

# Paying for ESG: the provenance premium for precious metals

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## Abstract

ESG goals in precious metal markets are intrinsically linked to provenance documentation. We perform structured expert interviews to study the perceived importance, the value and the required structure for provenance data of gold bars. We find that provenance data is regarded as “essential”, “very important” or “quite important” by almost all market participants. Two thirds of participants estimate the provenance premium to be in the range between greater than 0% and less than 2% of the value of gold. We furthermore find that the blockchain and chemical analysis are perceived as the most suitable technologies. Interestingly, the gap between perceived relevance and actual experience is largest for the blockchain amongst all potential technologies.

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# 1 Introduction and research question

Today, both consumers and investors are increasingly concerned with the impact of their actions and choices on the environment, the social impact and on the governance of their companies. For investments, these concerns are subsumed as the ESG (Environmental Social Governance) goals, which are especially relevant for precious metals, as they often originate from countries with weak institutions and lower environmental or labour standards. Concretely, investors in precious metals are concerned with the following possible negative impacts of their investments:

- Environmental pollution, due to absence or non-enforcement of regulation
- Corruption or promotion of corruption
- Child labour, precarious labour contracts and promotion of inequality

Not all gold comes from dubious sources. About 30% of the world gold production originates from OECD countries<sup>1</sup>. Many other gold mines operate in highly-regulated environments. It lies, however, in the nature of any commodity that it is almost impossible to assess the exact circumstances of its production from inspecting the product alone, putting both consumers and producers of ESG-gold in a “market for lemons”-type situation.<sup>2</sup> One possible solution to address ESG concerns is to split the problem into two parts:

- Assessment of the production conditions at the producer and
- Gapless tracing of the commodity such as gold to the final product.

In this paper, we want to focus the second aspect, effectively rendering the ESG problem a special case of supply chain documentation. In this scenario, final products will inherit the ESG properties of the producer, which have to be assessed separately. Furthermore, we want to focus on the gold market as exemplary commodity market with large ESG concerns.

While we can observe (a) a preference of consumers towards ESG-conscious sourcing in general and (b) an increasing trend towards ESG-based asset allocation, much less is known, about the exact form of a valid documentation of ESG-compliant production and about the market participants’ willingness to pay for the extra cost associated with ESG-compliant production and the related documentation and tracing systems. This question is relevant, as market-based systems for documenting and tracing ESG-compliant production will only emerge if market participants are willing to pay for them.

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<sup>1</sup><https://www.gold.org/goldhub/data/historical-mine-production>

<sup>2</sup>Chemical analysis of a gold bar will at most reveal its geographic origin.

We thus formulate the following research questions:

- Is there an market premium for ESG-compliant gold and what is its size?
- What is the market structure for gold with/without documented provenance?
- Which data points are considered necessary or desirable by market participants for a valid ESG provenance documentation?
- Which technology is perceived to be most suitable for the ESG provenance documentation of precious metals?

## 2 Literature review

**Gold statistics.** The countries that mine most gold are China, Russian Federation and Australia, with 368, 331, 329 tonnes respectively in 2020.<sup>3</sup> Almost 30% of gold production is mined in OECD countries. According to Gold.org [2020] statistics, approximately 50% of gold demand comes from jewellery.

**Provenance premia.** Chapman [2020] studies the provenance in the diamond industry, finding a very important role for provenance data: a gem from a specific country can attract a significant premium over a similar quality stone from another country. As the author points out, consumers demand knowledge of a diamond's source, for patriotic or political reasons. Due to the significant price impact of the source, major dealers have developed a capability to identify the source, usually on the basis of trace impurities and, in some instances, inclusion types. The situation is different for gold. Bates [2021] provides results of a survey of MVI marketing [2020] finding that most consumers do not know about the issues in the gold supply chain, but a significant number would pay extra for certified responsibly mined gold product (over 40% said they would spend 11% extra or more, while 60% said they would spend an extra 10% extra or less).

A similar, but related issue has been studied by Deloitte [2015], who analyze the rise of mass penalisation. The report shows that consumers are prepared to pay a premium for a customized product or service. This premium, however, drastically varies between industry sectors. For the jewellery sector, more than 75% of the survey participants are willing to pay 10% or more for a customized product, and 48% of them, would be willing to wait longer for such a product. In a study on global consumer trends, IBM [2020] found that the importance of brand purpose surpasses cost and convenience in purchase decisions. In

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<sup>3</sup><https://www.gold.org/goldhub/data/historical-mine-production>

fact, 57% of consumers answered that they were willing to change their purchasing habits to help reduce negative environmental impact, and 71% of those surveyed who indicated that traceability is very important are willing to pay a premium for brands that provide it.”

A good example for a possible provenance/green premium are green bonds on the financial markets. Lareker and Watts [2020] finds that there no difference in price or yield between green and standard bonds. Worse, investment banks tend to charge slightly higher fees for green bonds on average. Combined with the fact that external certification is needed, there is not only no cost savings for municipalities in issuing green bonds, they actually increase their borrowing costs.

**Existing Gold certifications.** A number of initiatives currently certify the provenance and/or ESG-aspects of gold. Based on an average gold price of USD 58 per gram in 2021, they correspond to premia of between 1.7% and 10%. Existing gold certifications include: Fairmined with a premium of 4 USD per gram (see Alliance for Responsible Mining [2021a]), Ecological Fairmined with a premium of 6 USD per gram (see Alliance for Responsible Mining [2021b]), Fairtrade, with a premium of 2 USD per gram (see UK Fairtrade Foundation [2020]) and the Better Gold Initiative (BGI) for artisanal and small scale mining, with a premium of 1 USD per gram, see Federal department of economic affairs [2017].

**Provenance and tracing technology.** The website Retail Insights ([retailinsights.gold](https://retailinsights.gold) [2020]) reports that 23 % of potential investors are worried about buying fake or counterfeit gold. They identify as possible solutions established and reliable vendors together with rigorous assaying standards and trading practices. A study from Accenture [2018] identifies sharing product data on the blockchain as a key to establishing and tracking provenance. According to the study, data needs to be robust, reliable, and standardized. The data is preferably recorded using data-capture technologies such as Internet of Things (IoT). The report highlights the importance of interoperability between the blockchain and enterprise systems across diverse actors, with an emphasis on the user experience at each level. It finally stresses the important role of trusted, neutral third party as auditor to increase trust in the data.

Along similar arguments Wolfson [2018] reports that the blockchain is concretely helping to avoid the unethical practices of the diamond supply chain. He mentions as concrete example the Rare Carat Report ([rarecarat.com](https://rarecarat.com) [2021]), which leverages the blockchain and artificial intelligence to let consumers intelligently evaluate provenance and characteristics of diamonds.

Amongst industry sectors, the consumer-facing jewelry industry seems to be most ad-

vanced in tracing the origin of their raw materials. Human Rights Watch, a nonprofit, reports that major jewelry companies are improving their sourcing of gold and diamonds, but most cannot assure consumers that their jewelry is untainted by human rights abuses (HRW [2020]). It also attacks current certification initiatives, stating that they "still lack rigor and transparency, or on-the-ground human rights assessments.

### 3 Provenance, Green and ESG premia

There is little to no market data on the provenance premium, and even the language used in this context is not always clear. We therefore propose three different definitions of premia for commodities, with increasing requirements.

**Definition 1 (Provenance Premium.)** *The Provenance Premium is the relative difference of the (market) price of a commodity with gapless documentation of its origin compared to the same commodity without documentation of its origin. It is expressed as percentage.*

**Definition 2 (Green Gold Premium.)** *The Green Gold Premium is the relative difference of the (market) price of gold with gapless documentation of environmentally-friendly production compared to the gold without documentation of its origin. It is expressed as percentage.*

**Definition 3 (ESG Premium.)** *The ESG Premium is the relative difference of the (market) price of gold with gapless documentation of ESG-compliant production compared to the gold without documentation of its origin. It is expressed as percentage.*

We have to remark that the above definitions only refer to differences in the market price of stylized gold (bars), without taking a position on which of the four mentioned prices (undocumented or with different levels of documentation) is reflected in official gold prices such as the London Gold Fixing. Market participants are divided about this, see Section 5.1, question "Value of provenance data".

In the subsequent study, we will focus on the Provenance Premium.

### 4 Research strategy and survey design

A lack of market data on the provenance premium makes it impossible to apply the traditional finance methodology based on transaction prices. We hence opt for a survey-based approach, profiting from the experience and market knowledge of industry experts. Concretely, we design a three-stage interview process.

As we do not want to prejudice the research direction based on an arbitrary choice of answer options, we start our process with a small number of in-depth unstructured interviews, following the approach of Hennik et al. [2011]. This critical first step allows us to understand the most critical areas of the topic and possible answer fields. It serves as input for formulating more precise questions for the second stage.

In the second stage, we formulate eight broad questions for a structured interview, see Appendix A, allowing for a balance between structure and flexibility. The structured interviews were conducted in December 2020 to January 2021 with 15 top-level executives from different sectors: gold industry (3), refineries (6), retailers (5) and regulatory (1). These are reported as “Interviews” in the subsequent paper. We took notes during the interviews, making it possible to perform text analysis on the answers.

Based on these notes, we formulated a short, web-based survey for the third stage, using Google docs. The survey had seven questions, see Appendix B. We sent several thousand email invitations to industry experts in February to March 2021, with a rather low response rate of only 32 answers. We attribute this low response rate to an industry policy of not participating in any survey.

As the questions in the second and third stages were sufficiently similar, we partially pool the answers for analysis. In total, 47 responses were obtained in these two stages. These are reported as “Survey” in the subsequent paper.

An additional 42 answers to a limited set of questions were obtained at the start of the “Bullion integrity forum” conducted by aXedras on 3 March 2021, see Appendix C. These are reported as “Panel” in the subsequent paper.

## 5 Results

### 5.1 Structured interviews

In this section, we present the results of the 15 structured interviews. A pooled word cloud of all transcripts from the 15 interviews is presented in Fig. 1. The third most frequent word is “blockchain”, which is remarkable given that this word was not part of any question (see Appendix A), unlike the two most frequently mentioned words “gold” and “premium”.

In detail, the answers to the structured interviews were the following.

**Importance for own business.** Question: “How important is it for your business to be able to track the provenance of gold?”. The interviewed unanimously answered that provenance is extremely important: “It’s not important, it’s vital”, “Gold without provenance can’t be sold legally in the international market.”.



Figure 1: Wordcloud of structured interview answers. Most prominent words are “gold” and “premium”, which were both part of questions. The word “blockchain”, which was not part of any question, is the third most frequently mentioned one.

**Importance for clients.** Question: “How important is it for your clients to be able to track the provenance of gold?” Again, most of the respondents answered that is very important also for their clients. However, there is a perceived distinction between geographical areas: Europe is the continent where the interest/necessity is highest, followed by the Americas. For the Asian countries, instead, important is perceived to be smaller. Regarding sectors, gold provenance was in the past mainly a topic for the jewellery and luxury goods sectors. It is nowadays increasingly perceived that the banking and investment sectors pay attention to it.

**Relevance of provenance data.** Question: “What is your general opinion on the relevance of provenance data?” The relevance of provenance is perceived to have grown “exponentially” in the last decades. The majority of interviewees do not expect the trend to stop in the foreseeable future.

**Value of provenance data.** Question: “How would you quantify the value of provenance data for gold?” In this question, the experts are split along two main lines of thought, which reflect alternative definitions for the Provenance Premium.

For the first group, provenance documentation is a “must”. Given that it is an essential property of any gold to be traded, there cannot be a premium for it. This group, however,

would assign a *negative* premium to any undocumented gold of up to 20% of the price – depending on the dubiousness of the source. Following our Definition 1, this translates into a positive premium for documented gold.

The second group agrees that provenance data has a value, which has been increasing overtime. This premium furthermore tends to increase (a) the less rational (more emotional) a purchase is and (b) the more trustworthy the certification. They mention several existing certifications for gold products, such as Fairmined, Fairtrade and BGI.

Both groups agree that there is difference in the perceived value of undocumented versus documented gold.

## 5.2 Pooled analysis of Interviews and Online Survey

In this section we present the results from both the interviews and the web-based survey, see also Tables in Appendix E and Figures in Appendix D.

**Provenance Premium.** Question: “What is your estimate for the value of provenance data for gold?” Most answers are the range of 0% to 2%, see Fig. 4 and Tab. 2.

**Relevant Data Points.** Question: “How relevant do you rate the following data-points on gold provenance?” There seems to be an inverted ”ESG” order, with ”G” (conflict-free) the most important data point, followed by ”S” (fair labour, no child labour) second, followed by ”E” (environmental conditions). The exact country, the exact mine or alternatively a possible recycling certification are perceived to be less important. Vanity data points such as the year of the mining are perceived as not important by the majority of the respondents. See Fig. 3 and Tab. 4.

**Technologies.** Question: “Which technologies are most suitable to track gold provenance? Which of these do you have experience with?” The parallel structure of these two questions allows not only to identify the technologies which are most widely used and which are of perceived importance. It is also possible to identify knowledge gaps, i.e. technologies which are perceived to be important but currently not adopted or understood at a company level.

The current state of the industry can be described as traditional and relationship-based. The most important mechanisms currently in use (“experience”) are trust to suppliers and internal databases. Both are also perceived to be of large importance in the future. Forward-looking (“importance”), the technology that is perceived to be the most important one is the blockchain, surpassing traditional relationships in importance. Chemical analysis is perceived to be slightly less important.



A striking result of our study is the huge experience gap in the industry. While 65% of respondents find the blockchain important, only 15% have experience with it. The gap is equally large with chemical analysis (61% vs. 15%).

## 6 Conclusions

We have performed structured expert interviews and an online survey to study the relevance of provenance data, the size of the provenance premium and the data structure that industry experts expect from a valid provenance documentation.

We find that there is a demand for provenance data for gold and that market participants are willing to pay for it. Concretely, we find that industry experts unanimously acknowledge the large importance of provenance data. Based on expert interviews, we estimate the provenance premium to be larger than 0% and smaller than 2%. This is slightly lower than existing gold certifications, which imply a premium of between 1.7% and 10%. Part of the difference can be explained by the wider ESG-scope of existing certifications.

For the optimal structure of provenance documentation, we identify an “inverted ESG” order of importance, with conflict-free (“G”) being the most important data point, followed by fair labour (“S”) and environmentally friendly or sourcing from recycling (“E”). Also of interest are the country of origin and the exact mine. Vanity data points such as the year of mining are perceived to be of less interest.

We find that the industry currently relies on traditional relationships, with supplier trust, followed by internal databases being the most important *current* technologies for ensuring provenance. Survey participants however regard blockchain technology as the most important future technology, closely followed by chemical analysis. They also believe that the importance of trust is going to slightly increase in the future, while the importance of internal database will slightly decrease, possibly as a result of moving to (public) blockchains.

Interestingly, we identify a large experience gap for the technologies that are perceived to be of importance. About half the respondents find blockchain important, but do not have any experience with it. A similar, slightly smaller gap is identified for chemical analysis.

Our study is limited as it had focused on the tracability of gold once its origin and possibly ESG-compliance had been assessed by other means. Topics for further research are the interaction of digital technology with the real world, i.e. the interaction of local inspections with the blockchain, the definition of a standard structure for provenance data and the answer to the question whether the provenance premium is included in official gold price fixings (with undocumented gold trading at a discount) or whether this premium is added to the official gold price.

# Appendices

## A Questions for the structured interviews

1. How important is it for your business to be able to track the provenance of gold?
2. And how important is it for your clients?
3. What is your general opinion on the relevance of provenance data?
4. Do you think that products made from gold with provenance information could be sold more expensive than the same product without provenance information? What is your estimate for this premium?
5. What type of provenance data is most relevant for gold provenance?
6. Which technologies do you think are most suitable for tracing gold provenance?
7. Could you give exceptionally good (or bad) examples, not necessarily from your company or industry?
8. Do you have experience with tracking the provenance of commodities?

## B Questions and answer options for the web survey

1. Which industry sector do you belong to?  
Mining / Refinery / Trading of precious metals / Production of jewelry, watches / Consumer sales / Marketing, Industry association / Other (specify)
2. How important is it for your business to be able to track the provenance of gold?  
Five answer options, from “Not important at all (1)” to “Extremely important(5)”
3. How important is it for your clients to be able to track the provenance of gold?  
Five answer options, from “Not important at all (1)” to “Extremely important(5)”
4. Do you think that products made from gold with provenance information can be sold more expensive than the same product without provenance information?  
Yes / No / Don't know
5. What is your estimate for this premium (in percent of the product's price)?  
0% / 1% to 2% / 3% to 5% / 6% to 10% / 11% to 20% / > 20% / Don't know

6. How relevant do you rate the following datapoints on gold provenance.  
Data points: Country of origin, Exact mine, Recycling certification, Environmental certification, Fair labour conditions certification, Year of mining  
Answer options for each data point: Not important/ Nice to have / Very important/ Essential / (possibility for empty answer)
7. Which technologies do you think are most suitable for tracing the provenance of commodities? Which of these technologies do you have some kind of experience with?  
Technologies: Blockchain, Tamper-proof ink, Micro engravings, Chemical analysis, Solid trust with suppliers, Internal databases  
Answer options for each technology: Suitable - Important (yes/no) / Experience (yes/no)

## **C Questions asked the Bullion Integrity Forum**

- What's the price for provenance documentation of gold in relation to its nominal value?
- Who benefits the most from provenance documentation of gold products?
- How should a global database for product integrity be set up?

## D Figures

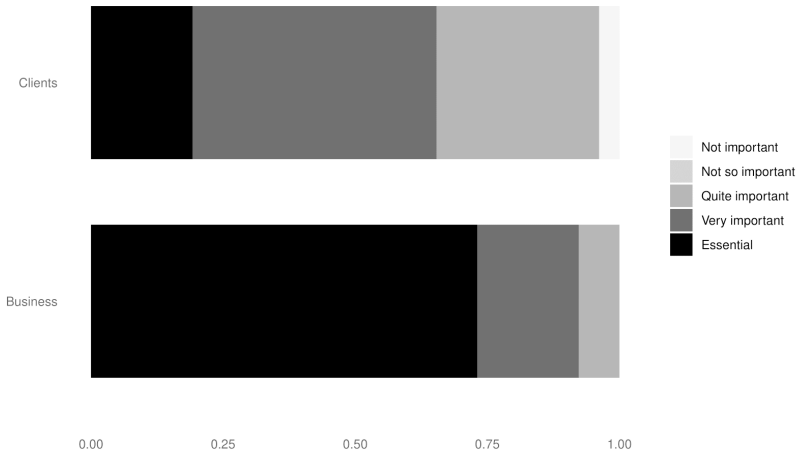


Figure 2: How important is for your business/for your clients to be able to track the provenance of gold?

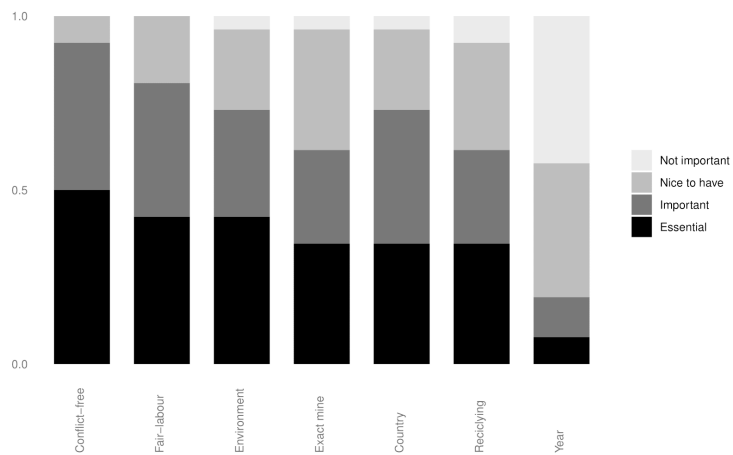


Figure 3: How relevant do you rate the following data points on gold provenance?

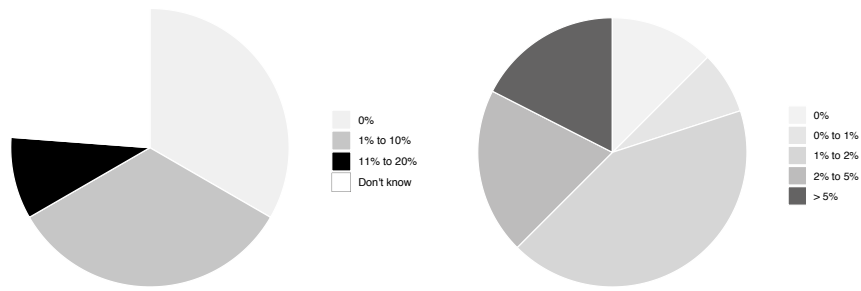


Figure 4: What is your estimate for the gold provenance data premium? Left: Survey, right: Panel

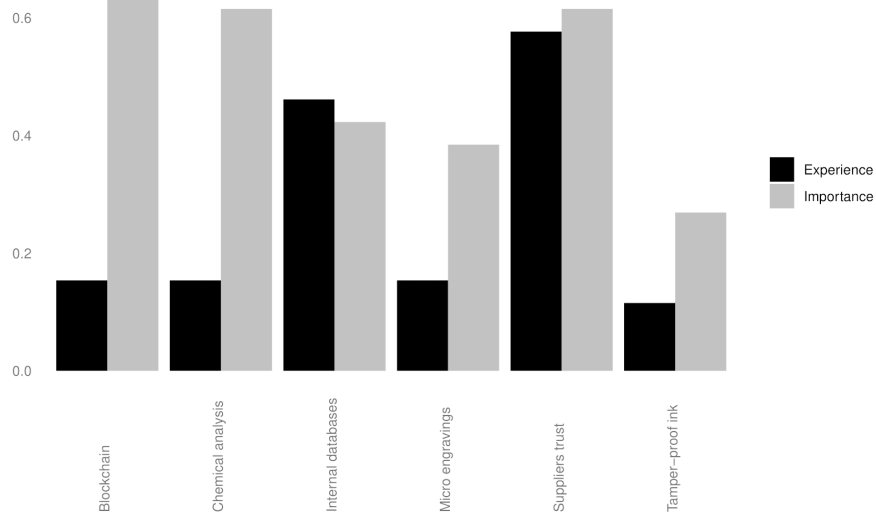


Figure 5: Which technologies are most suitable? With which of these do you have experience?

## E Tables

	for my business	for my clients
Not important at all	0	1
Not very important	0	0
Quite important	2	8
Important	5	12
Extremely important	19	5

Table 1: How important is for your business/your clients to be able to track the provenance of gold? (Survey)

Don't know	5
0%	7
1% to 10%	12
11% to 20%	2
More than 20%	0

Table 2: What is your estimate for the gold provenance data premium? (Survey)

0%	3
1% to 1%	17
2% to 5%	7
More than 5%	5

Table 3: What's the price for provenance documentation of gold in relation to its nominal value? (Panel)

Centralized database with omniscient data-aggregator	8
Decentralized database supported by blockchain technology	27

Table 4: How should a global database for product integrity be setup? (Panel)

Vault	4
Seller of precious metal products (Banks, Traders)	10
Refinery	11
Mine	9
Jewelry / watch manufacturers	1
Issuer of digitalized gold products	5
End consumer	8

Table 5: Who benefits the most from provenance documentation of gold products? (Panel)

	Essential	Important	Nice to have	Not important
Conflict-free certification	13	11	2	0
Fair labour certification	11	10	5	0
Environmental certification	11	8	6	1
Exact mine	9	7	9	1
Country	9	10	6	1
Recycling certification	9	7	8	2
Year	5	3	10	11

Table 6: How relevant do you rate the following data-points on gold provenance? (Survey)

	Importance	Experience
Blockchain	65%	15%
Chemical analysis	61%	15%
Suppliers trust	61%	57%
Internal database	42%	46%
Micro engravings	38%	15%
Tamper-proof ink	26%	11%

Table 7: Which technologies are most suitable? With which of these do you have experience? (Survey)

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