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The Climate Crisis of the 21st Century
Macroeconomic Implications and Policy Responses

A Qualitative Analysis

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The Climate Crisis of the 21st Century

Macroeconomic Implications and Policy Responses

A Qualitative Analysis

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Introduction

Floods, heatwaves and sea level rises – the increasingly present implications of climate change are widely known to the general public. Less well known, however, is that the climate crisis of the 21st century poses tremendous risks to the world economy and financial stability. According to Willem Buiter, extreme implications of global warming could depress aggregate demand and output significantly over long periods of time, thus impacting the prosperity of people around the world (Buiter, 2020). Therefore, it is necessary for financial policymakers to understand the potential future economic effects of climate change and to implement preventive policies today (Carney, 2019a).

This essay will analyse the different types of risks associated with the climate crisis as well as macroeconomic implications occurring as a result. Focus will be placed on both adverse supply and adverse demand shocks, using the PC-MR model, WS-PS model and AD-BT-ERU model of the open economy as a simplified illustration of real-world macroeconomic processes.[1] Furthermore, the essay will examine how climate change can threaten financial stability in our post-financial crisis world, before eventually providing policy recommendations for central banks to create market regulation and incentives that will lead the world into a sustainable future.

Different Types of Risks

The first step towards analysing the macroeconomic effects of climate change includes differentiating between different types of climate-related risks. Environmental economists and central bankers have identified two main kinds of risks related to climate change. On the one hand, there are physical risks that result directly from increasingly frequent severe weather events causing damage. Floods, hurricanes and similar examples of natural disasters destroying property and disrupting trade can result in severe economic shocks and enormous financial losses. This has immense negative effects on asset values and the creditworthiness of borrowers (Carney, 2015). On the other hand, there are transition risks which can arise from the adjustment process to a lower-carbon economy. Changes in policy, technology and sentiment towards environmentally friendly production and consumption could cause a

[1] See Appendix for further details of the models

reassessment of large asset values. This can transform into credit exposures for lenders such as banks and investors as hidden costs and opportunities are promptly revealed, potentially causing large sectors to tumble (Carney, 2019a). As a result, these two types of climate risks have the potential to significantly impact both the supply and demand side of economies around the globe (Barret et al, 2018).

Macroeconomic Analysis of the Climate Crisis

Climate-related disasters resulting from physical risks will represent severe adverse supply shocks. Interrupted supply chains causing production to stop, disrupted transport opportunities preventing people from travelling to work, or destroyed electricity grids triggering power failures are only a few examples leading to such negative supply shocks. As a result, this will lower labour productivity and reduce the labour force, especially if these disruptions last for extended periods of time. Ultimately, this will result in an unemployment increase, as the illustrations given below show (ESRB, 2016).

Simultaneously, the economy's demand side will experience negative shocks resulting from these physical risks too. Several components of aggregate demand will be impacted. Firstly, consumption will be substantially reduced due to the supply shock causing major income losses of suddenly unemployed workers. As this will lead to credit-constrained households being unable to continue smoothing their consumption, a fall in aggregate consumption will follow. Secondly, the general uncertainty about the persistence of the effects resulting from the climate event will lead to investment plans being cancelled. Consequently, the majority of business investment as well as household investment in new housing and consumer durables will sharply decrease (Hsiang and Jina, 2014). Finally, a major climate event might also negatively affect world trade. For instance, unexpected landslides or hurricanes can block important transport routes and thus make trade exchange impossible. In particular, countries specialising in climate-exposed industries such as agriculture will face considerable export losses, putting world trade out of balance. As a consequence of these factors, natural disasters will lead to a drastic decline in aggregate demand (Felbermayr and Gröschl, 2013).

The AD-BT-ERU model of an open economy together with the WS-PS model of the labour market shown below in Figure 1 effectively describes these economic shocks. According to these models, the economy is in medium-run equilibrium at the red dot before any economic shocks occur. After the climate event, labour productivity losses will cause the price-setting (PS) curve in the WS-PS model to shift downwards. This reflects the fact that a reduced marginal product of labour will require the firms to lower the real wage paid when choosing their profit-maximising price (Bowles, Carlin and Stevens, 2017). Moreover, a potentially reduced labour force will shift the wage-setting (WS) curve upwards. This is due to increased bargaining power of remaining workers which they will use during wage negotiations to set a wage higher than the efficiency wage. The new labour market equilibrium is shown at the green dot, with equilibrium output significantly reduced (y_e'). As a result, the labour market will eventually experience an increased equilibrium rate of unemployment (Carlin and Soskice, 2015).

In the AD-BT-ERU model, these labour market dynamics are represented by a leftward shift of the ERU curve. In addition to the ERU curve shift, aggregate demand will fall sharply at the same time due to declines in consumption, investment and possibly also trade exports. This can be seen in a leftward shift of the aggregate demand (AD) curve. Finally, depressed trade activities will potentially shift the balance of trade (BT) curve left as well. However, the new AD and BT curves will not likely intersect vertically above the initial medium-run equilibrium at the red dot, leaving the economy with either a trade deficit or surplus. This is because these climate-related economic shocks – unlike oil shocks – do not represent pure trade balance shocks. Ultimately, the economy will arrive at its new medium-run equilibrium at the green dot. At this point, output will have decreased, while unemployment will have risen accordingly. Assuming that the climate-related economic shock will be a global shock affecting countries around the world, the real exchange rate (q) will remain constant at the equilibrium rate before the shock (i.e. q'). The reason for this, building on the assumption of a global shock, follows from the Uncovered Interest Parity Condition which suggests that a zero difference between home and world real interest rate will result in a zero change of the real exchange rate (Carlin and Soskice, 2015). Since a global crisis is assumed by the given model, both home and world interest rates will be lowered equally towards the zero lower bound, resulting in an unchanged equilibrium real exchange rate. Figure 1 illustrates the macroeconomic consequences of climate-related shocks.

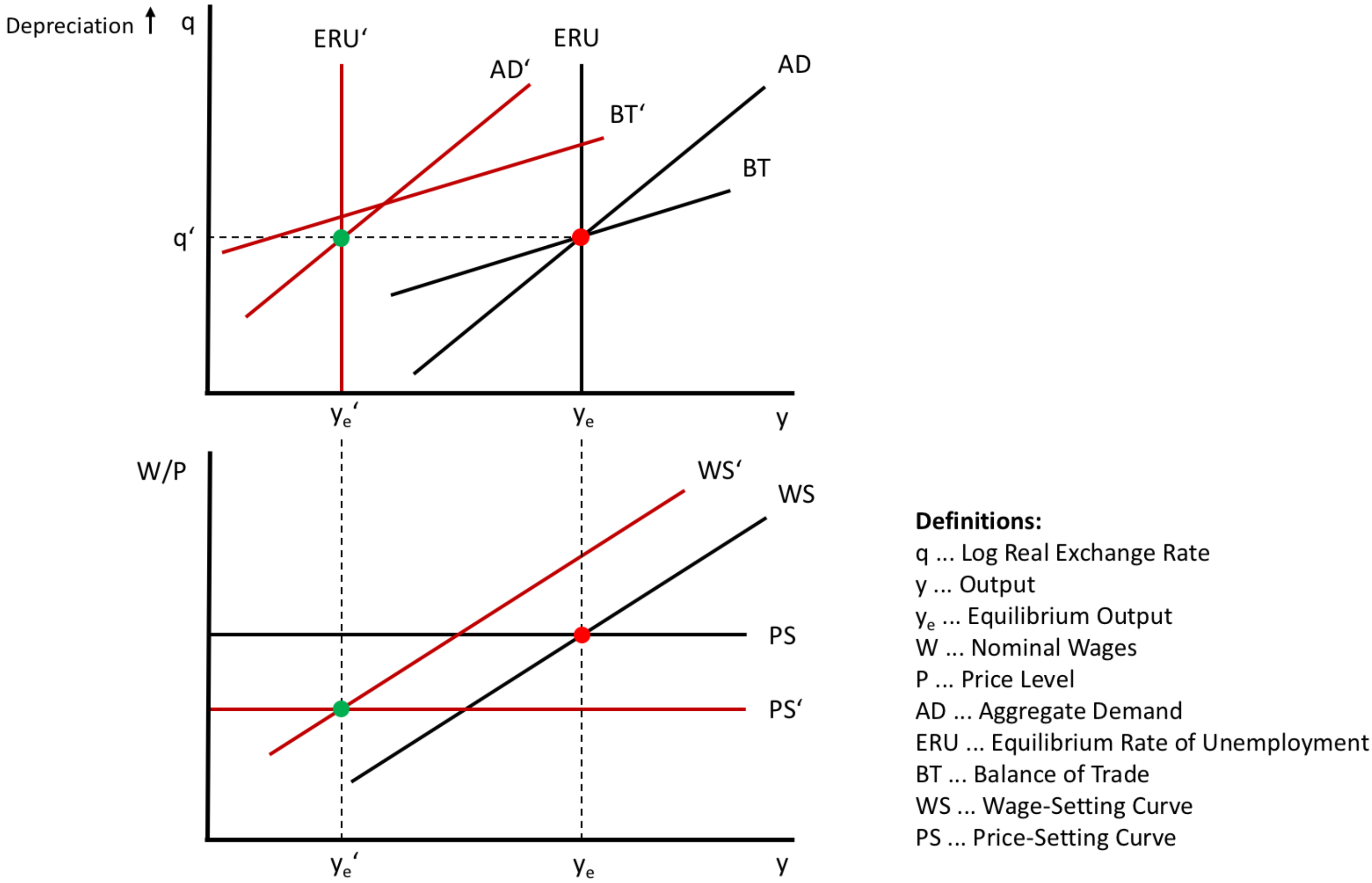


Figure 1: *The Macroeconomic Effects of a Climate Event Shown by the AD-BT-ERU Model and WS-PS Model* [2]

However, as described above, not only physical risks can cause potential climate-related economic shocks. Transition risks arising from the adjustment process to a lower-carbon economy can make considerable contributions to these shocks as well. In fact, a main source of transition risks, despite the seeming paradox, are climate policies with the goal to achieve lower carbon emissions. A common and much debated example is a carbon tax on firms in polluting industries such as the energy sector (European Environment Agency, 2019). An introduction of such taxes would affect the supply side of the economy by increasing the tax wedge of firms. An increased tax wedge would shift the price-setting curve further downwards due to a reduced profit-maximising real wage, resulting in rising downward pressures on employment (Carlin and Soskice, 2015). Such examples show that transition

[2] Models used according to Carlin and Soskice (2015), see Appendix for further details

risks have the potential to further contribute to the adverse shocks resulting from physical risks, imposing massive burdens on economic activity.

Furthermore, these climate-related risks will also lead to an increase in inflation. The WS-PS model illustrated below shows that workers will want to increase their real wages due to the increased bargaining power they will gain once the labour force is reduced. This is described by the bargaining gap between the PS’ and WS’ curves at the initial equilibrium output rate (y_e). Hence in period 1 after the shocks, firms will have to increase workers’ nominal wages by more than the level of expected inflation. Since the model assumes that wage-setters follow adaptive expectations, this level of expected inflation stays constant at target inflation (π^T) in period 1 after the shocks. The increase in nominal wages leads to firms immediately setting prices as a mark-up over wages. Eventually, this causes the inflation rate to rise to the blue dot ($\pi_1 > \pi^T$). The PC-MR model in connection with the WS-PS model, as can be seen in Figure 2 below, shows this inflationary process (Carlin and Soskice, 2015).

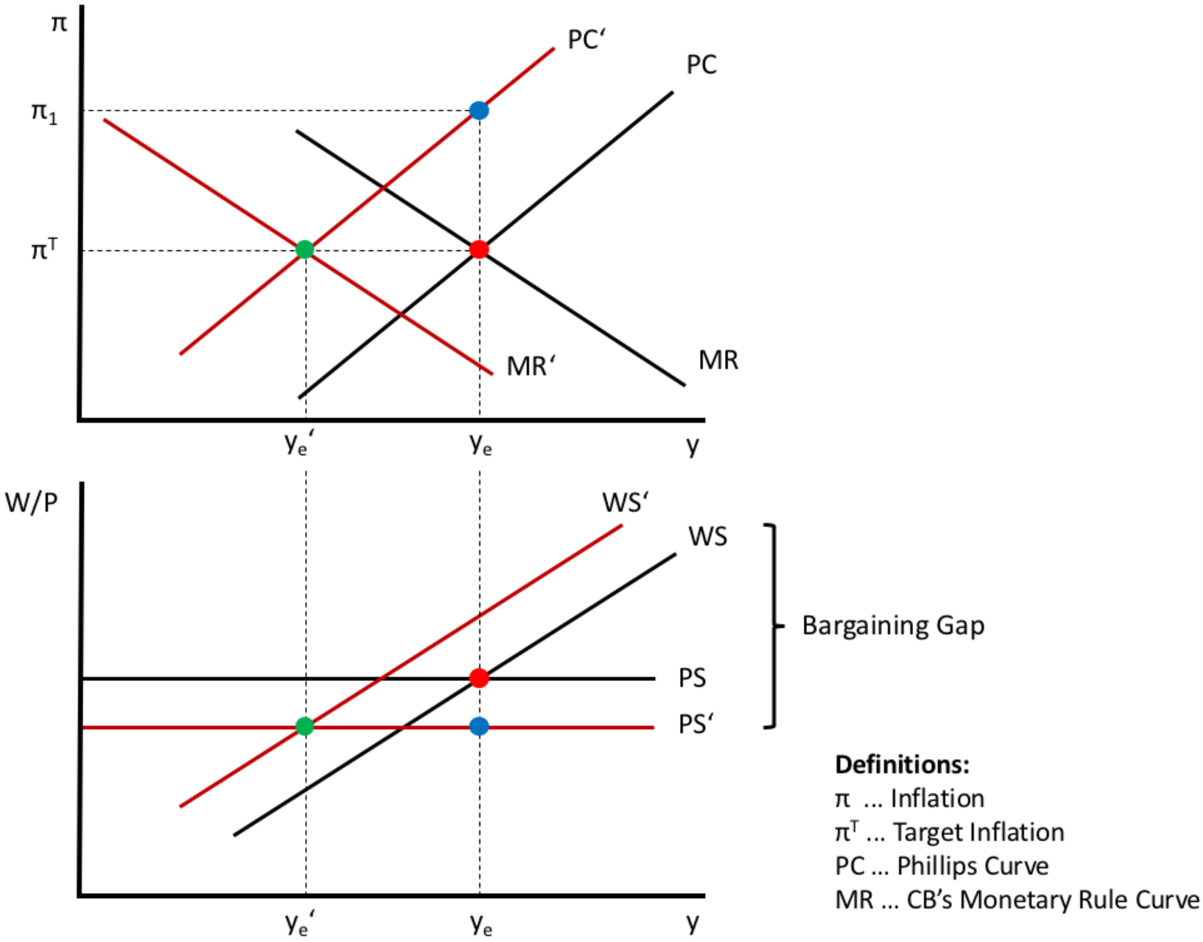


Figure 2: *Inflationary Process Shown by the PC-MR Model and WS-PS Model* [3]

[3] Models used according to Carlin and Soskice (2015), see Appendix for further details

In summary, the models presented have illustrated that the macroeconomic effects of climate events related to physical and transition risks will result in extended periods of low economic growth, rising unemployment and high inflation. Monetary and fiscal policymakers will therefore face major new challenges in stabilising the world economy in such times of stagflation (McKibbin et al, 2017).

Imminent Risks to Financial Stability

Since the Global Financial Crisis, central banks around the world have reassessed their mandate and established new preventive actions such as macroprudential policies to ensure stable financial systems in the future (Tucker, Hall and Pattani, 2013). However, climate-related events such as natural disasters and transition policies will pose serious risks to banks and financial institutions around the world, and hence threaten financial stability in several ways (Batten, 2018)

Firstly, the banking sector will increasingly be exposed to credit risks from both households and firms. Extreme weather events and resulting damages can cause significant financial losses. These losses will lead to reduced abilities to repay loans and mortgages, falling property values and declining housing markets. Also, aggregate demand shocks resulting from climate events might depress operating profits of a large number of firms, thus threatening their solvency (Barret et al, 2018). Moreover, firms with business models not aligning with the transition to a lower-carbon economy will be exposed to various types of transition risks. Examples include firms within the energy, agriculture or transport sectors. Possible introductions of environmental taxes, changes in capital allocations or new green technologies could quickly imply dramatic changes in the valuations of these types of firms. Consequently, this bears the potential of a large number of firms being unable to repay loans (Wolf, 2020). As a result, credit risks for banks will increase sharply since both the probability of default and loss given default will rise. This poses enormous risks for banks that extended credits to firms, as ultimately a negative spiral of loan defaults within major economies can arise (Barret et al, 2018).

Secondly, banks and financial institutions will need to face market risks resulting from climate-related transformations on financial markets. These are due to the fact that a transition to a lower-carbon economy will require large changes in capital allocation and investment. For instance, a study by the International Energy Agency suggested that meeting the objectives of the Paris Agreement will require $16 trillion less investments in fossil fuel related assets and $24 trillion more investments in efficient energy usage and renewables by 2040 compared to "business as usual" (International Energy Agency, 2018). Also, a limit on carbon emissions, for example, would affect several industries directly ("first-tier") and indirectly ("second-tier"). As Figure 3 below shows, these industries would together account for 28% of the global equity market capitalisation (Baranova, Jung and Noss, 2017). As a consequence of such types of major capital reallocations, financial markets and the banking sector are subject to enormous burdens. There will be dramatic changes in the values of corporate bonds, shares, commodities and other assets on financial markets, which in turn will massively impact the balance sheets of banks and other financial institutions. Altogether, this magnitude of changes in financial markets represents a great risk to financial stability across the world (Carlin and Soskice, 2015).

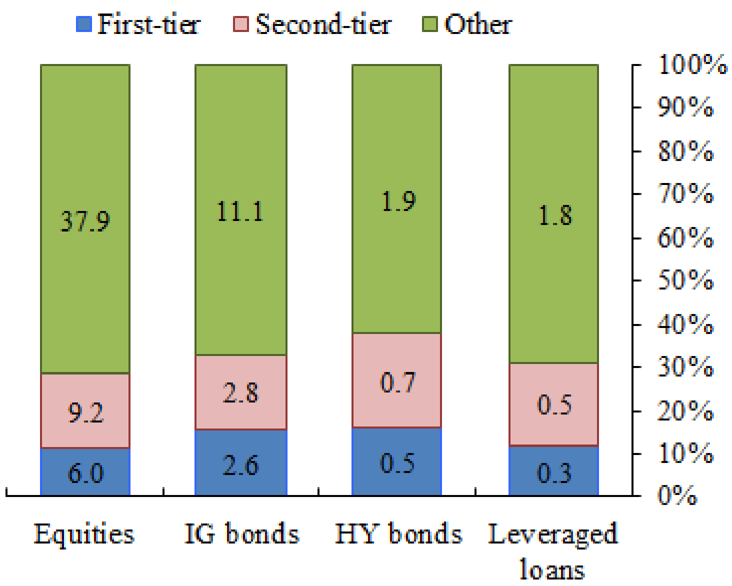


Figure 3: *Amount of Global Equity and Fixed-Income Assets at Risk* [4]

(Baranova, Jung and Noss, 2017)

[4] Numbers on the bars show the value of assets at risk, expressed in US$ trillions.

Preventive Policy Responses

Many central bankers and macroeconomists have been slow in starting to focus on the issues that the climate crisis will bring to the world economy. However, public policy can play a huge role in reducing the impacts of both physical and transition risks (Baranova, Jung and Noss, 2017). There have been some positive developments in recent years with influential central banks such as the Bank of England or the European Central Bank openly addressing the obvious risks. In order to prevent worst case scenarios with climate-related adverse demand and supply shocks causing worldwide recessions, financial policymakers need to start implementing preventive policies now. This can be interpreted as a "green mandate" for central banks to support overall government policies. There are three main factors that central banks need to address: the impact on their monetary policy decisions, their direct role in mitigating climate change through appropriate balance sheet management, and the transparent communication of climate change effects (Davies, 2020).

First of all, it is important to remember that the climate crisis poses significant risks to output and inflation, and hence the "usual" monetary policy objectives of central banks. As explained above, climate-related risks can create enormous stagflationary challenges and financial stability issues in the global economy. As a result, financial policymakers will need to actively consider the climate crisis in their economic forecasts in order to meet their output and inflation targets as well as ensure stable financial systems. One possibility of doing this is to incorporate climate variables in their macroeconomic models. Particularly, weather effect variables can be included in macroeconomic forecasting models to support central banks in assessing the short-term impact of extreme weather events on economic variables such as inflation or GDP. Longer term effects of gradual climate change on future policy objectives could be added by additional climate variables too (Campiglio et al, 2018). These amendments of current macroeconomic models will allow central banks to better forecast any climate-related shocks and enable them to provide adequate support to the economy as soon as it becomes necessary (Pindyck, 2013).

Additionally, central banks increasingly play an important role in directly mitigating climate change through sustainable asset purchases. This method, also known as "Green Quantitative Easing" (Green QE), includes central banks favouring to purchase assets that meet certain "green" criteria (Vaze, Meng and Giuliani, 2019). As recent data shows, the sustainable asset market has increased rapidly in recent years. 2019 was a global record year for green bond issuances, with a total value of $257.7 billion issued. As shown in Figure 4, this represents a 51% growth over the previous year (Climate Bonds Initiative, 2020). However, as green bonds accounted for only 3% of global bond issuance in 2018, there is still great potential for improvement. Through Green QE, central banks can provide positive incentives for the green bond market to increase (Carney , 2019). In addition to Green QE, central banks could offer favourable collateral conditions when lending to firms that have better sustainability and low-carbon credentials. These actions would provide effective incentives for firms to improve their sustainability standards in order to have long-term financial advantages. For central banks, these policies would not change the value of asset purchases or lending, as these sizes would continue to be determined by the stabilisation objectives. Only the composition of QE would be impacted by this green mandate towards more sustainability to meet the climate objective and thus effectively support the mitigation of climate change (Carney, 2019b).

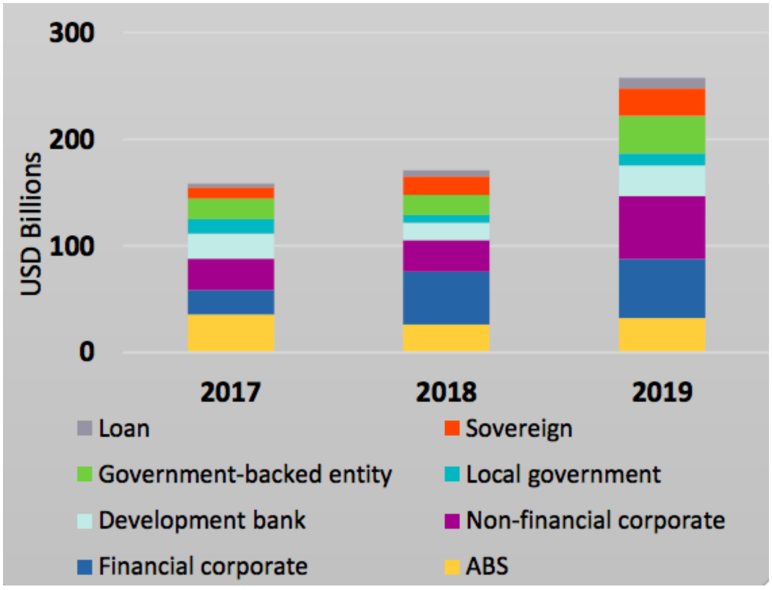


Figure 4: *Green Bond Issuance, 2017 – 2019*

(Climate Bonds Initiative, 2020)

Lastly, markets around the world need clear information to be able to anticipate and smooth the transition to a lower-carbon world. Hence it is crucial for policymakers to provide transparent communication and credible information about climate risks to financial stability and the economy (Carney, 2019a). Since climate change caused the first S&P 500 bankruptcy in 2018, when PG&E Corp. was overwhelmed by Californian droughts, market demand for accurate climate reporting has increased rapidly (Gold, 2019). It is the responsibility of both governments and central banks to meet this rising demand. More clarity about what the transition to a lower-carbon economy will take can reduce the risk of an abrupt adjustment. This is necessary to avoid a "Minsky Moment" like in 2008, when the markets suddenly realised the massive extent of hidden risks and got into turmoil. (Davies, 2020). If proper information is available at an early stage, firms can continuously align their production standards with sustainability objectives, while investors can adjust their portfolios towards greener targets. Thus, the transparent communication of correct climate change information provided by central banks and governments will be vital to ensure a smooth transition to a lower-carbon world and will hence minimise any transition risks on economic and financial stability (Carney, 2019a).

Conclusion

This essay has analysed the macroeconomic effects of risks related to the climate crisis and provided suitable policy recommendations. Using several economic models, it has been shown that severe climate events can create adverse shocks to aggregate demand and the economy's supply side. These shocks will subsequently result in significant negative pressures on output, inflation and employment. Moreover, even with macroprudential policies in place, financial stability around the globe will be threatened by these climate implications. Preventive policy responses by central banks and other policymakers include the introduction of climate variables in forecasting models, Green QE to provide essential market incentives and transparent communication of risks to support a smooth transition to a lower-carbon economy. And although it is the responsibility of governments and not financial policymakers to lead this transition process, the climate crisis requires significant additions to the current central bank mandates. In order for central banks to be able to achieve their usual monetary policy goals in the future, they must begin to develop suitable frameworks for markets to smooth the transition and signal the need for greater action across the financial sector. These actions are necessary to avoid an enormous reduction in long-term prosperity. And since the “window of opportunity is finite and shrinking”, as Mark Carney (2019a) put it, the time to act is now.

References

Baranova, Y., Jung, C. and Noss, J. (2017) *The Tip of the Iceberg: The Implications of Climate Change on Financial Markets*. [online] London: Bank Underground, Bank of England. Available at: https://bankunderground.co.uk/2017/01/23/the-tip-of-the-iceberg-the-implications-of-climate-change-on-financial-markets/ [Accessed 17 February 2020].

Barret, R., Dalhuijsen, E., Hussain, T., Kemmitt, S., Scott, M., and Huizen, J. (2018) *Transition in Thinking: The Impact of Climate Change on the UK Banking Sector*. [online] London: Prudential Regulation Authority, Bank of England. Available at: https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/report/transition-in-thinking-the-impact-of-climate-change-on-the-uk-banking-sector.pdf?la=en&hash=A0C99529978C94AC8E1C6B4CE1EECD8C05CBF40D [Accessed 16 February 2020].

Batten, S. (2018) *Climate change and the macro-economy: a critical review*. [online] London: Bank of England. Available at: https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2018/climate-change-and-the-macro-economy-a-critical-review.pdf?la=en&hash=D1A56DF33C50074F5D3383587A272BFD611CBA04 [Accessed 23 February 2020].

Bowles, S., Carlin, W., and Stevens, M. (2017) *The Labour Market: Wages, Profits, and Unemployment*. [online] London: The Core Team, The Economy. Available at: https://core-econ.org/the-economy/book/text/09.html#subheadline [Accessed 21 February 2020].

Buiter, W. H. (2020) *When Central Banks Go Green*. [online] Dhaka: The Business Standard. Available at: https://tbsnews.net/opinion/when-central-banks-go-green [Accessed 15 February 2020].

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G. and Tanaka, M. (2018) *Climate Change Challenges for Central Canks and Financial Regulators*. London: Macmillan Publishers Limited.

Carlin, W. and Soskice, D. (2015) *Macroeconomics. Institutions, Instability and the Financial System*. Oxford: Oxford University Press.

Carney, M. (2015) *Breaking the Tragedy of the Horizon – Climate Change and Financial Stability*. [online] London: Bank of England. Available at: https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horiz on-climate-change-and-financial-stability.pdf?la=en&hash=7C67E785651862457D99511147C7424FF5EA0C1A [Accessed 17 February 2020].

Carney, M. (2019a) *A New Horizon*. [online] London: Bank of England. Available at: https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/a-new-horizon-speech-by-mark-carney.pdf?la=en&hash=F63F8064E0408F038CABB1F29C58FB1A0CD0FE25 [Accessed 15 February 2020].

Carney, M. (2019b) Fifty Shades of Green. *Finance & Development, International Monetary Fund*, 56 (4) pp. 12-15.

Climate Bonds Initiative (2020) *2019 Green Bond Market Summary* [online] London: Climate Bonds Initiative. Available at: https://www.climatebonds.net/system/tdf/reports/2019_annual_highlights-final.pdf?file=1&type=node&id=46731&force=0 [Accessed 22 February 2020].

Davies, G. (2020) *Central Banks Begin to Grapple with Climate Change*. [online] London: Financial Times. Available at: https://www.ft.com/content/eafee5dc-2e52-11ea-bc77-65e4aa615551 [Accessed 19 February 2020].

ESRB – European Systemic Risk Board (2016) *Too Late, Too Sudden: Transition to a low-carbon economy and systemic risk*. [online] Frankfurt am Main: ESRB – European Systemic Risk Board. Available at: https://www.esrb.europa.eu/pub/pdf/asc/Reports_ASC_6_1602.pdf [Accessed 21 February 2020].

European Environment Agency (2019) *A Decade of Industrial Pollution Data*. [online] Copenhagen: European Environment Agency. Available at: https://www.eea.europa.eu/themes/industry/industrial-pollution-in-europe/a-decade-of-industrial-pollution-data [Accessed 18 February 2020].

Felbermayr, G. and Gröschl, J. (2013) Natural Disasters and the Effect of Trade on Income: A New Panel IV Approach. *European Economic Review*, 58 (1), pp. 18-30.

Gold, R. (2019) *PG&E: The First Climate-Change Bankruptcy, Probably Not the Last*. [online] New York City: Wall Street Journal. Available at:

https://www.wsj.com/articles/pg-e-wildfires-and-the-first-climate-change-bankruptcy-11547820006 [Accessed 17 February 2020].

Hsiang, S. M. and Jina A. S. (2014) *The Causal Effect of Environmental Catastrophe on Long-Run Economic Growth: Evidence from 6,700 Cyclones*. Cambridge, Massachusetts: National Bureau of Economic Research.

International Energy Agency (2018) *World Energy Outlook 2018*. [online] Paris: International Energy Agency. Available at: https://www.iea.org/reports/world-energy-outlook-2018 [Accessed 18 February 2020].

McKibbin, W. J., Morris, A. C., Wilcoxen, P. J. and Panton, A. J. (2017) *Climate Change and Monetary Policy: Dealing with Disruption*. [online] Washington, D. C.: Brookings Institution Available at: https://www.brookings.edu/wp-content/uploads/2017/12/es_20171201_climatechangeandmonetarypolicyv2.pdf [Accessed 23 February 2020]

Pindyck, R. S. (2013) *Climate Change Policy: What Do The Models Tell Us?* [online] Cambridge, Massachusetts: Massachusetts Institute of Technology (MIT). Available at: https://pubs.aeaweb.org/doi/pdfplus/10.1257/jel.51.3.860 [Accessed 18 February 2020].

Tucker, P., Hall, S. and Pattani, A. (2013) *Macroprudential Policy at the Bank of England*. [online] London: Bank of England. Available at: https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2013/macroprudential-policy-at-the-boe.pdf?la=en&hash=04FF3BF0E925A41CA47F56671ECE0A4D8E0331F5 [Accessed 24 February 2020].

Vaze, P., Meng, A. and Giuliani, D. (2019) *Greening the Financial System. Tilting the Playing Field. The Role of Central Banks*. London: Climate Bonds Initiative.

Wolf, M. (2020) *Last Chance for the Climate Transition*. [online] London: Financial Times. Available at: https://www.ft.com/content/3090b1fe-51a6-11ea-8841-482eed0038b1 [Accessed 21 February 2020].

Appendix

This essay has used the PC-MR model, the WS-PS model and the AD-BT-ERU model of an open economy in analysing macroeconomic implications of climate risks. These models are explained in detail in *"Macroeconomics – Institutions, Instability, and the Financial System"* by Wendy Carlin and David Soskice (2015). This appendix will provide the underlying equations as well as brief explanations of these models.

PC-MR Model

The PC-MR model describes the economy's level of inflation (π) and output (y). The Phillips Curve (PC) represents the relationship between output and inflation, while the Monetary Rule (MR) curve shows the central bank's optimal output-inflation combination for any PC it faces. The MR curve hence tells the central bank what output gap to choose, using conventional monetary policy, when inflation is away from its target (Carlin and Soskice, 2015).

The equations of these two curves are given as follows:

Phillips Curve: $\pi_t = \pi^E_t + \alpha\,(y_t - y_e)$

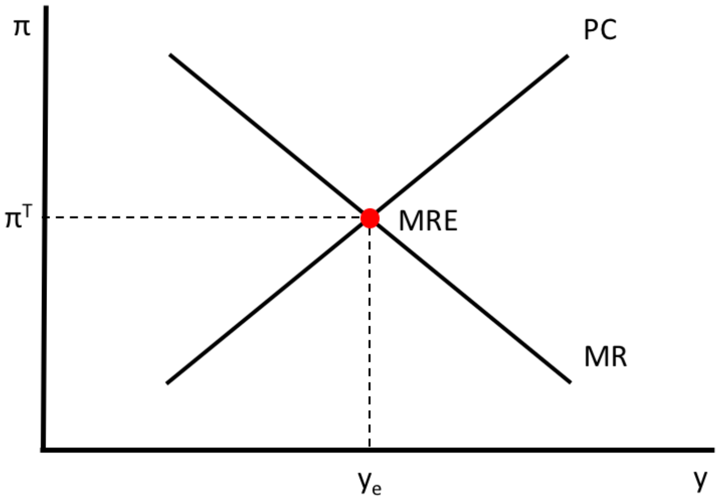
MR Curve: $(y_t - y_e) = -\alpha\,\beta\,(\pi_t - \pi^T)$

where π^E_t … Expected inflation rate at time t

π^T … Target inflation rate

y_e … Equilibrium output

α, β … Constants according to the central bank's loss function



PC-MR Model with Economy in Medium-Run Equilibrium

WS-PS Model

The WS-PS model describes dynamics of the labour market, showing how the supply side with its wage-setters and price-setters determines the equilibrium level of output. The model's diagram presents output on the horizontal axis and the real wage (W/P) on the vertical axis. The wage-setting (WS) curve indicates the real wage necessary at each employment level to incentivise workers to work hard. The price-setting (PS) wage represents the real wage paid by firms when they choose their profit-maximising price. The medium-run equilibrium output level is given by the intersection of the curves (Carlin and Soskice, 2015).

The equations of these curves are given as follows:

WS Curve: $W = P\,(1 - au + z)$

PS Curve: $W/P = \lambda \,/\, ((1 + \mu)(1 + t))$

where W … Nominal wage

P … Price level in the economy

a … Parameter (e.g. bargaining power)

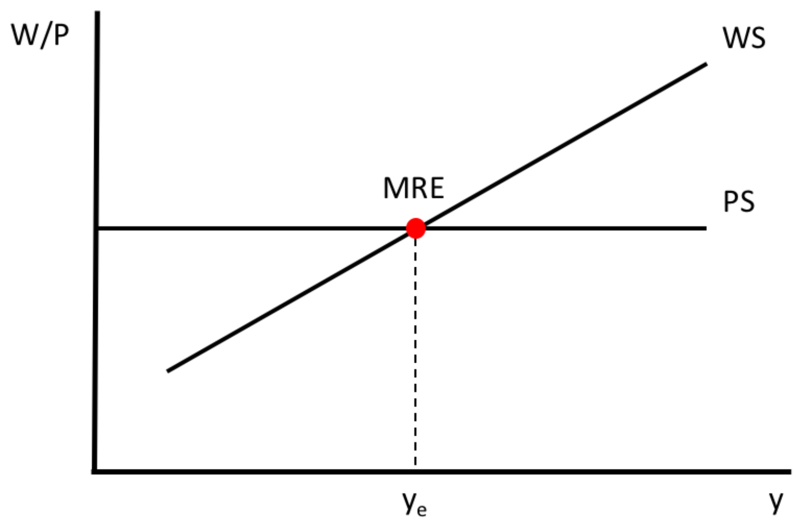
u … Unemployment

z … Other factors (e.g. taxes)

λ … Marginal product of labour

μ … Mark-up

t … Corporate taxes



WS-PS Model with Labour Market in Medium-Run Equilibrium

AD-BT-ERU Model

The AD-BT-ERU model provides a summary of both sides of the economy, showing how aggregate demand and supply shocks affect the real exchange rate and output in the constant inflation equilibrium. The model consists of a diagram with output on the horizontal axis and the log real exchange rate (q) on the vertical axis. The aggregate demand (AD) curve represents the economy's demand side. The equilibrium rate of unemployment (ERU) curve illustrates the equilibrium output level, thus representing the economy's supply side. To simplify, workers in the economy are assumed to only take domestic prices into account when setting wages, so that the ERU curve is independent of the exchange rate and thus vertical. The balance of trade (BT) curve is also included to explicitly show the trade balance. It slopes upwards because a real exchange rate depreciation boosts net exports and thus increases domestic output (Carlin and Soskice, 2015).

The equations of each curves are given as follows:

AD Curve: $y_t = k\,(c_0 + a_0 + G) - ar_{t-1} + bq_{\,t-1}$

BT Curve: $BT = X - M$

ERU Curve: $y = y_e\,(z^w, z^P)$

where k … Multiplier

c_0 … Autonomous consumption

a_0 … Autonomous investment

G … Government spending

a, b … Constants

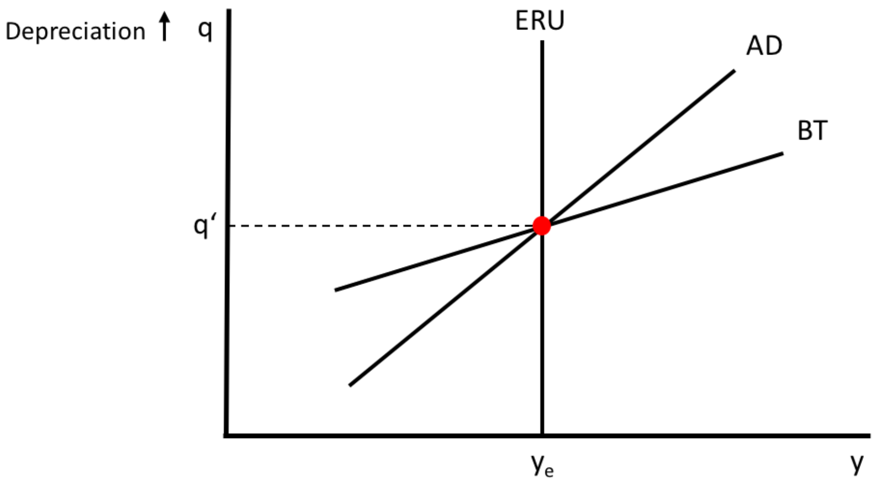
r … Real interest rate

X … Exports

M … Imports

z^W … Supply-side factors that shift the WS curve (e.g. unions, unemployment benefits)

z^P … Supply-side factors that shift the PS curve (e.g. corporate taxes, productivity)



AD-BT-ERU Model with Economy in Medium-Run Equilibrium