

The Rhino Poaching Crisis: A Market Analysis

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This paper started out as a response to the question:

“What has caused the recent upsurge in rhino poaching in South Africa?”

In writing my opinion on this, I decided to provide some background information, both technical and historical. And once I had provided my best answer, I felt inspired to add a few comments on possible solutions.

Before addressing the central question (in Part 2) of this paper, in Part 1 I discuss the factors driving rhino poaching and the market for rhino horn, including some essential aspects relating to the role of Asian tradition. I also discuss important technical concepts such as the meaning of market size and the persistence of demand and why these are relevant.

Part 2 begins with some historical context and describes what has happened in the rhino horn market over the decades leading up to the poaching spike. I then address the main question and consider the role played by the South African wildlife industry.

Part 3 considers the policy implications of what we know about the market. If our objective is to reduce wild rhino poaching, what are our best options?

At the end of the paper is a one page summary of suggested answers to the main question.

All the material in this paper can be supported by specific references, which I will provide on request.

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Introduction

Over the last five years we have seen a dramatic rise in the incidence of rhino poaching, notably in South Africa, custodian of the world's largest remaining populations. Previously secure populations are now being targeted by increasingly sophisticated and aggressive poaching operations, apparently backed by international organized crime syndicates. Why has this happened?

To answer this question, we must examine trends in the market for rhino horn, which is the main driver of poaching.

Since 1977, the world's governments have progressively attempted to shut down the rhino horn market globally via the mechanism of an international trade ban (under the banner of CITES, the UN Convention on International Trade in Endangered Species). Associated anti-trade measures have driven market activity underground, but not ended it. Consequently trade has become increasingly difficult to monitor and no credible, statistically significant data sets are available to allow for a rigorous market analysis. Nonetheless, I believe we have sufficient information to piece together a story that plausibly explains what has happened and why.

The following account is based on research I have conducted over the last 23 years covering all different economic aspects of rhino conservation, analysis of legal and illegal wildlife product markets (focussed on rhinos, but also covering other species such as tigers, elephants and bears), analysis of the effects of regulation and prohibition on a wide range of products, an investigation into cultural aspects of Asian demand for animal products, and any other avenues I considered relevant to this question.

Part 1: Background

What motivates rhino poaching and illegal trade?

We know that poachers are motivated by the prospect of profit. The greater the expected profit from poaching, the greater the incentive to poach. The same principles apply to illegal traders. Therefore, the extent of poaching and illegal trade will ultimately be determined both by the price that the end user is willing to pay and the expected costs of engaging in illegal activity.

What factors affect the cost of illegal activity? Poachers and smugglers tend to have short time horizons, so they will typically focus on potential immediate income but greatly discount the possibility of getting caught and incurring a penalty sometime in the future. It thus turns out that a high probability of detecting and intercepting poachers *before* they manage to reach and kill a rhino is the cost factor most likely to change the perception of expected profit. And if this probability is sufficiently low, even very severe penalties (including death) may be insufficient to deter poachers. Again, similar principles apply to smugglers and traders along the illegal supply chain. If the cumulative probability of being detected, arrested, convicted *and* punished is perceived to be low, even potentially harsh sentences will be disregarded. And experience from the rhino horn and many other illegal markets shows that the ultimate probability of punishment is indeed typically very low.

The message here is clear: measures to physically protect live rhinos act as a far better deterrent than after-the-fact law enforcement measures such as pursuing poachers, smugglers and illegal

traders. Unfortunately, effective physical protection of rhinos tends to be costly and subject to budget constraints. Under such constraints, the role of rhino horn end user prices becomes increasingly important as a motivating factor to address.

Prices provide the most significant indicator of what is happening in the market. They reflect information about scarcity. Prices that are high relative to other products (or relative to past prices) indicate that a product is relatively scarce. Low prices indicate that the product is relatively abundant. Rising prices indicate that a product is becoming increasingly scarce: they are a signal to society to either consume less or provide more of the product in question. Falling prices indicate that the product is becoming more abundant relative to the needs and wants of consumers.

So in the case of the illegal rhino horn market, when retail prices are rising we can typically expect poaching activity to increase if the expected costs of poaching remain unchanged. Similarly, falling retail prices should result in reduced poaching activity, due to the trickle-down effect of potentially lower short-term rewards.

Why do people want to buy rhino horn?

The modern desire of consumers to acquire rhino horn must be considered in a historical context. From archaeological evidence and historical records we know that humans hunted rhinos for food in many parts of the world: from hunter-gatherers in central Germany some 80,000 years ago up to early British and Dutch settlers in 19th Century South Africa, rhino meat appears to have been a dietary favourite. As rhinos were killed for meat, hunters developed uses for their other body parts; e.g., ornamental and medicinal. Successfully killing such a large and dangerous animal must have carried a certain amount of prestige in hunter-gatherer societies, so one can imagine how rhino products – especially the horn – would acquire an element of status and mystique.

Rhino horn has unique aesthetic properties which make it very desirable for ornamental use. Examples of such use include Yemini dagger handles and hand-carved bowls from Asia (especially China) and Europe. In the past, such ornaments were typically owned by the elite. Rhino horn also contains compounds that react with alkaloids and this led to rhino horn bowls being used by nobility to detect poisons in both Asia and Europe (there is evidence from records ranging between 5th century BC Greece and late 18th century France). This property also probably explains why rhino horn was considered to have healing powers, for which it was widely sought – again, not only in Asia, but also in Europe, where it was traded as ‘unicorn horn’.

The use of rhino horn in traditional Chinese medicine (TCM) can be traced back at least some 2,000 years from written records. Rhino horn was typically prescribed, in combination with certain herbs, for use as a ‘cold’ medicine to treat inflammatory disorders, fevers and other ailments associated with toxicity and bodily heat generation. As with other TCM practices, this application must have developed through trial and error, based on the experience of many successive generations (and initially via oral tradition), over a period possibly spanning thousands of years.

TCM employs a different approach to healing from conventional Western medicine, which is driven by a combination of science and the commercial interests of large pharmaceutical companies. TCM is based on belief and tradition rooted in ancestral experience, although recent research shows that the efficacy of many TCM practices is also supported by empirical evidence. Currently, TCM is

recognized in Asia as a legitimate field of medicine, with its own parallel (and rigorous) training and certification. TCM is also spreading beyond Asia, not only with the global Chinese Diaspora, but also increasingly within Western society, where practices such as acupuncture and the use of herbal preparations are growing in popularity.

Within the TCM community there appear to be different factions: some advocating the use of both animal and plant products, others only plants. Western environmental groups are keen to emphasize and align themselves with the latter faction. My own research reveals that the faction supporting the use of animal products remains a force to be reckoned with.

Rhino horn and tradition

In 1993, the People's Republic of China yielded to political pressure from the USA and banned the use of rhino and tiger products in TCM and had them removed from the official pharmacopeia. However, in 2007 China's State Forestry Association convened a workshop to consider re-opening a domestic legal trade in tiger products, supplied from captive breeding facilities, to meet medicinal demand for tiger bone. I attended this workshop and an associated study tour, along with various Chinese and international delegates. The Chinese delegation represented a range of interests including government, academia and the TCM industry; all those present appeared strongly in favour of re-establishing a legal supply source. Discussions with various Chinese delegates also revealed a firm belief that supplying markets with products obtained via captive breeding programs was the most sensible long-term solution for dealing with species threatened by unsustainable exploitation of wild populations.

At this workshop, one of the most interesting presentations provided extensive data from direct consumer surveys undertaken between 2004-2006 in 11 Chinese cities and 16 hospitals. The surveys posed questions to two different sample groups: the general public and ailing patients. Among the former, there was an 88% level of awareness that tiger bone was banned with 5.6% of respondents expressing an interest in acquiring some. However, among ailing patients there was 97.2% awareness of the ban and, despite this, 61.3% of respondents wished to acquire it. Also noteworthy was that among the general public the percentage of respondents eager to acquire tiger bone would drop to 0.26% if the ban were lifted: most of the 5.6% were keen to acquire bone to stockpile it for potential future use.

If this Chinese survey is credible and if its results can be used to gain some insight into demand for banned TCM animal products, then two issues stand out: 1) the majority of ailing patients place their perceived health needs ahead of complying with the ban and 2) the ban is likely to stimulate a degree of speculative stockpiling. I think it is reasonable to assume that these factors also apply to some degree in the rhino horn market because of similar medical imperatives. It is also worth noting that the retired head of the organization that conducted the tiger bone survey has been linked to the development of two rhino farming initiatives in southern China.

Within China, overt use and trade of rhino horn is not readily visible, despite the evidence of ongoing belief in its TCM healing properties. Since China's laws against the use of rhino horn are clear and quite strictly enforced, any ongoing use and trade is likely to be clandestine. In neighbouring Vietnam, however, laws are less clear and enforcement less rigorous. Recent research there shows

widespread continuing belief in and support of the use of rhino horn and other animal products in TCM, and also reveals that the principal purchasers are high-ranking members of society.

The ongoing interest in rhino horn in these countries is not just about 'medicine'. These are societies that continue to revere rhino horn for a complex cocktail of factors including aesthetic qualities, associations of status and elitism, deeply entrenched healing traditions and national and cultural pride. If we can start to grasp this complex and deeply-rooted Asian cultural affinity towards rhino horn – and move beyond misguided populist Western views of rhino horn being sought as an aphrodisiac or quack medicine based on a cancer-curing myth – we stand a far better chance of finding a sensible lasting solution to the problem of rhino poaching.

Market size and persistence

Conservationists and the general public, typically unfamiliar with economic principles, habitually express concern about the market for rhino horn being 'too big for the supply'. What they often fail to grasp is that markets have two dimensions and that both are variable. The one dimension represents the number of people who would be interested in acquiring the product and the amount of product they desire: this determines the *quantity* demanded. The other is the *price* they would be willing to pay to obtain it. These two dimensions are inter-dependent: at prices closest to zero the quantity demanded will be greatest; as prices increase, the quantity demanded will decline. This relationship between price and quantity can be illustrated graphically by a so-called 'demand curve'.

'Demand' is therefore a relationship between price and quantity and not a fixed number. To state, for example, that 'the demand for rhino horn is 10 tons per year' is in fact meaningless without specifying an associated price. The current amount of horn traded at the current price may indeed be 10 tons a year, but if the price were to change the amount of horn traded would most likely also change. The amount traded does not reflect 'demand' as such, but merely the quantity demanded at a specific price at a specified time.

There are two aspects of the rhino horn market that should be of concern to conservationists and are poorly understood: market size (as measured by total market value) and persistence of demand in the face of rising prices (as measured by so-called price elasticity).

When thinking about the 'demand' for rhino horn, it is more helpful to think about market size as measured by its value (average price multiplied by quantity traded). It is important to realize that a (hypothetical) market that trades only 10 tons of a rhino horn at an average price of \$1,000 per ton per year is effectively the same size as a market that trades 100 tons at only \$100 per ton per year. The value of both markets is \$10,000. Now if the average price in the first market had to rise to \$1,200 per ton per year, the first market would actually be larger in value (\$12,000) than the second, despite the fact that it trades only one tenth as much product. Since it is market profitability that drives poaching and illegal trade, this leaves us with the interesting paradox that a high value market moving smaller quantities could potentially pose more of a threat to an endangered species than a lower value market involving larger quantities.

The extent to which quantity demanded responds to changes in prices is also crucially important in understanding specific markets. In some instances consumers are very sensitive to changes in price. For example if the price of blue bouncing balls were to rise much against the price of green bouncing

balls, many consumers would simply switch to the latter as a suitable substitute. In such cases, demand is said to be 'price elastic'. However, if the price of drinking water in an isolated desert town suddenly rose, thirsty consumers with no alternatives would simply be forced to pay more. In this case demand is said to be 'price inelastic'. Price elasticity of demand of a product is determined by the ability and willingness of consumers to accept, and purchase, substitutes.

The concept of price elasticity can also be demonstrated by the example of patented versus generic pharmaceutical products. A pharmaceutical company can charge a high premium for a newly patented brand-name drug for which there are no available substitutes, because the demand for it at that time will be relatively inelastic. However, once the patent expires and less expensive generic drugs become available as substitutes, demand for the branded product becomes far more price elastic.

Oil, tobacco, alcohol and cannabis (marijuana) are all products that are relatively price inelastic. This is why governments are able to impose stiff taxes on the first three and why attempts to ban the latter two have failed. When demand for a product is price inelastic, banning consumption and trade can have a perverse effect: if consumers neither accept substitutes nor the moral legitimacy of such a ban, market size can actually increase rather than decrease. This is because the increase in price more than offsets any reduction in quantity demanded. Such markets then move into the underground economy ('black market').

If bans on such products continue to be aggressively enforced, market participants tend to engage with alternative enforcement structures: organized crime syndicates. In these product markets such syndicates gain monopoly power, providing them with a competitive economic advantage over the formal enforcement system, which they are able to undermine by using a combination of techniques that include intimidation and bribery to co-opt corrupt officials. In the case of endangered species this combination of factors (inelastic demand, increasingly concentrated organized illegal activity and growth in illegal market size) is lethal as it facilitates increased illegal harvesting effort.

Part 2: Understanding the rhino horn market, past and present

What is the size and nature of the rhino horn market? Is this a massive market with broad consumer appeal? Or is it a smaller niche market that simply persists in the face of rising prices? Or does it have variable elements of both, depending on price, timing and circumstance? Unfortunately, since the international market has been mostly illegal for more than three decades we cannot obtain reliable statistically-significant data that would decisively answer these questions. Nonetheless, the research work of Esmond Martin and others employed by organizations such as TRAFFIC provides us with some clues. Delving deep into this research reveals glimpses of a complex market subject to various fluctuations in time and space, and this is easily confusing. However, if we take a step back to look at broader trends and consider the overall market behaviour of rhino horn as a simple commodity over the last four decades, a much clearer picture emerges.

The evolving rhino horn market

Prior to the 1977 CITES ban, rhinos were extensively hunted in Africa, with much of their horn being exported to East Asia and the Middle East. In the 1960s and early 1970s the Yemeni market for ceremonial dagger handles accounted for much of the demand for horn from East Africa. Yemen

benefitted from a spill-over effect from the Saudi oil economy. With sharply rising disposable incomes, Yemeni men increasingly sought rhino horn dagger handles, which they regarded as a status symbol. This in turn led to a surge of rhino poaching in East African countries: Ethiopia, Somalia, Sudan and Kenya. Concern over this poaching surge at least partially motivated the 1977 CITES ban.

Most consumer countries did not immediately accede to CITES, thereby allowing for some collection of credible price data following the initial ban. These data show that the 1977 ban was followed by a sharp increase in consumer prices for rhino horn in Asian markets. Official import data from at least three countries (Japan, Taiwan and South Korea) show a significant price hike in subsequent years. Alongside Yemeni data we see recorded pre-ban wholesale values for rhino horn ranging from US\$17 to \$75 per kilogram, but by 1980 they varied between \$477 and \$764 per kilogram.

The 1977 ban had no discernible positive effect on poaching. Africa's black rhino population continued to be decimated, with estimated numbers dropping from about 12,750 in 1981 to some 2,550 by 1993. During this time populations in Tanzania, Zimbabwe and Zambia were severely reduced – in the latter instance, to complete extinction. By 1991 an undercover survey in Taiwan revealed that average black market wholesale price for African horn was about \$3,075 per kilogram (and Asian horn about \$60,025 per kilogram). In Yemen the early 1990s wholesale price (of African horn) was allegedly in the region of \$1,200 per kilogram.

The mid 1990s represented a significant turning point for rhinos. In mid-1994 civil war broke out in Yemen, heavily impacting the local economy. Several East Asian states yielded to US political pressure and banned the domestic use of rhino horn in manufactured medicines. In South Korea, stricter measures were initially followed by a doubling of the retail price and sales of horn products appeared to start declining. Poaching levels seemed to stabilize, thereby arresting the decline of Africa's black rhino population.

By this time 90 percent of the remaining African rhino populations survived in three countries: South Africa, Namibia and Zimbabwe. These populations all enjoyed greater levels of field protection than the previously decimated populations. With more effective institutional regimes and concomitant higher levels of funding for protection, Southern African conservation agencies and landowners were far better placed to protect their rhinos than their northern neighbours. An initial rise in poaching incidences within South Africa in the early 1990s was met with decisive resistance and successfully contained.

From the mid 1990s until 2007, reported poaching levels remained negligible. I have little information on what was happening in consumer markets during this time other than a suggestion of market activity in Vietnam from 1999. 2003 was the first year in which Vietnamese nationals visited South Africa for the purposes of white rhino trophy hunting (which provides the only legal way to commercially export horn under CITES). During the next few years the number of visiting Vietnamese 'hunters' rose sharply. Once it became apparent that Vietnamese nationals were essentially interested in acquiring horn, the South African government reacted by imposing various restrictive measures. These included far stricter permitting requirements for handling rhinos and their horn, a limit on the number of trophies one person could export and a moratorium on the domestic trade in rhino horn (which had been legal until that point). The imposition of these measures was swiftly followed by a sharp rise in poaching incidences that has continued ever since.

Subsequent research shows that the market price for rhino horn in Vietnam has reached extraordinary levels – there are suggestions that, although highly variable, the average retail price in 2011 appeared to be in the region of \$65,000 per kilogram. This high price has no doubt encouraged a far more concerted and sophisticated organized crime element to enter the rhino horn market and this is reflected in the tenacity and methods used by the current illegal suppliers.

What exactly caused the recent poaching spike?

So what happened between the mid 1990s and 2007? Why the sudden new apparent surge in demand? Tom Milliken from TRAFFIC has addressed this issue and implies that the ban was working by the mid 1990s but that this success was undermined after someone started rumours of rhino horn acting as an effective cancer cure in Vietnam, thereby creating an entirely new market. However, more recent evidence suggests that rhino horn is also used for other medicinal purposes in Vietnam – sometimes as trivial as a hangover cure – and that horns are also given as gifts. And a recent shipment of horn intercepted in Hong Kong was apparently destined for China – Milliken speculates that it may have been to supply the carving industry.

My own view is that there is nothing especially ‘new’ or remarkable about the recent market activity. All that has happened is a realignment of market supply and demand factors. Rhino horn remains a desirable product in Southeast and East Asian markets for the same complex cocktail of cultural reasons as always. It is still used to treat the same set of ailments related to toxicity, inflammation and bodily heat generation: cancer and hangovers are mere variations of this theme. And it remains a prestige item.

That Vietnam has emerged as a substantial market is also not that surprising. In the early 1990s it did not yet feature as significant and was thus ignored when Western countries applied political pressure to shut down domestic Asian markets. However, since then it has experienced rapid economic growth and one would expect locals to seek out new status-related products with their increased levels of disposable income. With its less stringent regulatory environment and long border with China, Vietnam may have initially served as a useful entrepôt for horn ultimately destined for its neighbour. If so, this could easily have provided the impetus for a domestic Vietnamese market: Experience from other markets such as illegal drugs shows that entrepôts frequently develop into new end user markets as local traders seek new easily accessible outlets for the products they are handling. Chinese populations in Vietnam would already have had an affinity for TCM and the consumption of animal products, representing an immediately accessible and lucrative market.

Some commentators have blamed South Africans in the hunting and game ranching industry for ‘fuelling demand’ for rhino horn by playing a role in the illegal supply chain. I disagree with this view, which I believe to be a confusion of cause and effect. In fact, it is more likely that the South African game ranching industry played a role in delaying an inevitable resurgence of poaching activity, driven by Asian consumer demand (I return to this point below).

If we examine the global market for rhino horn as a single commodity (and ignore the specific changes in local markets) we see a clear overall trend between 1977 and today: a dramatic increase in market price. The message here is clear: rhino horn is a commodity with increasing scarcity value. Growth in market demand threatens to outpace the potential rate of supply under a trade ban

regime that appears unlikely to change, so market prices should continue to rise. This makes rhino horn worthy of the attention of entrepreneurs who engage in trade and speculative investment.

During the last 35 years, price changes have not been consistent. Sharp increases immediately following the 1977 ban appeared to have steadied by the early 1990s. It is most likely that the 1977 ban initiated a market panic in East Asian markets – prompting a speculative scramble to accumulate stockpiles.

Stronger domestic measures in key consumer countries in the early 1990s probably succeeded in suppressing consumer demand to some extent, leading to a slow-down in consumption. This may have had the reverse effect of the initial ban, prompting some speculators to exit the market.

Anyone who has followed the gyrations of stock or commodity markets will know that markets do not move smoothly and predictably – they often move erratically and/or suddenly. They habitually over-react to good or bad news, an effect that is enhanced by the actions of speculators. Rapidly rising prices can induce speculative buying and stockpiling. Rapidly falling prices often result in panic selling and dumping. In dispersed black markets, where price information is not readily available, local prices may take longer than normal to assimilate market information. Consequently market corrections may be even more severe than in legal markets and arbitrage opportunities greater.

A noteworthy incident from the early 1990s suggests a reason for a temporary lull in market activity and resultant decline in poaching activity. In 1993, the Environmental Investigation Agency (EIA) initiated a successful sting operation in southern China. According to the EIA, a Taiwan-based syndicate had bought up most of the horn available in Taiwan, Japan and South Korea before selling it to a Chinese syndicate. The Chinese syndicate then allegedly offered to sell a ton of horn to the EIA undercover agents. The extent of this activity – and the fact that the Chinese syndicate would be sufficiently reckless to offer such a large consignment to an unknown buyer – suggests a degree of market euphoria. This is analogous to your taxi driver giving you stock market tips – you know it's time to get out of the market!

Following the EIA exposé and simultaneous political pressure from the USA and other CITES parties, China and Taiwan enacted domestic bans on rhino horn trade. By 1995, the EIA concluded, China's market had 'closed'. However, it is unlikely that the market really did 'close', given the clear re-emergence of consumer demand a decade later at significantly higher prices. A more plausible explanation is that the market needed time to readjust, perhaps absorb some excess existing stockpiles and then develop new supply channels, given that most of the 'easy pickings' (relatively poorly protected rhino populations) had already been harvested to extinction. Stockpiles held by (non-compliant) traditional doctors may have also played a role in delaying the resumption of poaching: Since rhino horn is often administered by way of shaving miniscule portions to add to medicine balls, a single doctor's horn could potentially last for around a decade. If individual doctors had taken care to stock up on horn prior to the domestic bans, some may only have started to seek replenishing their source in the early to mid 2000s.

Criminals typically try to avoid detection and will also seek out opportunities to achieve their means without overtly breaking the law. It therefore makes sense that underground Asian entrepreneurs would have targeted the private game ranching sector in South Africa as the easiest means to obtain new supplies of horn without having to instigate poaching. I do not know exactly when this process

began, but an insider has suggested that it already started 'in the 1990s', with local buyers in South Africa offering to purchase accumulated privately held stocks as well as horn obtained by vets from off-cuts during translocations. From 2003, the early Vietnamese 'trophy hunting' clients obviously made their intentions clear to selected local hunters and game ranchers and gradually established ongoing business relationships with them.

With the prospect of significant new sources of income it is hardly surprising that some members of the South African wildlife industry became willing participants in the illegal supply chain. However it is most unlikely that these South Africans initiated the development of a 'new' market in Vietnam. It is far more plausible that they were approached by entrepreneurial Asian traders, who were in turn motivated by the prospect of selling horn to end users. The claim that either suppliers or traders 'fuel demand' is dubious. Conservation economist Brendan Moyle recently analysed data from the alligator product market and found no evidence to support such causality. Perhaps one can make a case for this in markets for highly addictive substances, but in most normal markets demand is driven by the needs, wants and spending power of consumers, not by producers or traders.

The fact that poaching levels started to rise dramatically after the imposition of restrictions on domestic trade and Vietnamese hunts suggests that the South African suppliers were not only not 'fuelling demand' but had probably been acting as a buffer against potential poaching activity. By providing horn from non-lethal sources as well as technically legal income-generating hunts, they were playing a dual role of meeting market demand while continuing to generate financial returns that would ultimately continue to provide economic support for the local wildlife industry. Were it not for the role of the South African private sector, poaching activity in other private reserves and state parks such as Kruger may well have started far sooner than it did.

To conclude: the recent poaching spike most likely signalled the full re-emergence of a commodity market (for rhino horn) that had been temporarily choked in the mid 1990s by a combination of factors. Civil war in Yemen and domestic bans in key East Asian markets had depressed demand and discouraged trade. Traders and speculators therefore needed to redistribute accumulated stockpiles and since most easily accessible wild rhino stocks had been depleted, further poaching at that time was not economically justified.

However, within a decade, stockpiles were probably dwindling and relative demand increasing. Rising affluence in countries such as Vietnam meant that consumers could now afford to pay higher prices for horn. Entrepreneurs, noting the opportunity, sought fresh non-lethal supply sources and found them within the South African game ranching industry. Once the South African government became aware of this and imposed measures to restrict supply, the market responded aggressively. Prices had now risen sufficiently – and demand was sufficiently inelastic – to justify spending on more intensified illegal efforts to obtain horn; efforts that increasingly included organized crime syndicates and necessitated lethal methods. And given the likelihood of demand persisting in the face of a restricted supply, speculators may have once again entered the market, stockpiling horn in anticipation of further future price increases and opportunities for profit.

At this time of writing the poaching surge shows little sign of abating and so do the market forces that are driving it.

Part 3: Implications for policy

Is the demand for rhino horn price-inelastic and what are the implications?

The economist Gary Becker won a Nobel prize for his pioneering work on behavioural economics and understanding incentives for crime (his approach also underpins the recently popular *Freakonomics* books). In an important 2006 journal article, he and two co-authors (Kevin Murphy and Michael Grossman) explain why governments should not ban trade and consumption of products for which demand (and/or supply) is price-inelastic. They argue that such bans impose massive cost burdens on society and may even be unenforceable (due to the illegal market expansion effect and creation of monopoly power for criminal cartels discussed above). Instead, they propose that governments should rather legalize and tax such products (although in the case of rhino horn, heavy taxation would not be advisable as it would maintain artificially high prices, which would tend to encourage further poaching).

The cases of alcohol Prohibition and the failed 'War on Drugs' provide strong empirical support for this argument. Does this also apply to the rhino horn market?

Price elasticity may vary within market niches and over time. If we look at the behaviour of the rhino horn market over the last 35 years we see strong evidence of inelastic demand within certain niche markets at specific times, i.e., rapid increases in price and/or poaching incidents.

Why would demand for rhino horn be inelastic? In other words, why would consumers be relatively insensitive to increases in price? There are three reasons why this may be so. First, when horn is used as medicine, a single horn provides a very high number of tiny doses. This means that any price increases are shared over a large number of consumers (and numerous transactions). So the burdens of price increases are greatly dissipated and therefore small in absolute terms to each individual (even if large in relative terms). Second, it seems that rhino horn is regarded by many as the most effective medicine of its kind, so will be selected in cases where people are desperate (e.g. for severe cases of fever, cancer, etc – 'life and death' health matters). In such instances people are understandably relatively insensitive to price increases (and will disregard legal restrictions they do not accept). Third, aspects of status and cultural pride are also highly significant. Rhino horn is sought by the elite (both as an ornament and a medicine) who typically have high levels of disposable income and can therefore afford to disregard high prices – and will do so for 'must have' status-symbol products.

There is good reason to believe that demand for rhino horn remains price-inelastic within important consumer markets such as traditional elite Chinese and Vietnamese societies and that it may continue to do so in the near future. With the high likelihood of continued rapid economic growth in these countries – and continually rising levels of disposable income – this is cause for concern.

Although we do not have accurate figures for current market size, a plausible estimate of 2½ tons of horn entering the market during 2011 with an average retail value of \$65,000 per kilogram represents a total value of \$162.5 million. Even if, hypothetically, the amount of horn entering the market two decades earlier was 5 tons a year, at retail prices of \$6,000 per kilogram this would represent a market value of only \$30 million. Although the current market supply likely involves far less horn by volume, it is most certainly a larger market by value, allowing for greater expenditure

on efforts to acquire horn using more sophisticated techniques and engaging the services of organized crime syndicates. And if consumer spending power increases, and the supply of rhino horn does not, the rhino horn market will most likely continue to grow in value.

Evaluating options: increased enforcement

Can the apparent success of the mid 1990s be repeated with increased enforcement effort? Rhino range states, owners and custodians face serious budget constraints. Field protection measures such as anti-poaching patrols, dehorning and horn poisoning are all costly and the costs are ongoing. However, these measures are likely to yield more success than law enforcement measures that target subsequent levels in the illegal supply chain – such efforts are time-consuming and unlikely to ever cause more than temporary market disruptions. Measures such as increasing penalties (fines and prison sentences) may also backfire as judges typically demand better evidence to successfully prosecute more serious cases. The current case backlog and low prosecution rate in South Africa typifies the limitations of this approach.

On the consumer side, the Vietnamese market appears to present a serious enforcement challenge, given the alleged ubiquitous involvement of high-ranking officials. However, even if global political pressure eventually succeeds in forcing Vietnam to adopt and enforce far tighter domestic regulations, would this be sufficient to prevent further illegal trade and poaching? The persistence of TCM as a deeply embedded healing culture, coupled with the apparent price-inelastic demand characteristics of rhino horn discussed above, render this unlikely.

In assessing the potential of enforcement to change such a culture, consider an analogy: the psychedelic community in Western countries. Psychedelic drugs such as cannabis, psilocybin mushrooms, ayahuasca, mescaline, ibogaine, LSD and MDMA are used to varying degrees for medicinal, spiritual and recreational purposes. With limited exceptions all are illegal to consume or trade worldwide, yet there is a substantial underground community and culture that is dedicated to using these substances, with various distinct associated aesthetics and ritualistic practices. At the core of this community is a group of psychotherapists and their associates who firmly believe that psychedelics have significant therapeutic value in a range of applications.

This core group of ‘believers’ is deeply committed to convincing the world’s governments that it is time to re-evaluate the prohibition approach and accept that responsibly-administered psychedelics can play a positive role in society, despite some fierce political and mainstream resistance. Other members of the community work through well-established and trusted underground networks to ensure the continued supply of psychedelics to those who want to use them. And consumer demand for some of these drugs, notably cannabis, also turns out to be relatively price inelastic. Anyone familiar with this culture will acknowledge that it is thriving underground and will continue to successfully resist attempts through law enforcement to prevent the sale, distribution and consumption of psychedelic substances.

Rhino horn and drug markets differ insofar as the former allegedly harms the supply source (rhinos) and the latter the consumer, but in both cases this is largely disregarded by dedicated market participants. Powerful market forces – and the influence of a core group of believers – outweigh such concerns. Consequently, enforcement efforts may never succeed without a radical and widespread change in consumer beliefs and attitudes.

Evaluating options: ‘demand reduction’

Two decades ago, when I first started working on rhino horn trade policy, conventional wisdom held that demand for TCM would decline with increasing affluence and the gradual Westernisation of Asian society. However, this trend has not materialised. As China, Vietnam and other neighbouring countries increasingly flex their economic muscles, the acceptance and adoption of Western culture is only partial – other aspects of Asian culture continue to be embraced if not actively promoted. And increasing levels of affluence mean that Asians now have more disposable income to direct toward satisfying their own wants, some of which may be derived more from their own cultural traditions than from outright adoption of Western tastes.

Some Western conservation NGOs now seem to believe that the only solution is to (maintain the ban and) ‘educate’ or otherwise convince Asian consumers that the use of rhino horn is inappropriate because 1) it cannot be scientifically proven to work as medicine and 2) it is unethical to poach or farm rhinos. WildAid is such an organisation that has allegedly had some success in using Asian celebrities to champion hard-hitting campaigns against the use of products such as shark-fin soup. Can this success be replicated for rhinos?

There are three reasons why this approach may not work to prevent the current poaching onslaught. The first is that it is predicated on the conviction that rhino horn has no medicinal value. However, this is not a universally accepted fact – far from it. Just because Western reductionist science has not (yet) established a healing effect for rhino horn does not negate the deeply held beliefs and rich ancestral experience of an Eastern culture that adopts a more ‘systems-based’ approach to medicine. Even in Western society, naturopathic and alternative approaches to medicine and healing enjoy substantial (and probably increasing) public support. The ‘rhino horn is not medicine’ dictum will not be universally accepted.

Second, it is disingenuous to argue that the use of rhino horn medicine necessarily causes poaching when horn can be obtained by non-lethal means. The core group of TCM adherents already know this, which is why they are exploring the option of captive breeding and shaving horn off live animals. Furthermore, ethical arguments that live rhinos have the ‘right’ to retain their full horns do not carry much weight in a world where animals such as sheep or wild vicuñas are habitually sheared for their wool. Many, if not most, Asian consumers will most likely place their own ‘rights’ to acquire medicines ahead of those of rhinos.

Third, a general publicity campaign may have an impact on marginal (fringe) consumers, but is unlikely to reach those actually responsible for paying the extraordinary high prices that are driving the poaching problem. Those people are determined to acquire horn for reasons based on deeply held convictions about medicinal value or niche cultural status and may well be dismissive if not defiant of mainstream Western-influenced opinion (as with the example of the Western psychedelic community discussed above).

The ‘demand reduction’ approach assumes that there is ‘too much’ demand for rhino horn, that this needs to be somehow ‘reduced in volume’ and that this might save the rhino. However, the challenge for rhino conservation may not be that there are too many potential consumers, but rather the existence of a relatively small number of really persistent ones, oblivious to legality and ethical arguments, and willing to pay increasingly high prices to acquire rhino horn. In the case of

the latter scenario a different approach might be far more effective: providing an appropriately regulated supply to the market.

Evaluating options: legal trade

Establishing an appropriately structured legal trading regime for rhino horn may provide a more effective and lasting solution to the rhino poaching problem for three reasons:

First, it would bring trade out into the open. Market prices would be visible, thereby allowing for continued and accurate monitoring of ongoing consumer demand relative to supply. This would enable governments, conservationists and rhino owners to be far more immediately responsive to changing market conditions. It would also enable them to identify and engage directly with consumers.

Second, by providing a significantly increased and potentially ongoing source of supply, the incentives for speculative stockpiling by criminals would be greatly reduced, if not altogether removed. Furthermore, by meeting the demand at the highly inelastic and persistent 'top end' of the market, the price of horn would almost certainly drop, perhaps quite drastically, thereby reducing the profitability of the illegal market and concomitant incentives for poaching and illegal trade.

Third, by becoming active market participants, legal suppliers of rhino horn gain a new source of income, which they are able to re-invest in improved protection and breeding. Legal owners and custodians also have a significant competitive advantage over poachers and illegal suppliers: defensible legal rights and, in most cases, privileged physical access to and control of their stocks. If necessary, they can even dehorn their animals.

This combination of three factors would allow the legal owners and custodians of rhinos to acquire control of most of the rhino horn supply simply through market means. In value terms, the illegal market size would almost certainly be greatly reduced.

There are two main arguments against the legal trade option. The first is a hard-line ethical stance against any form of human interference with or commercial exploitation of rhinos on the grounds of them being 'wild' animals. This stance regards any form of rhino 'farming' as abhorrent, an attitude that typically extends to the dehorning of live, free-ranging animals. Increasingly, this aversion also extends towards trophy hunting.

A full discussion of this stance is beyond the scope of this paper, but a few points are worth mentioning. First, relatively few unmanaged or 'wild' rhino populations remain – most are at least subjected to the soft exploitation of tourist viewing as well as frequent veterinary interventions. Second, such ethical stances are neither objective nor absolute – they are subjective and relative. If the entire human population does not agree with this hard-line stance, then we face a problem: to enforce a ban requires resources and implies that the rights of certain humans (to health, to property or even to life) may be compromised to protect the so-called 'rights' of rhinos. Third, this stance is ultimately self-defeating if it results in the type of brutal treatment of rhinos that we are observing simply because a compromise position is not accepted.

The empirical consequence of the hard line of reasoning is evident – and morally questionable: we see scores of dead and (sometimes still live) mutilated rhinos, dead poachers, dead field guards and massive social costs of enforcement, diverting both private and public resources from other conservation and economic priorities (including key areas of public spending such as general policing, health-care and housing). In reality, the hard-line stance causes far more indirect harm to both rhinos and humans than is necessary, and is a luxury affordable only to the elite.

The second argument against legal trade is grounded in a concern that, if the ban were to be lifted, market size would grow significantly – to an extent even greater than can be provided by legal suppliers. This scenario, whilst not completely impossible, is highly unlikely. For poaching to actually increase after lifting a ban, this would necessitate a dramatic outward shift of the demand curve and/or a far more competitive cost function for illegal suppliers.

Addressing the second issue first, we know that illegal suppliers most likely do not enjoy a competitive cost function. Rhino poaching and illegal trade is an expensive and risky business, currently justified only by extraordinarily high consumer retail prices and the protective monopoly power of criminal cartels. From the mid 1990s until 2007 it was mostly not a viable form of enterprise. Would the illegal suppliers' costs be reduced or raised under a legal trading regime? This would depend on how the legal market was set up, but technological advances such as DNA fingerprinting allow for the mitigation of so-called 'laundering' of illegal stocks, and legal suppliers would have strong incentives to keep illegal supplies out of their market.

How likely is a dramatic outward shift in the demand curve? First, we need to distinguish between short-term effects and long-term effects. In the short-term, the demand curve would shift outward after a ban was lifted if previously law-abiding consumers decided to enter the market. This is known as the 'reverse stigma effect' and is often cited as a reason to maintain prohibitions. However, in examples of alcohol and drug markets where prohibitions were lifted, fears of a reverse stigma effect turned out to be exaggerated. The least law-abiding consumers under prohibition are also typically the least price-sensitive. These consumers will still most likely bid the highest prices for products in a legal market, with previously law-abiding consumers likely only willing to pay lower prices. With the repeal of prohibition prices are far more likely to fall than increase.

In the longer term two other factors could lead to an outward shift in the demand curve: rising levels of income and aggressive product marketing by suppliers. Rising income levels are a factor irrespective of whether the market is legal or not. Aggressive product marketing is probably easier in a legal market, but can also be addressed by measures that are far easier to establish in that environment than in an underground market. And any increases in demand are far more readily observed and addressed in a legal market.

Conclusion

The law enforcement approach decreed through CITES, and progressively implemented by various nations over the last 35 years, has failed to protect rhinos from the threat of poaching. This approach has severe limitations in dealing with certain types of markets: those for which demand is persistent / price-inelastic. Experience from other product markets with similar demand characteristics (e.g. alcohol, drugs) suggests that in such cases bans may not only be ineffective, but even counterproductive.

In wildlife product markets, where the objective is to save species *in situ*, protecting populations at source is a sensible policy. Intercepting products destined for the market after harvest (e.g., once a rhino is already dead) is not. In illegal drug markets the destruction of confiscated stocks makes theoretical sense because drug prohibition is intended to protect consumers. In illegal wildlife markets, if consumer demand is left unaffected, the destruction of confiscated stocks simply increases the scarcity value of the resource, driving up the price and ultimately creating incentives for further illegal harvesting. The same principle applies to all other measures that successfully restrict the supply to the market. The recent surge in South African rhino poaching following tighter regulation almost certainly provides evidence of this.

Is improved enforcement possible? This requires 'greater political will', which is a euphemism for increased government spending. But additional spending is no guarantee for success in this type of market as demonstrated by the USA's continuing failure to win the 'War on Drugs' despite a 2011 federal budget allocation of more than \$23 billion. Can governments actually afford the necessary spending to win the war on rhino poaching through enforcement alone?

If it turns out that the allocated budget for enforcement spending is insufficient and simply cannot be stretched any further, then we must consider other options to combat rhino poaching. The only other potential options are to either somehow reduce the demand or to meet it with a legal supply. Although I have my personal doubts about the potential efficacy of proposed demand reduction measures for this particular case, both these options deserve further scrutiny to assess their potential effectiveness and associated economic costs and benefits.

To solve the problem of rhino poaching, all those concerned with saving rhinos should engage in open and honest dialogue. African and Asian rhino owners and custodians, global conservation NGOs and Asian consumers of rhino products should all ultimately share the same objective: to prevent the extinction of wild rhino populations. Are these different groups capable of setting aside their differences and forging a mutually acceptable and sustainable solution?

The recent poaching spike: a summary

The recent surge in rhino poaching is most likely due to a combination of factors, and probably amounts to an effective realignment of the rhino horn market following a previous disruption in the early 1990s. We can summarize the factors as follows...

On the supply side:

By the early 1990s the 'easy pickings' were gone: all surviving rhino populations were far less accessible or more effectively protected than before and therefore mostly uneconomical for poachers to pursue.

At some stage during the late 1990s / early 2000s members of the South African wildlife industry started providing non-lethal supplies of horn concurrent with or followed by legal trophy exports from 'pseudo' trophy hunts, thereby obviating the need to poach.

Tighter regulation of the South African rhino market, including the domestic moratorium on horn sales and restrictions on pseudo hunts, caused a sudden supply constriction during 2008, most likely resulting in a price shock (increase) and abruptly creating a strong new incentive for poaching.

On the demand side:

A possibly overheated Asian market in the early 1990s was vulnerable to the effects of domestic bans in consumer countries such as China and Taiwan. Speculators may have offloaded stockpiles, thereby suppressing prices.

Civil war in Yemen in early 1994 disrupted that country's domestic economy and rhino horn market.

Following the domestic Asian bans, markets needed time to establish new underground supply channels. Remaining non-compliant TCM doctors may also have initially drawn on previously accumulated stockpiles.

Rising disposable incomes in Vietnam and possibly other consumer markets during the early 2000s led to price increases that stimulated searches for new supplies of horn – as evidenced by the Vietnamese attempts to acquire horn through pseudo hunts.

A price shock induced by supply restrictions in the late 2000s may have stimulated new secondary speculative investment demand for rhino horn, further exacerbating the price effect.