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The psychology of mineral wealth: Empirical evidence from Kazakhstan

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ABSTRACT

Despite rapidly-expanding academic and policy interest in the links between natural resource wealth and development failures – commonly referred to as the 'resource curse' – little attention has been devoted to the psychology behind the phenomenon. Rent-seeking and excessive reliance on mineral revenues can be attributed largely to social psychology. Mineral booms (whether due to the discovery of mineral reserves or to the drastic rise in commodity prices) start as positive income shocks that can subsequently evolve into influential and expectation-changing public and media narratives; these lead consecutively to unrealistic demands that favor immediate consumption of accrued mineral revenues and to the postponement of productive investment. To our knowledge, this paper is the first empirical analysis that tests hypotheses regarding the psychological underpinnings of resource mismanagement in mineral-rich states. Our study relies on an extensive personal survey (of 1977 respondents) carried out in Almaty, Kazakhstan, between May and August 2018. We find empirical support for a positive link between exposure to news and inflated expectations regarding mineral availability, as well as evidence that the latter can generate preferences for excessive consumption, and hence, rent-seeking.

1. Introduction

There is extensive literature probing the frequency of natural resource mismanagement, especially in the context of mineral-dependent economies (see Papyrakis, 2017 for a review of the literature). A common finding is that mineral-rich states often suffer from low growth rates, excessive macroeconomic volatility, and slow poverty alleviation (in comparison to mineral-scarce countries of similar levels of socioeconomic development). Macroeconomic instability is often attributed to the limited diversification undertaken in mineral-rich states (see Bayramov and Abbas, 2017, for Russia, Kazakhstan, and Azerbaijan). Evidence confirms that mineral resources can also explain within-country regional discrepancies, as in the case of subdued growth for most mineral-rich Chinese regions (Yu et al., 2022).

The negative impact of mineral wealth is not solely confined to macroeconomic outcomes but also extends to broader development indicators. For instance, this is the case for gender equality, educational and health outcomes, sustainability, life satisfaction, poverty, etc. (see Ali et al., 2020, Mignamissi and Malah Kuete, 2021). The phenomenon of underperformance in socioeconomic and institutional dimensions, despite abundant mineral rent, is commonly referred to as the resource curse paradox (Colgan, 2014). Studies also examine the differentiated impacts of different types of extractive resources. For example, in the case of Russia, positive income shocks stemming from gas rents suppressed economic growth during the last three decades, while oil rents consistently appeared to be a 'resource blessing' (Yang et al., 2021).

In recent years there has been a gradual shift of interest away from standard macroeconomic explanations of natural resource mismanagement (e.g., those based on Dutch Disease theory and debt overhang conditions). Instead, much more attention has been devoted to institutional explanations of the curse. Some of these analyses try to explain how mineral rents allow authoritarian regimes and incompetent leaders to prolong their stays in power in exchange for patronage, transfers, and favors (see Ross, 2015). Similarly, autocrats in mineral-rich regimes are likely to purposively stifle innovation that can potentially remove political power from their hands (Rosenberg and Tarasenko, 2020). More broadly, the presence of abundant mineral rents incentivizes rent-seeking behavior and dissipation of accrued public revenues. For instance, Belaid et al. (2021) find that Middle-Eastern and North-African (MENA) countries with military executives in power fail to translate oil wealth into sustained economic growth. They attribute this to the higher tendency for rent-seeking of military officers, who use the accrued rents to solidify their power and undermine competing military factions.

Horváth and Zeynalov (2016) also find that the resource sector

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gradually crowded-out manufacturing production in post-Soviet economies with weak domestic institutions (control of corruption, the rule of law, government effectiveness, etc.). Interest groups often vie for larger shares of accrued mineral rents through strikes, lobbying, or voting behavior, see Baland and Francois (2000). Especially in ethnically fragmented nations, rent-seeking competition across different groups can result in civil conflict (Elbadawi and Soto, 2015; San-Akca et al., 2020).

In a recent conceptual paper, Collier (2017) provides a novel psychological explanation for resource mismanagement (and the resource curse). He suggests that rent-seeking and excessive consumption of mineral revenues can be attributed mainly to social psychology. Mineral booms (due to the discovery of mineral reserves or drastic increases in commodity prices) start as positive income shocks that subsequently evolve into compelling and expectation-changing narratives (for a discussion on the role of narratives in influencing environmental behavior, see Brown, 2017). The dissemination of information on mineral wealth by both media and government agencies may result in unfounded euphoria and unrealistic expectations. Most citizens do not have complete information on what mineral discoveries imply for their personal income (or welfare more broadly). Inflated narratives about the impact of mineral wealth lead to the formation of populist demands that favor immediate consumption (and postponement of investment) of accrued mineral revenues. Determining the origin of demands for excessive consumption is crucial because it may lead to low quality of fiscal performance (and reduced fiscal decentralization), higher debt levels, and ultimately lower growth (Ampofo et al., 2021; Wang et al., 2021).

Our analysis aims to empirically test the resource curse's psychological foundations, as put forward in a theoretical note by Collier (2017). To our knowledge, this is the first empirical analysis to examine how perceptions of resource rent availability in mineral-rich nations can increase citizen pressure for excessive consumption. We contribute to the literature on the resource curse by examining how perceptions (overestimations) of mineral wealth can be influenced by exposure to associated news and associated with personal interest and characteristics (e.g., level of education, age, etc.). Our study relies on an extensive face-to-face survey (of 1977 respondents) carried out in Almaty, Kazakhstan, between May and August 2018. We focus on Kazakhstan, both due to its extensive extractive sector and its high vulnerability to the resource curse, primarily due to the presence of weak institutions (see Biresselioglu et al., 2019 for their newly-developed resource curse vulnerability index).

Kazakhstan is endowed with large reserves of oil, gas, and coal. According to the U.S. Energy Information Administration data (EIA, 2018), Kazakhstan accounts for 1.8% of world oil reserves and ranks twelfth globally. Over 50% of oil production takes place in the western part of the country and derives from the five largest oil fields of Tengiz, Karachaganak, Aktobe, Mangistau, and Uzen. 85% of all oil produced in Kazakhstan is intended for export (EIA, 2019). Attempts to diversify the export structure of the economy and reduce mineral dependence have been rather unsuccessful (Bayramov and Abbas, 2017). The government gave control of the main oilfields to international oil corporations through production-sharing agreements (Vakulchuk and Overland, 2018). However, the transportation costs for the export market are high given that Kazakhstan is a landlocked country (Shaffer, 2010) and the difficulty of securing export routes presents a big challenge to Kazakhstan's development plans (İpek, 2007; Karatayev and Clarke, 2014). Currently, the oil exports of Kazakhstan are done "via pipelines, tankers and railways to Russia, the Mediterranean coast of Turkey via Azerbaijan and Georgia, and to China" (Karatayev and Clarke, 2016). Karatayev and Clarke (2016) provide a good visualization of Kazakhstan's existing and proposed pipeline developments. Moreover, since 2000, the oil sector's revenues have represented nearly 20% of overall government expenditure (Heim and Salimov, 2020) and constituted 14% of total GDP in 2018 (World Bank, 2018).

According to EIA (2018) data, Kazakhstan accounts for more than 1.2% of world gas reserves and ranks fifteenth globally. Gas reserves are also concentrated in the country's west and are estimated to last for 157 years (Worldometers, 2021). Moreover, 48% of all gas produced in Kazakhstan is intended for export (EIA, 2019). However, there is potential for improvement given the current lack of proper infrastructure linking production and consumption locations. See Karatayev and Clarke (2016) for an excellent description of Kazakhstan's gas production and export particularities and plans for future developments.

Kazakhstan's coal reserves are 2.3% of the world's estimated reserves (EIA, 2018) and are expected to last 326 years (Worldometers2021). The mines are located in central Kazakhstan, and 80% is consumed domestically for electricity and heat production in thermal power plants (Karatayev and Clarke, 2014). However, this percentage is expected to fall as Kazakhstan moves towards the implementation of the Green Economy Concept adopted in May 2013. This concept has been implemented within Kazakhstan's strategic development plan framework that set a target of 50% electricity generation from sources other than coal or oil, including gas, nuclear and renewable energy, by 2050.

The choice of Almaty was based on logistical reasons concerning the organization of the field research (i.e., making it easier to simultaneously train multiple surveyors, avoid distance traveling for data collection, simplify coordination with the entire research team, etc.). Almaty was the capital of Kazakhstan until 1997 and is the most populated city in the country, with a population of nearly two million people in 2021 (and, as a result of inward migration, a mosaic of different Kazakh cultures and other groups). Almaty and its surroundings are not rich in oil, gas, or coal. On the contrary, it is mainly a service producer that generates approximately 20% of Kazakhstan's GDP and accounts for above 20% of government revenues (Kazinform, 2019) (Fig. 1).

We indeed find empirical support for Collier's hypotheses concerning the positive link between exposure to news (and resource-related narratives) and inflated expectations about mineral availability. We also find that the latter can generate preferences for excessive consumption. We expect these findings to be more broadly applicable to other mineral-dependent countries with similar characteristics (i.e., weak institutions, government mistrust, large inequality, etc.).

The structure of the paper is as follows. Section 2 provides a theoretical note on psychological biases created by mineral wealth. Section 3 describes our dataset. Section 4 explains our methodological approach and key findings. Section 5 concludes.

2. A theoretical note on the psychology of mineral wealth

Insights from psychology have been shedding light on the behavioral and emotional effects of positive income shocks (as in the case of mineral discoveries and extracted rents). Here, we make reference to behavioral theories that focus on how our behavior and judgment are unconsciously influenced by biases, especially in the context of such windfall gains.

2.1. Heuristics and coarse thinking

The work of psychologist Daniel Kahneman is especially helpful in understanding psychological biases that influence how we perceive mineral wealth and its optimal use. Tversky and Kahneman (1974) already discussed in the 70s how cognitive biases induce individuals to form their own inaccurate 'subjective reality' when they attempt to make a decision or formulate judgments (Tversky and Kahneman, 1974). According to Kahneman, as humans, we often rely on *fast coarse thinking* as a mental shortcut (*heuristics*) when we try to understand complex processes and make decisions (Kahneman, 2011). Hence, our understanding of the world can be much influenced by coarse thinking based on existing narratives and biases rather than slow, reflective thinking based on reason and rationality (Alba-Juez, 2021; Lewis, 2013). In the case of sudden windfalls, the anchoring and optimism (overconfidence) biases are particularly relevant in explaining how our

Fig. 1. Map of Kazakhstan with an indication of the location of Almaty city.

perceptions may deviate from rational judgments.

2.2. Anchoring bias

A common cognitive bias leading to a perceptual distortion of reality relates to anchoring. Individuals' perceptions and subsequent decisions are commonly influenced by an anchor (a reference point, see Furnham and Boo, 2011). The significance or value of the anchor affects how we formulate judgments and take decisions on a related issue. For instance, one's initial hesitation to purchase a house may be overcome when one becomes aware of similar or higher prices for comparable properties nearby. A typical example is given by Tversky and Kahneman (1974); in an early experiment, they split participants into two groups and asked them to quickly estimate (without the use of calculations) the product of either $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$ or $8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$. Those who were given the sequence of small numbers came up with a median value of 512, while those with the sequence of large ones with 2, 250. Through experiments, several psychologists have also shown that the anchoring effect is durable/persistent by varying the time that the anchor was introduced to different sample populations (Mussweiler and Neumann, 2000; Yoon and Fong, 2019). Along these lines, inaccurate numbers in the news can distort one's perception of reality and induce false judgments (Stubenvoll and Matthes, 2021).

2.3. Optimism bias

Another common cognitive bias that explains why individuals may form irrational and overoptimistic judgments is the so-called optimism (overconfidence) bias. The optimism bias arises from the fact that individuals are inclined to view desirable outcomes as more likely (and hence perceive risky scenarios as less probable, see Flyvbjerg, 2011 and Shepperd et al., 2002). Psychologists often attribute the optimism bias to self-enhancement. As individuals, we instinctively assume optimistic and favorable scenarios as likely to materialize. Doing so provides us with a personal feeling of contentment and a self-protective mechanism against anxiety (associated with the more risky outcomes, Jefferson et al., 2017). As a result, we often interpret data and information in a biased (and selective) manner that supports desired optimistic outcomes (simply because this automatically triggers positive emotions). This also relates to the so-called *planning fallacy*: for complex projects, individuals are often overly optimistic regarding when they can become completed and deliver expected benefits (Buehler and Griffin, 2015).

2.4. Psychological biases in the context of mineral wealth

Collier (2017) presents an innovative theoretical framework to explain possible psychological foundations underlying resource mismanagement and the temptation to overconsume mineral rents. He identifies several potential psychological drivers behind citizens' exaggerated expectations of mineral wealth and associated pressure for excessive consumption. First, exposure to memorable, high-profile narratives (e.g., in the form of powerful messages appearing as newspaper headlines or news broadcasting) can generate an anchoring bias, distort perceptions of reality and generate unrealistic expectations (see Jia et al., 2020 and Fenton Villar, 2021). Audiences often react to such narratives rather passively without bringing critical reflection to bear on the validity of the information presented (i.e., they rely on coarse thinking). Second, unrealistic expectations (and demands) can also be driven by an optimism bias when forecasting future mineral revenues. Multiple layers of uncertainty characterize mining projects (e.g., future commodity prices, geological features, changes in local and global socioeconomic and political conditions, exploration rights, execution timelines, etc.). The media and politicians frequently present best-case scenarios as baselines, with little reference to associated complexities and uncertainties (see Collier, 2017; Weszkalnys, 2008). In the presence of such an optimistic bias and unrealistic expectations regarding future rents, one may expect citizens to favor immediate consumption against investment (Andrade et al., 2019; Dawson and Henley, 2012). Third, companies active in the extractive sector often exaggerate not only the extent of reserves and possible future revenues but also the commercial viability of their operations. This strategy enables them to access easier and cheaper external funding, especially in socio-political environments generally characterized as risky. At the same time, such behavior feeds into the unrealistic expectations of citizens regarding the benefits they anticipate from mining activities (see also Gilbert, 2020).

Strong citizen preference for immediate consumption, rather than investment, of mineral rents may be driven by a widespread feeling of distrust toward politicians and government institutions. In many mineral-rich countries, kleptocratic governments have long histories, with the result that the public often fears that self-interested politicians will appropriate mineral revenues for their own benefit. The public reasons that immediate consumption will reduce the risk that mineral rents may disappear into the pockets of officials, preventing benefits from accruing to the average citizen (Fenton Villar, 2020). It is also the case that most mineral-dependent economies tend to be characterized by extensive poverty and lack of government ability to meet basic citizen needs (Collier, 2007). Within such contexts, citizens tend to have

relatively high rates of time preference (impatience), favoring immediate consumption over investment and uncertain future benefits (Adonteng-Kissi, 2017; Lawrance, 1991).

To reverse the psychological drivers of unrealistic expectations and demands for consumption, Collier (2017) puts forward several recommendations. Firstly, he suggests presenting any projected monetary flows in per capita terms, instead of aggregate numbers, to reduce overall psychological bias (see Collier, 2017 and Cust and Mihalyi, 2017) – e.g., in terms of expected revenues. Equally important is the need for government officials to explain the rationale behind favoring the allocation of mineral rents to investment rather than immediate consumption. Citizens will accept a 'sacrifice' if they become convinced that investment of mineral revenues (e.g., in public infrastructure or health/educational projects) is a strategy with larger long-term (and sustained) benefits (Papyrakis and Gerlagh, 2006; Edmunson, 2014). Naturally, all this also requires politicians and government officials to build citizen trust in them. By itself, such an exercise requires painstaking, long-term processes during which government officials need to adopt a consistent political ethos based on modesty and transparency (i.e., they need to lead by example).

2.5. *What else may matter? (Interest in economics, politics, business; perceived corruption; education; age)*

There is considerable research in experimental and behavioral economics linking cognitive biases (including those concerning economic/quantitative assessments) and *interest in economic issues*. For example, Slonim et al. (2013) claim that interest in economics increases reflection and effort dedicated to understanding the purposes and design of experimental economic lab activities. Wright (2010) links interest in economics with an enhanced understanding of pension schemes. For this reason, those better informed on economic matters are less likely to form biased and unrealistic perceptions (on mineral wealth or other economic issues). Interest in other fields related to public affairs (e.g., politics and business) may also influence our cognitive biases, although possibly in different ways. Evidence suggests, for instance, that people interested in business are typically more optimistic than the average person (Cooper et al., 1988; Ucbasaran et al., 2010) and maybe, hence, more prone to an optimism bias as described above.

The extent of perceived corruption can also feed into one's overestimation bias of a country's mineral wealth. There is extensive literature highlighting the secrecy behind mineral resource management in regimes considered to be corrupt. Corrupt leaders try to hide the exact extent of mineral revenues and assets so that they can appropriate part of them for their benefit and present themselves as being already exceedingly generous to the public regarding government spending (see Morrison, 2013; Ross, 2012).

Personal characteristics are also likely to influence our cognitive biases. For example, unemployed and less-educated respondents generally receive lower scores in experiments aimed at measuring optimism (Heinonen et al., 2006) and tend to favor consumption over-investment due to their tighter budget constraints. Age can also play a role as evidence suggests that older adults tend to be better in emotion regulation through having an inherently higher level of optimistic bias (as a means to prevent negative emotions, see Urry and Gross, 2010). In addition, the elderly (being closer to the ends of their lives) have a stronger preference for consumption than for investment and especially so in the case of public resources, which they cannot directly bequeath to their offspring (see also Modigliani, 1966; Hurd, 1990).

3. Survey description and data on perceived mineral wealth

For our study, we carried out an extensive survey of 1977 respondents in the center of Almaty, Kazakhstan, between May and August 2018. The survey was conducted in Russian and Kazakh (the official languages of Kazakhstan). Appendix 1 provides a summary of the questionnaire (in English).

The focal question of the survey was one referring to each respondent's perceptions about the country's mineral wealth, namely, gas, oil, and coal. For all three resources, respondents were asked to reflect on the value of Kazakhstan's reserves. During our pilot study preceding the survey, it became evident that most respondents had difficulties coming up with estimates regarding the value of subsoil mineral assets. As a result, it was necessary to provide guidance to survey participants to get meaningful answers, while at the same time taking precautions to minimize any 'anchoring effect' that would bias our results (i.e., a cognitive bias where a participant's response would depend too heavily on information offered in the survey). For example, in the case of gas reserves, each respondent was provided with a ranking of 206 countries, ranging from the most gas-abundant nations to the most gas-scarce ones. The monetized value of each country's gas reserves for 2017 was provided next to each country's name (in trillions of tenge, Kazakhstan's local currency). Kazakhstan was purposely excluded from the list. Data on international gas reserves came from the U.S. Energy Information Administration (EIA, 2018); for our calculations, we used the average 2017 international price for gas ($0.0028 per cubic feet, IEA, 2018). Each respondent was then requested to reflect on where Kazakhstan should be located in the international ranking of nations with gas reserves and provide an estimate of Kazakhstan's gas wealth (hereafter referred to as 'surveyee's perception of gas wealth'). For the sake of demonstration, Appendix 2 presents part of the international rankings for gas reserves (for the most gas-abundant nations). In effect, Kazakhstan's gas reserves were worth about 76 trillion tenges at the time of the survey (and were, hence, located between Mozambique and Egypt in terms of relative importance – with the 15th largest reserves globally).

Similarly, respondents were provided with country rankings for the value of oil and coal reserves. They were asked to reflect on Kazakhstan's position relative to other economies and the corresponding value of its oil/coal assets. Data on international oil and coal reserves in volume came from the U.S. Energy Information Administration (EIA, 2018) and B.P.'s Statistical Review of World Energy (Dudley, 2017), respectively. We used the average 2017 international price for oil and coal (i.e., $66 per barrel of oil and $70 per ton of coal, IEA, 2018) to calculate their value. At the time of the survey, Kazakhstan's had the 12th largest oil reserves globally (70 billion barrels, equivalent to approximately 634 trillion tenges) and the 8th largest coal reserves (25.6 billion tons, equivalent to about 574 trillion tenges).

4. Results

The survey data allows us to measure the extent to which respondents in Kazakhstan overestimated the actual availability of the country's mineral wealth. As the first step in our analysis, we constructed an index of this overestimation per type of mineral reserves *i* (i.e., gas, oil, coal) for each survey participant *j*:

$$\textit{Surveyee}'\textit{s overestimation rate of the country}'\textit{s mineral wealth}_{i,j} = \frac{\textit{Surveyee's perception of mineral wealth}_{i,j} - \textit{Real mineral wealth}_i}{\textit{Real mineral wealth}_i} \quad (1)$$

Any value above 0 corresponds to an overestimation of the matching mineral asset. We found strong evidence of an overestimation of the country's mineral wealth based on responses of the 1977 survey participants. The average overestimation rate for Kazakhstan's gas, oil, and coal wealth was equal to 4.99, 1.99, and 1.23, respectively. In other words, on average, respondents believed that Kazakhstan had gas, oil, and coal reserves that were worth 499%, 199%, and 123% more than their actual values! Descriptive statistics (for all dependent and explanatory variables) are presented in Appendix 3; Appendix 4 provides a correlation table.

We conduct tests on the data reliability of the variables used in our regression analysis and present results in Appendix 5, where we show the corresponding test retests or Intraclass Correlation Coefficients (ICC) as suggested by Koo and Li (2016) and Shrout and Fleiss (1979). For this purpose, the questionnaire was initially administered twice to the same group of 51 people residing in Almaty with an interval of three weeks. The first set of completed questionnaires was used for the test, while the second set was used for the retest. Following the interpretation suggested by Koo and Li (2016), the assessment of reliability should be based on the 95% confident interval of the ICC estimate (not the ICC estimate itself), with reliability values assessed as being either "poor" (less than 0.5), "moderate" (0.5 and 0.75), "good" (0.75 and 0.9), or "excellent" (greater than 0.90). Thus, out of the ten variables, three variables show "excellent" reliability, six variables show reliability in-between "good" to "excellent," and one shows reliability in-between "moderate" to "excellent." The variables age, work, and education are not reported, but their ICC estimates are equal to 1.

Next, we examined how exposure to news, which in Kazakhstan typically publicizes important, high-profile developments in the local extractive sector, could generate unrealistic expectations of mineral wealth. We proposed the following hypothesis:

Hypothesis 1. Greater exposure to news items is associated with larger overestimation rates of Kazakhstan's mineral wealth.

The method used to test our hypotheses is the ordinary least *squares*, a linear least-squares method commonly used to estimate the unknown parameters in a linear regression model. For Hypothesis 1, this is done in Table 1, where the dependent variable is the surveyee's overestimation of the country's mineral wealth (for gas, oil, and coal, respectively) as described above. In all regressions, we include the natural logarithm of a respondent's interest in news items (Ln_int_news) since this is the key explanatory variable to test Hypothesis 1.

The first three parsimonious regressions (i.e., with the fewest predictor variables across all specifications of Table 1) include two additional regressors, namely the respondent's self-assessment of optimism (Ln_optimism) and his/her extent of interest in economic issues (Ln_int_econ). We anticipated a positive correlation between expressed optimism and the degree of a respondent's overestimation of the country's mineral wealth (given the general disposition of optimists to look on the more favorable side of events). On the other hand, we expected a negative correlation between interest in economic issues and overestimation of the extent of mineral wealth. This is because those better informed on economic matters are likely to be less prone to biased overestimation based on influential reports and news items. Notice that the three explanatory variables (measuring the extent of optimism, interest in news items, and interest in economic issues) are measured initially on a scale from 1 (very low) to 5 (very high).

Our key focus is on the relationship between a respondent's exposure to news items (as captured by Ln_int_news) and his/her overestimation of Kazakhstan's mineral wealth. Results accord with intuition and support Collier's hypothesis. As shown in regression 1, increased exposure to news correlates positively with a higher overestimation of the country's gas wealth (statistically significant at the 1% level). Very similar results are obtained for oil (regression 2). In the case of coal, there is a positive but statistically insignificant correlation (regression 3). The magnitude of the effect is quite prominent in the case of gas and oil, as measured by corresponding elasticities presented at the bottom of Table 1 (which captures the percentage change of the overestimation rate in response to a change in the news index). A 1% rise in the index

Table 1
Determinants of overestimation rates per type of natural wealth (gas, oil, and coal).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Gas	Oil	Coal	Gas	Oil	Coal	Gas	Oil	Coal
Ln_int_news	2.17***	0.93***	0.28	1.96***	0.85***	0.26	1.77***	0.81***	0.32*
	(0.61)	(0.18)	(0.19)	(0.62)	(0.18)	(0.19)	(0.65)	(0.19)	(0.19)
Ln_optimism	2.39***	1.01***	0.85***	2.01***	0.92***	0.80***	2.08***	0.93***	0.83***
	(0.58)	(0.20)	(0.17)	(0.57)	(0.20)	(0.17)	(0.61)	(0.21)	(0.17)
Ln_int_econ	−2.03***	−0.61***	−0.39***	−2.59***	−0.86***	−0.40**	−2.73***	−0.93***	−0.37**
	(0.40)	(0.14)	(0.13)	(0.48)	(0.18)	(0.16)	(0.48)	(0.18)	(0.17)
Ln_int_pol				−0.04	0.16	−0.12	0.01	0.12	−0.06
				(0.51)	(0.17)	(0.15)	(0.52)	(0.17)	(0.15)
Ln_int_buss				2.35***	0.61***	0.34**	2.50***	0.64***	0.22
				(0.46)	(0.19)	(0.15)	(0.48)	(0.19)	(0.15)
Ln_corruption							0.49	0.27	0.19
							(0.49)	(0.21)	(0.19)
Work							−0.37	0.19*	0.01
							(0.31)	(0.11)	(0.10)
Ln_age							−0.05	0.22	−0.26*
							(0.50)	(0.17)	(0.14)
Ln_education							1.96**	0.43	0.08
							(0.95)	(0.36)	(0.35)
Constant	1.19	0.08	0.15	−0.42	−0.37	−0.06	−4.01*	−2.24***	0.37
	(0.75)	(0.31)	(0.28)	(0.78)	(0.33)	(0.30)	(2.21)	(0.72)	(0.75)
Observations	1,965	1,966	1,966	1,965	1,966	1,966	1,898	1,899	1,899
R-squared	0.04	0.05	0.02	0.06	0.06	0.03	0.06	0.06	0.03
Elasticities for key statistically significant variables									
Int_news	0.44***	0.47***	0.22	0.39***	0.43***	0.21	0.36***	0.41***	0.26*
Optimism	0.48***	0.51***	0.69***	0.40***	0.46***	0.65***	0.42***	0.47***	0.68***
Int_econ	−0.41***	−0.31***	−0.32***	−0.52***	−0.43***	−0.33**	−0.55***	−0.47***	−0.30**
Int_buss				0.12***	0.08***	0.07**	0.13***	0.08***	0.05*

Note: Robust (heteroscedasticity-adjusted) standard errors in parentheses. Superscripts *, **, and *** correspond to a 10, 5, and 1% significance level. The elasticities are measured at mean values.

measuring the extent of news exposure is associated with a 0.44% (0.47%) increase in the overestimation of the country's gas (oil) wealth. The smaller (and statistically insignificant) elasticity for coal may be attributed to the following two factors. First, coal is mainly consumed domestically for electricity production rather than exported (unlike gas and oil); consequently, coal receives less media attention. Second, while Kazakhstan has vast coal reserves (almost on par with its oil reserves when expressed in monetary terms), the contribution of coal rents to annual GDP values is relatively modest (0.9% for 2017, against 10.2% and 1.2% for oil and gas respectively, see World Development Indicators, 2020).

Regressions (1)–(3) also reveal that, as posited earlier, the more optimistic a person is, the higher his/her overestimation of the country's mineral wealth will be. The coefficient of interest in economics also satisfies our earlier expectation: those better informed on economic issues are less likely to overestimate the extent of gas/oil/coal wealth.

It might be the case that the negative association between overestimating a country's natural wealth and interest in economics is not exclusive to this disciplinary field. Indeed, if the influence were not exclusive, our previous argument that attributes a smaller bias in estimations solely to interest in economics would weaken. For this reason, we evaluate whether interests in politics and business might also be linked to the overestimation rate since both are related to public affairs. Economics and business are, however, different in fundamental respect: evidence suggests that people interested in business are typically more optimistic than the average person (Cooper et al., 1988; Ucbasaran et al., 2010). Thus, among other things, interest in business issues may capture that part of optimism that is not directly controlled by the variable Ln_optimism (self-assessed optimism), at least to the extent that optimistic people may not be fully aware of their optimism.

We add the variables Ln_int_pol and Ln_int_buss to capture the extent of expressed interest in political and business issues, respectively (again measured on a scale from 1 - very low - to 5 - very high). Evidence that interest in business issues indicates optimism can be seen in the positive correlation between the variables Ln_int_buss and *Ln_optimism*, 0.21 (see Appendix 4). This is the highest pairwise correlation of Ln_int_buss with any other variable, about twice the correlation coefficient between Ln_int_econ and Ln_optimism (0.11).

The results in columns (4)–(6) of Table 1 show that the relationship between one's exposure to news items (Ln_int_news) and one's overestimation of Kazakhstan's mineral wealth remains robust to the addition of the variables Ln_int_pol and Ln_int_buss. The corresponding coefficients for the variable Ln_int_news decrease only slightly and remain statistically significant in the case of gas and oil. The elasticity measures at the bottom of Table 1 show that a 1% rise in the index measuring the extent of news exposure is associated with a 0.39% (0.43%) increase in overestimation of the country's gas (oil) wealth. Interest in politics consistently appears statistically insignificant, and as expected, the variable Ln_int_buss shows a positive and significant effect in the three specifications.

In columns (7)–(9), we include four additional control variables potentially influencing perceptions of Kazakhstan's mineral wealth. We include the perception of corruption regarding the management of public resources (*Ln_corruption*: scale 1 to 5) and a dummy variable taking the value of 1 if a respondent is currently employed (Work). In addition, we include the natural logarithm of the respondent's age (Ln_age) and level of education (*Ln_education*: scale 1 to 8, see Appendix 1 for the corresponding levels of educational attainment). The extent of perceived corruption is expected to be positively correlated with one's overestimation of a country's mineral wealth. Respondents who acknowledge corruption as a serious concern in Kazakhstan are likely to believe that part of the country's mineral wealth is embezzled. Hence, they are likely to think that it is intentionally under-reported (i.e., actual mineral wealth is higher than that reported by official sources). Regressions (7)–(9) indeed present a positive coefficient for corruption, albeit a non-statistically significant one. The variables *Work*, Ln_age, and Ln_education are only significant for oil, coal, and gas regressions, respectively. Most importantly, the earlier results regarding a positive relationship between one's exposure to news items (Ln_int_news) and his/her overestimation of Kazakhstan's mineral wealth still hold (with the corresponding coefficient for coal now also becoming statistically significant, albeit at the 10% level).

Our second fundamental hypothesis focuses on how inflated expectations may influence preferences regarding how mineral rents should be spent (see also Collier, 2017):

Hypothesis 2. An overestimation of the country's mineral wealth is likely to generate unrealistic expectations and pressure for excessive redistribution and consumption.

We asked respondents to a) provide an estimated guess on the current division of mineral revenues between immediate consumption ('spend money for people's satisfaction today', e.g., in the form of subsidies, wages of public servants, income transfers) and saving/investment (e.g., in the form of infrastructure development, training programs, purchase of productive equipment, etc.) and b) reveal their preferences regarding their ideal division of revenues between these two uses. For the purpose of proxying demand for excessive consumption, we constructed a new index based on the ratio of ideal versus actual allocation:

$$ln\left(\frac{Pressure\,for}{excessive\,consumption}\right)=ln\left(\frac{Govt.should\,spend\,(consumption/investment)}{Govt.spends\,(consumption/investment)}\right). \quad (2)$$

For those respondents who felt that the government should allocate more (fewer) resources toward consumption, the ratio becomes greater (less) than 1, and the corresponding natural logarithm larger (smaller) than 0. The average (logarithmic) value of the index is 0.45, which means that the average preferred ratio of consumption/investment vs. the actual one is close to 1.57. We test Hypothesis 2 through a series of regressions presented in Table 2.

The critical focus of Table 2 (to test Hypothesis 2) lies in the relationship between a respondent's degree of pressure for excessive con-

Table 2
Determinants of citizen pressure for excessive consumption.

VARIABLES	(1)	(2)	(3)
Overestimation_total	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)
Ln_Corruption	0.11*	0.07	0.07
	(0.05)	(0.06)	(0.06)
Ln_Optimism		0.05	0.05
		(0.06)	(0.06)
Ln_age		0.20***	0.21***
		(0.04)	(0.05)
Work			−0.04
			(0.04)
Ln_Education			−0.03
			(0.12)
Constant	0.08	−0.64***	−0.61***
	(0.08)	(0.19)	(0.22)
Observations	1,398	1,387	1,387
R-squared	0.01	0.02	0.03

Note: Robust (heteroscedasticity-adjusted) standard errors in parentheses. Superscripts *, **, and *** correspond to a 10, 5, and 1% significance level.

sumption and his/her overestimation of mineral wealth. In all regressions, the primary variable is *Overestimation_total*, which measures the aggregate overestimation of wealth for gas, oil, and coal. It is calculated using expression (1), where the subscript *i* now indicates the aggregate value of gas, oil, and coal. Regression 1 shows that there is indeed a positive and statistically significant (at the 1% level) correlation between the two variables. Expressed in elasticity terms, an increase of the overestimation rate by 1% corresponds to an increase in pressure for excessive consumption (the ratio inside the bracket in expression (2)) of 0.06%, when the overestimation rate is measured at its mean value. In the same specification, we have also added the perception of corruption regarding mismanagement of public resources (Ln_Corruption). Collier (2017) suggests that other things equal, mistrust in government management makes citizens prefer more immediate consumption of public resources instead of the more uncertain benefits accruing from investment, which may never materialize. The coefficient for the variable perception of corruption is positive and statistically significant at the 10% level (although it loses statistical significance for the richer specifications that follow). Thus, an increase in perception of corruption by 1% corresponds to an increase in pressure for excessive consumption by 0.105%.

In column (2) of Table 2, we add two more control variables: the respondent's extent of optimism and age (Ln_optimism and Ln_age). One may suspect that optimistic respondents are more inclined to envisage brighter prospects for the future and hence, to see less need for investment at the expense of immediate consumption. The coefficient is indeed positive but insignificant. On the other hand, age has a positive and statistically significant coefficient; this may suggest that the elderly (by being closer to the ends of their lives) have a stronger preference for consumption than for investment. Their stronger preference for consumption is a result of their unlikeliness of being able to reap the benefits of postponed consumption. This is especially so in the case of public resources, which they cannot directly bequeath to their offspring.

The relationship between the overestimation rate and the index of pressure for excessive consumption (the focal point of Table 2) remains positive, of similar size, and statistically significant. In column (3), we enrich our specification with two additional control variables: the dummy variable capturing employment (Work) and the variable measuring level of education (Ln_education). One may surmise that employed individuals favor saving/investment as they face fewer budget constraints. Indeed, the corresponding coefficient for work is negative but statistically insignificant. Educated individuals may also face fewer budget constraints, as they are likely to have higher income levels and hence favor saving/investment. While the coefficient sign accords with this intuition, it is statistically insignificant (note that the coefficients for these two control variables remain statistically insignificant even when they are added separately instead of jointly). More importantly, our main results regarding the coefficient of the overestimation index remain robust.

5. Conclusion and policy implications

Despite keen academic and policy interest in the links between natural resource wealth and development failures, little attention has been devoted to the psychological underpinnings of the resource curse. Mineral booms are typically associated with rent-seeking behavior. Individuals strive for a share of accrued mineral rents and exert pressure on the government to achieve this. In this paper, we used data from extensive fieldwork carried out in Almaty, Kazakhstan, to examine possible psychological foundations underlying mineral rent-seeking. Positive mineral shocks often translate into influential and expectation-changing narratives. We find empirical support for a positive link between exposure to news and inflated expectations of mineral availability. We also find that the latter can generate preferences for excessive consumption (and hence, rent-seeking).

Our research has important policy implications. First, it demonstrates that information clarity is crucial regarding the availability of mineral rents and their potential to transform national economies and individual livelihoods. Governments in mineral-rich countries need to provide accessible information about the relative importance of the extractive sector in ways that are easily comprehensible to all citizens (see also Collier, 2017). Large aggregate numbers (e.g., of the value of reserves discovered) are unlikely to resonate with most citizens and may generate confusion and unrealistic expectations. Expressing values in per capita terms can help prevent unjustified mineral-induced euphoria that is likely to translate into demands for excessive short-term consumption and widespread rent-seeking behavior.

The remedies to be provided should be based on minimizing the coarse-thinking behavior of citizens in mineral-rich nations and their cognitive biases regarding the extent of mineral wealth and the demand to overconsume. Thus, the following recommendations may be considered. First, governments need to launch regular information campaigns (especially after the discoveries of significant mineral resources or during periods of rising mineral prices). Second, these information campaigns should rely on multiple types of mass media (internet, T.V., newspapers, radio, etc.). Third, the public should be informed through easily comprehensible data about the extent of expected mineral revenues. The use of examples regarding what a mineral windfall means per person in relation to the other already established social transfers and benefits will assist in visualizing anticipated benefits and curbing unrealistic expectations. Fourth, governments should also provide annual transparency reports on the extractive sector. These reports should give detailed information on the exact amount of mineral revenues and their allocation towards different priorities and activities. This can be done in the countries' mid- and long-term strategic development plans. It should be made clear how postponing the immediate consumption of mineral revenues for the sake of supporting such schemes is a wiser and more prudent policy option. Last but not least, the above will only succeed if politicians gain citizens' trust. The involvement of external auditors and international institutions, as in the case of the Extractive Industries Transparency Initiative, can be of much help. Politicians should lead by example by cultivating an image of modesty rather than one of excessive overspending and vanity.

Naturally, the present research is only a first step toward empirically examining the psychological foundations of the resource curse and natural resource mismanagement more broadly. This could be especially interesting in developing countries experiencing sudden major discoveries of mineral resources. Future research will benefit if time-series data availability allows monitoring changes in public opinion due to the discovery.

An alternative avenue for future research is to analyze mass media output and identify potential differentiated roles and impacts across media types and outlets (e.g., internet, T.V., newspapers, etc.) regarding the formation of views on mineral wealth and corresponding cognitive biases. Moreover, there might be differences even within the same media type (e.g., when comparing different newspapers and their readers). Future research could also probe into how disseminated information on major developments in the extractive sector influence

perceptions and views on the future energy path of a country (e.g., in relation to energy transitions towards renewables, energy efficiency investments, etc.).

Last, our corruption index was constructed based on survey responses regarded the perceived extent of loss of public resources due to both inefficiency and corruption. We acknowledge that this is potentially a limitation, given that perceptions of public corruption and inefficiency may not always coincide. However, they are likely to strongly correlate with each other, as in the case of the Government Effectiveness[1] and Control of Corruption indices of the World Bank's Worldwide Governance Indicators, see Charron (2021). We purposely added both inefficiency and corruption in the questionnaire, given that several respondents in Kazakhstan find government corruption a sensitive issue to discuss openly. In that respect, the responses to this question capture more broadly perceptions on mismanagement of mineral rents, either due to corruption or inefficiencies in public administration. Future research could include separate questions on government inefficiency and corruption and compare results.

Authors statement

The two authors have collaborated on every single aspect of the paper.

Data availability

Data will be made available on request.

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Appendices.

Appendix 1
Summary of questionnaire

Variable	Question asked	Possible answers
Surveyee's perceptions of gas, oil, and coal wealth	What do you think the value of Kazakhstan's gas, oil, and coal wealth is?	Value of gas ____, oil ____, and coal reserves ____ respectively (in tenge, Kazakhstan's national currency)
Government allocation (consumption/investment)	In which proportion do you think that the government allocates gas/oil/coal revenues between current consumption ('spend money for people's satisfaction today,' e.g., in the form of subsidies, wages of public servants, income transfers) and saving/investment (e.g., in the form of infrastructure development, training programs, purchase of productive equipment, etc.)?	Proportion of gas/coal/oil revenues allocated towards Consumption: __% Saving/Investment: __%*
Ideal government allocation (consumption/investment)	In which proportion do you think the government should allocate gas/oil/coal revenues between current consumption and saving/investment?	Proportion of gas/coal/oil revenues that should be allocated towards Consumption: __% Saving/Investment: __%*
Int_news	From 1 to 5, how much do you read, listen to or watch the news?	1 2 3 4 5 (1 not at all, 5 very much)
Int_econ	From 1 to 5, how would you rate your interest in economics?	1 2 3 4 5 (1 very low, 5 very high)
Int_pol	From 1 to 5, how would you rate your interest in politics?	1 2 3 4 5 (1 very low, 5 very high)
Int_buss	From 1 to 5, how would you rate your interest in business?	1 2 3 4 5 (1 very low, 5 very high)
Optimism	Do you consider yourself a pessimistic or optimistic person?	1 2 3 4 5 (1 highly pessimistic, 5 highly optimistic)
Corruption	A proportion of public resources becomes lost (wasted) because of inefficiency/corruption at different government levels. How substantial do you think this loss of resources is?	1 2 3 4 5 (1 very low, 5 very high)
Work	Do you work?	Yes/No
Age	How old are you? (age in years)	Any number
Education	What is the highest level of education that you have completed?	Choose the letter that applies to your case A. PRIMARY SCHOOL INCOMPLETE B. PRIMARY SCHOOL COMPLETED C. SECONDARY SCHOOL INCOMPLETE D. SECONDARY SCHOOL COMPLETED E. UNIVERSITY INCOMPLETE F. UNIVERSITY COMPLETED H. POSTGRADUATE DEGREE INCOMPLETE G. POSTGRADUATE DEGREE COMPLETED

NOTE: * The reason for asking for both shares was to ensure that respondents understood that the two percentages need to add up to 100%. This was added after a pilot survey showed that asking for only one share generated confusion for many respondents.

[1] Which measures the efficiency of revenue mobilization, quality of public administration and budgetary management.

Appendix 2
International ranking of gas reserves (value in trillion tenges) for the 20 most gas abundant countries (excluding Kazakhstan)

	Country	trillion tenge
1	Russia	1,513
2	Iran	1,067
3	Qatar	762
4	United States	289
5	Saudi Arabia	273
6	Turkmenistan	237
7	United Arab Emirates	193
8	Venezuela	182
9	Nigeria	173
10	China	172
11	Algeria	143
12	Iraq	121
13	Indonesia	91
14	Mozambique	90
15	Egypt	69
16	Canada	65
17	Australia	63
18	Uzbekistan	58
19	Kuwait	56
20	Norway	56

NOTE: The complete list of countries was included in the survey but not reported here.

Appendix 3
Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Surveyee's overestimation rate of the country's gas wealth	1,974	4.99	6.27	−1.00	72.97
Surveyee's overestimation rate of the country's oil wealth	1,975	1.99	2.34	−0.98	38.46
Surveyee's overestimation rate of the country's coal wealth	1,975	1.23	2.05	−0.99	11.20
ln(pressure for excessive consumption)	1,950	0.45	0.84	−2.20	4.60
Overestimation_total	1,973	1.82	1.94	−0.97	20.02
Ln_int_news	1,972	1.35	0.32	0.00	1.61
Ln_optimism	1,972	1.37	0.30	0.00	1.61
Ln_int_econ	1,973	1.18	0.41	0.00	1.61
Ln_int_pol	1,973	1.14	0.43	0.00	1.61
Ln_int_buss	1,974	1.32	0.35	0.00	1.61
Ln_corruption	1,924	1.41	0.29	0.00	1.61
Ln_age	1,977	3.57	0.37	0.00	1.00
Work	1,961	0.66	0.47	2.56	4.41
Ln_education	1,977	1.76	0.17	0.00	2.08

Appendix 4
Correlation table

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Surveyee's overestimation rate (gas)	(1)	1.00													
Surveyee's overestimation rate (oil)	(2)	0.40	1.00												
Surveyee's overestimation rate (coal)	(3)	0.36	0.43	1.00											
ln(pressure for excessive consumption)	(4)	0.16	0.17	0.10	1.00										
Overestimation_total	(5)	0.59	0.87	0.79	0.18	1.00									
Ln_int_news	(6)	0.14	0.18	0.09	0.05	0.17	1.00								
Ln_optimism	(7)	0.14	0.16	0.14	0.04	0.19	0.33	1.00							
Ln_int_econ	(8)	−0.11	−0.07	−0.04	−0.05	−0.08	0.16	0.11	1.00						
Ln_int_pol	(9)	−0.04	0.01	−0.02	0.01	−0.01	0.20	0.09	0.60	1.00					
Ln_int_buss	(10)	0.12	0.11	0.05	0.10	0.11	0.19	0.21	0.32	0.24	1.00				
Ln_corruption	(11)	0.01	0.03	0.02	0.04	0.03	0.04	−0.05	0.02	0.05	−0.02	1.00			
Ln_age	(12)	−0.02	0.05	0.00	−0.02	0.03	0.03	0.00	0.10	0.04	0.13	0.03	1.00		
Work	(13)	0.02	0.07	−0.04	0.11	0.02	0.20	−0.01	0.08	0.14	−0.07	0.12	0.09	1.00	
Ln_education	(14)	0.04	0.06	−0.02	0.06	0.04	0.13	0.01	0.10	0.11	0.05	0.09	0.25	0.45	1.00

Appendix 5

Intraclass Correlation Coefficient (ICC) estimates for the variables used in the regressions

	Intraclass corr.	95% Confidence Interval		F test	
		Lower bound	Upper bound	F test value	Prob > F
Surveyee's overestimation rate of the country's gas wealth	0.94	0.90	0.97	36.28	0.00
Surveyee's overestimation rate of the country's oil wealth	0.95	0.92	0.97	44.63	0.00
Surveyee's overestimation rate of the country's coal wealth	0.89	0.80	0.94	19.11	0.00
Pressure for excessive consumption	0.96	0.94	0.98	54.59	0.00
int_news	0.91	0.85	0.95	20.88	0.00
optimism	0.85	0.76	0.91	12.46	0.00
int_econ	0.93	0.88	0.96	27.12	0.00
int_pol	0.91	0.85	0.95	21.61	0.00
int_buss	0.87	0.77	0.92	13.58	0.00
corruption	0.84	0.74	0.91	11.7	0.00

NOTE: ICC estimates and 95% confidence intervals were calculated using Stata statistical package version 14.2 based on an individual-rating, absolute-agreement, 2-way mixed-effects model (Koo and Li, 2016; Shrout and Fleiss, 1979). The number of observations comes from 51 respondents who were surveyed twice. The variables age, work, and education are not reported, but their ICC estimates are equal to 1.

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