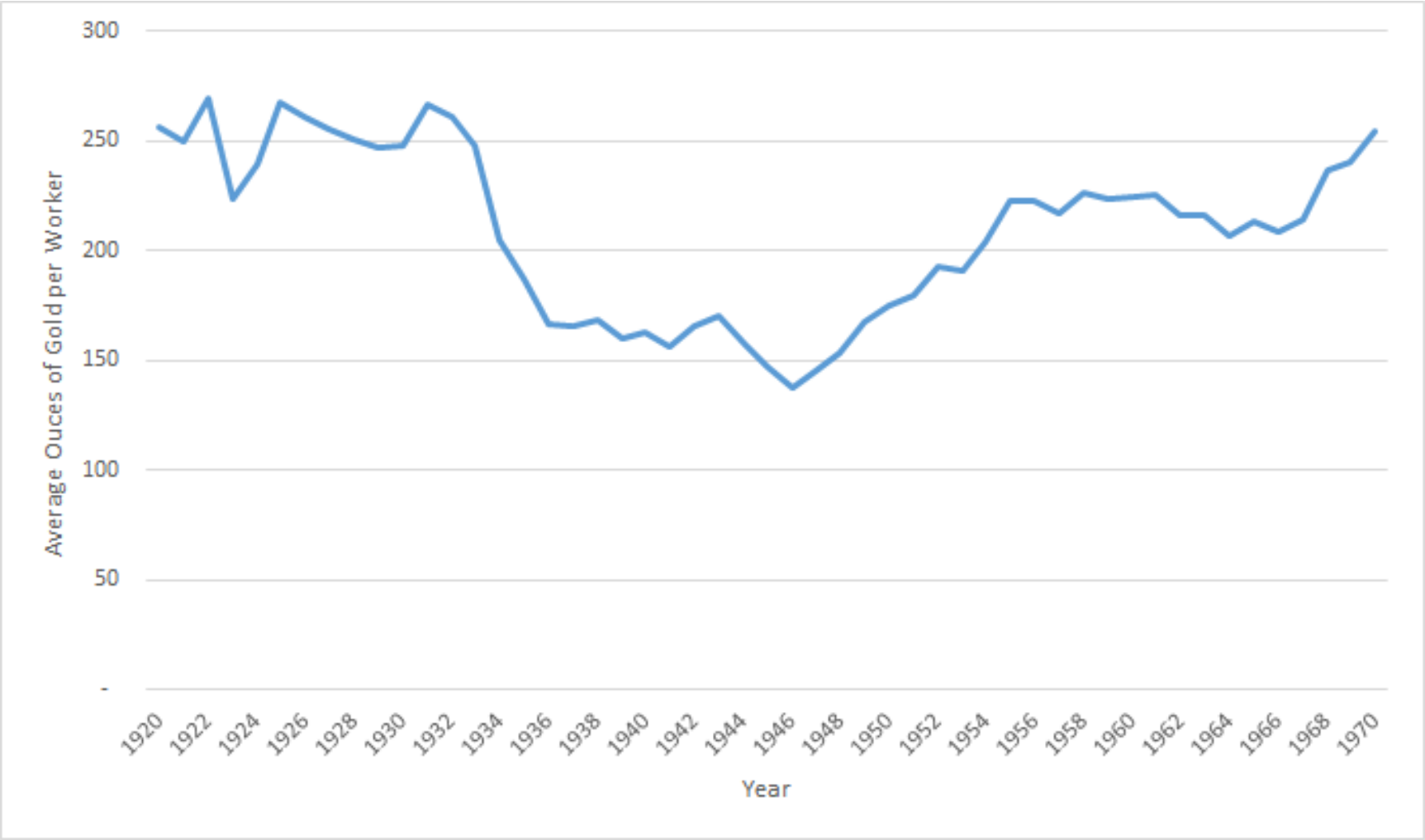
Data Sources

- Source: Annual Reports of the Ontario Department of Mines.
- Two components - Aggregated industry statistics & individual mine-level reports.
- Aggregated industry statistics:
  - 189 gold mines.
  - Limited data - ounces produced, tons milled, and value of output.
- Mine-level data:
  - 76 gold mines producing 91.5% of total output.
  - More complete data - financial, production, labour, exploration & development, reserves, and capital.

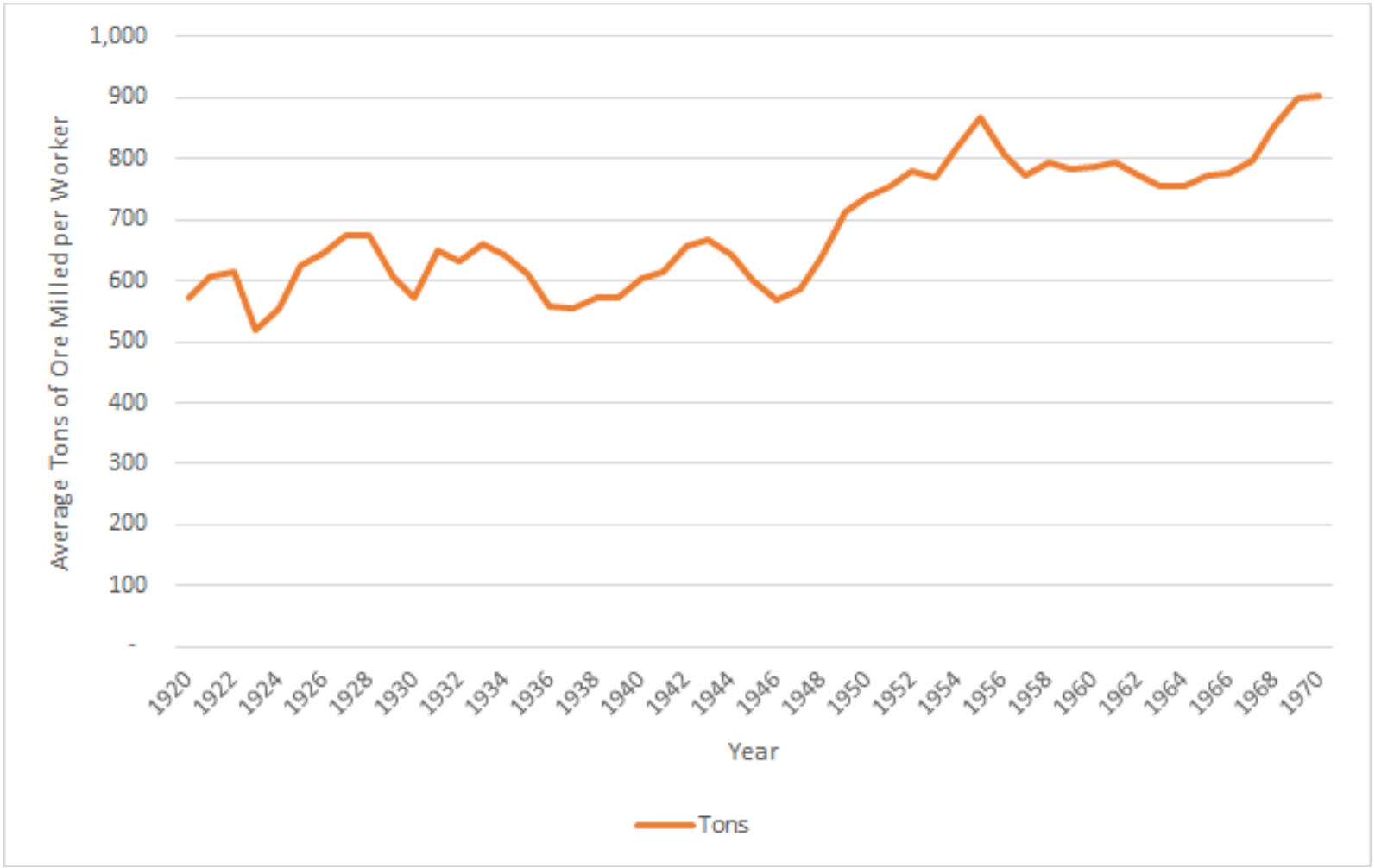
RED LAKE
Ontario
GREENSTONE
TIMMINS
KIRKLAND LAKE
Minnesota

Trends in Productivity

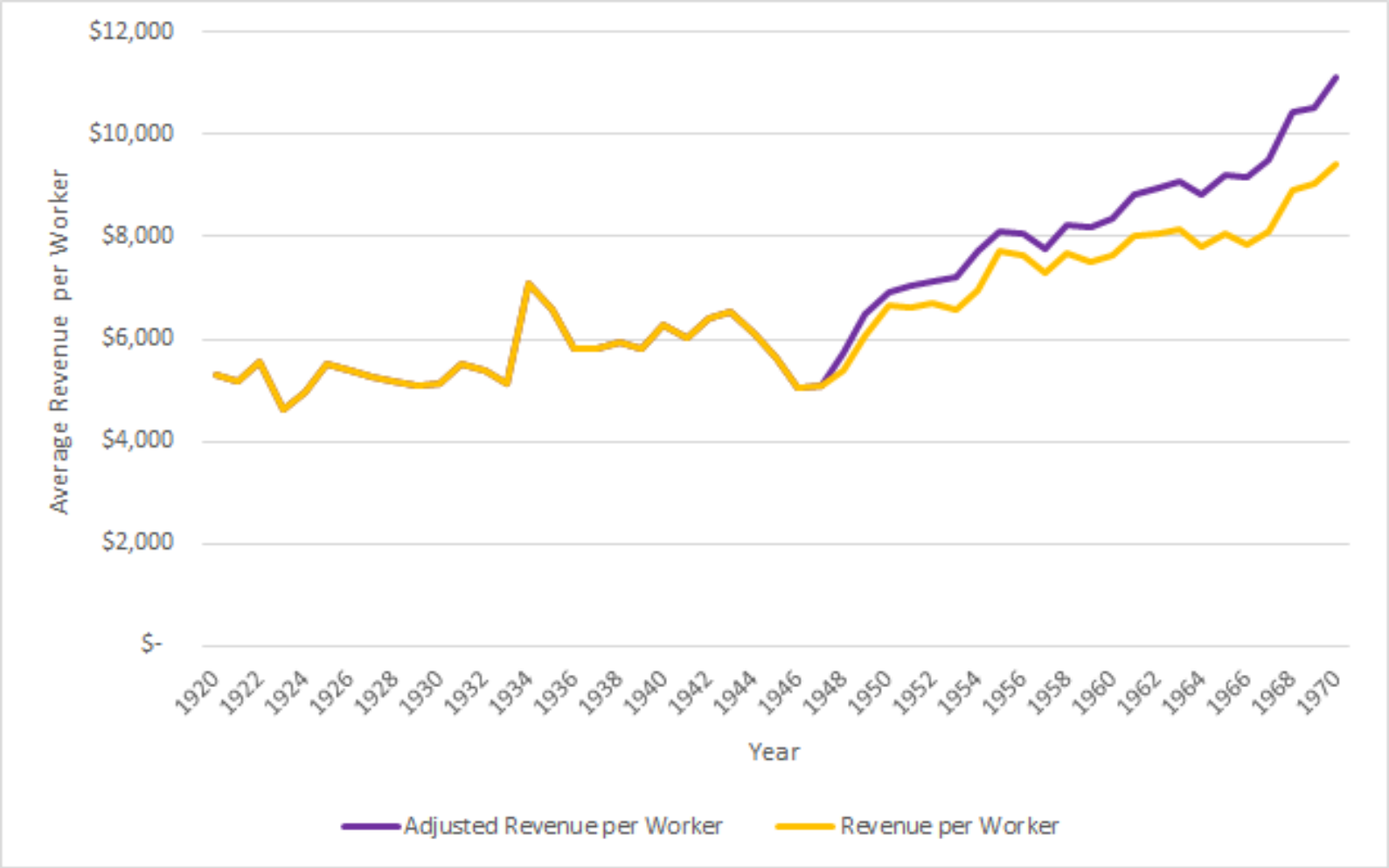
Aggregate Labour Productivity (ounces of gold per worker)

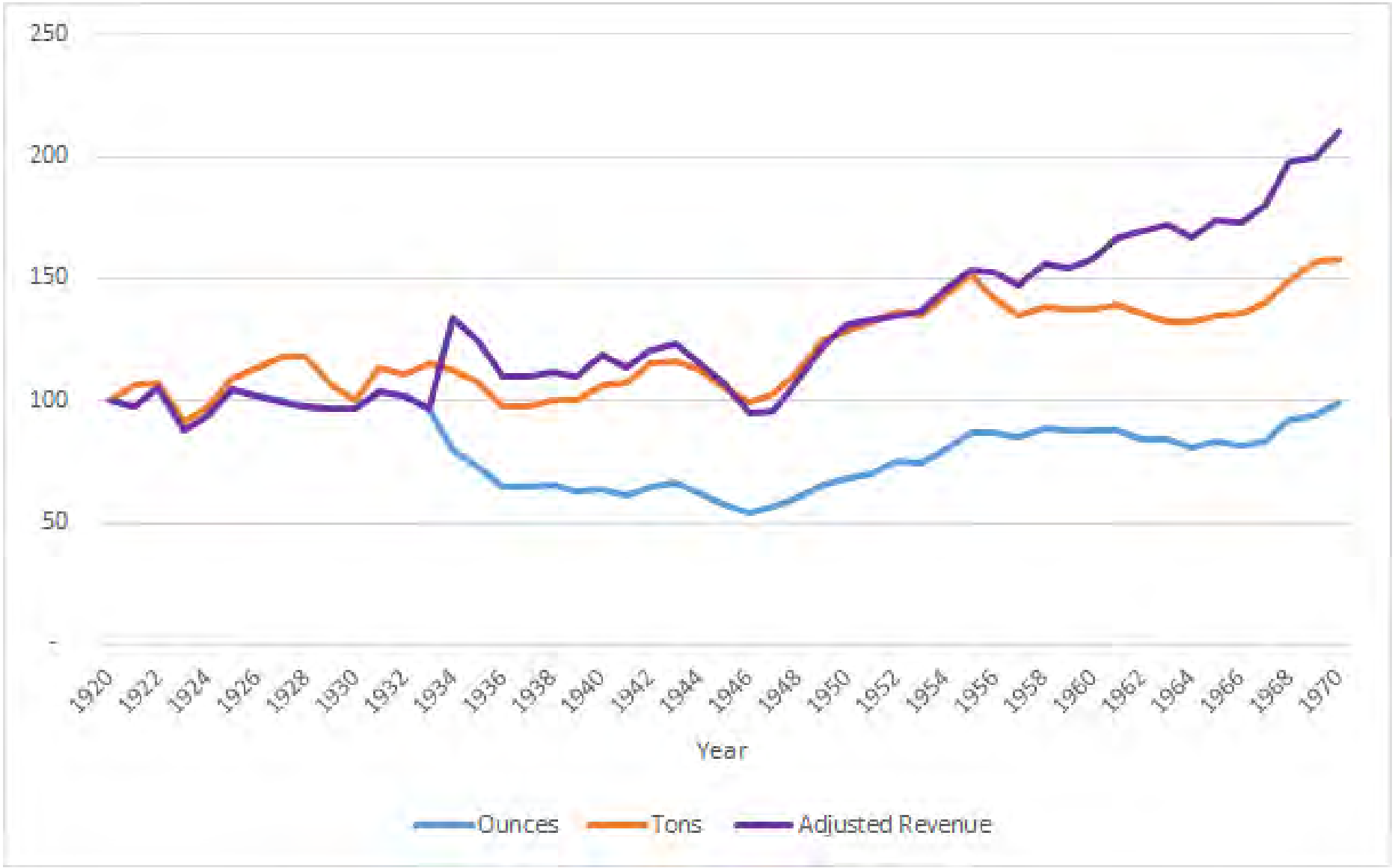


Aggregate Labour Productivity (tons of ore per worker)



Aggregate Labour Productivity (revenue per worker)

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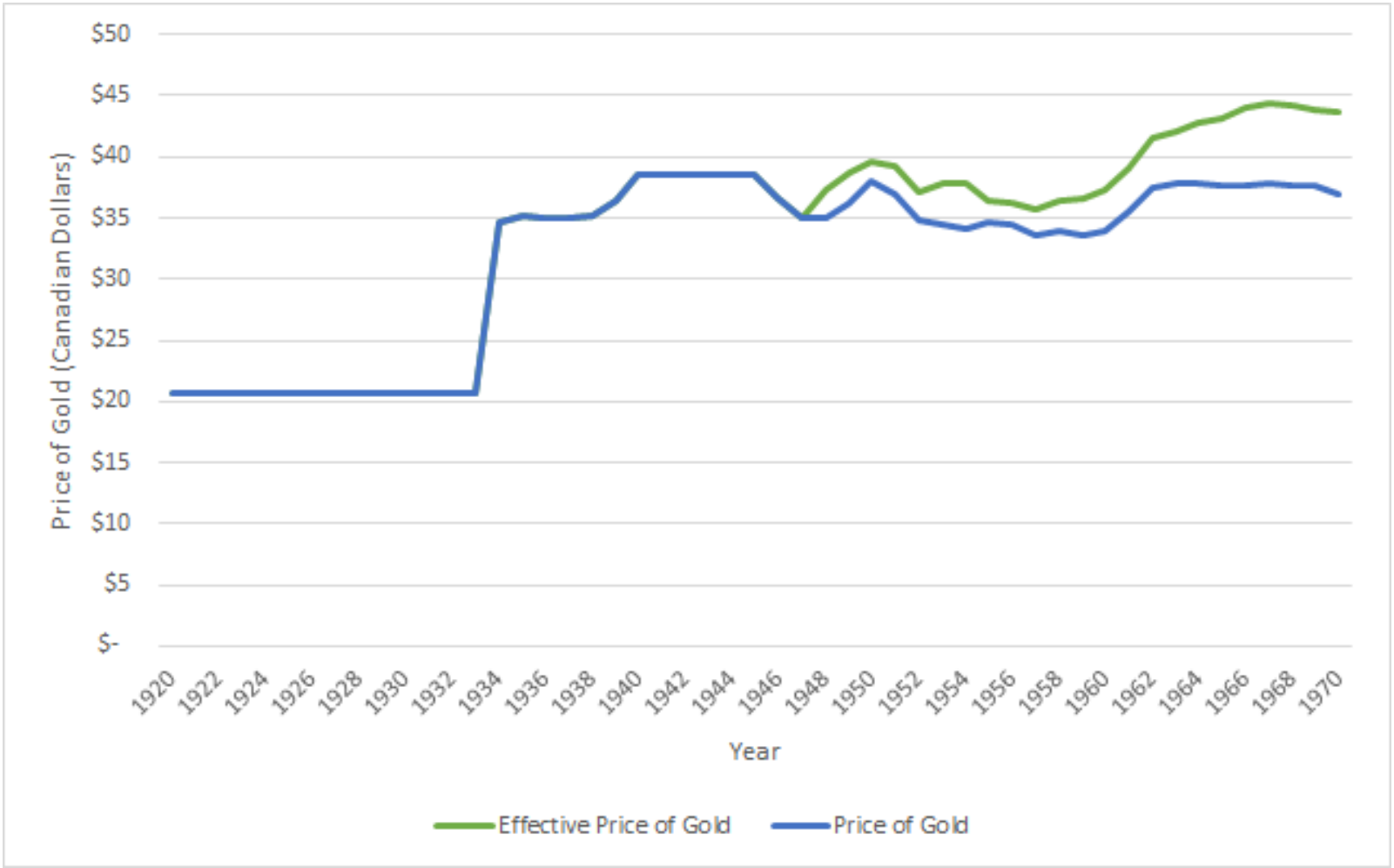
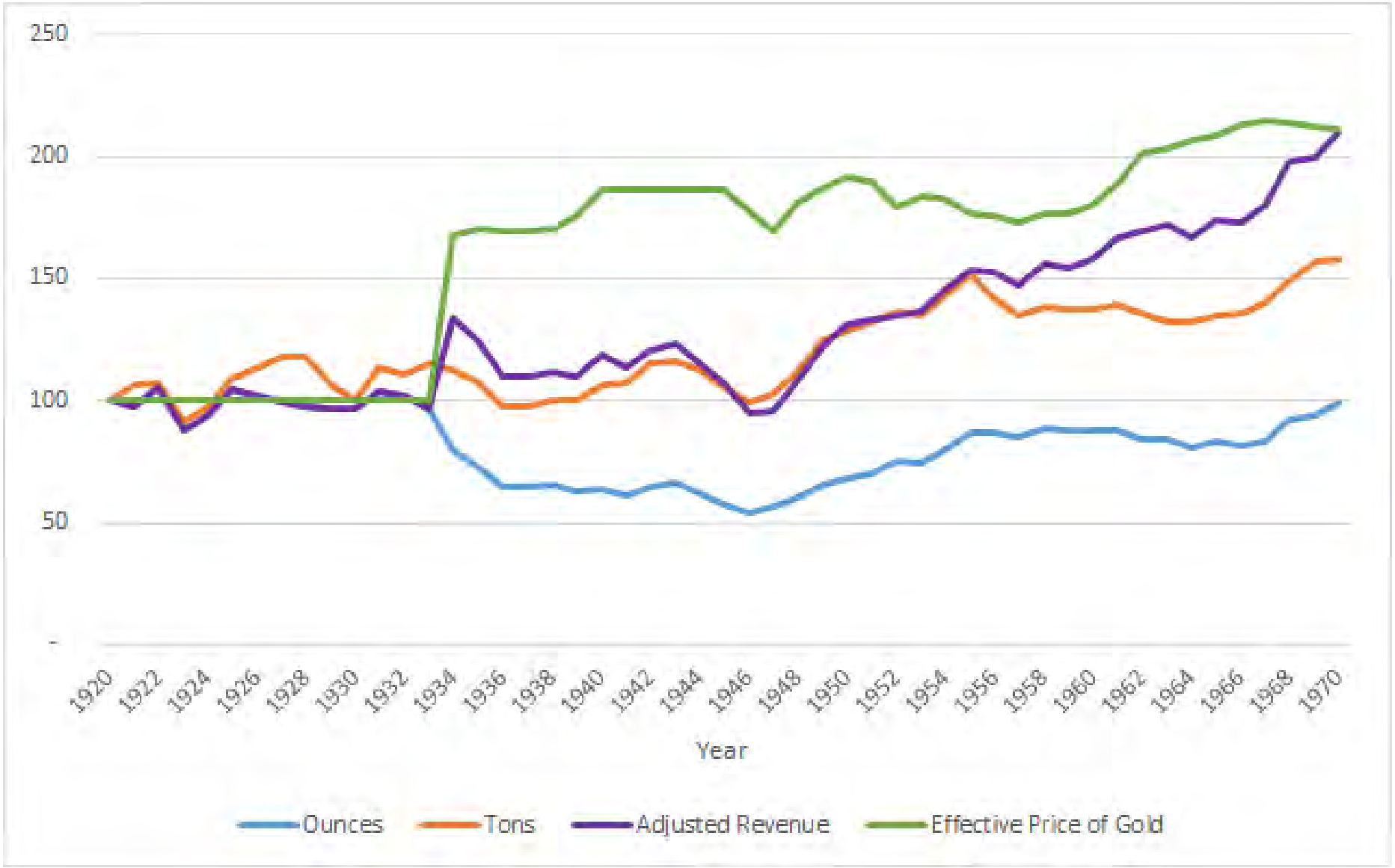
Adjusted Revenue

Price of Gold

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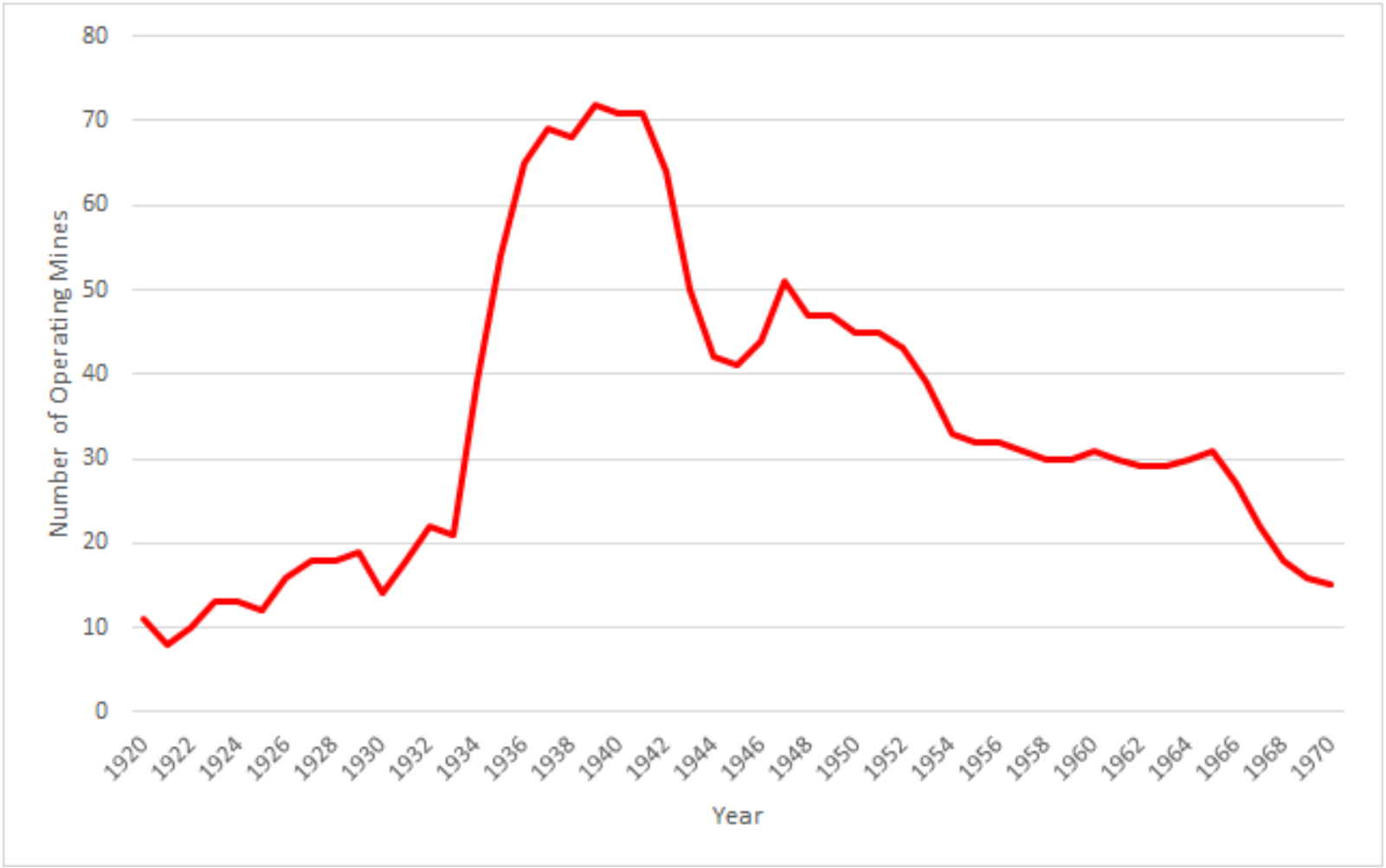
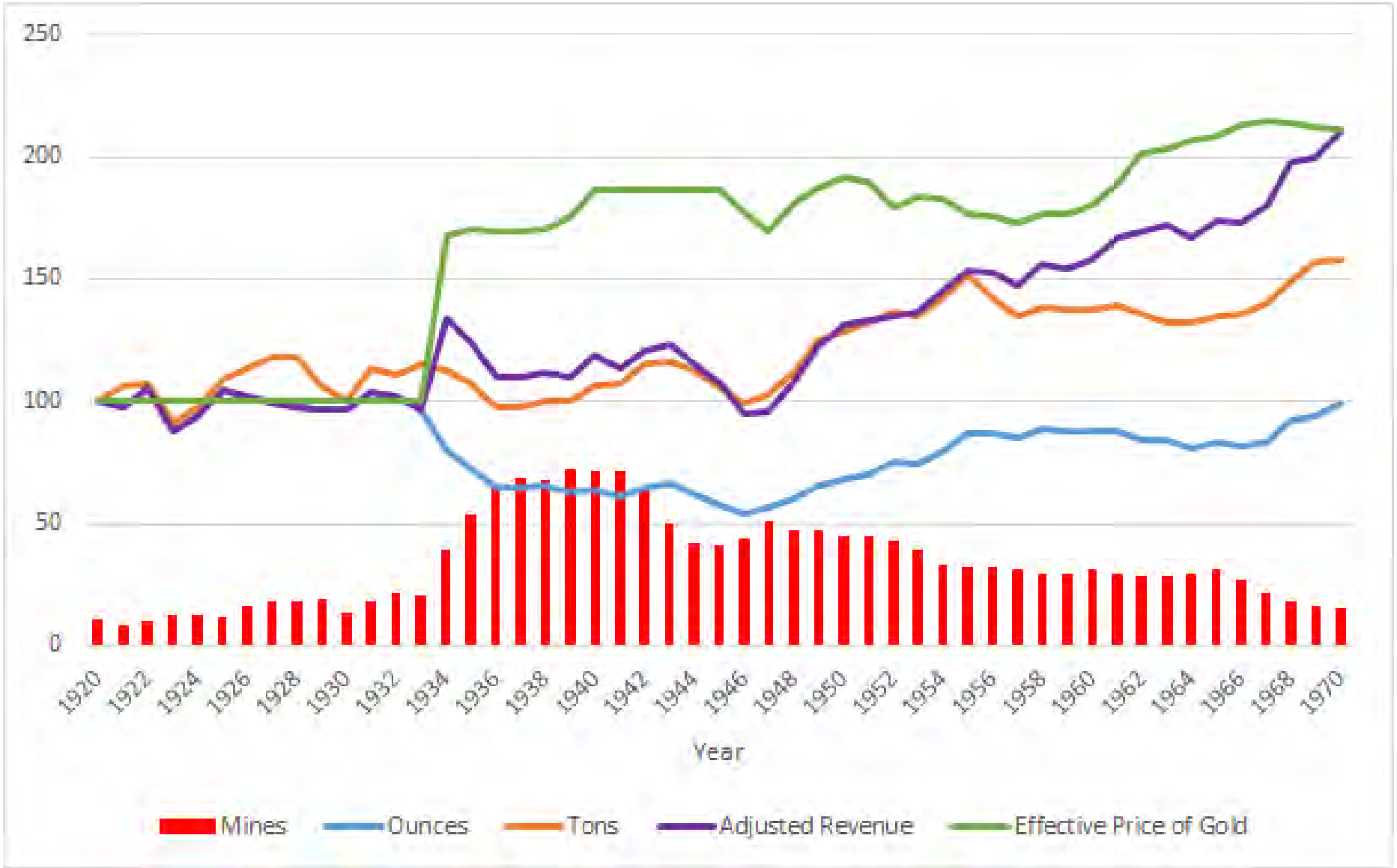
Effective Price of Gold

Number of Operating Mines

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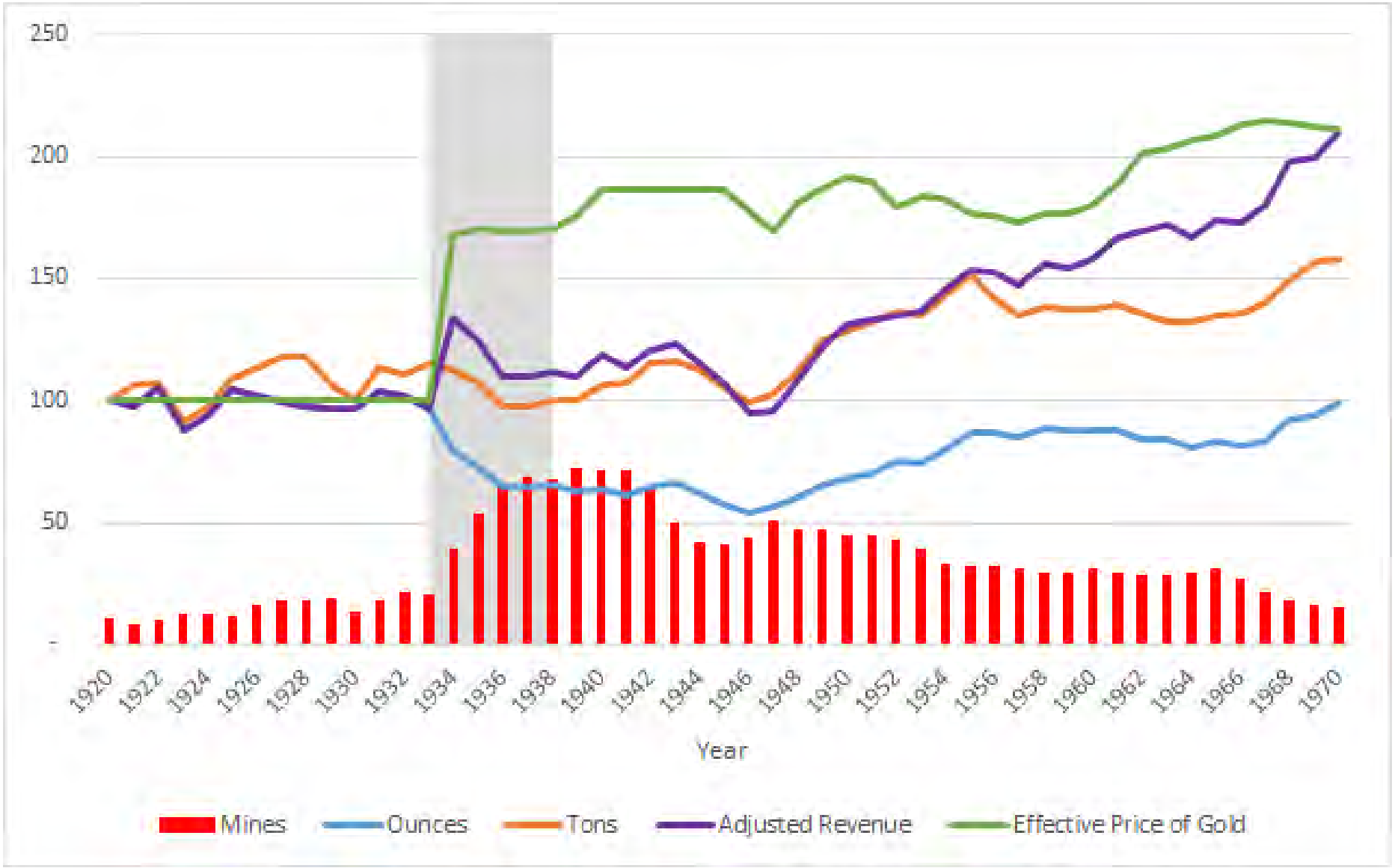
Decomposition

FHK Decomposition

$$\Delta P_t = \sum_{e \in C} s_{et-1} \Delta p_{et} + \sum_{e \in C} \left(p_{et-1} - P_{t-1} \right) \Delta s_{et} + \sum_{e \in C} \Delta p_{et} \Delta s_{et} + \sum_{e \in N} s_{et} \left(p_{et} - P_{t-1} \right) - \sum_{e \in X} s_{et-1} \left(p_{et-1} - P_{t-1} \right) \quad (1)$$

- The first term is the **within** component which indicates how the productivity at continuing mines is changing.
- The second term is the **between** component which indicates how the share of aggregate labour of continuing mines is changing.
- The third term is the **cross** of these two terms.
- The fourth term is the **entry** component.
- The fifth term is the **exit** component.

1933-1938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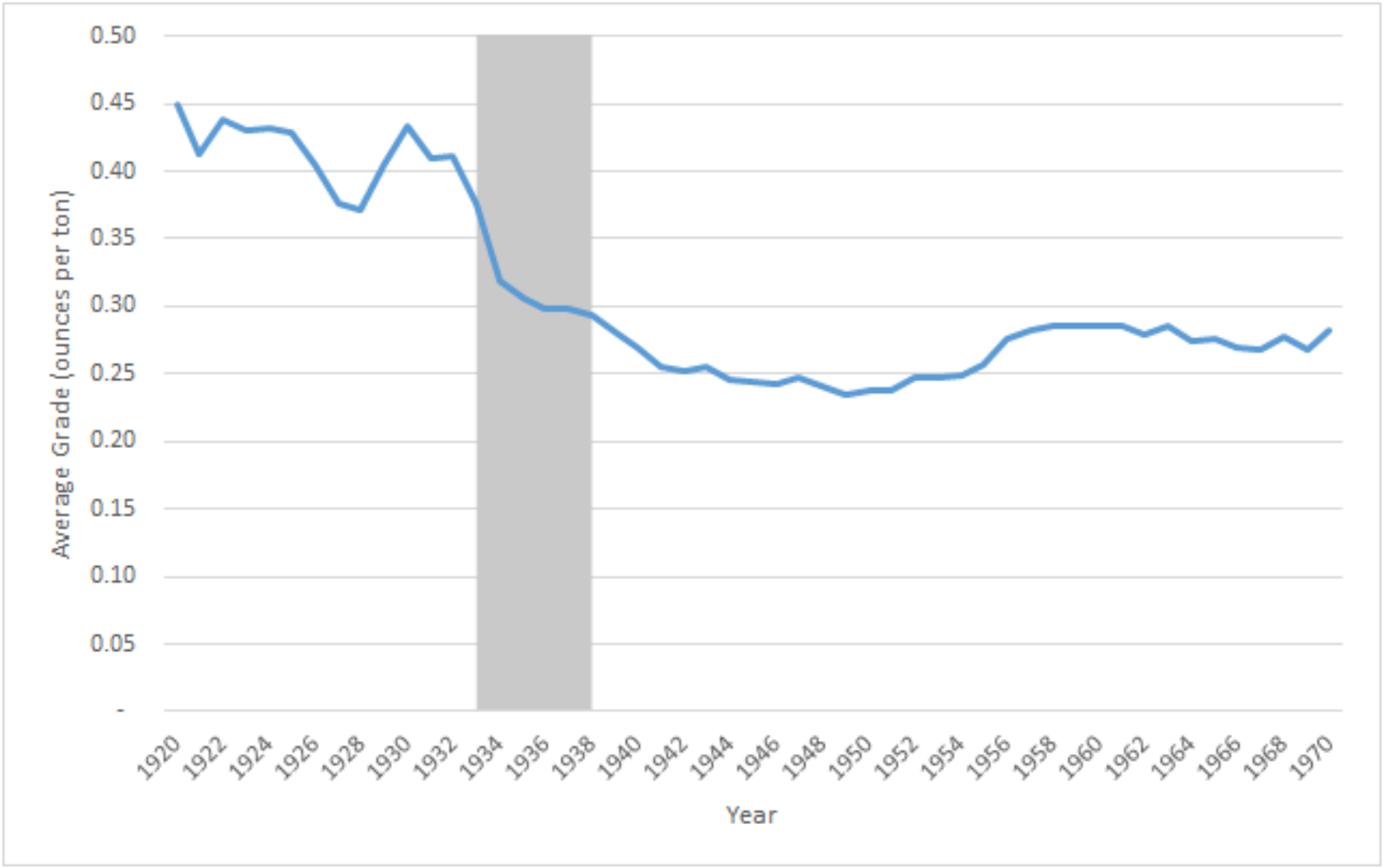
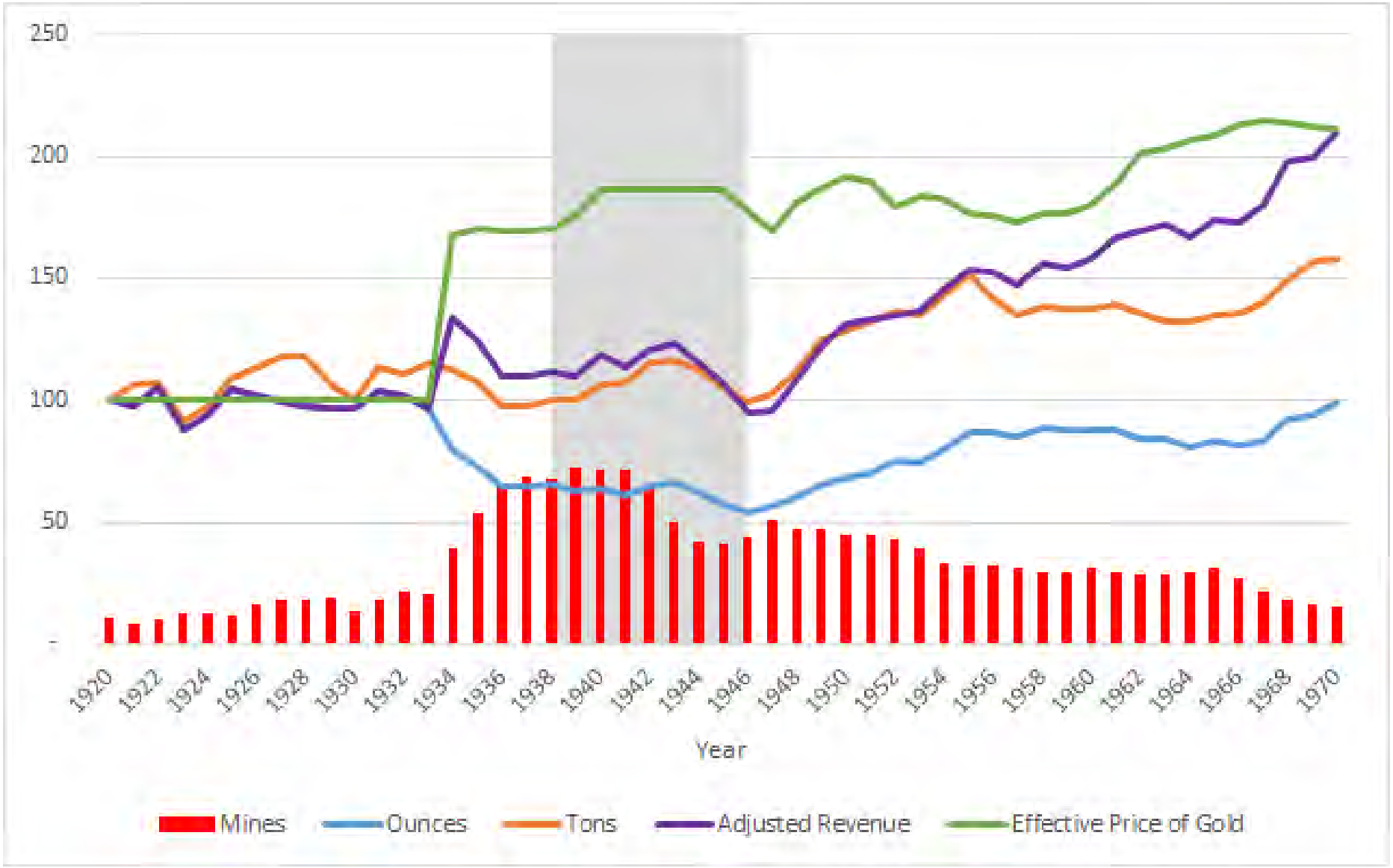
Average Ore Grade (ounces per ton)



1933-1938

Productivity Measure	Total	Shares				
		Within	Between	Cross	Entry	Exit
Ounces	-79	0.83	0.03	-0.29	0.52	-0.10
Tons	-85	0.45	0.29	-0.11	0.63	-0.27
Revenue	$808	1.50	-0.06	-0.45	-0.19	0.21

1938-1946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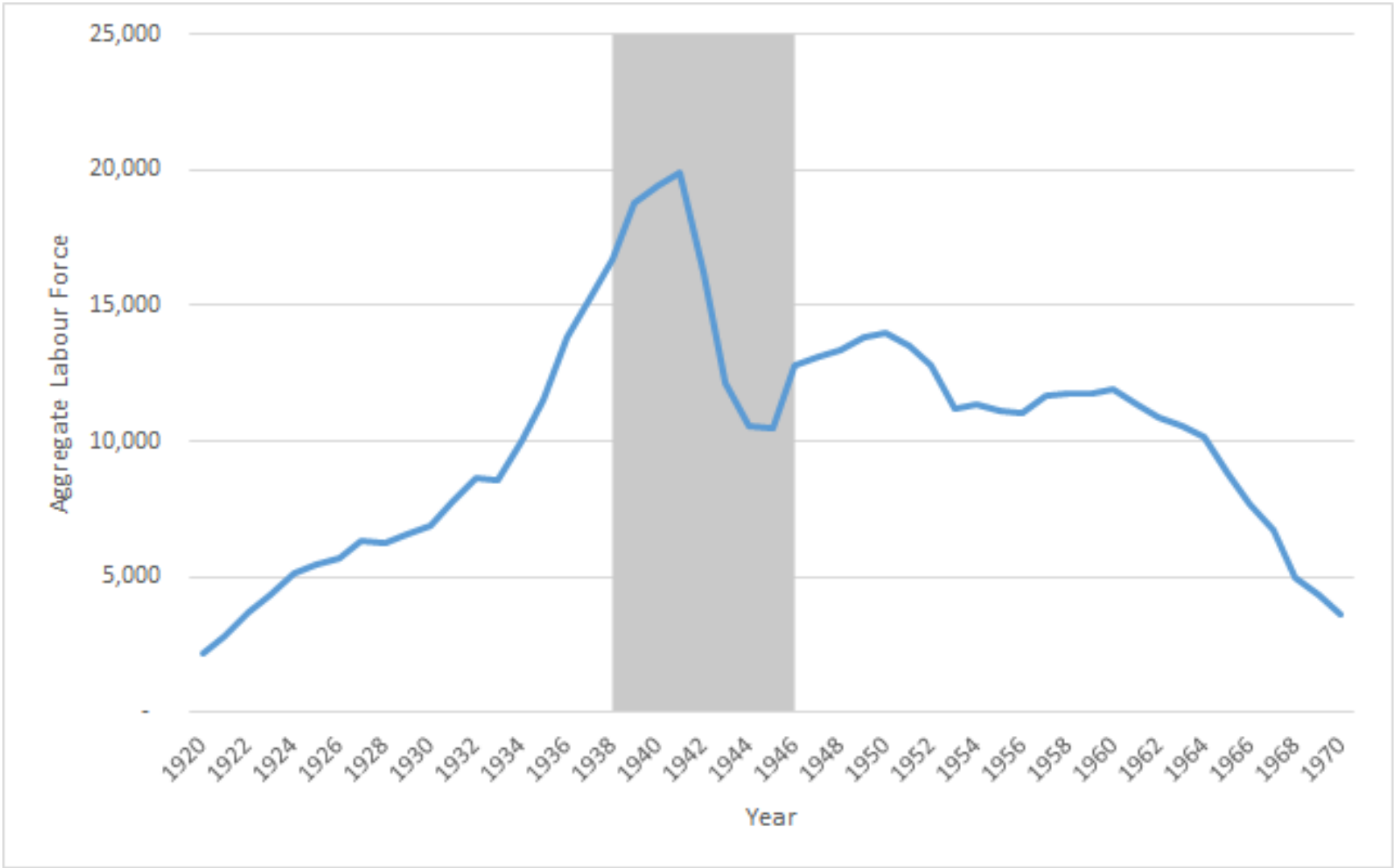
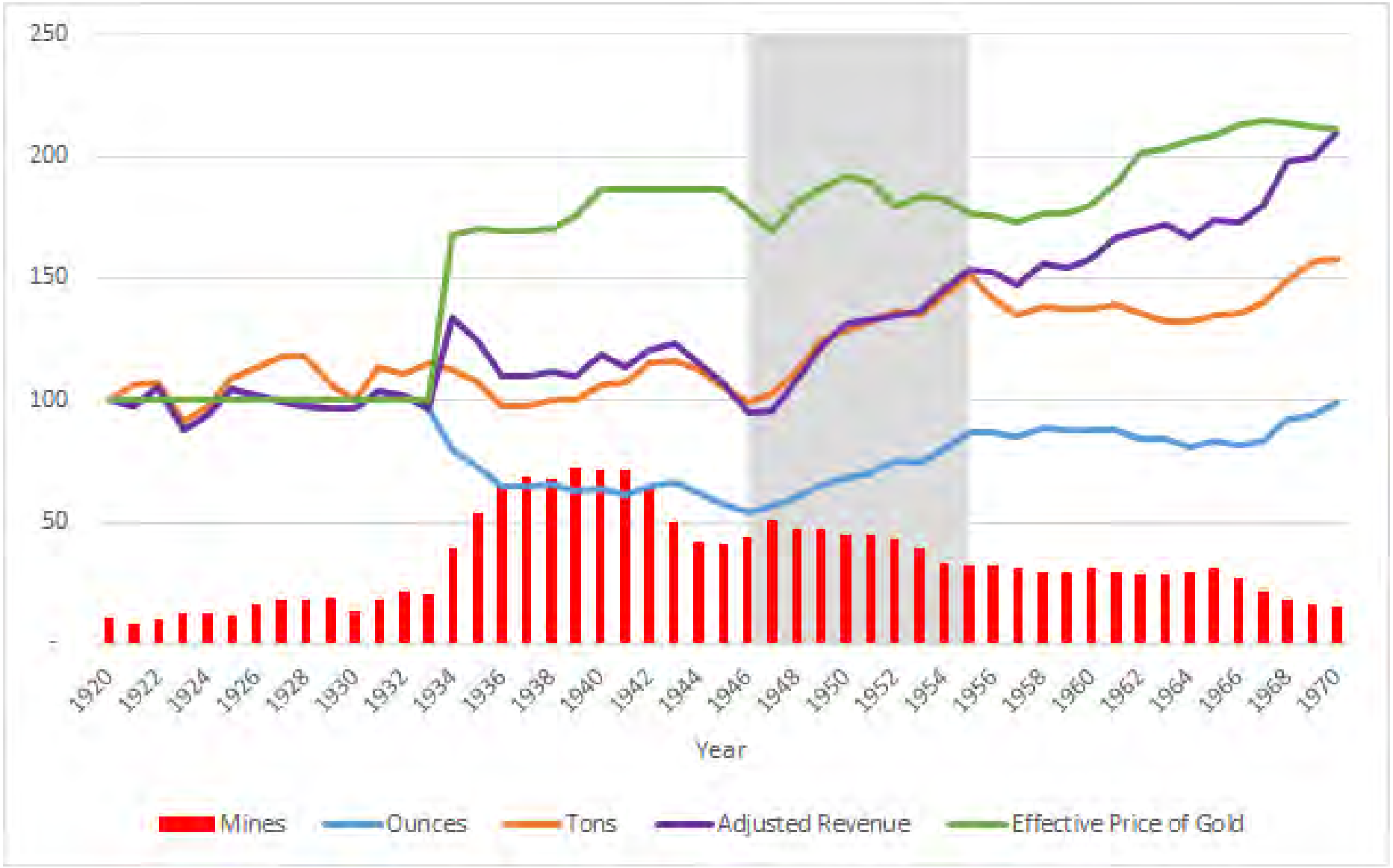
Aggregate Employment



1938-1946

Productivity Measure	Total	Shares				
		Within	Between	Cross	Entry	Exit
Ounces	-31	1.02	0.37	-0.24	0.14	-0.29
Tons	-6	4.94	4.49	-6.72	0.12	-1.83
Revenue	-$888	1.05	0.46	-0.30	0.15	-0.36

1946-1955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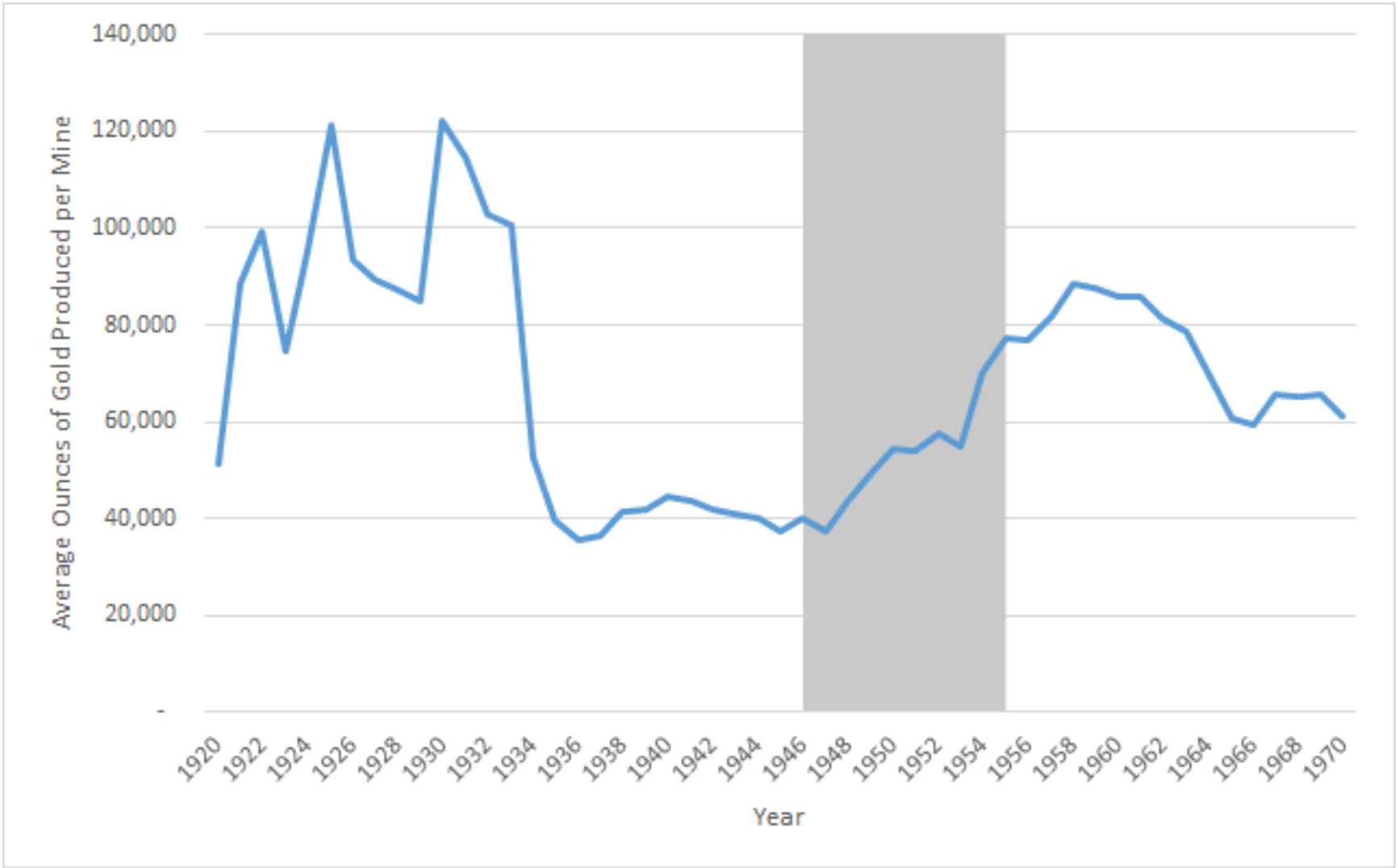
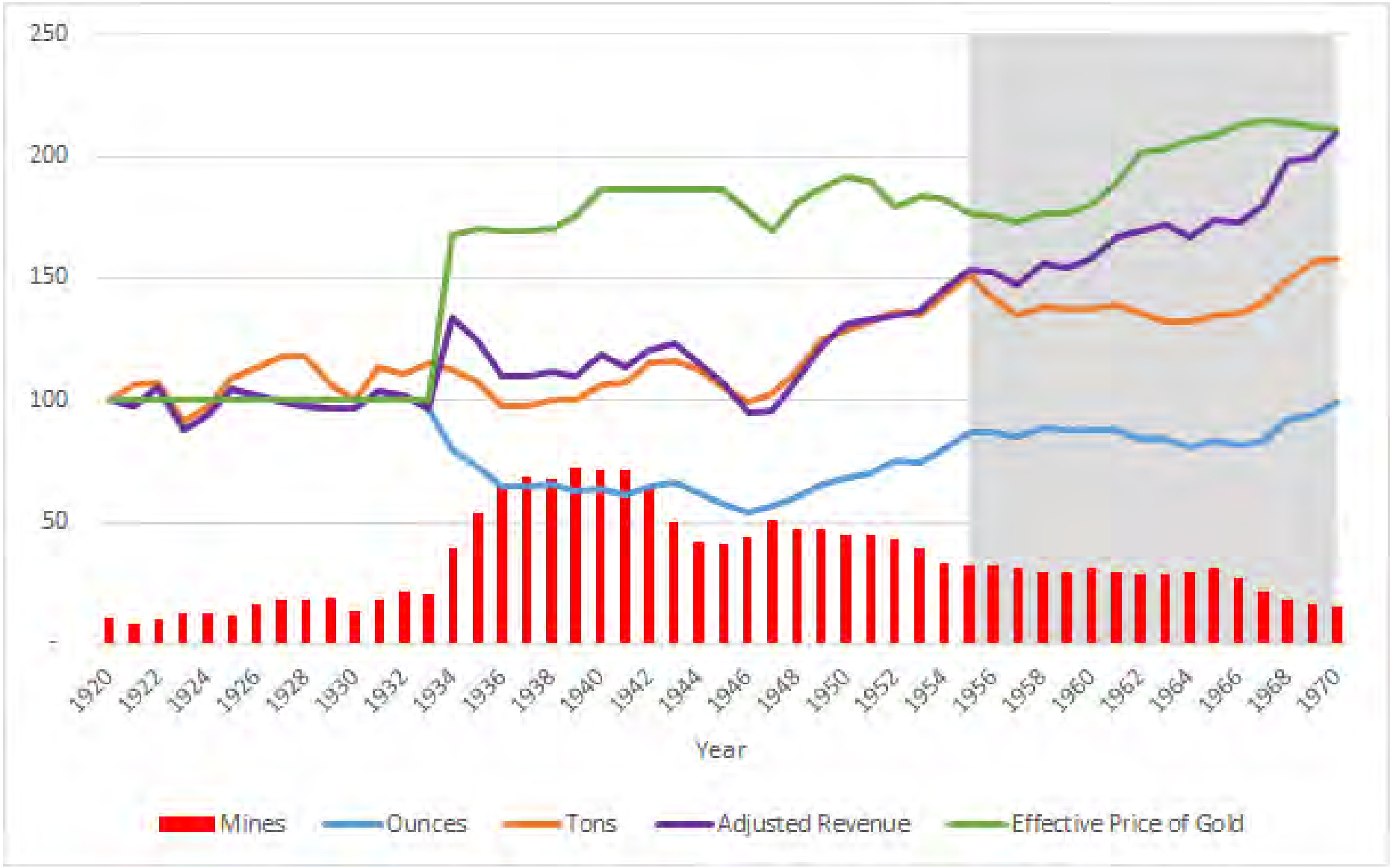
Average Ounces of Gold Produced per Mine



1946-1955

Productivity Measure	Total	Shares				
		Within	Between	Cross	Entry	Exit
Ounces	86	0.48	0.15	0.10	0.17	0.10
Tons	300	0.64	0.22	0.02	0.10	0.01
Revenue	$2,675	0.44	0.17	0.09	0.18	0.12
Adj. Revenue	$3,083	0.49	0.15	0.08	0.17	0.11

1955-1970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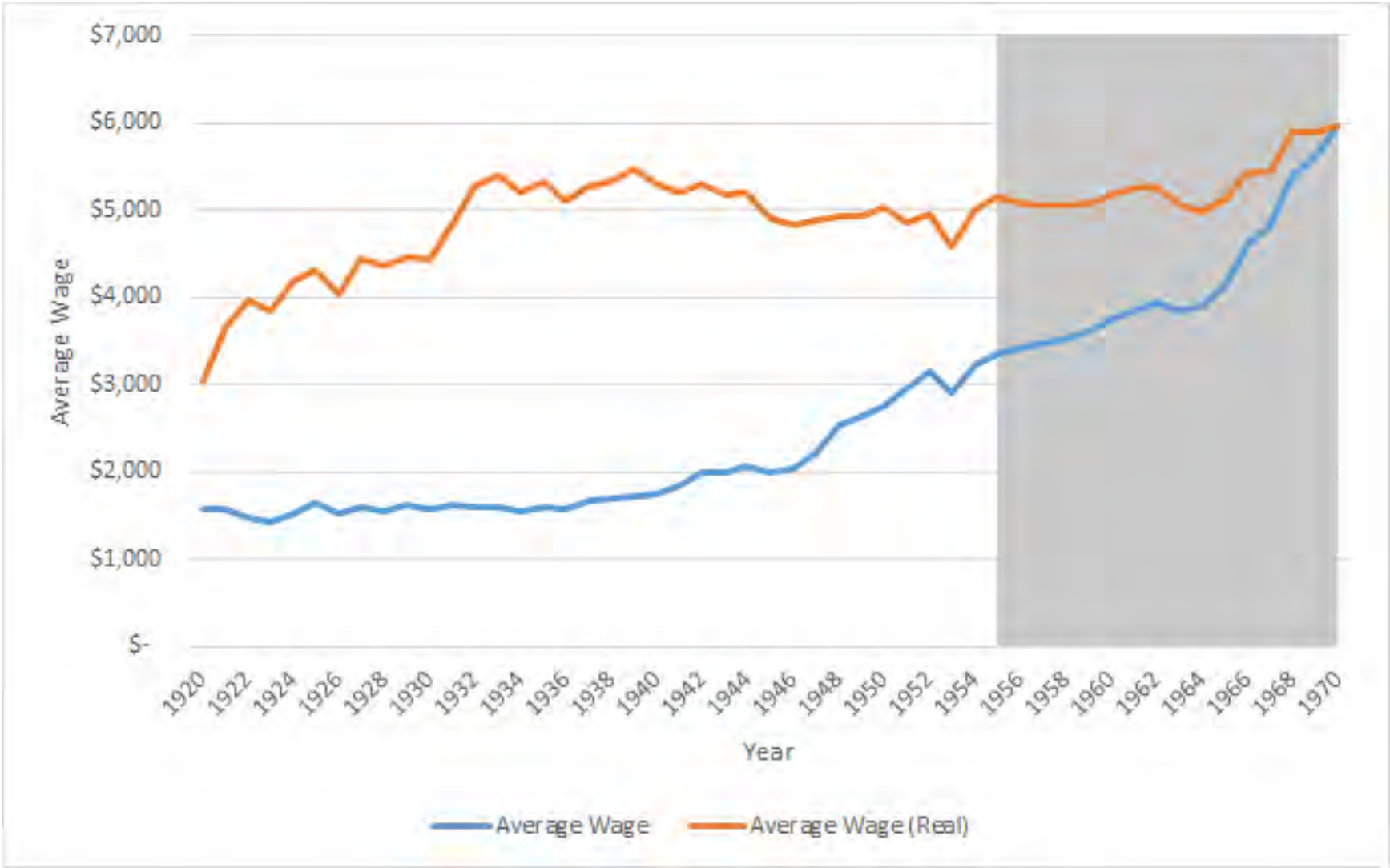
Average Yearly Wage



1955-1970

Productivity Measure	Total	Shares				
		Within	Between	Cross	Entry	Exit
Ounces	32	-0.43	0.55	0.07	0.17	0.63
Tons	35	-2.13	1.46	-0.90	0.73	1.85
Revenue	$1,705	-0.15	0.35	0.23	0.15	0.40
Adj. Revenue	$3,000	0.10	0.19	0.35	0.15	0.21

Conclusion

- The cause of the dip in productivity in the early 1930s was caused by existing mines pursuing lower grade portions of their ore bodies and by the entrance of small, relatively unproductive mines.
- It is likely that the recovery in productivity would have occurred sooner, were it not for the Second World War.
- Strong post-war productivity recovery was driven by scale effects and re-capitalization, but was only possible thanks to the EGMAA.
- If factors such as grade and scale are accounted for, then there were in fact some labor productivity gains throughout this period.
- Going forward we plan to make use of our mine-level data to better understand the relationship between, these factors and labour productivity.