The British National Strategic Fund

Investment Strategy

In promoting economic equality and independence

Rainbow Consulting Ltd.

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MIPC

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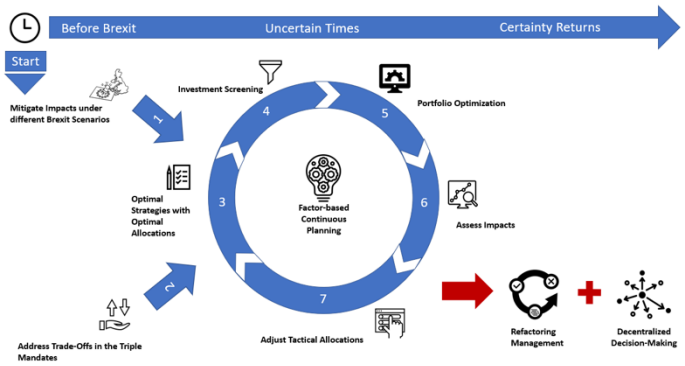
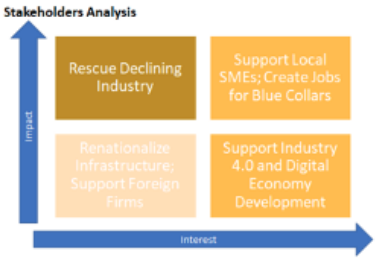
Executive Summary

With Brexit looming, the road ahead for United Kingdom is a challenging one. Uncertainty has many industries, companies and individuals waiting on the sidelines for the results dictating the future of the UK economy. Rainbow Consulting has created three different scenarios based on the possible Brexit outcomes and the asset allocation that should be attributed to each scenario. Our investment frame is illustrated on the right.



Research shows that industries like steel and automotive have once been a vital part of the UK's overall economy, but as times have changed and the UK economy has shifted from manufacturing to service-providing, these industries have declined. Although BNSF recognizes the significance of these industries, instead of directly investing in a dying industry, we will help gradually phase them out through public investments while promoting new economic growth in cities which will most be affected by the dying sectors.



Our focus lies in the future growth of the UK economy. Hence, our investments focus on the development of 5 UK cities to boost the overall UK economy and promote equality as well as on developing industries that are new and have large potentials to grow (i.e. fintech, artificial intelligence, and robotics). Focusing on these industries will help the UK become more self-sufficient and move on from industries that are falling behind. We also chose to invest in companies such as BP and Tesco that have high ESG ratings and employ more than 400,000 individuals in the UK. Supporting home grown conglomerates that are focusing on green futures satisfies the triple mandate while also ensures investment returns.

In the asset selection process, we have selected assets based on the different geolocations including UK based, UK international, and foreign investments. For the asset classes, our portfolio includes public UK, US, Japanese, and Germany equities, public fixed income, gold, private equity, and private fixed income. This divide our overall portfolio into public and private investments. The private investments satisfy our mandates for economic independence and promoting the well-being of the UK whereas our public investments diversify and optimize the whole portfolio return. The fund's allocation weights will vary for the different scenarios of Brexit as more job loss may occur and specific sectors may be impacted under no-deal or hard deal scenarios.

After maximizing the Sharpe ratio and considering the triple mandate, the return for our portfolio given the three Brexit outcomes are 9.75%, 8.71%, and 7.67% for Soft, Hard, and No-Deal Brexit accordingly.

OUR APPROACH TO THE CASE

BNSF's board members have varying opinions on how the fund's capital should be allocated, but one thing that should be kept in mind is the fund's mandates and the ultimate goal of British economic independence as well as the long-term well-being of the British population. Our strategies directly address the major concerns of the board, including investing in local SMEs, creating new national champions, promoting technological innovations, and diversifying away from the British economy for a sustainable fund. Some concerns brought forth by the board, however, cannot be economically addressed by the limited capital and will, instead, be indirectly addressed by the improved UK economy, the inflow of foreign investments, and the development of reginal cities that will, for example, drive increased demand for infrastructure. A major risk of failing to achieve the mandates is the economic uncertainty tied to the outcome of the Brexit negotiations. As January 1st, 2021 is the end of the Brexit transition period, we must prepare for all three outcomes (Soft, Hard, and No-Deal Brexit).

First, in alignment with BNSF's mandates, we summarized 4 overarching investment strategies forming the most optimal solution addressing all the major concerns. Second, in order to execute the strategies effectively, we have a rigorous screening process to ensure the quality of our investments and a maximized economic return. Third, we set out quantitative targets regarding the portfolio returns addressing each of the mandates. In order to make sure that BNSF meets its required minimum return, we ran a portfolio optimization analysis to find the minimum weighting of public investments needed to ensure that the public investment portion of the portfolio is able to guarantee the generation of over 2.83% total portfolio annual return. It is a top priority for the BNSF to impact the overall British well-being, other than chasing high numbers of returns. Therefore, our remaining portfolio weighting will be focused on making an impact on the well-being of the UK economy. BNSF should also issue its own agency bond in addition to the £20 billion available to the fund to meet the extra municipal bond demands should the cities' performance justify more investments. Finally, BNSF should adjust its asset allocation based on closely monitoring the outcome of Brexit and the performance of the investments. BNSF will allocate more of its portfolio towards investments that address the short-term impacts in case of a No-Deal Brexit

THE OPTIMAL STRATEGY

1. To invest in municipal bonds to promote the UK's economic independence and address its socio-economic inequalities.

BNSF should invest in the private municipal bonds of 5 UK cities: Manchester, Newcastle, Birmingham, Sheffield, and Plymouth. These cities are carefully selected to boost Northern UK economic growth, diversify the UK economy's reliance on automotive and steel industries, and drive demand and infrastructure developments through increased tourism. The cities offer geographic and industry diversification to minimize investment risks and allow for a ripple effect in the developments of neighbouring cities.

In ensuring maximum result in the development of the cities, BNSF should continue to invest in the 5 cities given they meet the set of performance requirements set out by BNSF (Table 1). The performance of the cities will be evaluated every year, and BNSF should require that each city submits an annual budget.

Table 1: City Performance Targets for Year 1 (See appendix 12-16 for current city performance)

Manchester	- Maintain current level of annual GDP per capita (2.9%) - Slow down annual unemployment rate growth by 0.2% then aim to reverse and decrease unemployment rate by 0.2% per year.
Newcastle	- Reverse annual GDP per capita decline. - Decrease change in annual unemployment rate to -0.3%.
Birmingham	- Increase annual GDP per capita growth to 2%. - Slow down annual unemployment rate growth by 0.3% then aim to reverse and decrease unemployment.
Sheffield	- Increase annual GDP per capita growth to 2%. - Maintain current level of annual unemployment rate decline of -0.9% each year.
Plymouth	- Increase annual GDP per capita growth to 2%. - Slow down annual unemployment rate growth by 0.1% then aim to reverse and decrease unemployment by 0.2% per year.
	-

2. To invest in PE funds and social enterprises in areas that are most vulnerable to Brexit to address immediate impacts in the event of a hard Brexit; to invest in PE funds and social enterprises which promote the long-term well-being of the British population.

This strategy is to invest in the private equity funds that allow BNSF to combat immediate impacts of Brexit like job losses as well as to help build the future economy of the UK. As addressed in the case, The UK is currently facing a historically high unemployment rate due to the decline of manufacturing and offshoring, as well as the uncertainty added by Covid-19. Further, the loss of financial passports and the erection of trade barriers due to Brexit will result in the financial and other

international companies moving out of the UK and consequently leading to more job losses. Therefore, the unemployment rate is projected to increase in any Brexit scenario, but being the worst under Hard Brexit.
Investing in PE funds will not only add diversity to our portfolio but also lower unemployment rate directly and indirectly by providing resources to social enterprises and local companies with growth potential. BNSF can

1. Choose funds that support small companies to create more job opportunities directly or
2. Select funds that focus on solving social issues like employment and income inequality, thus lowering the unemployment rate indirectly.

In measuring the performance of the funds, BNSF will require the funds to send an impact report annually. To ensure that the funds allow us to achieve our overall portfolio's goal of improving the unemployment rate and increasing the average wage, we will evaluate their impact outcomes based on three criteria:

Quantitative metrics:

i) Number of jobs created

ii) Number of enterprises/people benefiting from the investment

Qualitative metrics:

iii) Whether social enterprises are satisfied with the support from funds (level of satisfaction).

The qualitative part will be collected through annual surveys.
Our overall procedure for this strategy is shown in appendix 33.

3. To invest in low/non-correlated assets and British international conglomerates with high ESG scores and local employees to ensure the fund meeting its return objective despite a hard Brexit.

We have filtered out a few large multinational corporations for BNSF to invest in to provide further diversification to the portfolio. To fulfill BNSF's triple mandate, we narrowed down companies that employed or supported local UK citizens, had high MSCI ESG scores (min A-) and would not be affected by the general state of the UK economy. We included global defensive stocks such as Proctor & Gamble and PepsiCo, conglomerates like Microsoft and Japanese ETFs. We also have exposure to alternative assets through commodities markets such as gold and real estate markets through diversified REIT portfolios. Public investments in these types of assets will help provide stability to our portfolio and ensure steady growth and returns.

4. To boost the UK's long-term sustainability and independence in the next decades by investing in British venture capital funds that focus on late stage investing in the industry 4.0 and digital economy value chain start-ups and transition away from declining industries.

A Hard / No-Deal Brexit could adversely affect the overall well-being of the British economy, especially on the declining, yet crucial industries like steel and auto. However, given BNSF's limited size and ability, we recommend not to directly invest in these industries long-term. Instead, BNSF. should focus on investments in the technology sector that could either increase UK's manufacturing productivities or help UK secure a leadership position in the digital economy.

UK is quickly losing market shares and attractiveness to other nations in traditional manufacturing industries. For instance, the average UK auto industry growth over the last 5 years was -1.8%. Investment in such sectors generate low returns and make little social impacts. On the other hand, The UK has a leading position in Europe when it comes to technology, attracting far more investments into the sector than other countries on the continent. (London Stock Exchange Group, 2017). As one of the top priorities of BNSF is the future of the UK's economy, we recommended that BNSF take advantage of the British leadership in R&D, manufacturing, and finance by promoting UK's development in the next economic trends, which are the digital economy and Industry 4.0. Currently, the UK is ranked just 23rd in Europe in the Industry 4.0 development index (Hayriye Atika and Fatma Ünlüa, 2019) (appendix 22). Regional efforts around cyber security, e-commerce, robotics, 3D printing, and AI are expected to benefit the sustainability and independence of the economy. For example, they can improve the productivities in the manufacturing space and address the UK's national security concerns regarding big data over the next decades.

BNSF should partner with selected venture capital funds to invest in late venture stage tech UK tech start-ups based on the value chain they sit on in the Michael Porter's value chain framework while considering their size and growth potential. It is recommended that BNSF tracks the performance of its investments by assessing the companies' revenue growth rate comparing to its relative benchmark and its market share every year, as well as making sure that the companies' long-term strategies are in line with fulfilling BNSF's mandates.

INVESTMENT SELECTION PROCESS AND STRATEGY IMPLEMENTATION

Selection and implementation process of cities investments

In addressing BNSF's first and second mandates, the fund should invest explicitly in 5 UK cities: Manchester, Newcastle, Birmingham, Sheffield, and Plymouth. The cities are selected to best support the UK's economic growth, enable its self-efficiency, and address socio-economic inequalities within the nation.

Boost Northern Economic Growth

In general, over the past decades, Northern UK has experienced slower economic growth in comparison to Southern UK. Most evidently, North East England has the slowest growth. In 2018, GDP per capita of North East England was £23.6K and GDP per capita of North West England is £28.5K while that of South East England is £34.1K and South West England is £28.2K (ONS, 2019) (Appendix 8). Similarly, the average gross weekly earnings of those in the North West regions were £562 between April and June of 2020 compared to £730 and £613 in South East and South West respectively (ONS, 2020) (Appendix 9). The life expectancy is also higher in the South than the North by 3 years (ONS, 2016) (Appendix 10).

Investment decisions regarding supporting economic growth in the Northern regions can be based on a set of indicators measuring the potential of various cities in soaking up future R&D funding and transforming investments into outcomes. Based on the indicators of patents strength, trademarks strength, university innovation strength, business innovation strength, skills and spillover strength, and infrastructure strength, the city with the highest growth potential in the North West region is Manchester, and the highest growth potential city in the North East region is Newcastle (Appendix 11). The BNSP will therefore invest in these two cities' municipal bonds to support the growth of Northern UK.

Diversify Reliance on Automotive and Steel Industries

Historically, the UK is one of the major Steel and Iron exporters in the world. Currently, the UK's Iron and Steel industry generates an annual revenue of £5.7 billion and its growth rate has been declining at an average of 3.3% over the past 5 years due to climate change policies and increased competition. Annual growth rate is further projected to decline for the next 5 years at a 0.7% rate (Thomas, 2020). Brexit could also potentially limit the export demand from EU countries.

Similarity, UK was once the largest exporter of cars in the world. Currently, with a market size of £51 billion, the average industry growth over the last 5 years was -1.8%. Exports dropped by 3.1% in February 2020 in comparison to the same month last year due to lowered consumer confidence following Brexit, climate change concerns, and COVID-19 impacts. (Thomas, 2020)
As a result, to support the UK's economic growth, BNSF will help major iron and steel producing cities as well as automotive manufacturing cities to diversify away from a reliance on exporting minerals and automotive. In particular, BNSF will invest in the digital economy and Industry 4.0 technologies of Birmingham, a major automotive city in the Midlands region, and Sheffield, the "Steel City".

Tourism Development Plan

The UK is the 5th largest tourism sector in the world (Christoff, 2019) and the World Travel & Tourism Council (WTTC) claims that it still has room for growth. According to Gloria Guevara, president of WTTC, "Post-Brexit, travel and tourism stands to be one of the major sectors to drive a recovery in the British economy." Consequently, BNSF will invest in a major tourism city, Plymouth, to drive economic growth through tourism. Plymouth, Britain's "Ocean-City", has had government spending decrease by 12% from 2010 to 2018, and are ranked among the lowest of the UK cities in terms of number of business starts, business stock per capita, proportion of private sector jobs, and housing growth stocks. (CenterForCities, 2019) Yet, Plymouth has strong university innovation and strong skills and spillover (Appendix 11), and it can therefore improve its economic infrastructures through increased tourism spending and demand.

Screening process for impact investing

We selected funds and social enterprises based on three important criteria: 1. The mandate of the PE funds 2. Fund management. 3. The fund's previous impact outcome

The mandate of the PE fund

As our strategy is focus on bringing down the unemployment rate, the fund that we choose should also reflect this. There are three situations/types of mandates that satisfy our focus:

a. Mandate is to support local small and medium sized companies.
b. Mandate is to support social enterprises that focus on solving social issues, including employment and income inequality.
c. Mandate is to help people develop the skills, strengths and networks and become more employable.

Fund management

As the private fund's performance is highly correlated with the fund manager's decision, it is important to choose a right fund manager. Several factors should be considered: the fund manager's education, qualification, investment experience and fund

management style. In addition, the most important is that he/she should understand our objectives and also be willing to include job creation into the overall fund strategy, and this could be achieved based on interviews with the fund manager.
The fund's previous impact outcome
We will rely our analysis on the past outcomes of the fund. Example key indicators for different fund mandates could be number of jobs created, job conversion rate, and number of people/social enterprises/local companies benefitted.

As stated above, we have selected three sample funds:

1. UnLtd. Venture fund: They help local social entrepreneurs to grow by offering both "loan and grant between £50,000 – £150,000 with business support". They satisfy the mandate by focusing on the businesses that create more jobs and training for people furthest from the labor market for the minor groups (UnLtd, 2018).

   Impact outcomes:
   - More than 333k people have benefited from the fund.
   - Over 1,000 jobs with 7.7 million investments.
2. The Big Issue Invest: This fund invests £20k to £3MM into social enterprises with sound business models. Their fund has various projects including one called Circle Collective. It helps young people get access to jobs, and also another project called Collage Arts which is designed to provide support to under-represented sections of the community by offering skills, experience and opportunities in the arts industry and therefore help them get jobs.

   Impact outcomes:
   - 150 organizations have benefited from the current investment in various projects.
3. Big Society Capital: It is a leading impact investment fund in the UK. They engage with investors, fund managers, charities and social enterprises including "The Big Issue Invest fund" mentioned as above. They aim to improve the UK population's lives especially for homelessness and also help youth get employed.

   Impact outcomes:
   - More than 1200 social enterprises have benefited from the fund.

Selection and Implementation process for diversification

We chose a variety of companies that had high ESG scores and employed UK citizens to provide greater diversification to BNSF. These are strategically chosen so BNSF's performance will be minimally affected during adverse economic conditions in the UK. We chose leaders in tech and consumer staple that are ahead of their peers not only in revenue generation but also in aspects such as climate change awareness, governance issues, and treatment of their employees. The fact that the culmination of these conglomerates employ more than 500,000 Brits makes it a great investment for BNSF to provide stability not just in good times, but also in bad. We also chose to invest in 20+ year US treasuries and gold as they have a low correlation with equity returns and can help further diversify our portfolio. See Appendix 5 for a table of companies we propose BNSF invest in and their corresponding ESG scores and employment numbers.

In order to alleviate future negative effects a recession or pandemic like COVID-19 will have on the UK's economy, it is prudent to invest in asset classes and stocks that are not correlated with the ebbs and flows that the UK faces. One such asset is gold, which in the past had a negative correlation to equity returns making it a great hedge for BNSP. The addition of gold into our portfolio will allow us to capture these premiums at times of market uncertainty. Gold is currently trading near all-time highs, at levels that were previously only seen in 1981 and the great financial crisis of 2007-2008. At these levels, it would be unwise to allocate too much of our capital gold only for it to depreciate as the world recovers from COVID-19. This is something that should be strategically added to the portfolio over time. See Appendix 3 for historical gold prices.

Another asset class that going forward shouldn't be affected by economic downturns is UK's very own British Petroleum (BP). BP has previously been at the mercy of oil prices, with crude oil prices reaching a peak in 2008 but has steadily been downhill from there. BP has recognized that they are under the heel of oil prices and that oil consumption will peak in mid-2020s and have a plan in place to transition to green energy by 2050 (British Petroleum, 2019). They believe that the primary energy source by 2050 will be renewables (wind, solar). As they're in this transition phase, S&P has given them an ESG Score of A- and will surely increase as they move towards to net zero by 2050. BP also employs 90,100 through its supply chain networks, either directly or indirectly and contributes 0.5% to the UK GDP. Including BP in our fund is a necessity as they are an essential part of the UK economy.

To add further diversification BNFS's portfolio, the fund will invest in Canadian and American REIT ETFs that have taken a significant hit with the COVID-19 pandemic and have historically provided strong dividends to their shareholders. The benefit of these ETF's is its diversification across real asset classes. The fund also diversified its country risk with investment in a Japanese large and mid-cap ETF; the top holdings of the ETF chosen (EWJ) also have high ESG scores and consists of companies such as Toyota, Sony and Takeda Pharmaceutical.

Selection and Implementation process for investing in industry 4.0 and digital economy value chain

We referenced Porter's value chain framework to make sure that the suggested portfolio covers the whole value chain in digital economy and industry 4.0(Appendix 6). They include Data and IT Infrastructure, Cyber Security, Industrial Software, Fintech, Artificial Intelligence, and Robotics. BNSF should partner with venture capital funds to invest in British based, small to medium

sized companies in those areas with market capitalization between 100 million to 10 billion Pounds**.** In order to limit BNSF's exposure to high venture risks and drive developments in the public market, BNSF should invest only in the late-venture stage or public companies. These firms need to demonstrate potential in becoming a segment leader or have high top line growth, focused on employing local employees, and have potential to be expanded internationally.

For example, it is strongly recommended that BNSF should invest in companies like DotDigital, which is a successful A.I. analytics online marketing firm. The British company contributes to the local economy and employment market, and it has a revenue growth in the high teens. Its recent successful IPO also shows its potential to expand internationally, while its data analyzation intellectual properties will be significant in reaching economic independence in the digital age.

Given that the field requires a great amount of due diligence and expertise, it is recommended that BNSF should partner with a few carefully selected venture capital funds with similar investment strategy as BNSF. The partnered funds should be selected based on the history of their portfolio performance, experiences of managing high amount of inflows, and expertise in the field of industry 4.0 related industries. The funds should also be selected based on their DVPI and DPI multiples, their IRR, as well as the historical performance of their invested companies' post-IPO performance in comparison to the corresponding benchmark metrics for late-stage tech investing venture capitals.

It is recommended that BNSF track the performance of its investments by assessing individual companies' revenue growth rate compared to its relative industry benchmark and its market share every year while also making sure that the companies' values are in line with BNSF's mandates

There are high chances that BNSF can become a majority shareholder of the start-ups. Along with the expertise of some of BNSF's board member, seats in the board of directors open more opportunities to ensure that the companies are in favor of achieving BNSF's mandates.

ASSET ALLOCATION

The asset allocation of BNSF's portfolio is based on three criteria. Firstly, the portfolio must satisfy the required return; secondly, the portfolio must address the short-term disruptions caused by a No-Deal/Hard Brexit; Thirdly, the portfolio allows the long-term development of the UK economy and the well-being of the UK population.

In order to satisfy these three criteria, we first optimize the weightings of the public investments in our portfolio and allocate the minimum weighting necessary to the public investment portions in order for it to generate the 2.83% total portfolio return. This is because our private investments are key to addressing the impacts of Brexit and boosting the long-term economic growth, dependence, and sustainability of the UK. Then, given a No-Deal Brexit, we would prioritize private PE fund investments and city investments over industry 4.0 long-term investments, and the reverse given a Soft Brexit.

By Asset Class	Weights (Soft Brexit)	Weights (Hard Brexit)	Weights (No-Deal Brexit)
Public Fixed Income	3.99%	3.99%	3.99%
Public Equities	14.51%	14.51%	14.51%
Alternatives	6.50%	6.50%	6.50%
Private Fixed Income	35.00% +	37.50% +	40.00% +
Private Equity	40.00%	37.50%	35.00%
Notes	* All weights rounded to 2 decimal places. See appendix 30 for more precision. - Public Fixed Income includes treasuries mentioned in strategy 3. - Public Equities includes equity investment part of the public portfolio mentioned in strategy 3 - Alternatives include real estate investment trusts and commodities in the public investment portion of the portfolio. - Private Fixed Income include municipal bond investments in the 5 cities. If cities require more funding and demonstrate appropriate usage of the fund, BNSF will issue more debt financing and invest into the municipal bonds. - Private Equity includes the social impact investment funds investments and private Industry 4.0 start-ups investments. The weightings of the public investments stay the same regardless of the Brexit outcomes as they are the minimum amount needed to ensure BNSF's return of 2.83%. BNSF will prioritize investments in the cities in the case of a no-deal Brexit to boost the UK economy in specific industries/locations in order to reach domestic demands and help Brexit-impacted sectors.		

By City (Part of Municipal Bonds)	Weights (Soft Brexit)	Weights (Hard Brexit)	Weights (No-Deal Brexit)
Manchester	20%	20%	20%
Newcastle	20%	10%	5%
Birmingham	20%	25%	35%
Sheffield	20%	25%	35%
Plymouth	20%	20%	5%

Notes	According to KPMG and VoxEU reports (appendix 18-21), industries hit the hardest by Brexit and COVID-19 are Automotive, Manufacturing, Oil and Gas, Metals, and Pharmaceuticals. They are the most dependent on EU labour, imports, and exports. Since Birmingham is one of the UK's main Automotive Manufacturing hub, and Sheffield is the "Steel City", BNSF will invest more heavily in these two cities given a No-Deal or Hard Brexit. Manchester is a center for foreign company headquarters and is a key city for biotechnology. BNSF will also prioritize investing in Manchester to encourage foreign investments. Investments in Newcastle and Plymouth are focused more on the long-term development of the cities in driving the UK economy.

By Strategy	Weights (Soft Brexit)	Weights (Hard Brexit)	Weights (No-Deal Brexit)
Strategy 1 (City Development)	35%	37.5%	40%
Strategy 2 (PE funds)	20%	25%	30%
Strategy 3 (Asset Diversification)	25%	25%	25%
Strategy 4 (Industry 4.0)	20%	12.5%	5%
Notes	We placed less emphasis on the industry 4.0 developments in the case of a no-deal Brexit as it is a more long-term goal. Strategy 3 summarizes all of the fixed income, equity, and alternative asset classes.		

RISK AND PERFORMANCE

The performance of BNSF's strategies can be evaluated based on its quantitative indicators regarding its triple mandates.
5 year targets/expected fund performance:

UK's long-term economic independence, growth, and sustainability:

	Current (2019)	(Soft Brexit)	(Hard Brexit)	(No-Deal Brexit)
M2M cards per 100 inhabitants UK	• World Ranking: 23 • 9.46 Million connections • 14.2% inhabitants	• World Ranking: top 15 • (or) 20 Million connections • (or) 25%+ inhabitants	• World Ranking: top 17 • (or) 14 Million connections • or) 20%+ inhabitants	• World Ranking: top 20 • (or) 12 Million connections • (or) 12%+ inhabitants
	Note: GSMA intelligence forecasted in 2014 that UK would rank 3rd in cellular M2M connections with a total of 43 million connections by 2020 (Appendix 23).			
Industry 4.0 development index	World Ranking: 23	World Ranking: top 15	World Ranking: top 17	World Ranking: top 20
	Note: Currently, UK has a poor performance in the 4.0 development index's categories regarding ERP systems used in enterprises. Appendix 26 shows that approximately 24% of UK enterprises have enterprise resource planning software in 2019 compared to 53% of Belgium enterprises.			
imports of goods and services as % of GDP	32.71%	Range: between 28% - 32%	Range: between 28% - 32%	Range: between 28% - 32%
	Note: The past 5 years saw a steady increase in UK's imports as % of GDP (appendix 27). In order to achieve economic independence without limiting UK's growth and benefits of trade, BNSF has set a target range of 28%-32% imports as % of GDP.			
Annual GDP growth	1.41%	1.7%+	1.6%+	1.5%+
	Note: The last 10-year average annual GDP growth is 1.85%, with the past 5 years seeing a continuous decline (appendix 27). Under a soft Brexit, BMSF expects to see a maintained 1.7% growth rate. BNSF aims to maintain a 1.5% growth rate in the case of a no-deal Brexit.			

Long-term well-being of the British population:

	Current	(Soft Brexit)	(Hard Brexit)	(No-Deal Brexit)
Distribution variance of GDP per capita among cities	Mean: 0.66 Var: 6.21 (avg 2016-2018) (appendix 12)	Var: 5.58 (10% decrease in Var)	Var: 5.77 (7% decrease in Var)	Var: 5.89 (5% decrease in Var)
	Note: BNSF will prioritize boosting economic development in the slow-growth regions given a soft Brexit. In the case of a no-deal Brexit, BNSF will prioritize more on meeting domestic economic demands instead.			
Distribution variance of average weekly full-time employee earnings by regions (£ per week)	Mean: 613 Var: 5630 (avg 2018-2020)	Var: 5067 (10% decrease in Var)	Var: 5236 (7% decrease in Var)	Var: 5349 (5% decrease in Var)
	Note: BNSF will prioritize boosting economic development in the low-income regions given a soft Brexit. See appendix 9 for current earnings by regions.			

Gini Coefficient of final income of all individuals	29.9 (2019)	26	27	28
	According to World Bank's last estimate in 2016, UK had a Gini coefficient of 34.8. Looking at the final income of all individuals in 2019, ONS estimates it to be at 29.9. Given the significant improvement over the years, BNSF should continue promoting income equality and reach the level of Finland's in 2015 (around 27)			
Distribution variance of unemployment rate in all UK cities	Mean: 3.81% Var:1.22% (2017-2020)	Var: 1.10% (10% decrease in Var)	Var: 1.13% (7% decrease in Var)	Var: 1.16% (5% decrease in Var)
	Note: BNSF will prioritize boosting economic development in the high unemployment cities given a soft Brexit. See appendix 14, 15 for current unemployment levels by cities.			

Portfolio Annual Return:

	(Soft Brexit)		(Hard Brexit)		(No-Deal Brexit)	
	return	Weighted return	Return	Weighted return	Return	Weighted return
Strategy 1 (City Development)	2.40%*	0.84%	2.40%	0.90%	2.40%	0.96%
Strategy 2 (PE funds)	8%	1.60%	8%	2.00%	8%	2.40%
Strategy 3 (Asset Diversification)	13.26%***	3.31%	13.26%	3.31%	13.26%	3.31%
Strategy 4 (Industry 4.0)	20%****	4%	20%	2.5%	20%	1%
Total fund return		9.75%		8.71%		7.67%
Notes:	* The recent issue of the £350 million 5-year FRN through the UK Municipal Bonds Agency Finance Company DAC to fund a matching loan to Lancashire County Council provided by the UK Municipal Bonds Agency was rated Aa3 by Moody's. Similarly, Lancashire County Council has an Aa3 rating from Moody's. ** Financial Times, Investing for Global Impact, 2017 *** By portfolio optimization (appendix 28, 29) **** Callan Institute, 2019 benchmark					

BNSF's expected return is illustrated above. We can be 79% confident that the weighted return of the public investments from strategy 3 to be at least 2.83%, the minimum required by mandate 3 (appendix 32). However, as the total portfolio return is made up of also public investments, the portfolio should have no trouble generating over 2.83% annual return and meeting mandate 3. Expected performance regarding mandate 1 and 2 can also be seen in the two tables above.
Finally, we have identified the main risks associated with the fund's strategy and have summarized ways they can be mitigated.

Risk factors	Likelihood	Severity	Mitigation
Failing to actively monitor the portfolio	Low	High	Having an arms-length compliance team in place to ensure that investment team and portfolio managers are consistently monitoring and updating their portfolio to match BNSF's triple mandate. Having portfolios managers to present their ideas to the board will also help alleviate this risk factor.
Unable to implement Municipal city investment due to political pressures	High	High	BNSF does everything in its power to please all parties involved, especially board members that have large influences in their area of expertise. If political pressures arise, it is in BNSF's best interest to stick to its investment philosophies and if municipalities are not willing to comply to withdraw from future investments. The use of annual budget constraints will also help alleviate any future conflict.
Prolonged COVID-19 lockdowns	High	Medium	Mitigations are currently in place to mitigate risks to the portfolio based on its construction. Having a well-balanced and diversified portfolio will help reach investment outcomes with minimal downside risk to the portfolio.
Depreciation of the Pound	Medium	Medium	Although, a weaker pound in a post-BREXIT world might be beneficial in terms of foreign investment, a strong GBP is needed for financial stability and soundness. BNSF can mitigate this by either purchasing USD currently and hold multiple currencies or hedge their foreign exchange risk with forward contracts.
Venture risk of investing in Start-ups	Medium	Medium	Investing in late-stage start-ups helps mitigate the majority of risks that would be incurred if investing in early-stage start-ups, i.e. revenue risk and liquidity risk.
High inflation	Low	Low	With currency markets being leading indicators and future looking, the centre research shows that inflation has already increased 1.7% in 2017 and has already priced in worst case Brexit scenarios, so further deuteriation is unlikely.

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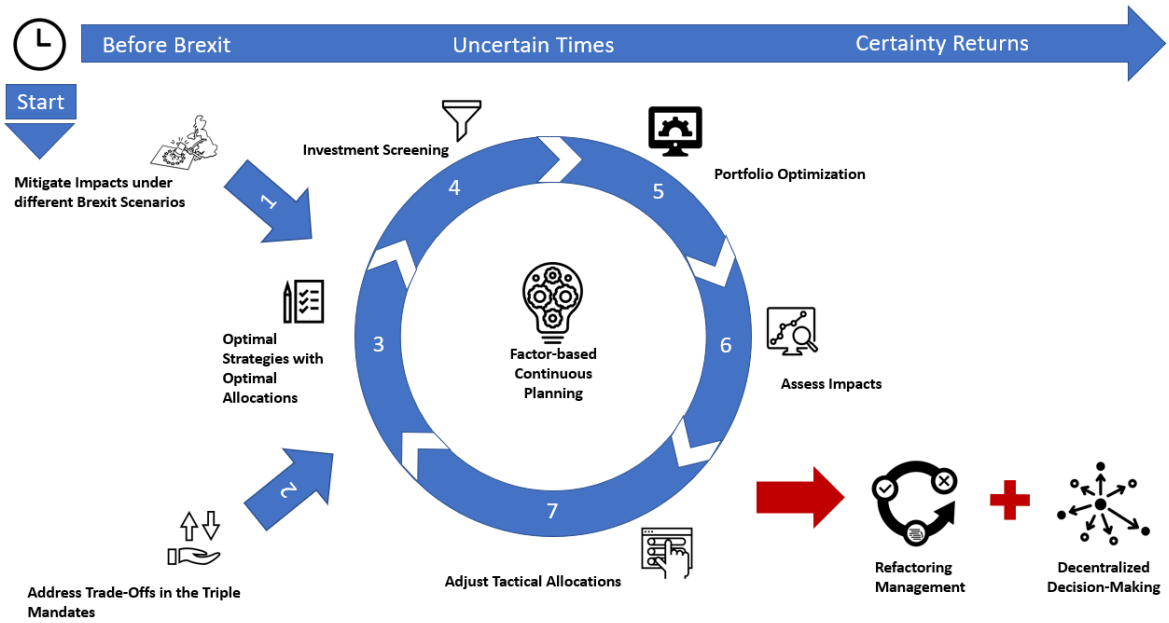
Appendix 1



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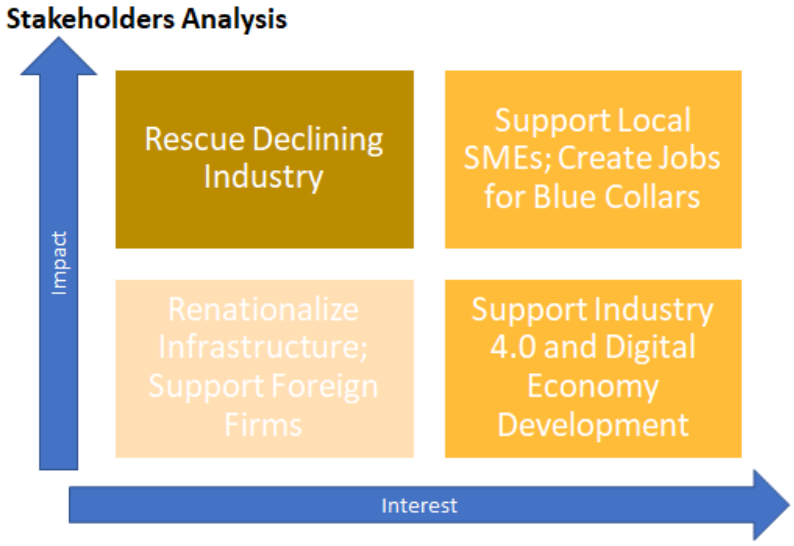
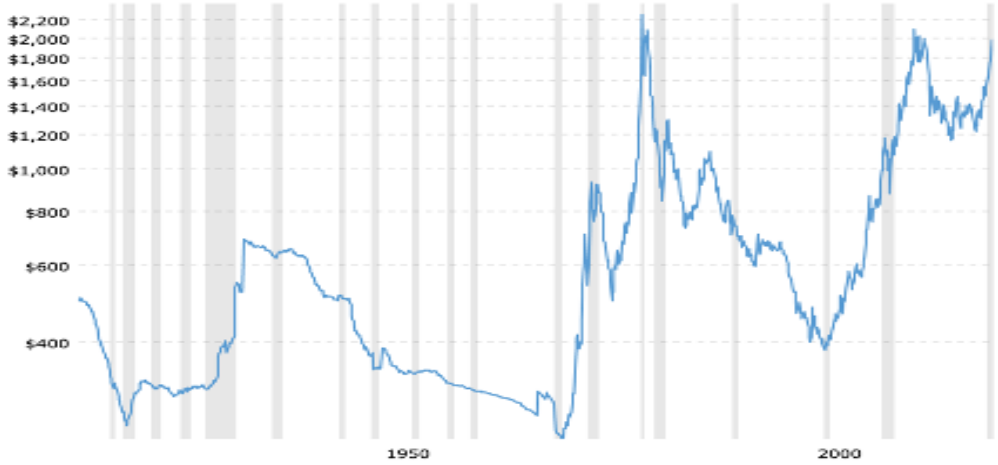
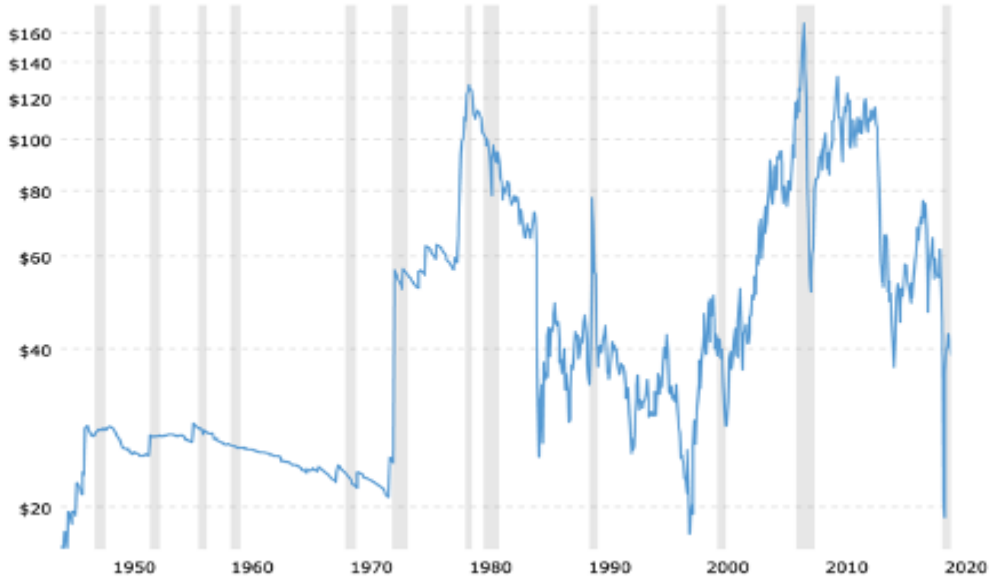


Appendix 3, Price of gold from 1920-2020. (Macrotrends, 2020)



Appendix 4, Price of oil from 1950-2020. (Macrotrends, 2020)

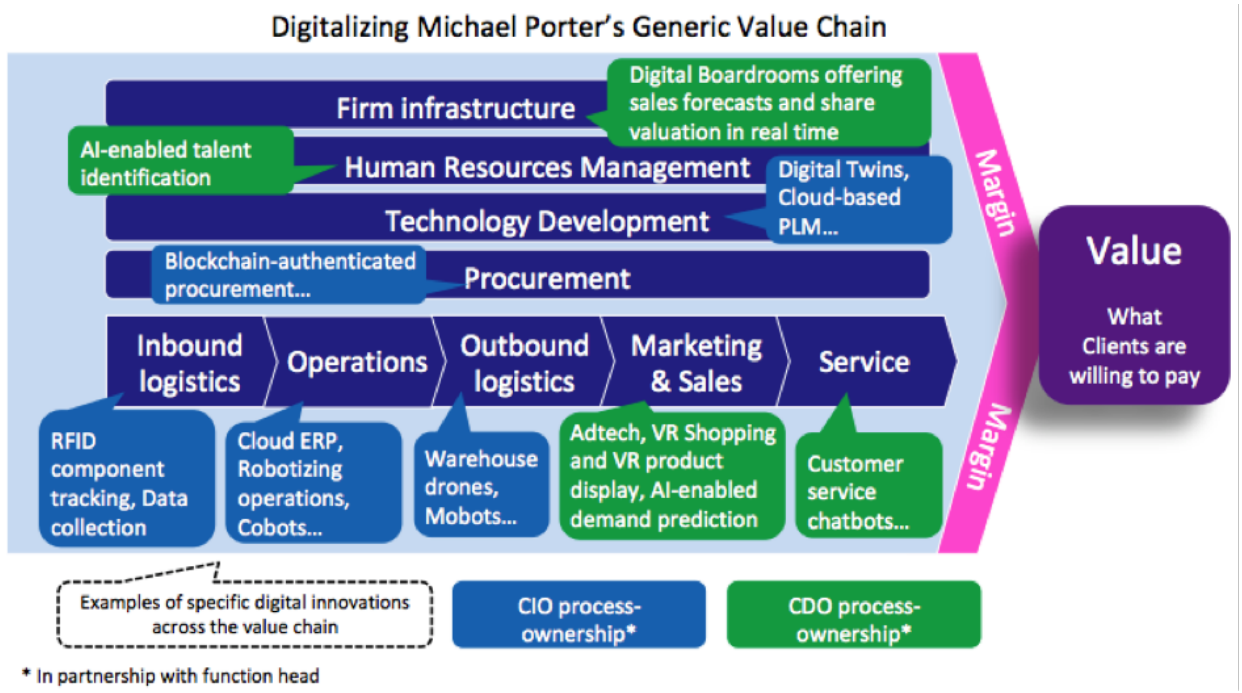


Appendix 5, Table of diversified investment companies

Investment	ESG Rating (IBD, 2019)	Number of British Employees	Nationality
Microsoft (MSFT)	AAA	3,000	US
PepsiCo (PEP)	AA	4,500	US
Proctor & Gamble (PG)	AA	6,000	US
AECOM (ACM)	AA	11,000	US
Alphabet (GOOGL)	AA	4,439	US
Tesco (TSCO)	AA	423,092	UK
BP (BP)	A-	90,100	UK
20+ year US Treasury (TLT)	-	-	-
Gold (GLD)	-	-	-
Siemens (SIE)	A	16,500	German
Sanofi (SNY)	A	1,200	France
Japan ETF (EEJD)	A	-	Japan

Vanguard REIT ETF (VNQ)	-	-	US
Blackrock REIT ETF (XRE)	-	-	Canada

Appendix 6



Appendix 7

Sensitivity Analysis of the Number of Jobs that could be Created with BNSF's Impact Investment

		Aveage Salaries per Worker							
		£ 40,000	£ 45,000	£ 50,000	£ 55,000	£ 60,000	£ 65,000	£ 70,000	£ 75,000
Amount of Impact Investments	£ 7,000,000,000	17,500	15,556	14,000	12,727	11,667	10,769	10,000	9,333
	£ 8,000,000,000	20,000	17,778	16,000	14,545	13,333	12,308	11,429	10,667
	£ 9,000,000,000	22,500	20,000	18,000	16,364	15,000	13,846	12,857	12,000
	£ 10,000,000,000	25,000	22,222	20,000	18,182	16,667	15,385	14,286	13,333
	£ 11,000,000,000	27,500	24,444	22,000	20,000	18,333	16,923	15,714	14,667
	£ 12,000,000,000	30,000	26,667	24,000	21,818	20,000	18,462	17,143	16,000
	£ 13,000,000,000	32,500	28,889	26,000	23,636	21,667	20,000	18,571	17,333
	£ 14,000,000,000	35,000	31,111	28,000	25,455	23,333	21,538	20,000	18,667

Appendix 8

Table 1: Summary of gross domestic product statistics for the NUTS1 countries and regions, 2018[1 2]					
NUTS1 Regions	Population[3]	Total GDP (£ million)[4]	GDP per head (£)[1 4 6]	Annual growth in 'real' GDP (%)[5]	Annual growth in 'real' GDP per head (%)[5 6]
UK	66,435,550	2,140,278	31,976	1.4	0.8
England	55,977,178	1,839,264	32,857	1.4	0.8
North East	2,657,909	62,644	23,569	0.9	0.4
North West	7,292,093	207,452	28,449	1.4	0.9
Yorkshire and The Humber	5,479,615	141,698	25,859	1.2	0.6
East Midlands	4,804,149	124,647	25,946	1.1	0.4
West Midlands	5,900,757	159,832	27,087	2.0	1.3
East of England	6,201,214	186,462	30,069	1.7	1.2
London	8,908,081	487,145	54,686	2.0	1.1
South East	9,133,625	311,300	34,083	0.6	0.0
South West	5,599,735	158,084	28,231	0.9	0.1
Wales	3,138,631	74,906	23,866	1.3	0.9
Scotland	5,438,100	161,295	29,660	0.9	0.7
Northern Ireland	1,881,641	48,887	25,981	-0.5	-1.1
Extra-Regio[7]	n/a	15,927	n/a	7.1	n/a

Notes:

1 Figures may not sum due to rounding in totals; per head (£) figures are rounded to the nearest pound sterling.
2 2018 estimates are provisional.
3 Population estimates are sourced from the Population estimates for the UK release.
4 GDP in current prices.
5 GDP in chained volume measures.
6 Per head figures exclude Extra-Regio: the off-shore contribution to GDP that cannot be assigned to any region.
7 n/a equals not applicable.

Source: Office for National Statistics - Regional economic activity by gross domestic product, UK: 1998 to 2018

Appendix 9

EARN05: Average gross weekly earnings of full-time[1] employees, by region: People (not seasonally adjusted)

Date of publicatic Tuesday, August 11, 2020 **Date of next publication: Tuesday, November 10, 2020**

Inquiries: Email: labour.market@ons.gov.uk **Telephone: +44 (0)1633 455400**

United Kingdom, not seasonally adjusted

	Averages (£ per week)														
	United Kingdom	Great Britain	England	North East	North West	Yorks & the Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Scotland	Northern Ireland	VAR
Jan-Mar 2018	609	612	620	526	561	534	515	562	654	780	675	562	542	567	512	5245.45
Apr-Jun 2018	619	621	631	550	537	533	552	568	652	797	711	575	528	578	532	5771.67
Jul-Sep 2018	617	619	629	494	559	569	554	554	655	780	690	576	527	570	539	5252.96
Oct-Dec 2018	637	639	645	523	564	561	564	579	656	846	685	585	564	628	545	6301.92
Jan-Mar 2019	623	626	634	560	575	564	574	565	674	762	691	571	553	586	513	4157.26
Apr-Jun 2019	640	642	650	537	575	574	554	577	653	831	718	603	576	601	545	5913.81
Jul-Sep 2019	646	648	658	551	595	550	584	591	685	830	710	595	527	622	542	6222.12
Oct-Dec 2019	647	650	655	530	595	577	580	595	668	805	728	582	566	648	537	5418.16
Jan-Mar 2020	650	653	663	590	583	606	591	586	653	847	702	608	548	611	537	5611.61
Apr-Jun 2020	659	662	674	562	616	582	564	612	693	843	730	613	535	618	555	6405.91
AVERAGE																5630.09

IMPORTANT NOTE REGARDING LFS EARNINGS ESTIMATES Source: Labour Force Survey

The data on individual's earnings captured by the LFS is thought to be of a lower quality than ASHE or AWE as LFS information is self-reported by employees. ASHE and AWE however, gather information from the employer which is thought to be more accurate as employers can consult payroll records. Individuals may not have such records to hand and their responses may therefore be subject to higher levels of recall error. Furthermore LFS responses can be given by proxy (by other individuals in the same household) when an individual is unavailable for interview. This gives further scope for recall error from respondents. Due to this recall error, estimates of earnings based on the LFS that are published by the ONS typically exclude those who earn more than £100 per hour as a quality assurance measure. These factors combined mean that gross weekly and hourly pay are known to be underestimated on the LFS.

Estimates of gross weekly and hourly earnings from the LFS are based upon 2/5 of the quarterly sample and are therefore subject to high sampling variability. For this reason, ONS recommends that any short term

[1] Full-time is based on respondents' self assessment. The estimates relate to an individual's main job only.

Note: As the estimates are not seasonally adjusted, it is best practice to only compare the same quarter for different years (e.g., compare January-March 2018 with January-March 2019 but do not compare July-September 2018 with January-March 2019).

Appendix 10

Office for National Statistics

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Healthy life expectancy (HLE) and life expectancy (LE) for males and females at birth by English regions, 2009 to 2011

England

English region	LE (years)	HLE (years)	Lower 95% confidence interval	Upper 95% confidence interval	Proportion of life spent in "Good" health (%)	LE rank	HLE rank
Males							
South East	80.0	65.7 *	65.3	66.1	82.1	1	1
South West	79.8	65.1 *	64.6	65.6	81.6	3	2
East of England	79.9	64.8 *	64.3	65.3	81.1	2	3
East Midlands	78.7	63.0	62.4	63.6	80.0	5	4
London	79.3	63.0	62.5	63.4	79.4	4	5
West Midlands	78.4	62.5 **	62.0	62.9	79.7	6	6
North West	77.4	61.0 **	60.7	61.4	78.9	9	7
Yorkshire and The Humber	78.1	61.0 **	60.5	61.5	78.1	7	8
North East	77.5	59.7 **	59.2	60.3	77.1	8	9
England	**78.9**	**63.2**	**63.1**	**63.4**	**80.1**		
Females							
South East	83.8	67.0 *	66.6	67.5	80.0	1	1
South West	83.7	66.3 *	65.8	66.9	79.2	2	2
East of England	83.6	66.2 *	65.6	66.7	79.2	4	3
London	83.6	63.8	63.3	64.3	76.3	3	4
East Midlands	82.8	63.3 **	62.7	64.0	76.5	5	5
West Midlands	82.6	62.8 **	62.3	63.3	76.1	6	6
Yorkshire and The Humber	82.0	62.1 **	61.6	62.6	75.7	7	7
North West	81.5	61.7 **	61.3	62.1	75.7	8	8
North East	81.5	60.2 **	59.7	60.8	73.9	9	9
England	**82.9**	**64.2**	**64.0**	**64.3**	**77.4**		

Notes

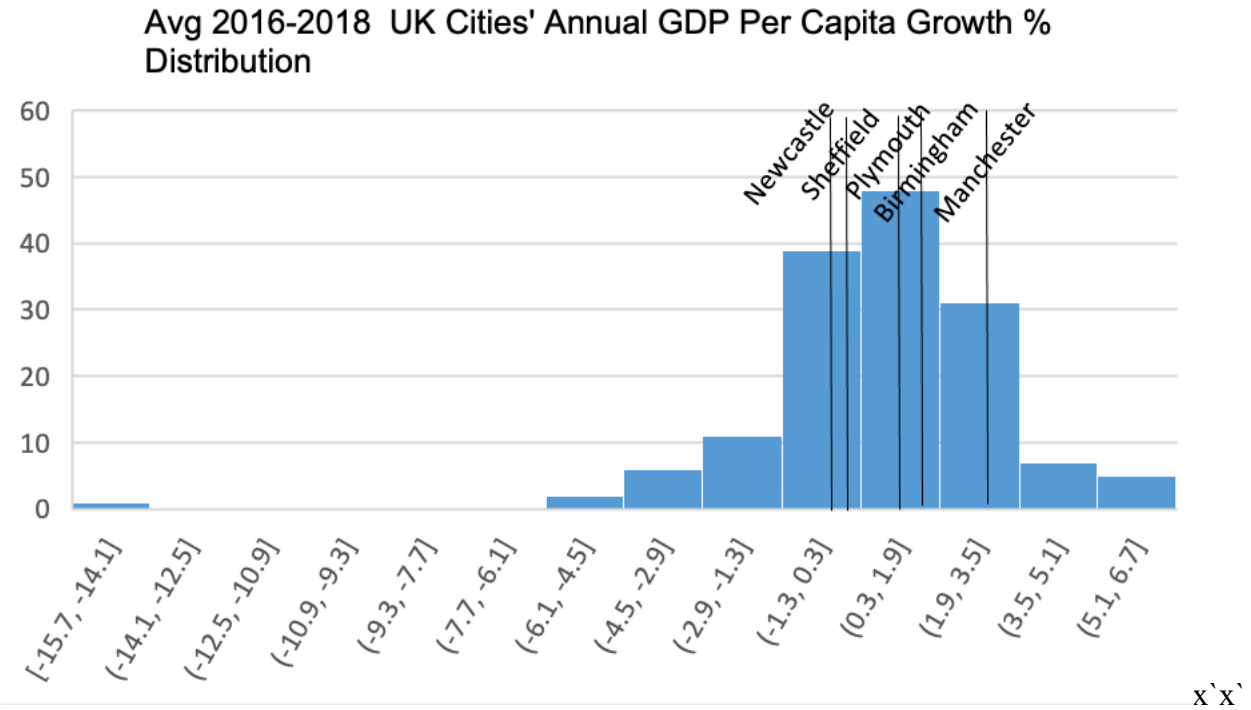
1. Excludes residents of communal establishments except NHS housing and students in halls of residence where inclusion takes place at their parents'
2. Regions are presented by gender and have been ranked at the England level, based on HLE to more than one decimal place. Their respective rankings within England are also shown.
3. Figures may not sum due to rounding.
4. * denotes that the region HLE estimate is significantly higher than the England HLE estimate at the 95% confidence level.
5. ** denotes that the region HLE estimate is significantly lower than the England HLE estimate at the 95% confidence level.
6. The significance test refers to a one tailed Z test of the difference of the estimates as detailed in:

Jagger et al., (2007)

Appendix 11

		Patents strength	Trademarks strength	University innovation strength	Business innovation strength	Skills and spillover strength	Infrastructure strength	City size (PUA)	Region
	London	Strong	Very strong	Strong	Very strong	Very strong	Very strong	10,151,260	South East
	Slough	Strong	Very strong	Very weak	Strong	Very strong	Strong	149,112	South East
	Aldershot	Strong	Weak	Very weak	Strong	Strong	Very strong	184,016	South East
	Reading	Strong	Weak	Weak	Very strong	Very strong	Very strong	331,182	South East
	Derby	Very strong	Very weak	Strong	Strong	Strong	Very strong	257,174	East Midlands
Top 10%	Cambridge	Very strong	Very weak	Very strong	Very strong	Very strong	Very strong	125,758	East
	Milton Keynes	Weak	Very strong	Very weak	Strong	Strong	Very strong	268,607	South East
	Aberdeen	Very Weak	Weak	Weak	Strong	Weak	Weak	227,560	Scotland
	Crawley	Strong	Very weak	Very weak	Strong	Very strong	Very strong	112,448	South East
	Oxford	Very strong	Very strong	Very strong	Strong	Vey strong	Very strong	154,327	South East
	Edinburgh	Very weak	Very strong	Very strong	Strong	Strong	Weak	518,500	Scotland
Top 20%	Luton	Very weak	Very weak	Very strong	Strong	Very Strong	Very strong	214,109	East
	Southampton	Very weak	Weak	Very strong	Very strong	Strong	Strong	384,615	South East
	Swindon	Very weak	Very weak	Very weak	Weak	Strong	Strong	221,996	South West
	Bristol	Strong	Strong	Strong	Strong	Strong	Strong	746,049	South West
	Glasgow	Very weak	Strong	Strong	Weak	Strong	Strong	1,007,700	Scotland
	Birmingham	Very weak	Weak	Weak	Weak	Very strong	Strong	2,549,673	West Midlands
	Leeds	Very weak	Strong	Strong	Weak	Strong	Very strong	789,194	Yorkshire
Top 30%	Manchester	Very weak	Strong	Strong	Strong	Very strong	Weak	2,486,481	North West
	Blackpool	Very weak	Weak	Very weak	Weak	Very weak	Very weak	219,075	North West
	Portsmouth	Weak	Very weak	Weak	Strong	Strong	Strong	542,568	South East
	Coventry	Very strong	Strong	Strong	Weak	Strong	Weak	366,785	West Midlands
	Hull	Very weak	Weak	Weak	Very weak	Strong	Very weak	260,645	Yorkshire
	Northampton	Very weak	Weak	Weak	Strong	Strong	Strong	225,146	East Midlands
	York	Strong	Weak	Strong	Weak	Weak	Weak	209,893	Yorkshire
	Cardiff	Strong	Strong	Very strong	Weak	Strong	Strong	364,248	Wales
	Bournemouth	Very weak	Strong	Weak	Weak	Weak	Weak	395,800	South West
	Liverpool	Very weak	Weak	Strong	Very strong	Strong	Weak	644,385	North West
	Warrington	Very weak	Strong	Very weak	Weak	Strong	Weak	209,547	North West
	Exeter	Weak	Weak	Strong	Weak	Strong	Strong	130,428	South West
50%	Basildon	Weak	Weak	Very weak	Strong	Weak	Weak	185,862	East
	Brighton	Weak	Strong	Weak	Very strong	Strong	Very strong	354,264	South East
	Blackburn	Very weak	Very strong	Very weak	Weak	Very weak	Weak	148,942	North West
	Newcastle	Very weak	Very weak	Strong	Weak	Strong	Weak	858,954	North East
	Newport	Very weak	Very weak	Very weak	Strong	Very weak	Strong	246,351	Wales
	Wakefield	Very weak	Very weak	Very weak	Very weak	Very weak	Very weak	345,038	Yorkshire
	Gloucester	Strong	Strong	Very weak	Weak	Strong	Weak	129,285	South West
	Dundee	Very weak	Very weak	Strong	Weak	Weak	Very strong	148,750	Scotland
	Sunderland	Very weak	Very weak	Weak	Weak	Weak	Very weak	277,417	North East
	Peterborough	Strong	Strong	Very weak	Strong	Very weak	Very strong	201,041	East
	Chatham	Very weak	Very weak	Very weak	Weak	Weak	Weak	277,855	South East
	Ipswich	Very weak	Very weak	Weak	Weak	Strong	Very strong	137,532	East
	Sheffield	Weak	Very weak	Strong	Weak	Weak	Weak	847,177	Yorkshire
	Telford	Very weak	Very weak	Weak	Weak	Very weak	Very strong	177,799	West Midlands
	Worthing	Very weak	Weak	Very weak	Weak	Strong	Strong	110,025	South East
	Middlesbrough	Weak	Very weak	Weak	Weak	Weak	Very weak	474,476	North East
	Nottingham	Weak	Weak	Strong	Very weak	Strong	Weak	667,617	East Midlands
	Bradford	Very weak	Weak	Weak	Weak	Weak	Weak	537,173	Yorkshire
	Plymouth	Very weak	Very weak	Strong	Weak	Strong	Very weak	263,100	South West
	Doncaster	Weak	Very weak	Very weak	Weak	Very weak	Weak	310,542	Yorkshire
	Birkenhead	Very weak	Weak	Very weak	Very weak	Weak	Very weak	323,235	North West
	Barnsley	Very weak	Very weak	Very weak	Weak	Very weak	Very weak	245,199	Yorkshire
	Preston	Weak	Weak	Very Strong	Very weak	Weak	Very weak	369,166	North West
	Leicester	Weak	Strong	Weak	Weak	Strong	Weak	512,695	East Midlands
	Mansfield	Very weak	Very weak	Very weak	Weak	Very weak	Very weak	235,992	East Midlands
	Norwich	Weak	Very weak	Strong	Very weak	Very weak	Very weak	270,601	East
	Stoke	Weak	Very weak	Strong	Very weak	Weak	Strong	385,323	West Midlands
	Swansea	Weak	Very weak	Strong	Strong	Very weak	Very weak	389,372	Wales
	Wigan	Very weak	Very weak	Very weak	Very weak	Weak	Very weak	326,088	North West
	Burnley	Very weak	Very weak	Very weak	Strong	Very weak	Very weak	179,932	North West
	Huddersfield	Very weak	Strong	Weak	Weak	Very weak	Very weak	438,727	Yorkshire
	Southend	Very weak	Very weak	Very weak	Weak	Weak	Weak	359,514	East

Appendix 12



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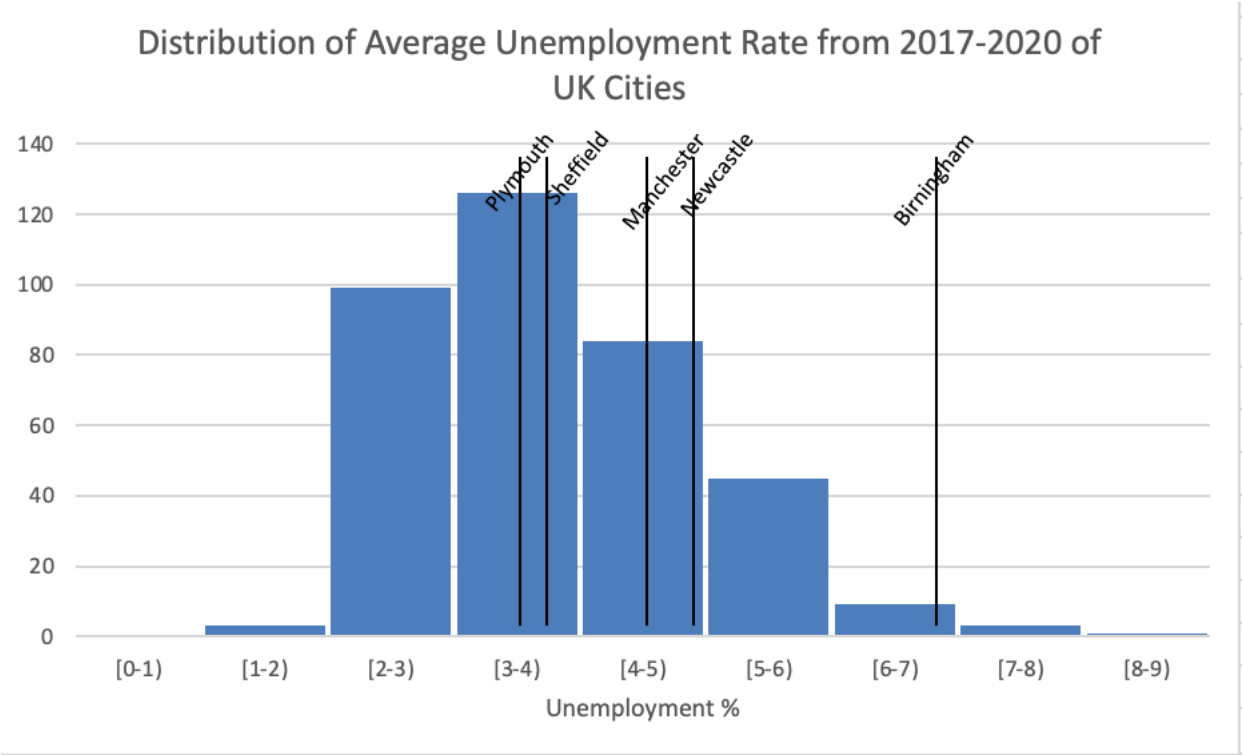
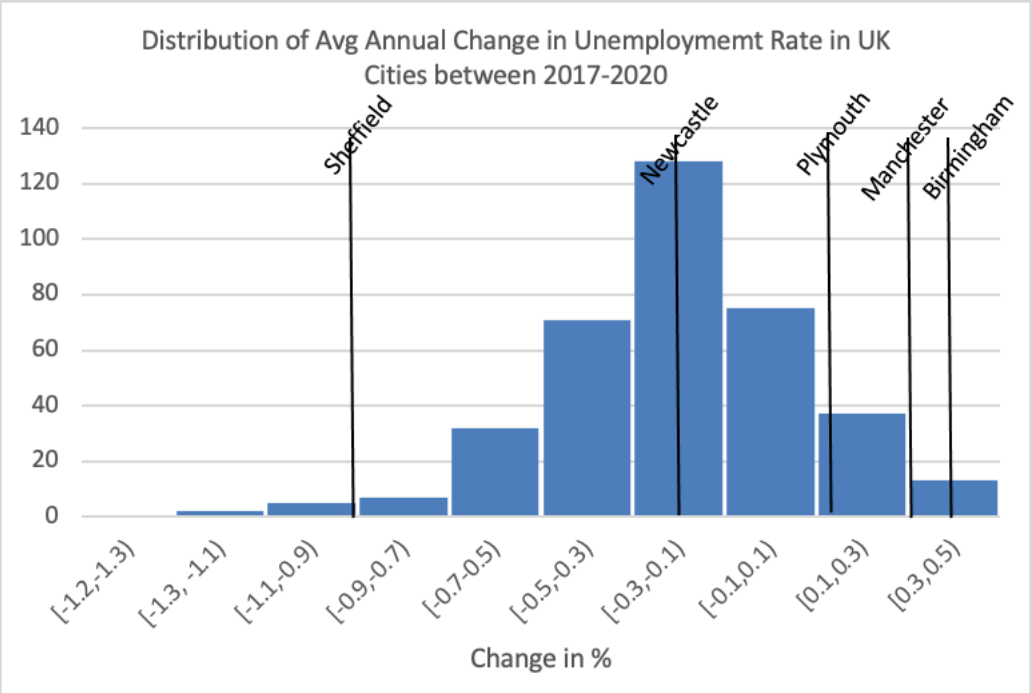
Appendix 13

Gross Domestic Product (GDP)[1] chained volume measures (CVM) per head[2] annual growth rates	%			
Area name	**2016**	**2017**	**2018**	**avg. 2016-2018**
Manchester	3.0	4.7	1.1	2.9
Newcastle upon Tyne	0.5	0.3	-1.5	-0.2
Birmingham	1.8	-0.2	3.6	1.7
Sheffield	0.2	0.7	-0.8	0.0
Plymouth	4.3	-2.0	1.3	1.2

Appendix 14



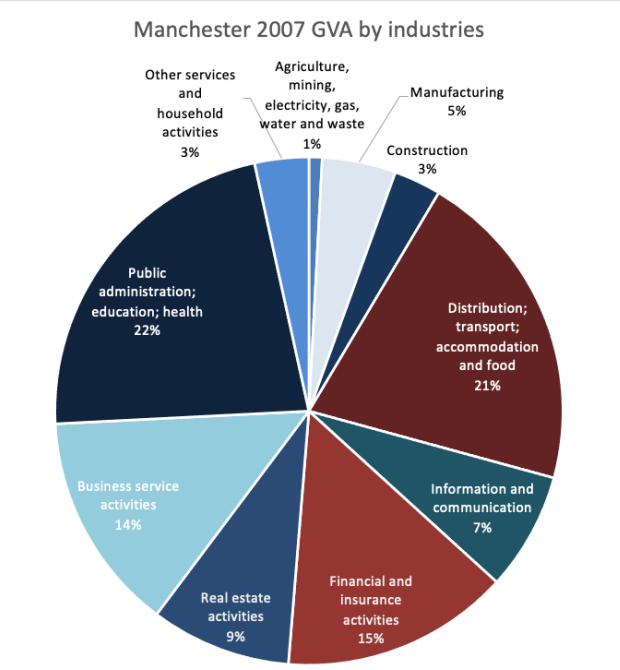
Appendix 15

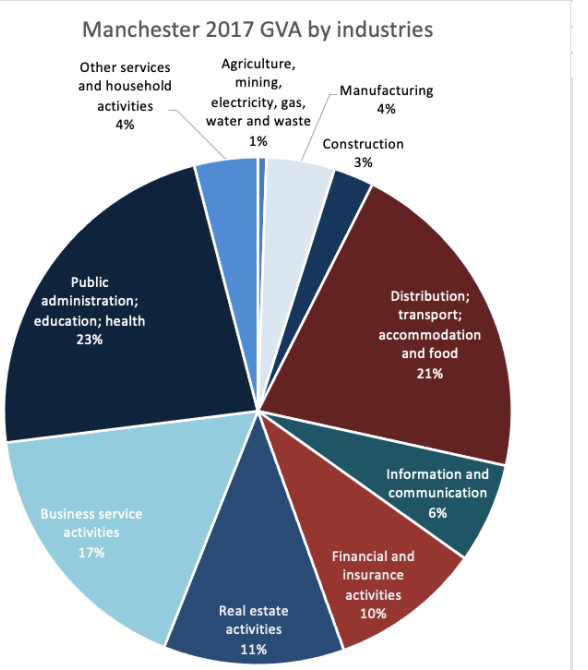


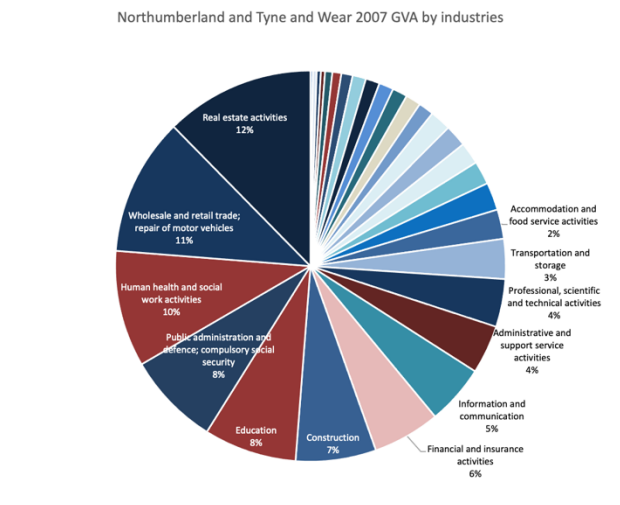
Appendix 16

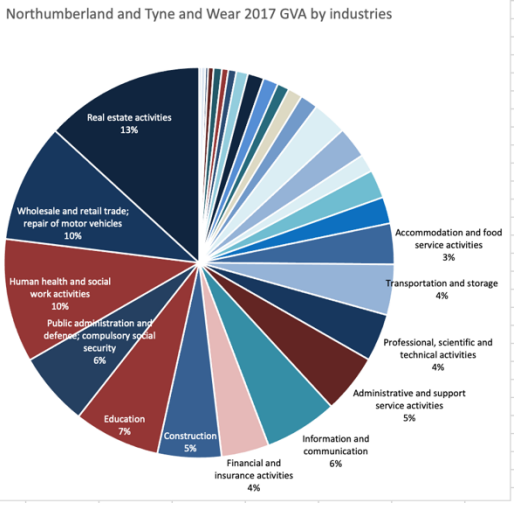
Unemployment	Jan 2017 to Dec 2017	Apr 2017 to Mar 2018	Jul 2017 to Jun 2018	Oct 2017 to Sep 2018	Jan 2018 to Dec 2018	Apr 2018 to Mar 2019	Jul 2018 to Jun 2019	Oct 2018 to Sep 2019	Jan 2019 to Dec 2019	Apr 2019 to Mar 2020	**Jul 2019 to Jun 2020**	2017-2020	Avg annual %change
	Rate (%)	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	**Rate (%)**	AVG Rate (%)	2017-2020
Manchester	5.6	5.6	5.2	4.9	5.2	4.7	5.4	5.5	5.8	6.1	6.1	5.5	0.307
Newcastle upon Tyne	6.8	6.3	5.8	6.2	5.4	5.3	5.3	5.4	6.1	6.2	6.0	5.9	-0.203
Birmingham	8.3	7.8	7.3	6.8	7.3	7.2	8.1	7.8	8.2	9.0	8.0	7.8	0.414
Sheffield	6.0	5.7	5.4	5.1	4.8	4.5	4.4	4.2	4.2	4.0	3.6	4.7	-0.915
Plymouth	4.7	4.4	4.4	3.9	4.5	4.5	4.3	4.6	4.3	4.8	4.7	4.5	0.126

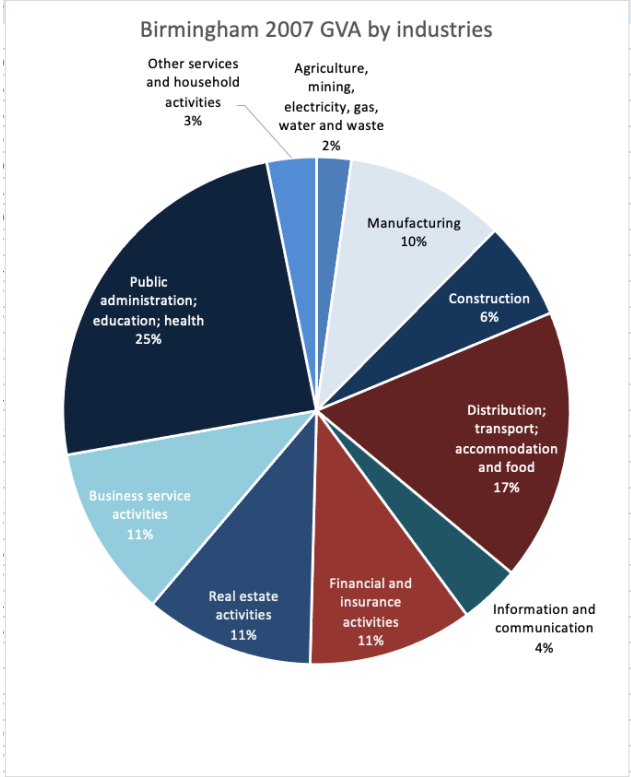
Appendix 17

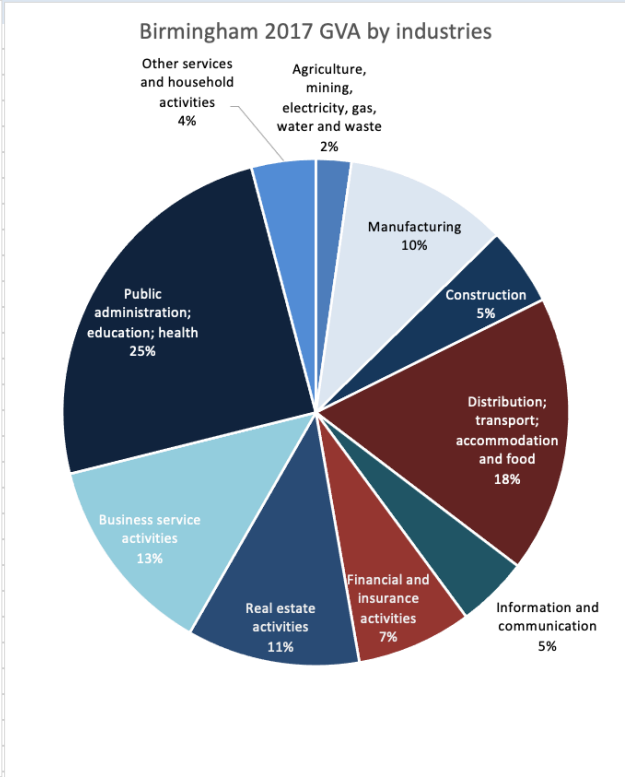

Manchester 2007 GVA by industries
Other services and household activities 3%
Agriculture, mining, electricity, gas, water and waste 1%
Manufacturing 5%
Construction 3%
Distribution; transport; accommodation and food 21%
Information and communication 7%
Financial and insurance activities 15%
Real estate activities 9%
Business service activities 14%
Public administration; education; health 22%

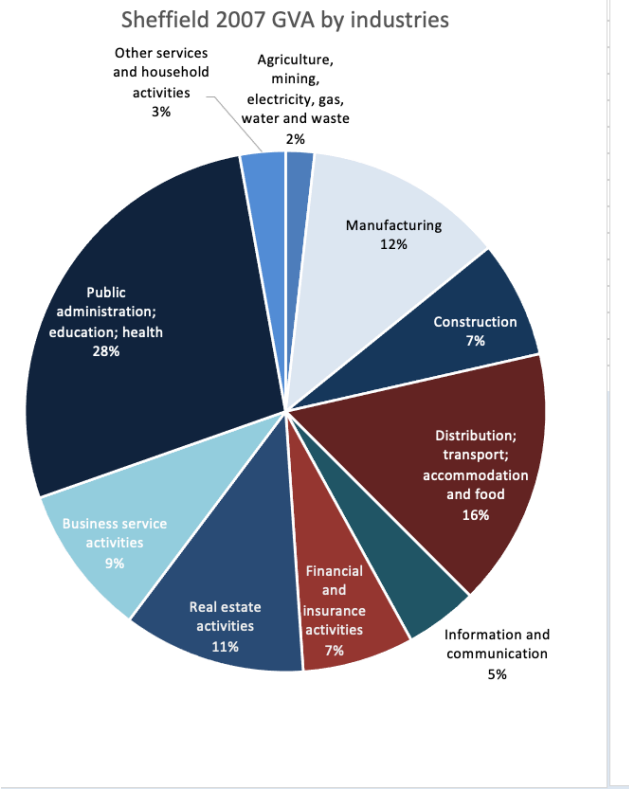

Manchester 2017 GVA by industries
Other services and household activities 4%
Agriculture, mining, electricity, gas, water and waste 1%
Manufacturing 4%
Construction 3%
Distribution; transport; accommodation and food 21%
Information and communication 6%
Financial and insurance activities 10%
Real estate activities 11%
Business service activities 17%
Public administration; education; health 23%

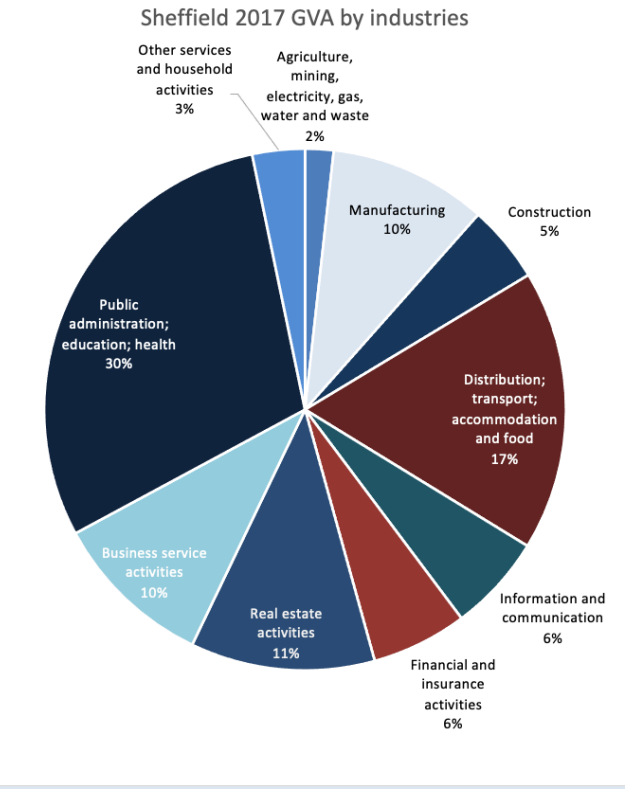

Northumberland and Tyne and Wear 2007 GVA by industries
Real estate activities 12%
Wholesale and retail trade; repair of motor vehicles 11%
Human health and social work activities 10%
Public administration and defence; compulsory social security 8%
Education 8%
Construction 7%
Financial and insurance activities 6%
Information and communication 5%
Administrative and support service activities 4%
Professional, scientific and technical activities 4%
Transportation and storage 3%
Accommodation and food service activities 2%

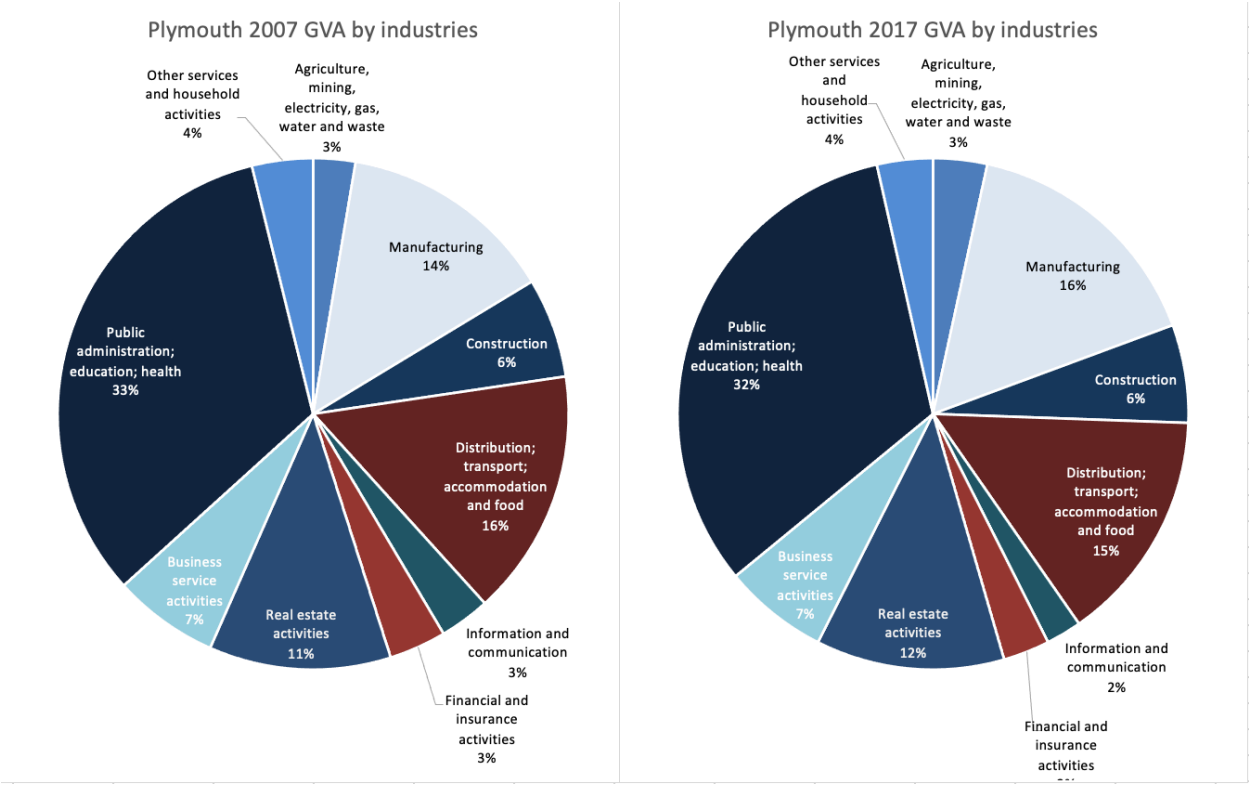

Northumberland and Tyne and Wear 2017 GVA by industries
Real estate activities 13%
Wholesale and retail trade; repair of motor vehicles 10%
Human health and social work activities 10%
Public administration and defence; compulsory social security 6%
Education 7%
Construction 5%
Financial and insurance activities 4%
Information and communication 6%
Administrative and support service activities 5%
Professional, scientific and technical activities 4%
Transportation and storage 4%
Accommodation and food service activities 3%


Birmingham 2007 GVA by industries
Other services and household activities 3%
Agriculture, mining, electricity, gas, water and waste 2%
Manufacturing 10%
Construction 6%
Distribution; transport; accommodation and food 17%
Information and communication 4%
Financial and insurance activities 11%
Real estate activities 11%
Business service activities 11%
Public administration; education; health 25%


Birmingham 2017 GVA by industries
Other services and household activities 4%
Agriculture, mining, electricity, gas, water and waste 2%
Manufacturing 10%
Construction 5%
Distribution; transport; accommodation and food 18%
Information and communication 5%
Financial and insurance activities 7%
Real estate activities 11%
Business service activities 13%
Public administration; education; health 25%


Sheffield 2007 GVA by industries
Other services and household activities 3%
Agriculture, mining, electricity, gas, water and waste 2%
Manufacturing 12%
Construction 7%
Distribution; transport; accommodation and food 16%
Information and communication 5%
Financial and insurance activities 7%
Real estate activities 11%
Business service activities 9%
Public administration; education; health 28%


Sheffield 2017 GVA by industries
Other services and household activities 3%
Agriculture, mining, electricity, gas, water and waste 2%
Manufacturing 10%
Construction 5%
Distribution; transport; accommodation and food 17%
Information and communication 6%
Financial and insurance activities 6%
Real estate activities 11%
Business service activities 10%
Public administration; education; health 30%


Plymouth 2007 GVA by industries
Other services and household activities 4%
Agriculture, mining, electricity, gas, water and waste 3%
Manufacturing 14%
Construction 6%
Distribution; transport; accommodation and food 16%
Information and communication 3%
Financial and insurance activities 3%
Real estate activities 11%
Business service activities 7%
Public administration; education; health 33%
Plymouth 2017 GVA by industries
Other services and household activities 4%
Agriculture, mining, electricity, gas, water and waste 3%
Manufacturing 16%
Construction 6%
Distribution; transport; accommodation and food 15%
Information and communication 2%
Financial and insurance activities
Real estate activities 12%
Business service activities 7%
Public administration; education; health 32%

Appendix 18

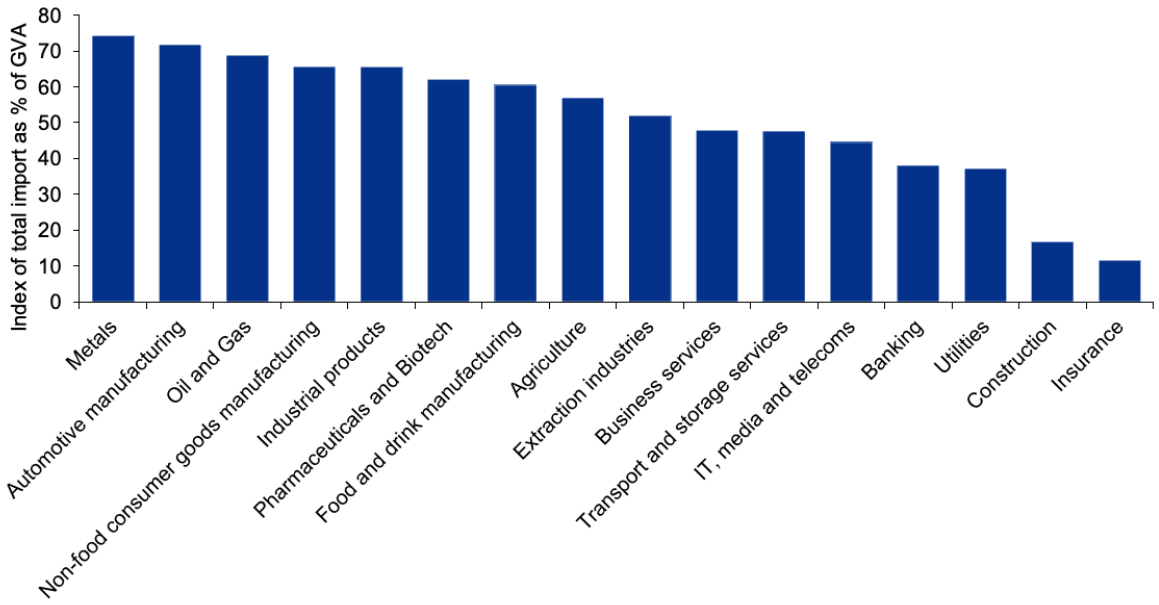
Change in business volume in April and predicted effect of Brexit by industry (VOXEU.org)

Industry Name	Rank of Net Increase in Business Volume, April 2020	Rank of Brexit Predicted Effect (CEP Trade Model)
Other Manufacturing	1	5
Other Supporting and Auxiliary Transport Activities	2	14
Electrical and Optical Equipment	3	19
Textiles and Leather	4	18
Other Business Activities, and Renting of Machinery and Equipment	5	17
Agriculture, Forestry and Fishing	6	3
Retail Trade, Excluding Motor Vehicles	7	12
Chemicals and Chemical Products	8	20
Other Non-Metallic Minerals	9	6
Transport Equipment	10	10
Real Estate Activities	11	15
Other Machinery	12	7
Rubber and Plastics	13	9
Basic Metals and Fabricated Metal	14	2
Hotels and Restaurants	15	7
Wholesale and Commission Trade, Including Motor Vehicles	16	11
Food, Beverages and Tobacco	17	4
Post and Telecommunications	18	16
Recreation, Community, Social and Personal Services	19	12
Pulp, Paper, Printing and Publishing	20	1

Notes: Industries are ranked in terms of net increase in business volume in April 2020 (see notes of Figure 1 for details on this variable). The rows are shaded according to the predicted long-term effect of Brexit (Dhingra et al, 2017): green for top, blue for middle, and red for most negatively affected. Sectors with fewer than 5 businesses in the data in April 2020 are omitted. Industries are ranked from least negatively affected (1) to most negatively affected (20).

Appendix 19

Sector imports dependence



Source: ONS data, KPMG calculations.

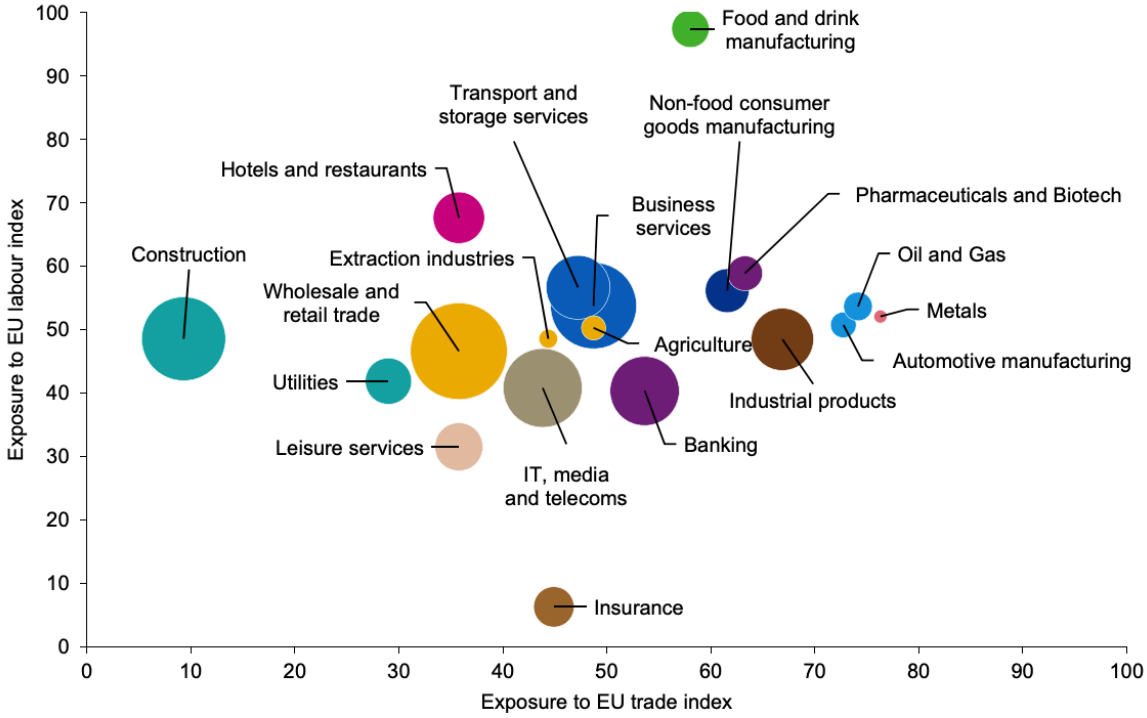
Appendix 20

Hard Brexit		Free trade		Free labour	
Food and drink manufacturing	78	Food and drink manufacturing	94	Metals	74
Metals	64	Hotels and restaurants	64	Oil and Gas	72
Oil and Gas	64	Pharmaceuticals and Biotech	59	Automotive manufacturing	71
Automotive manufacturing	62	Non-food consumer goods manufacturing	57	Industrial products	65
Pharmaceuticals and Biotech	61	Transport and storage services	56	Pharmaceuticals and Biotech	63
Non-food consumer goods manufacturing	59	Oil and Gas	56	Food and drink manufacturing	62
Industrial products	58	Metals	54	Non-food consumer goods manufacturing	61
Transport and storage services	52	Business services	53	Banking	52
Hotels and restaurants	52	Automotive manufacturing	53	Business services	49
Business services	51	Industrial products	50	Agriculture	49
Agriculture	49	Agriculture	50	Transport and storage services	48
Banking	47	Extraction industries	48	Extraction industries	45
Extraction industries	46	Wholesale and retail trade	46	IT, media and telecoms	44
IT, media and telecoms	42	Construction	45	Insurance	41
Wholesale and retail trade	41	Banking	42	Hotels and restaurants	39
Utilities	35	IT, media and telecoms	41	Wholesale and retail trade	37
Leisure services	34	Utilities	41	Leisure services	35
Construction	29	Leisure services	32	Utilities	30
Insurance	26	Insurance	10	Construction	13

Source: ONS data, KPMG calculations.

Appendix 21

Sector exposure to EU labour and EU exports



Source: ONS data, KPMG calculations. The size of the bubble represents the size of the sector as measured by GVA compared to UK total.

Appendix 22

Table 1: Indicators used to calculate Industry 4.0 Index, (% total enterprises)

Codes	Name of the Indicators
(a)	Enterprises who have ERP software package
(b)	Enterprises using Customer Relationship Management (CRM)
(c)	Sharing supply chain management information
(d)	Enterprises giving portable devices for a mobile connection to the internet
(e)	Enterprises having received orders online
(f)	Enterprises using software solutions like Customer Relationship Management (CRM)
(g)	Enterprises who have ERP software package to share information between different functional areas
(h)	Enterprises with broadband access
(j)	Enterprises using internet in communication with public institutions
(k)	Enterprises using the Cloud Computing applications

Table 3: Industry 4.0 Index for Turkey and European Countries

Country	Secondary Indicators								Industry 4.0 Index			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	Score	Rank
Denmark	0.8043	0.5924	1.0000	0.9623	0.9259	0.6561	0.8043	0.9545	0.8824	0.7576	0.8340	1
Finland	0.5870	0.7554	0.6364	1.0000	0.5556	0.7884	0.5870	1.0000	0.9412	1.0000	0.7851	2
Belgium	0.8696	0.8098	0.7273	0.7358	0.7778	0.8148	0.8696	0.8636	0.7059	0.4545	0.7629	3
Netherlands	0.7609	1.0000	0.5909	0.5283	0.4815	1.0000	0.7609	1.0000	0.7353	0.6667	0.7524	4
Germany	1.0000	0.9457	0.7727	0.4906	0.8519	0.9471	1.0000	0.7727	0.5294	0.1818	0.7492	5
Sweden	0.5000	0.7011	0.2273	0.8302	0.8889	0.6825	0.7174	0.8636	0.8824	0.8182	0.7112	6
Lithuania	0.6522	0.6739	0.7273	0.7547	0.5926	0.6561	0.6522	1.0000	1.0000	0.2727	0.6982	7
Norway	0.2174	0.7283	0.5455	0.8302	0.8889	0.7354	0.4783	0.6818	0.7059	0.8182	0.6630	8
Austria	0.6739	0.9457	0.3182	0.6604	0.4444	0.9206	0.6739	0.9091	0.7941	0.2121	0.6552	9
Ireland	0.3261	0.5380	0.2727	0.5660	1.0000	0.6296	0.3261	0.9091	0.8824	0.5758	0.6026	10
Portugal	0.7391	0.5380	0.4091	0.5660	0.5926	0.5238	0.7391	0.8182	0.7941	0.2727	0.5993	11
Luxembourg	0.6304	0.7011	0.4545	0.7170	0.2222	0.7090	0.6304	0.8636	0.7353	0.2424	0.5906	12
Cyprus	0.7174	0.8098	0.4091	0.3585	0.3704	0.7884	0.7174	0.8182	0.5882	0.1818	0.5759	13
France	0.6304	0.5652	0.2273	0.5849	0.5185	0.6032	0.6304	0.8182	0.9118	0.2121	0.5702	14
Spain	0.5435	0.6467	0.4091	0.6604	0.5926	0.6825	0.5435	0.8636	0.5000	0.2424	0.5684	15
Czech Republic	0.4348	0.2663	0.5909	0.6792	0.8889	0.2857	0.4348	0.9091	0.8529	0.2424	0.5585	16
Slovenia	0.4348	0.5380	0.2727	0.6981	0.4074	0.5238	0.5000	0.9545	0.8235	0.3333	0.5486	17
Croatia	0.4130	0.3207	0.7273	0.7925	0.5926	0.3386	0.4130	0.5455	0.8235	0.3636	0.5330	18
Iceland	0.0217	0.5109	0.3636	0.8679	0.7407	0.2593	0.0217	0.7273	0.7059	0.9091	0.5128	19
Malta	0.4348	0.4565	0.2273	0.6038	0.6296	0.4974	0.4348	0.7727	0.6765	0.3030	0.5036	20
Estonia	0.2609	0.4293	0.3182	0.6415	0.4815	0.4709	0.2609	0.7727	0.8824	0.4242	0.4942	21
Slovakia	0.4348	0.2935	0.5909	0.6226	0.3333	0.3386	0.4348	0.6364	0.7941	0.2727	0.4752	22
UK	0.1522	0.4837	0.1818	0.5094	0.5926	0.5503	0.1522	0.7273	0.7647	0.5455	0.4660	23
Italy	0.5652	0.5109	0.2273	0.4528	0.1852	0.5503	0.5652	0.7273	0.5882	0.1818	0.4554	24
Poland	0.2391	0.4022	0.4091	0.4528	0.2963	0.3915	0.2391	0.6818	0.7353	0.0909	0.3938	25
Macedonia	0.4565	0.5109	0.3636	0.5283	0.0000	0.3386	0.1739	0.7273	0.7059	0.0909	0.3896	26
Serbia	0.0000	0.5109	0.3636	0.5283	0.6667	0.1534	0.0000	0.9545	0.7059	0.0000	0.3883	27
Greece	0.5870	0.2935	0.3182	0.1321	0.2593	0.3386	0.5870	0.3182	0.5588	0.0909	0.3483	28
Latvia	0.1304	0.2391	0.0000	0.4717	0.1852	0.2328	0.1304	0.8636	0.8235	0.0909	0.3168	29
Hungary	0.1304	0.1304	0.0455	0.4717	0.3333	0.1534	0.1304	0.6364	0.5588	0.1515	0.2742	30
Turkey	**0.2196**	**0.0000**	**0.0455**	**0.4245**	**0.2926**	**0.0000**	**0.2196**	**0.6545**	**0.4206**	**0.2818**	**0.2559**	**31**
Bulgaria	0.3261	0.1848	0.4545	0.0000	0.0741	0.2063	0.3261	0.0000	0.5294	0.0606	0.2162	32
Romania	0.2609	0.2663	0.0909	0.0377	0.1481	0.2857	0.2609	0.0909	0.0000	0.0909	0.1532	33

Appendix 23

	CAGR 2010–13	Rank	CAGR 2014–20	Rank
MENA	57%	1	24%	4
Asia Pacific	54%	2	29%	2
CIS	52%	3	29%	1
Latin America	41%	4	25%	3
Sub-Saharan Africa	38%	5	23%	5
Europe	27%	6	23%	5
Northern America	24%	7	22%	6
World	37%	-	26%	-

Table 1: Cellular M2M connections, compound annual growth rate by region
Source: GSMA Intelligence

	Q2 2014	Rank		Q4 2020	Rank
China	61.5	1	China	355.0	1
United States of America	37.5	2	United States of America	135.8	2
Japan	9.9	3	United Kingdom	43.0	3
Brazil	9.1	4	Brazil	41.9	4
France	7.8	5	Russian Federation	35.1	5
Italy	6.4	6	Germany	31.2	6
United Kingdom	6.2	7	France	31.1	7
Sweden	5.9	8	Japan	28.1	8
Germany	5.8	9	India	24.6	9
Russian Federation	5.5	10	Sweden	19.4	10

Table 2: Cellular M2M connections (in millions)
Source: GSMA Intelligence

Appendix 24

	M2M cards, millions (right axis)	M2M cards, per 100 inhabitants (left axis)
Sweden	15.01	*146.0*
Austria	4.99	56.3
United States	137.00	41.6
Netherlands	*7.07*	40.7
Italy	24.25	40.2
New Zealand	1.82	36.8
Norway	1.96	36.7
Germany	29.70	35.7
France	20.86	30.9
Finland	1.65	29.9
Belgium	3.10	27.0
Estonia	0.34	25.9
Denmark	1.46	25.1
Ireland	1.21	24.5
OECD	*328.12*	24.2
Japan	27.39	21.7
Latvia	0.37	19.3
Korea	9.64	18.6
Slovak Republic	0.98	18.1
Iceland	0.05	15.1
Switzerland	1.25	14.6
Spain	6.75	14.3
United Kingdom	9.46	14.2
Luxembourg	0.08	13.7
Hungary	1.20	12.3
Canada	4.63	12.3
Portugal	1.19	11.6
Lithuania	0.32	11.6
Czech Republic	1.09	10.3
Poland	3.82	10.0
Turkey	5.86	7.1
Greece	0.43	4.0
Slovenia	0.08	3.8
Chile	0.51	2.7
Mexico	2.57	2.0

Appendix 25

Proportion of UK businesses using Enterprise Resource Planning (ERP) software, by size of business, 2011 to 2014

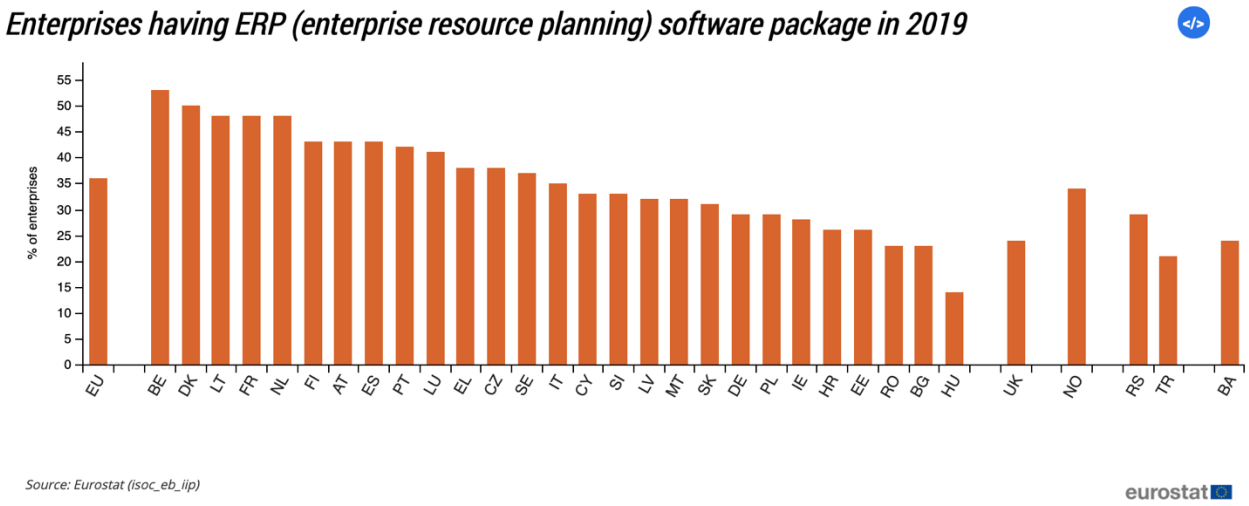
%

		Employment size						
		0 to 9 employees	10 to 49 employees	50 to 249 employees	250 to 999 employees	1000 or more employees	**10 or more employees**	**Inc micro enterprises**
Enterprise Resource Planning (ERP) Software	2011		5.6	22.9	43.4	57.5	**9.4**	
	2012		6.9	23.4	47.7	59.4	**10.6**	
	2013		6.7	28.5	52.4	64.4	**11.2**	
	2014	2.7	11.9	37.1	57.8	69.1	**16.7**	**4.3**

Source: Office for National Statistics

Estimates from 2012 onwards have been revised.
Estimates prior to 2014 are all based on businesses with 10 or more employees.
To allow comparison with earlier years, estimates for 2014 are presented on the original basis of 10 or more employees and the new basis including micro enterprises.

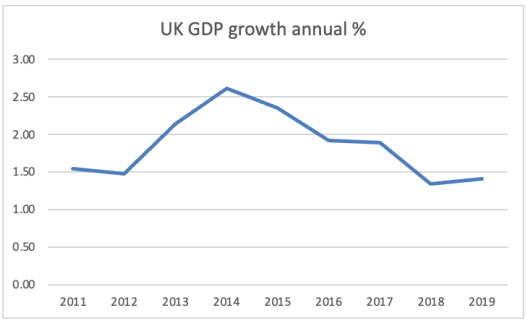
Appendix 26

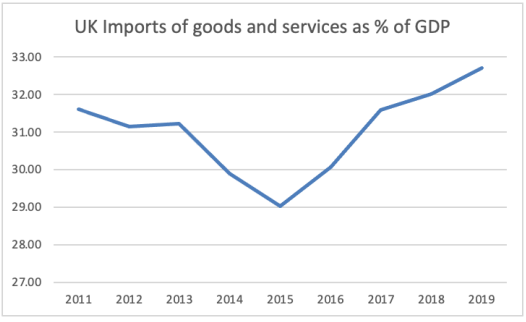


Appendix 27

		2011	2012	2013	2014	2015	2016	2017	2018	2019	avg
United Kingdom	Imports of goods and services (% of GDP)	31.60	31.15	31.23	29.90	29.03	30.06	31.58	32.00	32.71	31.03
United Kingdom	GDP growth (annual %)	1.54	1.48	2.14	2.61	2.36	1.92	1.89	1.34	1.41	1.85

Data from database: World Development Indicators
Last Updated: 10/15/2020

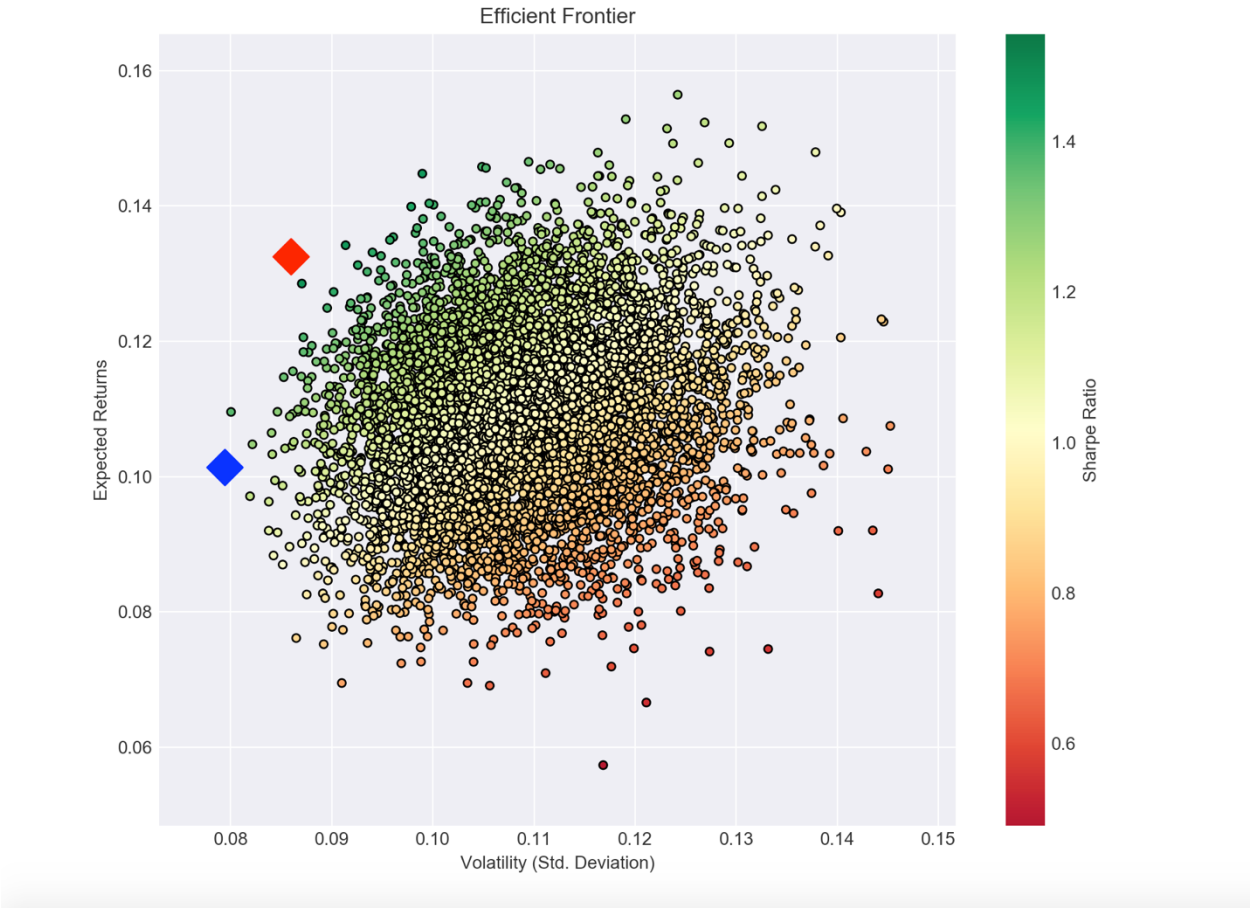




Appendix 28

Returns 0.132556
Volatility 0.085913
Sharpe Ratio 1.542911
MSFT Weight 0.148658
PEP Weight 0.061975
PG Weight 0.064992
ACM Weight 0.012713
GOOGL Weight 0.066741
TSCO Weight 0.110263
BP Weight 0.001883
TLT Weight 0.159482
GLD Weight 0.131154
SIE Weight 0.060712
SNY Weight 0.017224
EWJ Weight 0.035258
VNQ Weight 0.007327
XRE Weight 0.121617

Appendix 29


Efficient Frontier
Expected Returns
Volatility (Std. Deviation)
Sharpe Ratio
0.16
0.14
0.12
0.10
0.08
0.06
0.08
0.09
0.10
0.11
0.12
0.13
0.14
0.15
1.4
1.2
1.0
0.8
0.6

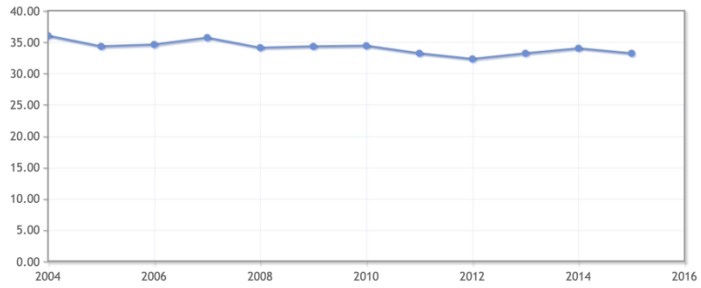
Appendix 30

		Optimal Weight	Soft/Hard/No-Deal Brexit		
Fixed Income	TLT	0.159482	0.25	0.0398705	**0.0398705**
Equities	MSFT	0.148658	0.25	0.0371645	**0.1451048**
	PEP	0.061975	0.25	0.01549375	
	PG	0.064992	0.25	0.016248	
	ACM	0.012713	0.25	0.00317825	
	GOOGL	0.066741	0.25	0.01668525	
	TSCO	0.110263	0.25	0.02756575	
	BP	0.001883	0.25	0.00047075	
	SIE	0.060712	0.25	0.015178	
	SNY	0.017224	0.25	0.004306	
	EWJ	0.035258	0.25	0.0088145	
Alternatives	GLD	0.131154	0.25	0.0327885	**0.0650245**
	VNQ	0.007327	0.25	0.00183175	
	XRE	0.121617	0.25	0.03040425	
Returns	0.132556				
Volatility	0.085913				
Sharpe Ratio	1.542911	`			

Appendix 31

	ALL individuals				
	Original income	Gross income	Disposable income	Post-tax income	Final income
Quintile group[2]					
Bottom	4	6	7	6	10
2nd	8	11	12	12	14
3rd	15	15	17	16	17
4th	22	21	22	22	21
Top	51	46	42	44	38
Decile group[2]					
Bottom	1	2	3	2	4
Top	34	31	27	29	25
Gini coefficient	50.2	40.2	34.7	38.5	29.9

Notes:



Appendix 32

Probability to generate sufficient return for public investments

Result

The probability between 0.018 and 1 is **0.78814**

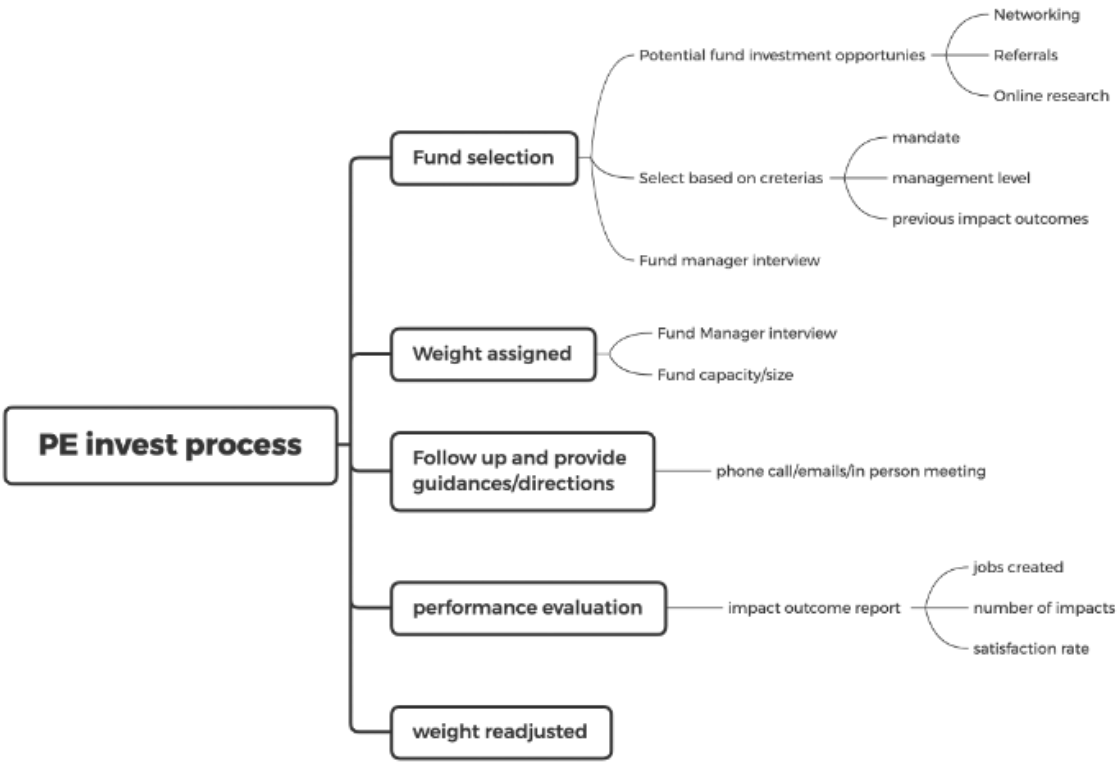
The probability outside of 0.018 and 1 is 1 - 0.78814 = **0.21186**
The probability of 0.018 or less (≤ 0.018) is **0.21186**
The probability of 1 or more (≥ 1) is **0**

Confidence Intervals Table:

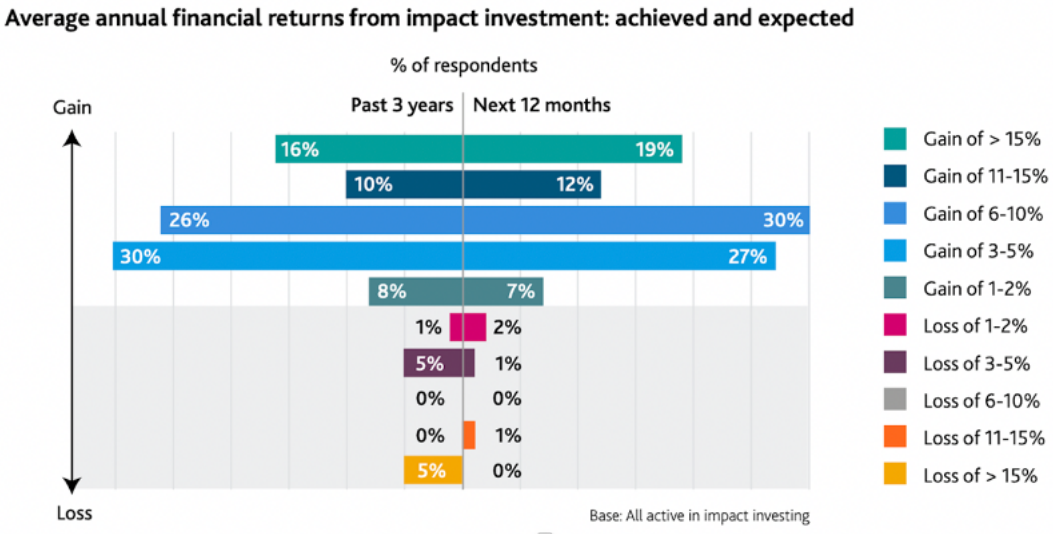
Confidence	Range	n
0.6828	0.014000–0.054000	1
0.80	0.0083690–0.059631	1.281551565545
0.90	0.0011029–0.066897	1.644853626951
0.95	-0.00520–0.073199	1.959963984540
0.98	-0.01253–0.080527	2.326347874041
0.99	-0.01752–0.085517	2.575829303549
0.995	-0.02214–0.090141	2.807033768344
0.998	-0.02780–0.095805	3.090232306168
0.999	-0.03181–0.099811	3.290526731492
0.9999	-0.04381–0.11181	3.890591886413
0.99999	-0.05434–0.12234	4.417173413469

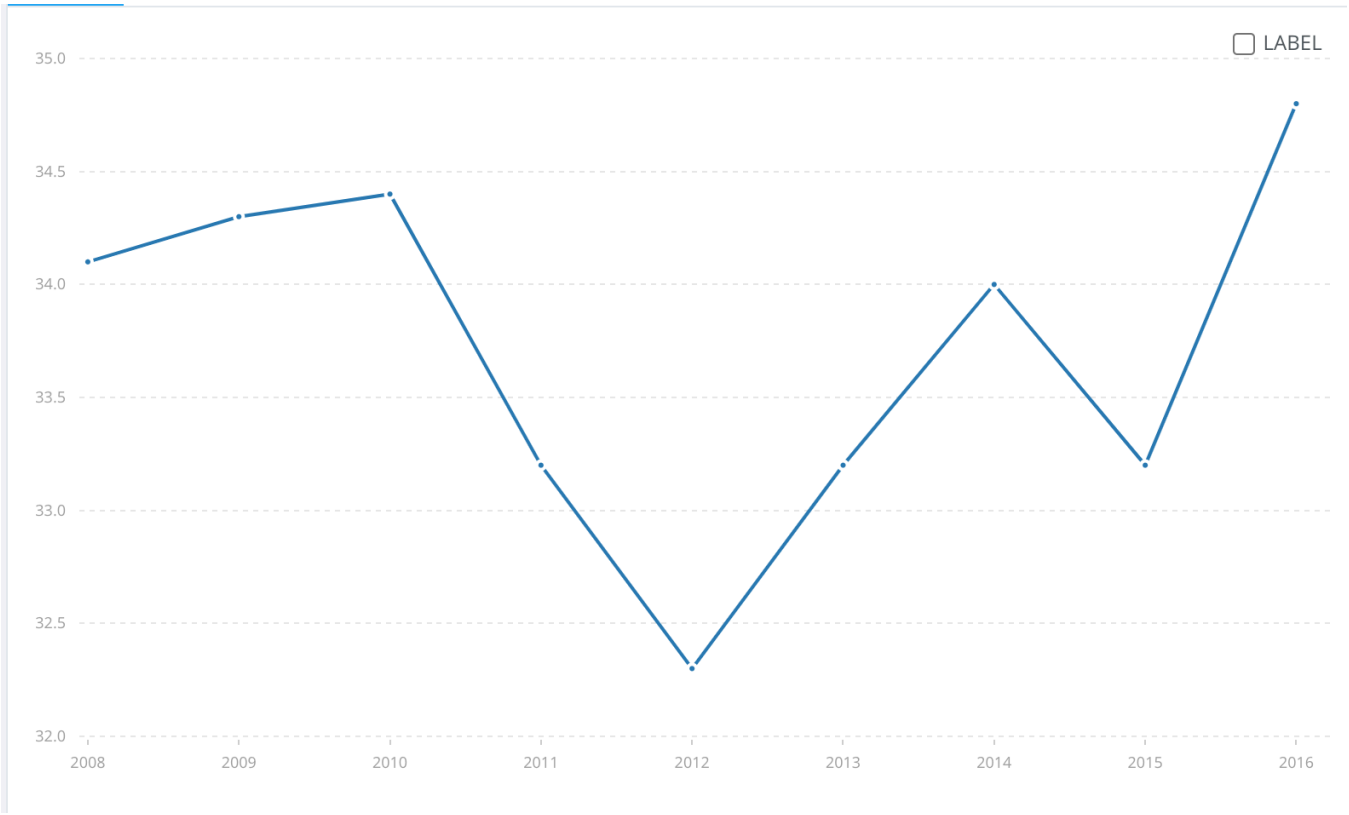
Mean: (μ)	0.034	
Standard Deviation (σ):	0.02	
Left Bound (L_b):	0.018	For negative infinite, use -inf
Right Bound (R_b):	1	For positive infinite, use inf

Appendix 33


PE invest process
Fund selection
Potential fund investment opportunies
Networking
Referrals
Online research
Select based on creterias
mandate
management level
previous impact outcomes
Fund manager interview
Weight assigned
Fund Manager interview
Fund capacity/size
Follow up and provide guidances/directions
phone call/emails/in person meeting
performance evaluation
impact outcome report
jobs created
number of impacts
satisfaction rate
weight readjusted

Appendix 34


Average annual financial returns from impact investment: achieved and expected
% of respondents
Gain
Past 3 years
Next 12 months
16%
19%
10%
12%
26%
30%
30%
27%
8%
7%
1%
2%
5%
1%
0%
0%
0%
1%
5%
0%
Loss
Base: All active in impact investing
Gain of > 15%
Gain of 11-15%
Gain of 6-10%
Gain of 3-5%
Gain of 1-2%
Loss of 1-2%
Loss of 3-5%
Loss of 6-10%
Loss of 11-15%
Loss of > 15%

Appendix 35

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