Vanilla Options - The Effect of Commodity Price Risk on Madagascan Vanilla Farmers

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Bio-sketch and Photo Page

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Title of Submission: Vanilla Options - The Effect of Commodity Price Risk on Madagascan Vanilla Farmers

I am a candidate for the degree: MBA

Bio-sketch

Mark Porter is an MBA student at Cambridge Judge Business School. He holds a Masters degree in Geophysics from Imperial College.

Prior to commencing MBA studies, Mark worked for six years as a seismic processing geophysicist at a multinational oilfield services firm in various international locations both on land and offshore. He has experience with project and technical risk in the upstream oil and gas industry and broader interests in operational risk across the entire energy sector.

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Introduction

Commodity risk refers to the risk to an organisation or entity associated with changes in the price of a given commodity due to market externalities outside their control. Producers and their customers are both affected by commodity risk, though typically with opposing fortunes. If the price of a given commodity falls, so the theory goes, a farmer risks being unable to recoup costs. Conversely, should prices rise, customers risk exposure to financial losses through higher expenses. The uncertain but opposing nature of commodities risk to producers and their customers has given rise to a significant number of hedging strategies designed to mitigate these risks, from futures contracts, where an agreed future sale price is set in advance, to so called vanilla options, whereby the value of a financial derivative is used to offset a potential price change. However, not all commodities behave equally, and not all actors have access to financial brokers. Consider the vanilla cultivation industry. A highly prized spice used in a wide variety of luxury confectionary products, global demand for plant based vanilla extract has surged in recent years (Bomgardner, 2016). Cultivators in Madagascar, the world's largest producer of the most sought-after variety, should therefore have been a primary beneficiary. Instead the industry has been plunged into crisis. In 2017, tropical cyclone Enawo ravaged the country, wreaking substantial destruction in the North East vanilla growing heartlands and causing prices to soar to highs of $600 per ounce (Pilling, 2018). Even those farmers who managed to save their crop were not able to capitalise, instead becoming prey for violent gangs hunting for a crop now more valuable than silver (figure 1, from moneyweek.com (2018)). The risks associated with vanilla cultivation were arguably higher than ever.

This report analyses the Madagascan vanilla cultivation industry from a risk perspective. It describes the environmental and economic setting of vanilla cultivation in Madagascar, before discussing its inclement risks. First, the external, macro-factors of natural hazard risk on Madagascan vanilla are examined and an assessment made as to whether, given a certain level of common knowledge surrounding these hazards, combined with challenges specific to vanilla agriculture, the decision by farmers to cultivate vanilla at the expense of other subsistence crops constitutes a measured choice or reckless act. The report then discusses how the ensuing price surge following cyclone Enawo created new risk factors in the form of poor-quality product and community violence, upending a simplistic model of

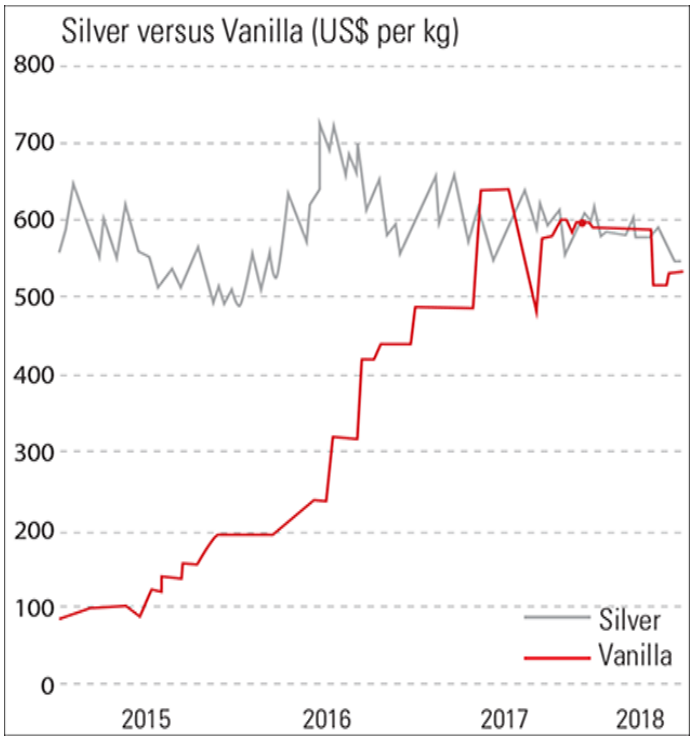

Figure 1 Vanilla price compared with silver (from Money week, 2018)

commodities risk by placing both producers and their customers on the same side. Finally, the paper asks whether this alignment of risk provides a path forward, by providing incentives for both farmers and buyers to work together toward a more sustainable future.

A brief overview of Madagascan vanilla: Origins, cultivation and commerce

It is perhaps ironic that for an island where an estimated 89% of all plant species are unique and endemic (WWF, 2018), vanilla, one of the key components of the Madagascan economy, is a non-native species. Originally from Mexico, vanilla arrived in Madagascar during the early 19th Century with French entrepreneurs who sought to grow the plant commercially (Correll, 1953). However, all initial attempts at cultivation failed due to the lack of pollinating wildlife resident in Madagascar and the fact that flowers remain open for only a single day each year (Correll, 1953). It was not until 1841 when Edmond Albius, originally a slave born on the neighbouring isle of Reunion, developed a method of hand pollination that vanilla cultivation began in earnest (Cameron, 2012). Today, the vast majority of plants are still propagated using similar techniques by individual small hold farmers (Bomgardner, 2016), a highly labour-intensive enterprise. In addition to the fickleness of its reproductive cycle, cultivation of vanilla plants is time-consuming. Vines take around three years to mature into fruit bearing plants, with pods harvested around nine months after pollination and then undergoing a further five month curing period prior to obtaining vanilla extract (Correll, 1953).

Despite, or perhaps because of these challenges plant-based vanilla is highly prized. Although synthetic alternatives are widely available, created from a range of base materials and account for 99% of all global production (Gallage and Møller, 2018), the naturally derived extract commands a significant price premium. The value of the spice has been further increased by a surge in demand after announcements from multi-national corporations such as Nestle, in 2015, of aims to increase the use of natural ingredients in products and flavourings in response to changing consumer attitudes (Bomgardner, 2016). Madagascar accounted for 62% of all natural based vanilla supplied globally in 2016 (*OEC - Vanilla (HS92: 0905) Product Trade, Exporters and Importers*, no date) (see figure 2a). The crop therefore forms an important part of the national economy, delivering $532 million, or 19% of trade revenues to the country in 2016 (*OEC - Madagascar (MDG) Exports, Imports, and Trade Partners*, no date) (figure 2b).

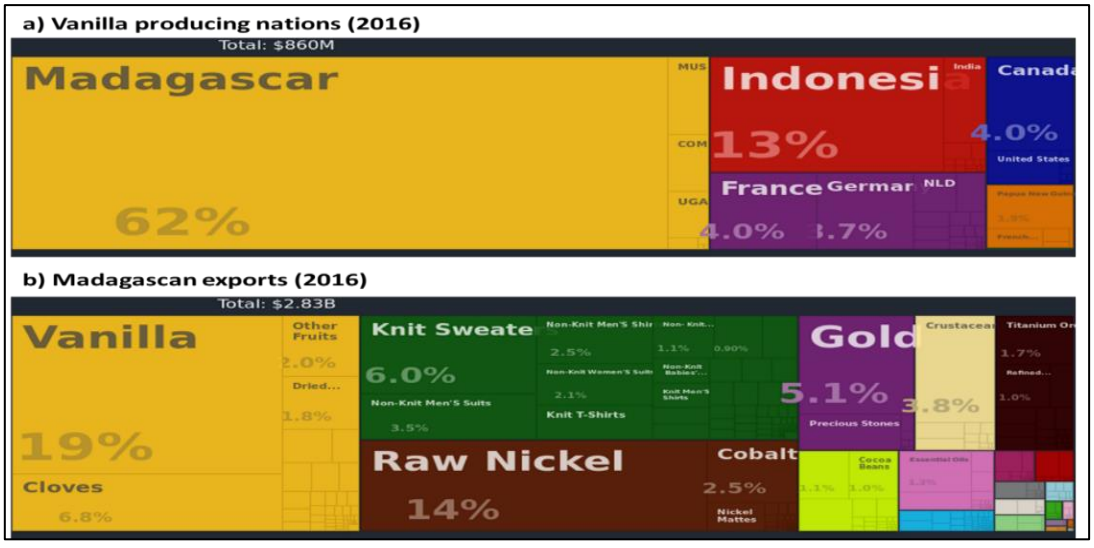

Figure 2 a) Major natural vanilla producing nations (2016) & b) Madagascan trade revenues (2016). Information and graphics courtesy of OEC: The Observatory of Economic Complexity.

As a developing nation, such trade is vital to Madagascar. The country ranks 218th for purchasing power parity adjusted GDP per capita (CIA, 2018). Agriculture, including vanilla cultivation, accounts for around 80% of employment within the country (World Bank Group, 2015), much of it within the informal sector. Infrastructure in the country is poor, with Madagascar's road density per capita being one of the lowest in the world (World Bank Group, 2015) and, partly as a consequence, there is significant disconnection between the informal, rural agricultural dominated economy and the more formalised urban sectors (World Bank Group, 2015). Given such circumstances, it is understandable that farmers may wish to cultivate vanilla as a potentially valuable cash crop. As will be seen, however, the risks of such a strategy should not be underestimated.

Seeking risk in the eye of the storm

As an island in the western Indian Ocean, cyclones are a fact of life on Madagascar. The world bank estimates that the country is affected by three natural disasters per year (World Bank, 2018). Cyclone Enawo, which made landfall in March 2017 off the North East coast, is estimated to have affected more than 430,000 people, over half of whom lived in the coastal Sava region, a vanilla growing heartland (figure 3, from Probst *et al.*, 2017). Clearly, the risks created by such natural disasters constitute external events far outside the influence and control of the small hold farmers who grow the bulk of vanilla crops. However, although cyclones may be unpredictable, their impacts are certainly not unforeseeable; farmers may not know when exactly a disaster may strike, but it would be naïve to conclude they are unaware of its possibility. Mikes and Kaplan (2012) note that risk creation can be voluntary when it is accepted as an inherent part of business operations. This is as true for Madagascan vanilla small holders as it is for multi-national corporations. By choosing to use land to cultivate vanilla, a cash crop, over lower value but more subsistence forms of agriculture such as cereals cultivation, farmers are voluntarily creating risk in search of higher profits. However, the risks for Madagascan vanilla growers are far higher than their business executive counterparts; should disaster strike, a farmer and their family face not bankruptcy, but starvation and extreme poverty. These risks are exacerbated further by the long cultivation cycle of the vanilla plant, taking up to four years from planting to maturation and pod growth (from which the spice is extracted) (Correll, 1953). Over this period of time Madagascar will face an average of 12 disaster events, any one of which has the potential to wipe out four years' worth of work and investment, leaving the grower destitute.

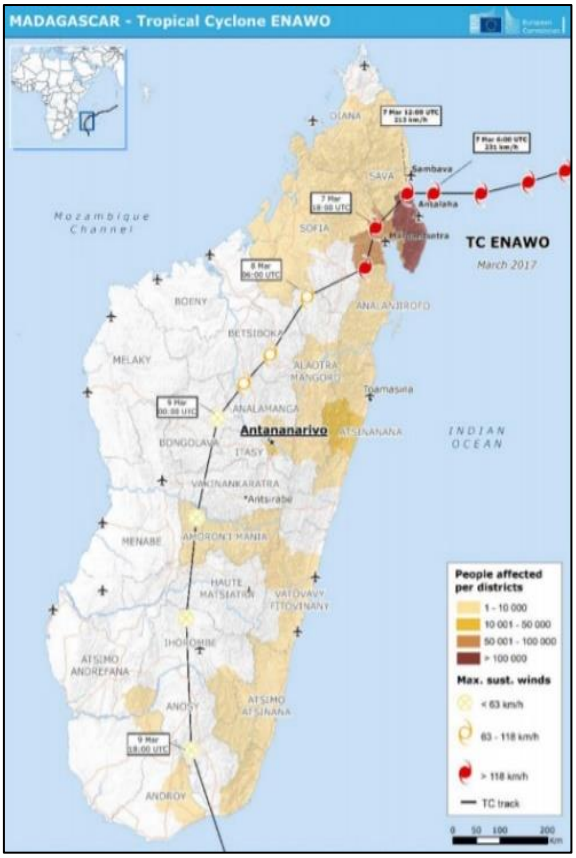

Figure 3 The track of Cyclone Enawo across Madagascar (from Probst et al. (2017))

Given these risk factors, should farmers who convert the entirety of their holdings to vanilla cultivation be considered reckless? There is some evidence in favour of such an argument. Lopez, as quoted in Pilling (2018) states, "People are saying, 'I don't care about growing food to feed myself. I only want to grow vanilla',". The high potential value inherent in vanilla cultivation

provides a strong framing device for such sentiments, potentially biasing a farmer's decision over what crops to grow. Prospect theory suggests individuals to be more risk-seeking in the face of uncertain losses, and more risk averse when facing uncertain gains (Kahneman and Tversky, 1979). Farmers may view the uncertain loss of a valuable vanilla crop due to cyclone damage more favourably than the uncertain gain of having protected oneself against such a disaster through diversification into more rapidly growing food crops, causing their behaviour to become more risk-seeking and promoting an overemphasis on vanilla. Equally, farmers may be subject to availability bias, in which information that is more salient in the local environment overshadows a more truthful and accurate depiction of events (Tversky and Kahneman, 1973). Stories abound of successful vanilla barons, or 'vanillionaires' (Kacungira, 2018), who have profited wildly from fruitful plantations. Although these individuals are the exception rather than the rule, their wide influence and notoriety in local communities may place them in the forefront of consciousness, enhancing the appeal of vanilla cultivation to farmers whilst at the same time downplaying negative outcomes. In this way, farmers may decide to cultivate vanilla without fully appreciating all the risks involved. Such individual actions, when taken by many farmers, can lead to the further generation of even greater risk. Collective overemphasis on vanilla, a currently valuable cash crop but with long cultivation times, not only increases the exposure of individual farms to natural hazard risks, but also depresses the availability and local supply of other basic subsistence crops such as cereals. Such a situation, when over-focus is given to one profitable resource at the expense of other potential sources of value, is termed 'Dutch disease' (Bruno and Sachs, 1982) and can result in entire regions becoming less diverse and self-sufficient. Should disaster strike, communities in these areas will be less equipped to recover independently due to a lack of resource diversity. Biases which influence farmers to engage in more risky behaviour at an individual level therefore create a culture of systemic risk-taking with potential impacts across wider society.

Why high prices don't help

Even for farmers who manage to avoid the effects of natural disaster risk, a high price does not necessarily guarantee profit. Perversely, skyrocketing prices have created a scenario which may, in fact, expose those who successfully cultivate a vanilla crop to new risks. Poor infrastructure and the small hold nature of vanilla cultivation means that vanilla agriculture is highly fragmented, and farmers are often isolated from direct contact with customers buyers. They are thus at the mercy of unscrupulous middlemen, who buy vanilla from farmers at low prices, hoarding the spice to restrict supply, before selling to international buyers at inflated prices. It is estimated that farmers receive on average only 5-10% of the true value of their produce (Pilling, 2018). In a more sinister turn of events, reports of criminal gangs stealing and even murdering farmers to pillage their vanilla crop. As Madagascan vanilla farmer Francois Ravelonjara states in Kacungira (2018), "It would be better if prices went down. We didn't make much – but at least we did not live in fear". Rather than providing rewards, high prices have simply created new risks.

At a wider level, high price and the worries of losing an entire crop to criminal elements can also cause cultivators to act in a manner which, although potentially profitable in the short term, may create longer term risk to the sustainability of the Madagascan vanilla industry. Kacungira (2018) reports that farmers sometimes harvest vanilla crops before they are fully ripe, both to capitalise on high but volatile prices and minimise the window of opportunity for would-be thieves. By doing so, farmers are exercising the behavioural trait, often noted in safety management circles, of individuals acting in a manner providing benefits which are soon, certain and positive (UK Government, 2012). Although this may be beneficial in the short term, over a longer duration such practises threaten the competitiveness of Madagascan vanilla in the international market. Harvesting pods before they are fully ripe degrades spice quality. For Madagascar, long associated

with the highest standards of product, such degradation may ultimately prove harmful by opening the door to other producing nations. In this manner the attempts by individuals to minimise one type of risk actually give rise to a potentially more fundamental danger.

Risk alignment and a way out

It has previously been shown how the high price of vanilla upends the traditional assumptions of commodity price risk among producers. Instead of high prices providing commensurate rewards for those farmers who engage in vanilla cultivation, it simply adds new layers of risk exposure. Buyers of vanilla too, are affected by commodity risk, albeit in a more traditional manner. High prices eat into profit margins, with Kacungira (2018) documenting how some UK ice cream parlours have been forced to stop stocking vanilla due to its exorbitant cost. For the multi-nationals who buy significant quantities, high prices and restricted supply create risks to complex supply chains. A high price creates risks for almost everybody.

That may not necessarily be a bad thing. By aligning both producers and their customers on the same side, incentives are created to work together in finding a solution which mitigates risk for all. A lower price may not necessarily mean farmers profit less if it also means a fairer, more stable price, with less incentive for dubious, racketeering middlemen. Guaranteed pricing is one method, similar to a rudimentary futures contract, whereby a buyer stipulates a specific price to be paid in advance, removing uncertainty from the equation along with those that profit from it. Such schemes are relatively common and are used in developing world agriculture by organisations such as Fairtrade (Aldred, 2014). Commonly, however, they specify only a minimum baseline price and so do not address risks associated with high prices. They also fail to help farmers deal directly with external natural hazard risk. One suggestion to mitigate both the risks of price and external factors is to combine guaranteed pricing with micro-insurance schemes such as those documented in Mechler *et al.* (2006). Under such a plan, producers would be paid a fixed price (both floor and ceiling), limiting downside risk exactly like a futures contract. However, should market value rise above the agreed price, rather than the buyer being the sole beneficiary (as occurs in standard futures contracts), some of their savings would be apportioned off as insurance for farmers against natural hazards or other risks (figure 4). In this way price risks, both low and high, would be minimised whilst farmers would also be insured against natural disasters. As Loewe (2006) notes, implementation of such schemes is often challenging in

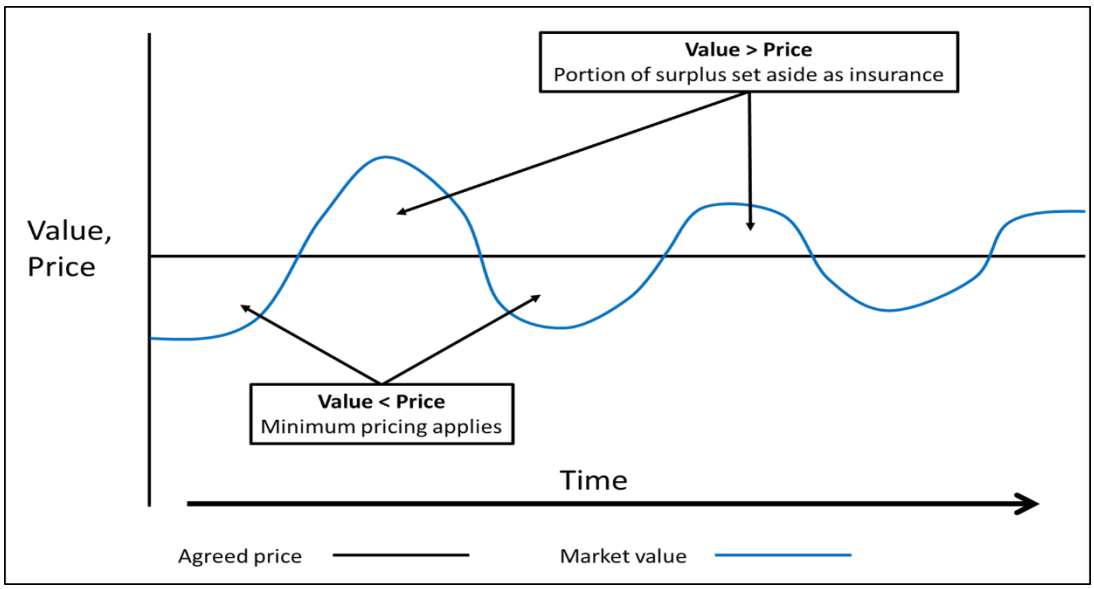

Figure 4 An illustration of a mechanism for providing both minimum pricing protection and insurance provision through fixed pricing schemes for a commodity of varying value

developing countries and Madagascar, with its recent history of political instability and high levels of corruption (Baum *et al.*, 2017) is likely to be no different. A lack of strong, effective institutional mechanisms would necessitate the willing and active participation by large vanilla buyers such as Nestlé, as well as facilitation by non-governmental organisations who can provide the levels of legitimacy and trust within communities required for such schemes to flourish (Dahan *et al.*, 2010). All the more reason then for the alignment of risks between vanilla producer and buyer to be highlighted; an effective solution requires the equal incentivisation of both parties against risk.

Conclusion

Madagascan vanilla cultivation presents an interesting case study into some of the risks of developing world cash crop agriculture. External risk, in the form of natural hazards, is exacerbated by high prices that create and inform biases, encouraging risky behaviour with impacts at a wider, societal level. Those farmers who do succeed in generating a vanilla crop, rather than reaping the rewards of high prices, are exposed to yet more risk in the form of criminal gangs and may unwittingly contribute to longer term, sector-wide risk through their short-term mitigation actions. This upends the traditional assumption that a high commodity price is necessarily positive for producers, instead aligning both farmers and customers on the same side of commodity price risk. Whilst Madagascar is a challenging implementation environment, this alignment could incentivise farmers and customers to work together towards a lower risk, more sustainable future.

References

Aldred, T. (2014) 'Setting the Fairtrade Minimum price - about more than just keeping the wolf from the door', *Fairtrade blog*, 20 February. Available at: http://www.fairtrade.org.uk/Media-Centre/Blog/2014/February/Setting-the-Fairtrade-Minimum-price (Accessed: 21 March 2019).

Baum, A. *et al.* (2017) *Republic of Madagascar: Selected Issues*. IMF Country Report 17/224. IMF. Available at: https://www.imf.org/~/media/Files/Publications/CR/2017/cr17224.ashx.

Bomgardner, M. (2016) 'The Problem with Vanilla', *Chemical & Engineering News*, 12 September, pp. 38–42. Available at: https://cen.acs.org/articles/94/i36/problem-vanilla.html (Accessed: 23 October 2018).

Bruno, M. and Sachs, J. (1982) 'Energy and Resource Allocation: A Dynamic Model of the "Dutch Disease"', *The Review of Economic Studies*, 49(5), pp. 845–859. doi: 10.2307/2297191.

Cameron, K. (2012) *Vanilla Orchids: Natural History and Cultivation*. Timber Press.

CIA (2018) *The World Factbook*. Available at: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html#ma (Accessed: 29 October 2018).

Correll, D. S. (1953) 'Vanilla-its botany, history, cultivation and economic import', *Economic Botany*, 7(4), pp. 291–358. doi: 10.1007/BF02930810.

Dahan, N. M. *et al.* (2010) 'Corporate-NGO Collaboration: Co-creating New Business Models for Developing Markets', *Long Range Planning*. (Business Models), 43(2), pp. 326–342. doi: 10.1016/j.lrp.2009.11.003.

Gallage, N. J. and Møller, B. L. (2018) 'Vanilla: The Most Popular Flavour', in Schwab, W., Lange, B. M., and Wüst, M. (eds) *Biotechnology of Natural Products*. Cham: Springer International Publishing, pp. 3–24. doi: 10.1007/978-3-319-67903-7_1.

Kacungira, N. (2018) *Fighting the vanilla thieves of Madagascar*, *BBC News*. Available at: https://www.bbc.co.uk/news/resources/idt-sh/madagascar_vanillla (Accessed: 23 October 2018).

Kahneman, D. and Tversky, A. (1979) 'Prospect theory: An analysis of decision under risk', *Econometrica*, pp. 263–292.

Kaplan, R. S. and Mikes, A. (2012) 'Managing Risks: A New Framework', *Harvard Business Review*, 90(6), pp. 48–60. Available at: https://ezp.lib.cam.ac.uk/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=75369695&site=bsi-live&scope=site (Accessed: 20 March 2019).

Loewe, M. (2006) 'Downscaling, Upgrading or Linking? Ways to Realize Micro-Insurance', *International Social Security Review*, 59(2), pp. 37–59. doi: 10.1111/j.1468-246X.2006.00238.x.

Mechler, R., Linnerooth-Bayer, J. and Peppiatt, D. (2006) *Microinsurance for Natural Disaster Risks in Developing Countries*. ProVention Consortium, p. 31. Available at: https://s3.amazonaws.com/academia.edu.documents/40206193/Microinsurance_for_Natural_Disaster_Risk20151120-5133-ei2ith.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1553138723&Signature=LO19T4Y7WVEJvCjj%2B7%2BJGhwxA3U%3D&response-content-disposition=inline%3B%20filename%3DMicroinsurance_for_Natural_Disaster_Risk.pdf (Accessed: 21 March 2019).

moneyweek.com (2018) *Chart of the week: vanilla is more valuable than silver*, *MoneyWeek*. Available at: https://moneyweek.com/493637/chart-of-the-week-vanilla-is-more-valuable-than-silver/ (Accessed: 21 March 2019).

OEC - Madagascar (MDG) Exports, Imports, and Trade Partners (no date). Available at: https://atlas.media.mit.edu/en/profile/country/mdg/ (Accessed: 21 October 2018).

OEC - Vanilla (HS92: 0905) Product Trade, Exporters and Importers (no date). Available at: https://atlas.media.mit.edu/en/profile/hs92/0905/ (Accessed: 28 October 2018).

Pilling, D. (2018) *The real price of Madagascar's vanilla boom | Financial Times*. Available at: https://www.ft.com/content/02042190-65bc-11e8-90c2-9563a0613e56 (Accessed: 23 October 2018).

Probst, P., Proietti, C., Annunziato, A., Paris, S. and Wania, A. (2017) *Tropical Cyclone ENAWO - Post-Event Report*, *EU Science Hub - European Commission*. Available at: https://ec.europa.eu/jrc/en/publication/tropical-cyclone-enawo-post-event-report (Accessed: 26 March 2019).

Tversky, A. and Kahneman, D. (1973) 'Availability: A heuristic for judging frequency and probability - ScienceDirect', *Cognitive Psychology*, 5(2), pp. 207–232. Available at: https://www.sciencedirect.com/science/article/pii/0010028573900339?via%3Dihub (Accessed: 21 March 2019).

UK Government (2012) *The ABC Analysis*. Available at: http://www.hse.gov.uk/construction/lwit/assets/downloads/abc-analysis.pdf (Accessed: 21 March 2019).

World Bank (2018) *Madagascar Overview*, *World Bank*. Available at: http://www.worldbank.org/en/country/madagascar/overview (Accessed: 29 October 2018).

World Bank Group (2015) *Madagascar: Systematic Country Diagnostic*. World Bank. doi: 10.1596/23113.

WWF (2018) *Madagascar | Animals, People, and Threats | WWF*, *World Wildlife Fund*. Available at: https://www.worldwildlife.org/places/madagascar (Accessed: 23 October 2018).