DISCUSSION PAPER

Written by:
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Climate Contagion: 2020-2025

FEBRUARY 2020

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Wall Street's denial of climate dangers is setting us up for a 2008-style financial explosion where "risk spreads in a way that cannot be contained or isolated".

Graham Steele, Stanford Graduate School of Business, December 2019

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Published by

Breakthrough - National Centre for Climate Restoration

Melbourne, Australia

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February 2020

SO IT BEGINS.....

You can pretty much hear it now. It's like being in a forest and hearing the leaves rustling in the tops of trees, just before the storm hits. Then it comes with a roar, everything shakes, and we look around wondering what will fall – and will it fall on us.

This is how I see the global economy and climate change. Everything is ready, everyone knows it's coming, we're just waiting for the storm to hit.

When it does, it will be the climate emergency meets financial contagion.[1] When the global market flips to FOMO[2] – from fear of acting too early, to fear of being left behind as everyone races for the exits.

This moment was always going to come, and it was always going to be messy. Markets rarely move smoothly. But why now? Simply because all the practical economic and financial impediments are gone. The financial logic of acting is now impeccable, meaning the only thing left is for there to be a shift in sentiment – that moment of an intangible, hard to define flip in how the decision makers in the market see the world. That can happen overnight. It may be triggered by a single catastrophic event with clear economic consequences – like the Australian fire emergency. Or it can just happen. And because markets hunt in packs – when they go, they'll all go.

There are four critical factors that lead me to conclude this shift in sentiment is now imminent – anytime from tomorrow morning to 2025, but not later;

1. Clean technology for zero emisions is available, scalable, superior and investable;
2. Physical climate change is obvious and accelerating;
3. Public engagement and political momentum are rapidly turning; and
4. The financial markets are primed – from central banks, to lenders to stock markets.

The scale of change that will result — and the likely timing — can only be understood by the way these factors interact in combination, as a *system*. This is the way to understand markets and forecast their behaviour.

Key to this, and perhaps most critically, is the way markets behave synergistically with politics and public sentiment. The markets are not abstract machines. They are run by people who feel, think and fear. They see what we see.

To explore all this, I'll first expand on these four factors and then analyse how they will interact and drive a financial contagion across the global market, a contagion that will tip the system into a new state.

THE FOUR FACTORS SHIFTING MARKET SENTIMENT

1. The technology to end climate damaging emissions is ready – it's available, scalable, superior and investable. This is a real game changer. It has long been the case that the technology was available, but it was less developed, not widely deployed and more expensive. It was therefore assumed policy would be needed *before* it would go to scale – policy to address the market failure of not pricing climate change risks. Now, across energy,[3] transport[4] and food,[5] countless climate solutions are not just available, but are broadly superior in performance to incumbent offerings. In most cases, they are also cheaper or at least price competitive[6] and will keep getting more so. As a result, they are investable propositions today and capital is flowing into them at scale.[7] Taken together this means deployment could easily be ramped up and there would be considerable economic benefit in doing so.[8]

2. Physical climate change is now obvious and accelerating[9] – with two critical impacts. Firstly, it is being viscerally felt by the public[10] and that drives public sentiment[11] which increases the pressure for a political response.[12] If the markets believe a policy response is more likely in the future, they will start to price future market impacts today. Secondly, physical climate impacts bring the economic implications of the physical risks into much sharper focus. This applies to physical infrastructure,[13] real estate,[14] agriculture[15] and the cost and availability of insurance.[16] When climate change ceases to be an abstract future risk and is all around you, it is more likely to impact decisions on lending risk, insurance premiums, hedging strategies and much else. When cities like Sydney are choking on smoke from unprecedented bushfires and the impacts are being measured in % of GDP lost, the humans that make market decisions start thinking.

3. Public sentiment and political momentum are turning and will soon be unstoppable. It might be hard to see in the era of laggard politicians like Trump, Bolsanaro and Morrison but they are the last hurrah of a dying philosophy and world view. The political context is shifting, driven by two factors. Firstly, by a new generation of vigorous and uncompromising climate activism that both represents *and* builds a new political momentum. Secondly by the irrefutable business and economic logic of the need to act,[17] and the huge opportunity in doing so. When business and activists both demand change, politicians resist at their peril.

4. The financial markets are primed to act at scale. They are just waiting for the tide to turn. Then FOMO will click in and contagion will erupt. While markets have so far only acted at the margins in terms of global market impact, those actions show they are paying attention, and are waiting for the moment. Signs include government bonds being sold due to climate risk,[18] the recent fizzled IPO of Saudi Aramco,[19] high valuations of plant-based food companies[20] and the continued slide in value of the oil majors.[21] Central banks and regulators are now wide awake to the systemic risks.[22] The market is engaged and waiting. And remember they hunt in packs.

By considering these factors together and in particular by understanding how synergies between them could drive contagion across the system, we can start to see how a market tipping point could occur – and do so any day.

Let's consider a few potential examples of the reinforcing interactions.

CLIMATE CONTAGION AND ENERGY

For capital to decide to leave the fossil fuel industry at scale — perhaps the most significant indicator of climate contagion being underway — two things need to happen.

First there needs to be a viable competitor for capital to go to. With the technology to replace the industry now superior, cheaper and ready to scale – that's done. Secondly, there needs to be a perceived risk of loss if the capital stays where it is – the risk of being late to the exits.[23] The key issue that will drive this loss of value is not the level of demand *today*, but the level of *belief* that demand will be there in 10–20 years' time. This is key because the fossil fuel industry today invests hundreds of billions of dollars *every year* finding and proving new reserves to meet the assumption of strong demand in 10-20 years. That future demand assumption is based on a belief that climate change is a 'future' risk, that policy is not imminent, that the public isn't engaged and that the new technologies aren't ready to scale.

Those assumptions were all true 20 years ago. Now they are all wrong. If the market starts to believe that demand won't, or even might not be there in 10-20 years,[24] then hundreds of billions is suddenly wasted every year. If that sentiment turns, the value is gone.[25] The already struggling oil and gas majors will not then transform, they will just fail, as incumbents usually do.[26]

"…the economics of oil for gasoline and diesel vehicles versus wind- and solar-powered EVs are now in relentless and irreversible decline, with far-reaching implications for both policymakers and the oil majors".

BNP Paribas September 2019

CLIMATE CONTAGION AND POLICY

To date, climate policy has been effectively resisted by the likely losers – largely the fossil fuel industry - using the argument that policy would cause economic loss not just to them, but to society as a whole. But what if the reverse were now true? What if it became accepted that strong climate policy would reduce economic loss and even *increase* economic gain?[27] Then the rest of the business community would become a lobby for climate policy.

What could turn that tide? There are a number of ways the above four factors could reinforce each other to this end.

- Physical climate impacts and youth driven activism are together changing public sentiment, driving much stronger public concern and demand for policy. The intensity of both youth activism and climate impacts are likely to increase.
- This also weakens the resistance to policy, with incumbent industries losing their social licence and with it their political power. The fossil fuel industry is becoming increasingly toxic to support[28] and this can have very real financial impact given the extent to which the industry depends upon subsidies and other policy support.
- The zero emissions solutions (that policy would help deliver), are now largely superior for consumers and society,[29] are lower in cost and are ready to scale. With the solutions bringing significant broad economic benefit, it makes policy easier to put in place.
- Taken together, this means most of the business community will be economic losers without climate policy and will benefit from it being put in place.

This all makes policy far more likely – especially in the 5 to 10-year timeframe. But again, it is critical to understand the synergies and not to see this as a linear process, with policy leading to later market change. While it is the case that policy drives change in markets — indeed that is usually the reason for it — market change also accelerates policy. It does so by

pricing in a belief that it is it coming, which reduces the value of assumed future policy's losers and increases the value of its winners. Then, because policy makers are nervous about policy having negative economic impact, the more they see the market moving ahead of policy, the more likely they are to put in place policy that will accelerate this. So again, sentiment is key.

CLIMATE CONTAGION IN ACTION

When we focus on "markets", most people think about the stock market. But markets are more complex than this – they are a broad and diffuse system comprised of a near infinite array of interconnected and interdependent components.

Risks and future assumptions are priced into this system in many ways. So, when assumptions change, the impacts cascade from one component to the next. It can be government bonds being repriced or sold due to climate risk; re-insurers managing risk exposure by capping coverage for retail insurers in certain geographies, forcing increased premiums or the removal of cover to avoid bankruptcy;[30] infrastructure becoming de-valued or harder to borrow for, due to climate risk; corporate bonds increasing in cost, tipping shaky industries over the edge. This is how contagion spreads. Filtering through an economy and impacting value in many diffuse ways.

It is easy to imagine how this could unfold for the fossil fuel industry. With future demand looking increasingly shaky, due to clean technology getting cheaper every year and policy to support it more likely, forecasts are downgraded and the market value of fossil fuel producers decreases. Corporate debt increases as asset values drop and money has to be borrowed to pay dividends to restless shareholders. With the trend being global, assets cannot be sold to pay- off debt as they are not worth their book value.

Meanwhile, ratings agencies see declining asset value and increasing debt and downgrade company credit ratings making debt more expensive. Major institutional investors see these financial risks but are also sensitive to public sentiment, so reduce their exposure and share prices fall further. The companies' debt grows closer to its value, its political influence and social licence evaporate, and its own people lose faith in their employer's future. It's too late to transform and they enter a death spiral.

But this is not just about fossil fuels. It may start there but will then have knock on impacts across the whole economy, because many sectors and countries are deeply exposed to climate risk.[31] The state of Queensland, Australia, provides a perfect real-life case study of the potential for such contagion. It provides a clear example of how this could spread across economies.

The state's tourism slogan is "Queensland – Beautiful One Day, Perfect the Next."

Queensland's economy is heavily focused on coal mining (now in global decline), [32] agriculture (suffering successive droughts),[33] tourism around its natural wonders including the Great Barrier Reef (which may not survive)[34] and tropical rainforests (now burning),[35] and a warm, beach front lifestyle that is highly attractive to retirees (whose water front property is now threatened by sea level rise and could be slashed in value and become uninsurable).[36]

A few weeks ago, the Swedish Central Bank announced it had sold all its Queensland Government Bonds due to the state's heavy exposure to climate risk.[37]

Queensland – Beautiful One Day, Too Risky the Next.

So it begins...

[1] Contagion is the spread of an economic crisis from one sector, market or region to another and can occur at a regional, domestic or global level.
[2] An emotional trigger to act, caused by the 'Fear Of Missing Out'.
[3] Bloomberg NEF reports that for two thirds of the global population, it is already cheaper to get power by building new wind or solar farms (unsubsidised) than a fossil-fuel power plant. For the rest of the world, including countries like Japan and much of southeast Asia, where coal currently has the edge, renewable plants are likely to be cheaper within the next five years.
[4] September 2019 research released by BNP Paribas, compared how an outlay of $100 billion for oil and renewables converted to useful energy at the wheel for cars and light-duty vehicles. The report identified that for gasoline to remain competitive as a source of mobility, prices would need to fall to $9-$10 per barrel, and for diesel $17-$19 a barrel (to put this in context, in November 2019, oil prices fell to $50 per barrel from $70 the year before, resulting in Exxon posting a 49% decrease in profit for their 3rd quarter). The report concludes "that the economics of oil for gasoline and diesel vehicles versus wind- and solar-powered EVs are now in relentless and irreversible decline, with far-reaching implications for both policymakers and the oil majors".
[5] For example: With consumers more concerned about health and sustainability than ever before, and meatless meat out-performing animal based meats against all environmental metrics (e.g land use, water use, emissions), meat alternatives are attracting attention from analysts, investors and consumers. With a new focus on taste, these disruptive companies are performing well. Beyond Meat's stock surged after its IPO in early May 2019 and Impossible Foods raised $300 million in more funding and may be looking at an IPO itself. Now, major meat companies, such as Tyson and Purdue Farms, are launching their own plant-based meat products.This increased competition will keep prices down and make it likelier that the industry can scale up to meet growing demand.
[6] Using energy as an example, Forbes recently reported that in order to meet 2018 levels of energy demand, the oil industry would have to spend $25 trillion a year for the next 25 years, while to produce the equivalent level of energy from renewables would cost only $4.6 trillion - $5.2 trillion.
[7] For example: In 2018 FTSE Russell announced that "the green economy (defined as an economy that aims at reducing environmental risks and ecological scarcities, and that aims for sustainable development without degrading the environment), is now worth as much as the fossil fuel sector and offers more significant and safe investment opportunities". This represents 6% of the market capitalization of global listed companies, approximately US$4 trillion.
[8] An October 2019 report from Investment bank Morgan Stanley, advised that global investment of US$50 trillion will be required to meet the Paris Agreement's goals. The report lists the potential investment opportunity by sector: Renewable power & storage (US$14 trillion); electric vehicles (US$11 trillion); carbon capture & storage (US$2.5 trillion); hydrogen (US$2.7 trillion); and biofuels (US$2.7 trillion).
[9] 2019 included the hottest month ever recorded, giant fires across the northern latitudes and in Australia, where more than 1.8 million hectares had burnt before the start of summer and a hurricane that stalled over the Bahamas producing what meteorologists called "the longest siege of violent, destructive weather ever observed" on the planet.
[10] Driven by climate activists such as Extinction Rebellion and school climate striker Greta Thunberg, in September 2019 millions of people across the globe took part in protests demanding that climate change be treated as an emergency. As of November 2019, 1,212 governments across 26 countries representing nearly 800 million people have declared a climate emergency.
[11] So much sentiment in fact, that Oxford Dictionary declared 'climate emergency' the word of the year after a 10,796% increase in its usage, making it "one of the most prominent – and prominently debated – terms of 2019".
[12] For example: In May 2019 following a visit to Parliament by teenage activist Greta Thunberg , the broadcast of David Attenborough's documentary 'Climate Change: The Facts' and 11 days of protest by Extinction Rebellion that paralysed parts of London, the UK became the first national parliament to declare a climate emergency.
[13] Losses from the physical impacts of the climate emergency are already being felt with a five-fold increase in insured losses in the last three decades. In 2018 alone, losses from natural disasters were US$160 billion (of which US$80 billion were insured losses). Hurricanes and wildfires caused the highest losses.
[14] A study by the Australian Climate Council warned the value of Australian real estate could plunge unless future governments have the political will to deal with climate change. The research estimates residential property value losses of $571 billion by 2030 due to increased extreme weather events, inundation of some low-lying coastal properties and higher insurance premiums – this equates to approximately 9 per cent of the nation's total residential property value.
[15] As part of its 2019 Risk Report, Australia's Commonwealth Bank undertook scenario analysis on the physical risks of climate change on its agribusiness lending portfolio. With AU$22.4 billion exposure to group agriculture, including AU$11.2 billion in loans to farmers, detailed scenario analysis was undertaken to understand climate change risk from acute and chronic shifts in temperature, humidity and rainfall. The bank found grain-growing regions could see productivity falls of 50 % in some areas by 2060 (compared with a 2018 baseline), profitability drops by 40% in the livestock sector because of a decline in pasture quality and falls of 40% in profitability in most dairy industry regions as after five days of extreme conditions, cows can stop producing milk.
[16] In March 2019, even before the 2019 Californian wildfires, Munich Re, the world's largest insurer, warned that climate change could make cover for ordinary people unaffordable after the firm blamed global warming for US$24 billion of losses in the Californian wildfires.
In December 2019 a report rating the world's 35 biggest insurers on their actions on fossil fuels reported that coal exit policies have been announced by 17 of the world's biggest insurers controlling 46.4% of the reinsurance market and 9.5% of the primary insurance market, with most now refusing to insure new mines and power plants. Insurers have also divested coal from roughly $8.9 trillion of investments – over one-third (37%) of the industry's global assets.
[17] In May 2019, 76 major companies asked US congress for a price on carbon advising that "Climate is clearly the biggest issue that we have in front of us". Majors include Royal Dutch Shell, DSM, Unilever, BP, BHP and Nestle.
[18] For example: Sweden's central bank Riksbank announced in November 2019 that to manage the economic consequences of climate change it will reject bonds that have a "large climate footprint". As a result, bonds issued by the Canadian province of Alberta and the Australian states of Queensland and Western Australia were sold.
[19] Aramco is the most profitable company on the planet, with proven reserves of 270 billion barrels of the world's cheapest oil. In what was predicted to be the largest IPO in history, Saudi Arabia announced that it would sell 5% of the state-owned oil company, raising $100 billion to cover deficit, improve services and diversify the economy. With lack of interest from private investors and valuations coming in lower than expected, the sale was scaled back to 1.5% which may only raise $25 billion.
[20] For example: Beyond Meat, whose plant-based version of beef and pork can be found in popular restaurant chains across the US, launched its IPO in May 2019. In under a month its stocks rose over 250%. Beyond Meat is now valued at $5 billion with analysts calling the company "a true disruptor and innovator" and predicting that plant-based meat will generate more than $100 billion in sales within 15 years.
[21] As recently as early November 2019, the Wall Street Journal described several factors impacting the ability of large oil companies to deliver shareholder value, including:

- Energy being the worst-performing sector of the S&P 500 for more than a decade;
- Oil-and-gas companies now make up about 5% of the S&P 500 index, down from 14% a decade ago;
- Increasingly, companies such as Exxon Mobil, Royal Dutch Shell and BP are having to increase debt or sell assets, to pay dividends and conduct share buybacks to maintain shareholder confidence and in some cases fund new investments. In November rating agency Moody's lowered Exxon's debt rating to negative due to "substantial" reliance on debt to fund growth, which will likely rise despite asset sales. Fracking giant Chesapeake has shed 98 per cent of its stock value since 2008 and recently warned investors it may not be able to make scheduled payments on its crushing $10-billion debt.

- As demand for oil falls and with oil prices low, asset values are also declining. As a result, when assets are sold to raise capital, they are selling at lower prices than expected, forcing write-downs. Petrobras' ultra-deep water drilling platform worth $683 million in 2011 was just sold for just $15 million after receiving no bids at auction.

[22] For example:
June 2019: Rostin Behnam, one of the 5 member US Commodity Futures Trading Commission warns "If climate change causes more volatile frequent and extreme weather events, you're going to have a scenario where these large providers of financial products — mortgages, home insurance, pensions — cannot shift risk away from their portfolios," "It's abundantly clear that climate change poses financial risk to the stability of the financial system."
August 2019: The Australian Securities and Investments Commission names climate change as a 'systemic risk' that could have a material impact on the future financial position, performance or prospects of entities in its rulebook.
October 2019: IMF announces that they will examine the impact of climate on the world's financial markets and whether it is priced into market valuations.
October 2019: Governor of the Bank of England Mark Carney warns that "Companies that don't adapt [to zero carbon] will go bankrupt, without question."
November 2019: The European Investment Bank, the largest public bank in the world, announces it will phase out lending to fossil fuel projects by 2021.
November 2019: Bank of Canada outlines its research priorities including a focus on the potential impacts of climate change, including physical risks of intensifying weather, the financial risks of stranded assets, and wider risks to the system of increased volatility and unpredictability.
[23] In September 2019, an IMF working paper examining macroeconomic and financial policies for climate change concluded: "There is growing agreement between economists and scientists that risk of catastrophic and irreversible disaster is rising, implying potentially infinite costs of unmitigated climate change, including, in the extreme, human extinction." To quantify the cost, looking at assets alone, Mercure, JF et.al (2018) using an integrated global economy–environment simulation model to study the Macroeconomic impact of stranded fossil fuel assets, finds the magnitude of the loss from stranded fossil fuel assets may amount to a discounted global wealth loss of US$1–4 trillion.
[24] There are already strong indicators that this is the case – even the International Energy Agency (IEA) which has historically underestimated the growth of the clean energy sector has this year, in their annual World Energy Outlook, predicted that growth in global oil demand will "slow to a crawl" in their 'stated policy' scenario, and fall by more than 50% between in advanced economies between 2018 and 2040 in the 'sustainable development' scenario.
[25] This scenario was discussed in a 2018 Nature Climate Change study. Describing the current overvaluation of fossil fuel assets as a "carbon bubble", the study warns that plunging prices for renewable energy and rapidly increasing investment in low-carbon technologies could leave fossil fuel companies with trillions in stranded assets and spark a global financial crisis. The authors' detailed simulations found the demand drop would take place even if major nations undertake no new climate policies or reverse some previous commitments.
[26] Gilding, P (September 2018) Why incumbents fail and what this means for sustainability. And Gilding, P (August 2018) Disruptive markets – what sustainability really means for business, describe how, with a few notable exceptions, incumbent businesses consistently fail to respond to system threats to their companies and their business models. They can see the threats, analyse them, resist them, talk about them and when resistance has failed, develop strategies to respond. But they generally fail to deliver these strategies and so they die and are replaced. This is a process of "creative destruction", a term developed by Austrian economist Joseph Schumpeter in the 1920s, where the market incessantly destroys the old while creating the new, opening up pathways to rapidly transform the market.
[27] There is compelling evidence to suggest that strong climate action and rapid transition towards a low carbon economy would result in social and economic benefits. Investments in new power generating capacity would bring an economic return for decades. The electrification of transport and the shift to renewable power generation would lower consumers' costs and dramatically reduce outdoor air pollution, which kills around 4.2 million people each year according to the World Health Organisation. Innovation in technology would be unleashed at a massive scale that would most likely deliver lower cost and more accessible energy supplies around the world, while also enhancing energy security and thus reducing related economic uncertainty and military spending. It is likely it would also reduce inequality both within and between nations.
[28] In one of the most significant shifts towards climate action to date, the European Investment Bank (the world's largest multilateral financial institution) announced in November 2019 that it would phase out its multibillion-euro lending to fossil fuels by 2021. The banks president, Werner Hoyer, stated that "Climate is the top issue on the political agenda of our time… will stop financing fossil fuels and launch the most ambitious climate investment strategy of any public financial institution anywhere." This announcement builds on endowments and portfolios worth more than $11 trillion that have already begun divesting their fossil fuel stocks.
[29] Forbes recently reported that in addition the economics advantages of a global transition to renewable energy, additional social advantages would include:

- the environmental benefits in terms of climate change and cleaner air;
- the public-health benefits that flow from this;
- the fact that electricity is much easier to transport than oil;
- the much greater price stability of wind- and solar-generated electricity compared with the price volatility of oil. Geopolitically, this transition will also alter the global distribution of power, relations between states, the risk of conflict and the social, economic and environmental drivers of geopolitical stability.

[30] In 1992 Hurricane Andrew caused $15.5 billion in damage, bankrupting 16 insurance companies. Cambridge University's Judge Business School modelling the impacts of Category 4 hurricane south of Miami could cause $1.35 trillion in damage.
[31] In a December 2019 Vice article, Graham Steele, a Director of the Stanford Graduate School of Business warns that Wall Street's current denial of climate dangers is setting us up for a 2008-style financial explosion where "risk spreads in a way that cannot be contained or isolated".
[32] Coal exports bring in around AU$23.7 billion to the Queensland economy. 2019 will see the largest drop on record for global electricity production from coal.
[33] Meat exports bring in around AU$3.6 billion to the Queensland economy. By 2060, the profitability of this sector is expected to drop by as much as 40%.
[34] Tourism from the GBR brings in around AU$3.9 billion to the Queensland economy. In August 2019, the Great Barrier Reef Marine Park Authority downgraded the reef's status to the lowest level advising that it was in very poor condition because of climate change, over-fishing and land clearing - which could jeopardise its World Heritage status.
[35] In 2018 the World Heritage tropical rainforest in Japoon National Park burned for 10 days – a landscape which is supposedly resistant to fire. Experts and rainforest authorities say the remarkable extent of the damage, across an environment supposed to naturally suppress fires, is among the clearest evidence that climate change has shifted the paradigm in the tropics. The authority has previously said climate change damage to the forest is as bad as coral bleaching on the reef.
[36] Research by Australia's Climate Council expects a 0.2 metre sea level rise by 2030, putting 61,500 Queensland homes at risk, provided the same planning and building regulations as today remain. By 2070, this is forecast to double to 121,000 homes.
[37] Sweden's central bank Riksbank announced in November 2019 that to manage the economic consequences of climate change it will reject bonds that have a "large climate footprint". As a result, bonds issued by the Canadian province of Alberta and the Australian states of Queensland and Western Australia were sold.

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