

An Algorithm for Responsible Prosperity

By sea, land, air and space

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I warrant that this document is my original work, and I am the sole legal and beneficial owner of the submission in its entirety. This submission has been written as a response to the question, relying on previous and current original work, and based on the published rules.

Mistakes remain my own.

WC: 4969 (Excluding the question, footnotes, appendices, and references)

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“Nothing exists except atoms and empty space; everything else is opinion.”

Democritus (ca.460 - ca.370 BCE)

The Question¹

“What policy changes could shift the UK on to a long-run growth path equal to, approaching or exceeding the world average of 3.5 per cent a year, while also reducing inequalities, enhancing the welfare of the population, and protecting the environment?”

“What would be your radical plan to force a step change in the quality and quantity of the UK’s economic growth?”

¹ When I first downloaded the terms and conditions of the IPPR Competition soon after the announcement, the prize question published was the first one. A few weeks later, I downloaded the terms again, and noticed that the question had been changed to the second one. I address them as one and the same question at different levels of granularity.

Abstract

We need a value revolution, a radical rethink of our financial value paradigm.

It is only after reinventing our value paradigm that we can inspire and trigger the choices and actions that will be necessary to ensure enhanced equality, welfare, and sustainability across the country, and the entire population. Only then can we be sure that the whole of the United Kingdom, with all its regions, industries, and people, is fully engaged and included in the qualitative and quantitative change.

We need a new core principle of finance that establishes our responsibility in space, similar to how Greenwich establishes 0° longitude. We also need to adjust our equations of value, to ensure we translate our new framework into a new set of tools that helps public and private entities design and execute their impact more responsibly. Indeed, the principle of space value of money and the associated metrics can help translate our vision of prosperity and justice into a daily tool for responsible value design, measurement, and creation.

By requiring that we take responsibility for the space value impact of each pound invested in space, the space value tool allows us to design our impact into the future. When we collectively begin to design our impact in line with the algorithm of prosperity the question seeks to fulfil for the UK, we may very well achieve it.

The transformation in our value paradigm does not just ensure the proper and effective deployment of the necessary investments, when applied to central banking and money creation, it also reveals the blueprints of the architecture that could be used to finance a nationwide investment drive.

1. Introduction

It is unequivocally clear that all the possible answers to this question, and all its variants, will involve, in one form or another, a nationwide investment drive. After almost a decade of austerity, aggravating already existing structural challenges (IPPR, 2017, 2018), it would be absurd to think that the 'step change in the quality and quantity of UK's economic growth' can happen without any new investment.² We must and should invest considerable amounts, and we can afford it.

Any viable answer to the question, therefore, must address two key ancillary questions regarding this new investment drive: how is it going to be deployed, and how is it going to be financed. The algorithmic conditions put forward in the question require that the investments be deployed in such a manner so as to create responsible growth, a step change in the quality of growth, enhancing equality, welfare, and sustainability.

I believe policy changes are necessary, but not sufficient, to shift that which needs shifting in order for the UK to achieve the target growth rates while fulfilling the three key conditions. A step change in the quality and quantity of UK growth requires more. What we need is a value revolution, a radical rethink of our financial value paradigm.

It is only after reinventing our value paradigm that we can inspire and trigger the choices and actions that will be necessary to ensure enhanced equality, welfare, and sustainability across the country, and the entire population. Only then can we be sure that the whole of the United Kingdom, with all its regions, industries, and people, is fully engaged and included in the qualitative and quantitative change.

We need a new core principle of finance in our value framework, a principle that establishes our responsibility in space, similar to how Greenwich establishes 0° longitude. We also need to adjust our equations of value, to ensure we translate our new framework into a new set of tools that help public and private entities design and execute their impact more responsibly, and in line with the algorithm of responsible prosperity depicted in the question.

The transformation in our value paradigm does not just ensure the proper and effective deployment of the necessary new investments, when applied to central banking and money creation (Bank of England, 2014), it also provides the blueprints of the architecture that could be used to finance the nationwide investment drive.

² The IPPR reports (2017, 2018) provide an in depth structural analysis of the UK economy. Given space limitations, and to provide a snapshot of the last decade, based on Office of National Statistics data, Appendix A summarises a handful of key measures drawing specific attention to the period since the 2008 crisis. Those charts are provided without any additional discussion or comment.

2. Risk Time Finance

Our own financial value framework makes it almost impossible for us to adequately fund our own evolution.

Finance theory and practice make use of two core principles as the discipline's analytical foundation: Time Value of Money and Risk and Return. When applied, these principles serve the preferences and interests of one stakeholder: the individual risk-averse mortal investor.³ These two principles of value govern our entire analytical imagination in finance, and they clearly confine us to a mental framework where value, monetary value, is derived through equations and models that measure and assess cash flows relative to *risk* and *time* alone.

By the very nature of the risk return relationship, higher risks imply higher required and expected returns. But what happens when projects have incalculable risks? Indeed, what discount rate should we apply to a project that aims at building a permanent human station on the moon? Incalculable risks trigger fear and worry in the risk averse investor, and make the funding of such projects less likely and sometimes impossible within a risktime framework.

Meanwhile, in a time based value model where a pound today is worth more than a pound tomorrow, projects with very distant returns, however attractive and valuable, face a negative bias built in the model through the time value of money relationship.

Our current value paradigm is unable to deal with highly risky and very distant horizon returns. Curiously, most of our evolutionary frontiers involve projects and ventures that are either highly risky or with distant horizon returns. Somehow, it seems, human evolutionary investment is in a blind spot. This may be so because evolutionary investments make sense not vis-à-vis risk or time, two very mortal things to be concerned about, but rather, vis-à-vis space and our collective, timeless and thriving existence within it.

The risk and time framework is reflected with accuracy in our debt based architecture of money creation, in the UK and the world. Debt based money fits into the time value of money and risk and return framework. But when we create money via debt, we chain humanity to calendar time, as if to ensure that we never freely and abundantly invest in our own evolution in space, timelessly.

³ A review of finance literature in industry and academia supports this summary. Brealey, Myers, and Allen (2017), a 12th edition core textbook in corporate finance, built on the wider academic literature, is a typical example. Similarly, Pike, Neale, Akbar, and Linsley (2018), a 9th edition textbook on corporate finance and investment, and Watson and Head (2013), a 6th edition Principles and Practice handbook for corporate finance. In the more professional banking and finance literature, Choudhry (2012, 2018), we can see evidence of the same. Investment valuation (Damodaran, 2012, 2017), and management and company valuation (Koller, Goedhart, Wessels, McKinsey and Company, (2015) (Koller, Dobbs, Huyett, McKinsey and Company, (2011), we encounter the same fundamental principles in action. In project finance (Yescombe, 2014), in investment banking (Rosenbaum and Pearl, 2013), in property valuation and investment (Isaac and O'Leary, 2013), in applied finance with excel (Benninga, 2011), we find the direct and indirect reference as well as use of these two principles across the board. The references mentioned here are given as a small recent sample selection of a much wider literature with diverse levels of complexity, all built around the two main principles of value.

Somehow our financial value models cater well to the needs of the mortal individual in the chain, but are at odds with our collective needs and interests in spacetime. Indeed, this may explain why the Governor of the Bank of England describes climate change as ‘the Tragedy of the Horizon’ (Carney, 2015).

“We don’t need an army of actuaries to tell us that the catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors – imposing a cost on future generations that the current generation has no direct incentive to fix.

That means beyond: the business cycle; the political cycle; and the horizon of technocratic authorities, like central banks, who are bound by their mandates. The horizon for monetary policy extends out to 2-3 years. For financial stability it is a bit longer, but typically only to the outer boundaries of the credit cycle – about a decade.

In other words, once climate change becomes a defining issue for financial stability, it may already be too late.” (Carney, 2015, 3)

The ‘tragedy of the horizon’ is a by-product of the risktime value paradigm, and it is altogether something that can be addressed with relevant adjustments in our value framework.

Reinventing our value framework allows us to steer ourselves towards responsible prosperity. It does so by providing us the theoretical foundations needed to design the architecture of investment that can propel us into an entirely new trajectory of productivity and growth, a trajectory that ensures we exceed the world average of 3.5%, responsibly.

The appropriate reference here is the Prime Meridian. The conceptual mapping of spacetime on and from Earth, epitomised by the Greenwich laser beam, at 0° longitude, is an important element of earthly communications and a structural pillar of the entire world economy.

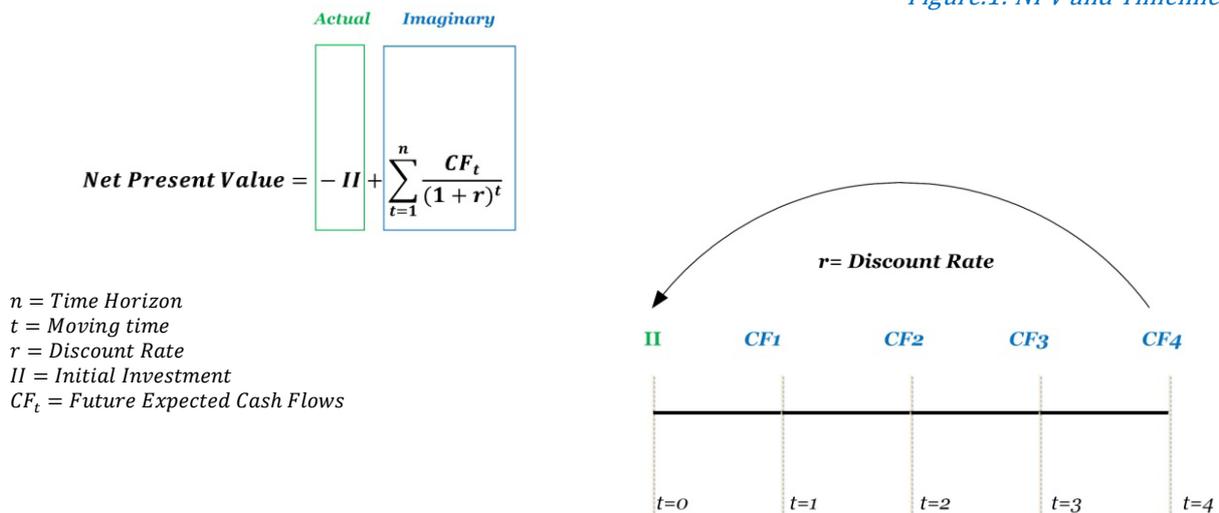
“The Prime Meridian is the line and the point at which the world’s longitude is set at 0°. It does not exist in any strict material sense, yet through maps and clocks, the prime meridian governs the life of every human on Earth.” (Withers, 2017, 5)

Just like the choice of the Prime Meridian, our healthy prosperity on Earth is up to us to build. Just like the point and the line that allow us to map our own spacetime, we need to draw an equation of value that is more aware and more responsible. To bring about real and meaningful change we must trigger an evolutionary leap into responsible value and wealth creation across all productive activities, across all regions, and the entire population, and that can only be achieved through a revamped toolkit for value design and measurement.

3. Discounting Dreams

When we translate the risktime paradigm into a mathematical expression of value, the first, most basic and yet most fundamental equation we encounter in finance, amongst the many discounting formulas widely used across industry and academia, is the Net Present Value formula.⁴ NPV epitomises a universe where time and risk parameters define the value of an investment opportunity or of a series of expected future cash flows (See Figure.1).

Figure.1: NPV and Timeline



The Net Present Value equation is made up of two parts, an imaginary part, and an actual part. The actual part is the initial investment, II; the imaginary part is made up of the future expected cash flows CF_t .

Future expected cash flows are imaginary because they have not happened yet. They may happen, or they may not, as expected or agreed. If these cash flows were guaranteed, it would not be necessary to factor in risk in the form of the discount rate. Worth noting though, however, that applying a discount rate to the cash flows does not make the cash flows any less imaginary, or more real.

The model discounts the future expected cash flows to the present with a discount rate r ; which is the opportunity cost in the form of the return on an alternative investment with the same level of risk. The only certain element in the equation is the initial investment, and it is treated with a negative sign to indicate an outflow for the investor. Meanwhile, the imaginary bit is mathematically treated for time and risk.⁵

The omission of space happens when we ascribe an abstract negative sign to the initial investment, disregarding it entirely as a real process with a terrestrial impact. Furthermore, the relative treatment of

⁴ Graham and Harvey (2002) reveal that Net Present Value (NPV) is one of the most frequently used capital budgeting techniques by CFOs, along with the internal rate of return (IRR), which is the discount rate that equalizes NPV to zero.

⁵ The treatment of risk and uncertainty through the application of the discount rate involves, without a doubt, and most often, an in depth analysis of the past, the projected conditions in the future, trends, probabilities, and other aspects that aim to make as realistic projections as possible. However, whatever the level and extent of the analytical process applied to those cash flows, the fact remains that those cash flows have not yet come to pass, and therefore, remain in the sphere of the imagination.

the future expected cash flows and the initial investment reveals a bias towards our own imaginary figures in the future.

We must reinvent our models to recognise that the impact of an investment, positive or negative, is very much part of the value of an investment, and it is the responsibility of the mortal risk averse investor to respect a pollution averse planet, and design and execute investments in such a way that, at the very least, they have no negative impact.

While the risk averse investor is free to discount its imagination as it pleases, in the shared space we call the United Kingdom, the impact of the investment cannot be omitted or left to a marginal side discussion of externalities, if we are to deliver the conditions set by the question algorithm.

4. The Space Value of Money

What the risktime model omits is the formal assessment of the value of cash flows relative to *space*. Indeed, this is where we miss the junction to responsible prosperity, where our most critical omission is. Our most critical omission is the omission of space, our physical context, stretching from the quantum world of atoms to the gravitational world of cosmology (Smolin, 2006).⁶

The principle of space value of money establishes our responsibility in space. Although, in theory and practice, we could extend the debate to subatomic space as well as interstellar space, for the purposes of our current discussion, space is understood to be terrestrial space.

The space value of money principle is built on the observed premise of reciprocity between our thoughts and actions, and what happens to and in space. Indeed, what goes around comes around, and as we think, design, choose, and define our actions in space, we define our impact on space. Space Value of Money establishes our spatial responsibility, and requires that a pound invested in space has, at the very least, a pound's worth of positive impact on space (Papazian, 2017, 12). Naturally, this is established as the bottom line condition, and in truth and for maximum effect, investments must optimise space value per pound invested.

$$\frac{\textit{Space value}}{\textit{Invested Capital}} \quad (0)$$

It is common sense that this should be so for all types of investments in order to avoid negative impact. This should be true for public as well as private investments. Indeed, all investments in space must fulfil the space value of money principle before being taken on in space.

⁶ Greene (2004), Tegmark (2014), Scott (2018) are additional background resources to explore the observational as well as theoretical understanding and exploration of space.

Space value of money complements time value of money and risk and return, and changes our optimisation target. From now on, while we are maximising our returns and minimizing our risks, we *must* also optimise our space impact.

The space value of money principle entrenches responsibility into our models, and thus requires that our mathematical expressions of value reflect that fact. In other words, we cannot accept a negative sign to II as a satisfactory treatment, and we should dig into the initial investment (II) to quantify its space impact.

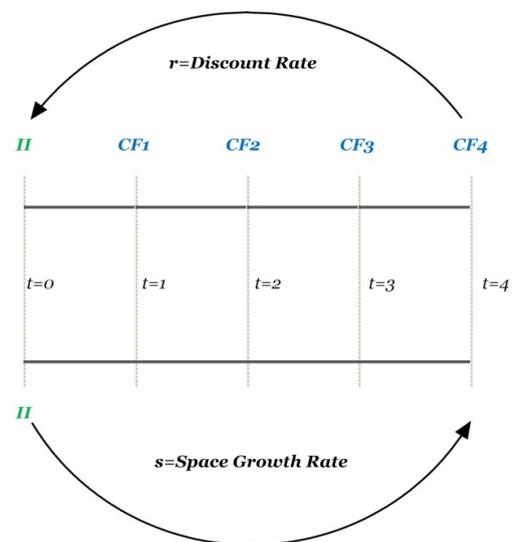
5. Compounding Impact

Achieving sustainable growth requires that we take responsibility, and taking responsibility means designing and measuring our impact differently. The Space Value metrics help us dig deeper into the impact of the initial investment (II). Doing so, the metrics offer a possible way through which responsibility can be made integral to the value of the investment, and thus of the investment decision.⁷

We need to start by making some adjustments to the timeline as in Figure.2. Alongside the commonly used discounting timeline, which moves from the future to the present, we add the actual timeline going forward. The actual timeline is where the initial investment happens. Indeed, an axis for each, the actual and the imaginary elements of NPV.

Figure.2: The Double Timeline

t = Moving time
 r = Discount Rate
 s = Space Growth Rate
 CF_t = Future Expected Cash Flows
 II = Initial Investment



⁷ In the currently active and growing field of impact investing, Bugg-Levine and Emerson (2011) have put forward the concept of Blended Value combining the economic, social, and environmental components of value (2011, 10). But, as they describe, “[d]espite this new attention, the fundamental challenge remains unresolved: How do we develop a measurement system that offers an integrated understanding of blended value creation that matches the interest of the impact investor?” (Bugg-Levine and Emerson, 2011, 167). The space value metrics proposed here can be seen as a plausible way to conceptualise and measure blended value as well. Furthermore, space value metrics create an alternative to scoring, as environmental scores are eventually opinion points, rather than data points. See also GIIN (2016), Spiess-Knafl, and Scheck (2017), and Then, Schober, Rauscher and Kehl (2017). Meanwhile, in the very similarly defined field of responsible investing through the integration of Environmental, Social and Governance (ESG) factors, Sherwood and Pollard (2019) find and reveal an analytical process primarily focused at analysing these elements as part of the broader dimension of risk. Inderst and Stewart (2018) reveal that ESG integration in fixed income investments follows a very similar logic to the risk approach, and is also in search for appropriate metrics. TCFD (2017) identifies the need for appropriate financial reporting, describes and treats climate change as a risk, while identifying the need for appropriate disclosure standards. Nusseibeh (2017) and Blanqué (2017) provide very unique perspectives from the asset management industry, revealing the importance of a structured qualitative and quantitative integration of our investments, our models, and our desired impact.

While the first timeline denotes the cash flows in the future, the second timeline denotes the Initial Investment II in the present with the investment periods to $n=4$.

As we move from right to left on the first timeline, we use the discount rate r , to discount the future cash flows according to our risktime logic. The second timeline denotes time moving forward as the investment is initiated. As the investment is deployed, we use the space growth rate to adjust the investment for space impact, by compounding from left to right.

The key measure of space growth rate s is a summary rate built through a detailed analysis of the impact of the initial investment. The first measure of impact we discuss is Gross Space Value. Gross Space Value (GSV) provides an assessment of the aggregate space impact of an investment taking into account the New Money (NM) and the New Assets (NA) that the investment will create, and its Carbon and Waste Footprint (CF and WF).⁸

Gross Space Value = GSV

$$GSV = II + NM_n + NA_n \pm CF_n \pm WF_n \quad (1)$$

n = Project Timeframe

$$Gross\ Space\ Value\ (GSV) = Initial\ Investment\ (II) + New\ Money\ (NM) \\ + New\ Assets\ (NA) \pm Carbon\ Footprint\ (CF) \pm Waste\ Footprint\ (WF)$$

It is very much possible to debate what impact is made of and what elements should or should not be included. Indeed, authentic impact assessment involves recognising what *actually* happens with II, and each investment has its own unique space profile. The carbon footprint and waste footprint can be aggregated as ecological footprint, along with other types of activities that may not pollute the air or destroy the oceans, but nevertheless have a value destroying effect on our ecosystem.

In other words, the actual elements of gross space value may differ from investment to investment. The GSV equation here tracks the Initial Investment in spacetime. From first money transfer to asset acquisition, infrastructure setup, and operations, the impacts considered are New Money, New Assets, Carbon Footprint, and Waste Footprint.

The new money created by the initial investment is the first element, because it is the first line of contact of the initial investment with the banking system. Any monetary investment starts off as a transfer of some kind, which means that from a monetary perspective, every initial investment can be treated as a new deposit somewhere. Recognising the debt based nature of our monetary architecture, this implies that the initial investment (II) may lead to new money creation within the economy, and may itself be new money.

⁸ These formulas and their descriptions have been expanded and adjusted since Papazian (2017). Also, it is relevant to note that the equation calculates the NA, NM, CF, and WF of the investment by the end of the investment period, or horizon n .

$$\mathbf{New\ Money = NM_n}$$

$$\mathbf{NM_n = II.DR.BLR + (II + X - M).mm} \quad (1b)$$

*mm = Money Multiplier, DR = Debt Ratio, BLR = Bank Loan Ratio,
M = Planned Imports, X = Expected Exports*

We must first clarify if the initial investment⁹ itself is new money in the form of bank debt. Then, treating the initial investment as a new deposit, we multiply it with the actual money multiplier¹⁰ in order to understand the credit creation impact of the investment. We must account for planned imports and expected exports for the duration of the investment as those will take away or add to the initial investment's monetary impact. Imports will involve part of the initial investment being sent abroad, while exports involve the reverse inflow into the macro-economy.

Once the initial investment is transferred, a process of value/asset acquisition and creation begins. The invested money is spent or used to create or acquire assets and generate a set of cash flows through their operation. The next measure of impact therefore aggregates all asset creation through the investment.

$$\mathbf{New\ Assets = NA_n}$$

$$\mathbf{NA_n = aINV + bRE + cT + dIP + eFIN + gEMP} \quad (1c)$$

a, b, c, d, e and g = Coefficients

*INV = Average Inventories, RE = Real Estate Assets, T = Technology Assets,
IP = Intellectual Property, FIN = Financial Assets, EMP = Employment*

The new assets equation is where we come face to face with the diversity, nature, and mode of utilisation of all the assets that the investment will create or use. Each investment has a unique new assets projection that is partly determined by the nature of the investment, and partly determined by the industry and value chain involved. Through New Assets, we have a closer look at the real impact of the initial investment.

The assets listed in this equation are not divided across tangible or intangible categories, but they are both accounted for. The elements of the new asset equation are in effect: *the people* (albeit not an asset from an accounting sense), *the place, the product/service, the technology, the intellectual property, and the finances*. The coefficients a, b, c, d, e, and g are qualifying coefficients that adjust the considered impact of an asset. Indeed, there could be many reasons to consider only an x % of the real estate asset value of an investment because some parts are not environmentally clean or acceptable. Similarly, we may want and have to adjust the coefficient g for Employment, because the investment does not take proper steps to ensure gender equality, and or employee welfare. Thus, it is through the coefficients we

⁹ We could also consider the scenario where the initial investment (II) is a foreign investment implying direct capital inflow from the start. However, in order to respect space limitations, we leave that aspect for a later discussion.

¹⁰ We use the actual money multiplier as observed in t-1, as a descriptive measure.

ascribe to the assets that we reveal more about the fairness, welfare, and sustainability of the investment at hand, and increase the granularity of our metrics.

As the investment acquires and builds assets and operates them to earn the expected cash flow, in parallel to its monetary and asset impacts, it will also have a carbon footprint and a waste footprint. Carbon and waste are not the only ecological aspects to consider, and other more specific footprints should also be accounted for when relevant.¹¹

$$\mathbf{Carbon\ Footprint = CF_n} \quad (1d)$$

$$\mathbf{CF = EET \cdot ECR}$$

CF = CO2 Equivalent Emissions in Toones of CO2 (EET) . Effective Carbon Rate (ECR)

$$\mathbf{Waste\ Footprint = WF_n} \quad (1e)$$

$$\mathbf{WF = WOT \cdot CTT}$$

WF = Waste Output in Tonnes(WOT) . Cost of Treatment per Tonne (CTT)

The Effective Carbon Rate (ECR) is borrowed from OECD (2018) and is defined as “the total price that applies to carbon dioxide emissions from energy use as a result of market-based instruments (specific energy taxes, carbon taxes and carbon emission permit prices)” (OECD, 2018, 13).¹²

The Cost of Treatment per Tonne (CTT) is a measure that must be adapted to the type of waste and the local gate costs for treatment. As such the recent WRAP report (2018) is a possible source of waste treatment cost comparisons in the UK. “The survey covers gate fees charged to local authorities in the UK for a range of municipal waste recycling, recovery, treatment and disposal options, for the calendar year 2017.” (WRAP, 2018)

These ecological footprints can be negative or positive. Indeed, a waste recycling plant that produces storable clean energy can thus be creating value both in terms of energy inventory and other assets, but also, through waste removal and cleanup.

The next step would be to calculate or identify the implied space growth rate *s* of the investment based on II and GSV. Having defined the Gross Space Value at *n*, we can measure the annualised growth rate that will bring II to GSV. Once we have calculated the Gross Space Value of an investment we know how much monetary value it creates in terms of money and assets, and we know how much it will cost or benefit ecologically speaking. The Gross Space Value of the investment is the future value of II, as it achieves its impact. Whatever the horizon *n* of the investment, given a present value (II), and a future value (GSV), we can calculate the relevant space growth rate.

¹¹ Trucost (2013) looking at the top externalities of business give s a detailed perspective of what type of ecological costs can and should be accounted for depending on industry and value chain.

¹² It is possible to consider a number of different approaches to Carbon pricing, and how we consider abatement costs. Ellerman, Convery, and de Perthuis (2010), describe in detail the evolution of the European ETS system, and provide a useful conceptual and institutional approach to Carbon Pricing.

$$s = \sqrt[n]{\left(\frac{GSV}{II}\right)} - 1 \quad (2)$$

When GSV is smaller than II, the growth rate is negative. Negative space growth rates are not aligned with the space value of money principle, where each pound sterling invested in space, should have, at the very least, one pound sterling worth of positive impact on space. So the lower threshold for GSV, without violating the principle of space value of money is:

$$\begin{array}{ll} GSV \geq II & NSV=0 \\ \text{Gross Space Value} \geq \text{Initial Investment} & \text{Net Space Value} = 0 \end{array} \quad (2a)$$

$$\text{Net Space Value} = NSV = GSV - II$$

Setting a required space growth rate for a project has practical implications for the investment, its management, and execution. By setting a positive space growth rate target, we are in effect requiring that the investment's new money and new asset impact, as well as its ecological and waste footprint are designed and executed in line with our target growth rate and conditions (Papazian, 2017).

Indeed, much like discount rates, benchmark space growth rates may be considered across an economy and its sectors. The target growth rate would require that, when planning investments, we design our monetary, asset, carbon, and waste impact in such a way so as to achieve a positive GSV.

$$GSV = II \cdot (1 + s)^n \quad (3)$$

$$NSV = -II + II \cdot (1 + s)^n \quad (3a)$$

In the case discussed in Figure.3, with the initial investment II deployed as cash expenditures CE, the Gross Space Value would then be equal to:

$$GSV = \sum_{t=0}^n CE_t (1 + s)^{n-t} \quad (4)$$

$$NSV = -II + \sum_{t=0}^n CE_t (1 + s)^{n-t} \quad (4a)$$

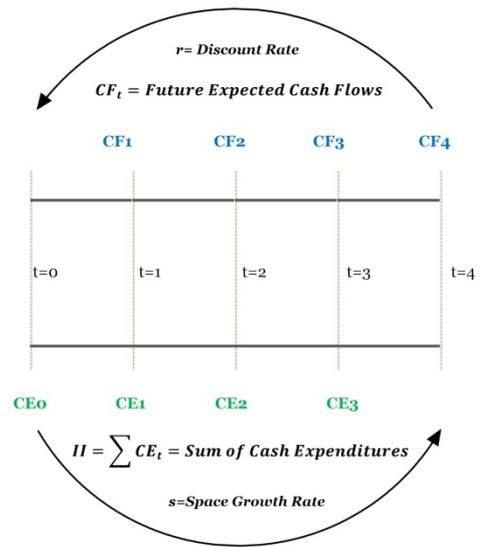
$$II = \sum CE_t = \text{Sum of Cash Expenditures}$$

By tracking the initial investment a few steps in space, we have now a lot more information about II and its impact. Indeed, we can use these metrics to design the type of impact we want. Without a doubt, there are other important aspects of the initial investment (II) that should be included, besides the negative sign.

Net Space Time Value (NSTV) brings into one equation NPV and NSV, providing us with an aggregated measure of the space and time returns of the investment, while accounting for risk.

Figure.3: NSTV and Double Timeline

$II = \sum CE_t = \text{Sum of Cash Expenditures}$
 $CF_t = \text{Future Expected Cash Flows}$
 $n = \text{Project Timeframe}$
 $s = \text{Space Growth Rate}$
 $r = \text{Discount Rate}$
 $t = \text{Moving time}$



$$NSTV = -II + \sum_{t=1}^n \frac{CF_t}{(1+r)^t} - II + \sum_{t=0}^n CE_t(1+s)^{n-t} \quad (5)$$

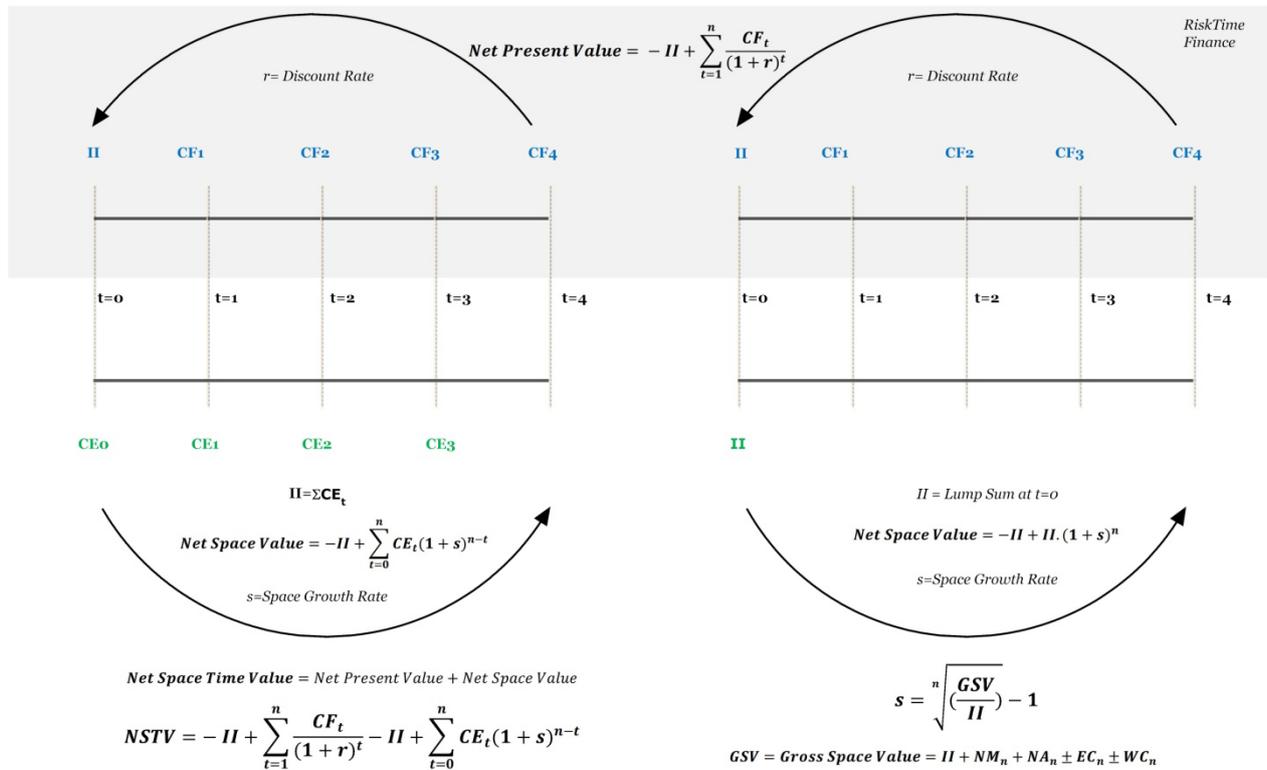
Net Space Time Value (NSTV) = Net Present Value(NPV) + Net Space Value (NSV)

The screening of projects can now witness a two tier decision making process. The first with NPV is the risk time assessment of the cash flows, where the main stakeholder is the mortal risk averse investor, and the second, with NSV, is the impact of the Initial Investment in terms of money, assets, carbon and waste, where the main stakeholders are everyone else and the planet.

What would happen to the British economy, if, across the board, investments were modelled with space impact? Indeed, achieving a high growth rate that ensures equality, welfare, and sustainability will also require that new investments, across the board, maximise their space growth rate and optimise their impact responsibly.

Figure.4: Summary Timelines and Equations for Lump Sum II, and for II= Σ Cash Expenditures

Gross Space Value, Net Space Value, Net Space Time Value, and the Space Growth Rate



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6. A New Paradigm, A New QE

With the introduction of our new value paradigm we are one step closer to ensuring that the growth we have is the kind of growth we want, and that investments are deployed with a mindset that is aligned with our question algorithm. Interestingly, this new paradigm also resolves the question of financing these investments.

Our new value paradigm requires that all cash flows are space value optimised, and on top of the list are central bank monetary injections, like QE. Currently, our debt based monetary architecture echoes our risktime value paradigm (Bank of England, 2014). The instruments we use for the creation of money on the central bank level are government and corporate bonds, and on the banking level, personal, business, and corporate loans or equivalent instruments.

The Bank of England will have to optimise the space impact of its monetary injections, such that the Gross Space Value of the injected new money is most appropriately maximised.

The first optimisation to be applied is a change in the location of new money creation. To maximise space impact, the newly injected money must be created not where it has been till now, i.e., in banks, but in the real economy, creating assets directly, income and expenditure first. This change is necessary because with a bank based QE, the real impact of the new money is dependent on further bank lending.

Thus, QE with space impact will need to be channelled into the account of a non-bank institution which will then play the role of a long horizon investor in the UK economy. This entity could very well be called a 'National Investment Bank' (IPPR, 2018), but whatever it is called, the great industrial and monetary catalyst in Great Britain must play the role of a long horizon investor partner, not lender. Furthermore, this entity must be a uniquely defined public or semi public institution with the highest standards of corporate governance and transparency; it must embody this new vision of responsible growth and translate it into a nationwide executable plan. This new industrial catalyst needs to be funded appropriately, both in terms of amount and structure, so that it can confidently trigger and sustain a new wave of value creation across the economy, in line with our growth targets and conditions.

With a new value paradigm, we can devise a new funding strategy, and engineer new instruments that can finance the nationwide investment drive, deployed through a long term strategic investor able to tolerate high levels of risk, and very distant returns. I have elsewhere proposed Public Capitalisation Notes as non-debt instruments that could do the job of facilitating such a high impact QE (Papazian, 2011).

7. Conclusion

By sea, air, land and space, as we build and grow value, we must design our impact in line with responsible prosperity. While we grow and expand across space, we must find the strength and humility in ourselves to prevent ourselves from destroying our home environment, and we must teach future generations to take responsible care of it. Our financial value paradigm is central to both tasks.

Just like 0° longitude at Greenwich, we need to establish our responsibility in space, our responsibility to design our impact in space. Once we have established our responsibility, we must translate it into the value equations we use to design, assess and create value.

Empowered with a new paradigm of value, and a new money creation methodology, we can design the next industrial wave that can lead us to a step change in the quality and quantity of UK growth. Given the last few decades, a nationwide investment drive is a must, and its targeted deployment in line with the space value of money principle and metrics delivers a real chance for success.

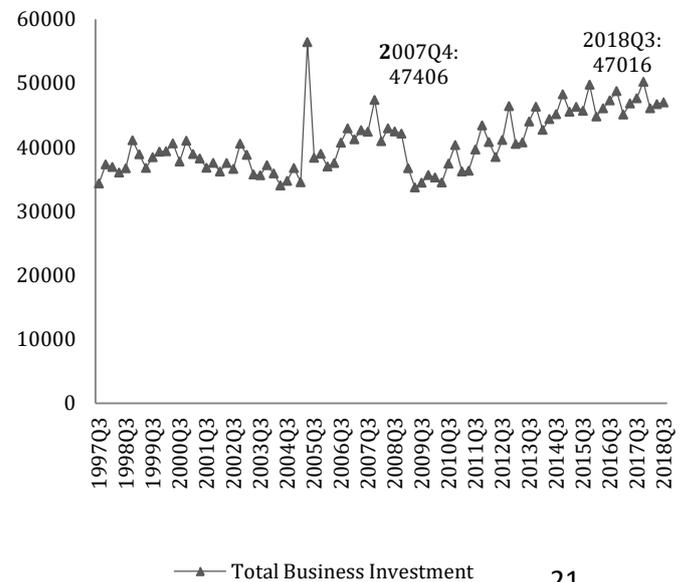
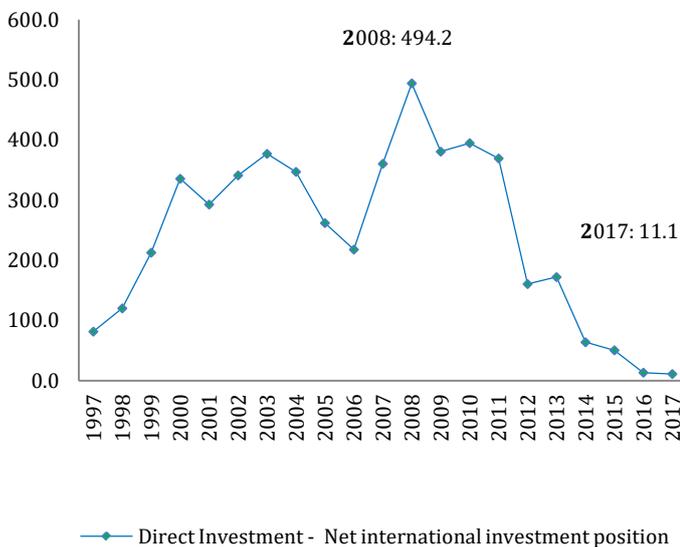
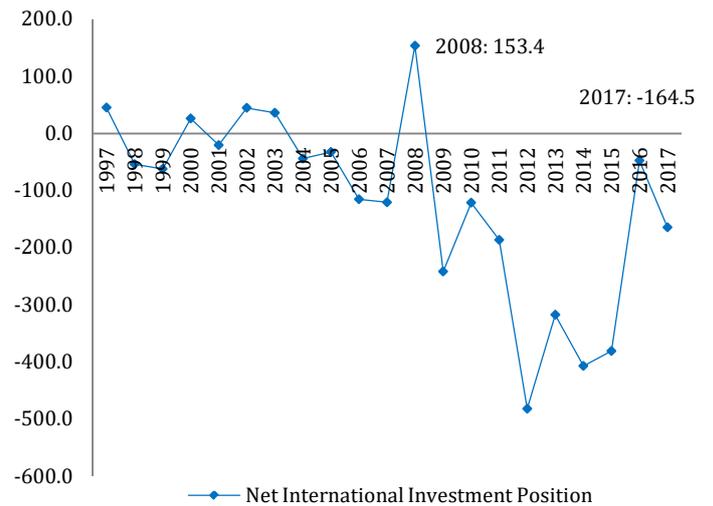
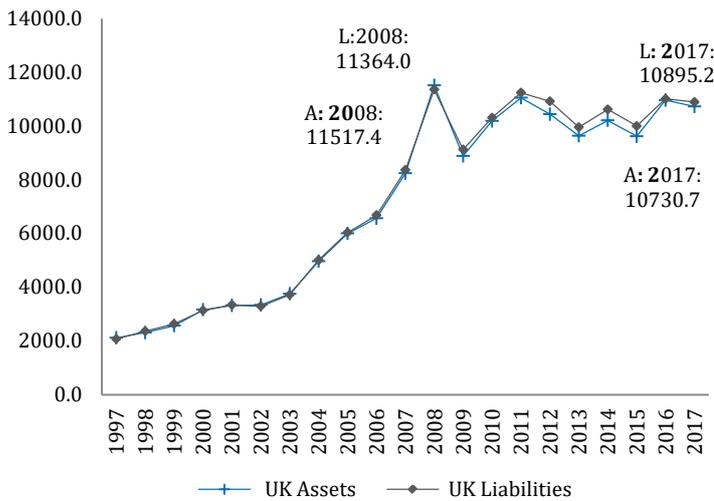
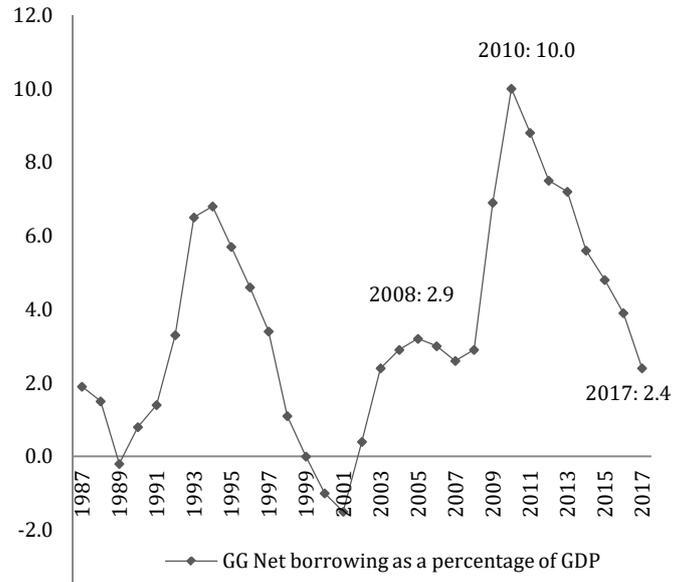
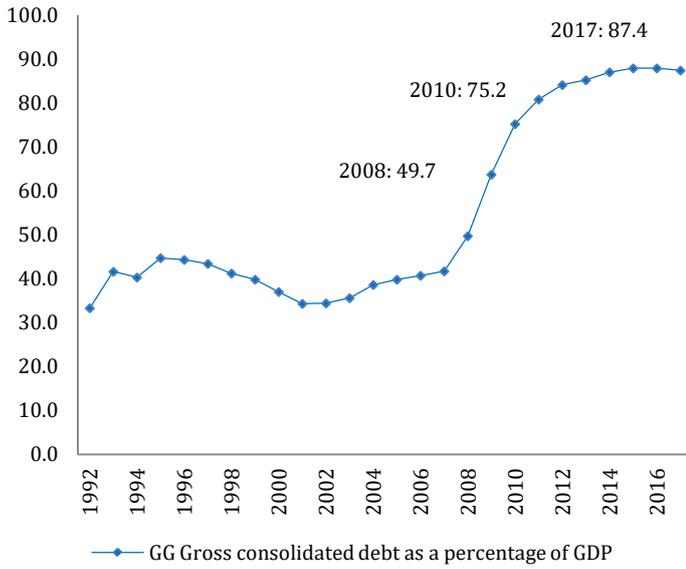
By requiring that we take responsibility for the space value impact of each pound invested in space, the space value tool allows us to design our impact into the future. When we collectively begin to design our impact in line with the algorithm of prosperity the question seeks to fulfil for the UK, we may very well achieve it.

Through a radical transformation of our financial value paradigm we can truly change course and embark on a global path towards responsible prosperity.¹³

¹³ With or without Brexit, with or without a deal.

8. Appendix A

UK G. Government Debt & Borrowing (%), Business Investment (£m), International Investment, Assets, Liabilities, Direct investment (£b) Source: Office of National Statistics



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