

June 2013



**BIG  
INNOVATION  
CENTRE**

**Two spheres that don't touch  
The relationship between British finance  
and British innovation**

Hiba Sameen



The author would like to acknowledge the major contributions to this report of:

- Professor Birgitte Andersen, Director of Big Innovation Centre
- Will Hutton, Chair of Big Innovation Centre
- Stian Westlake, Executive Director of Policy and Research, Nesta
- Gareth Quested, Research Assistant, Big Innovation Centre



The Big Innovation Centre is an initiative of The Work Foundation and Lancaster University. Launched in September 2011, it brings together a range of companies, trusts, universities and public bodies to research and propose practical reforms with the ambition of making the UK a global open innovation hub as part of the urgent task of rebalancing and growing the UK economy, and with the vision of building a world-class innovation and investment ecosystem by 2025. For further details, please visit [www.biginnovationcentre.com](http://www.biginnovationcentre.com)

## Executive summary

**Between 2001 and 2007, total capital raised in the UK financial system increased by £1,340bn but investment in innovation over the same period increased by just £26bn. This evidence indicates that there may be a disconnect between the British innovation system and the British financial system.**

This report looks into how the UK's financial system supports the financing of innovative activities at the aggregate level. Using Nesta's Innovation Index, a very inclusive measure of innovative activities, we compare the proportion of total capital raised in financial markets to the amount that is spent on innovative activities.

One of the functions of financial markets is to allocate savings to the most deserving and high quality businesses. Financial markets match up household savings with businesses that need investment to grow or to develop new products. This report presents evidence that suggests that in the run up to the financial crisis, investment in innovation had been falling as a proportion of total capital flows, which itself was growing rapidly and pro-cyclically. Between 2001 and 2007, that total capital raised in the UK financial system increased by £1,340bn but investment in innovation over the same period increased by just £26bn. Looking at just R&D the contrast is even starker – R&D investment increased by only £3bn over the same period.

This evidence suggests that there is a structural problem within the financial system in supporting investment for innovation, which may have also contributed to the depth of the crisis by supporting an economic structure in which innovative activity was less central than it should have been. Although the proportion has risen in the two post financial crash years, this is largely accounted for by the cyclical fall-away in capital raised, indicating that the financial system is largely disconnected from the innovation system.

## Table of Contents

<b>1. Setting the scene: Innovation and the financial system.....</b>	<b>5</b>
<b>2. How are the UK's businesses financed? .....</b>	<b>7</b>
<b>3. How well does the UK perform in financing innovation? .....</b>	<b>10</b>
<b>4. Conclusions.....</b>	<b>16</b>
<b>Appendix: Nesta's Innovation Index .....</b>	<b>17</b>
<b>Acknowledgements.....</b>	<b>21</b>
<b>Contact details .....</b>	<b>22</b>

# 1. Setting the scene: Innovation and the financial system

The UK is home to one of the world's leading financial centres – but how well does this financial centre perform when it comes to financing innovation? There is widespread agreement that innovation is the key to economic growth, particularly at a time when the traditional options on monetary and fiscal policy are so constrained. This note gives a snapshot of how the UK financial system performs in investing in innovation.

Well-functioning financial ecosystems tend to promote growth and expand economic opportunities. There are four key ways in which financial systems support the economy:

- (1) by screening borrowers effectively and identifying firms with the most promising prospects, they allocate savings from disparate households to invest in these promising projects;
- (2) by monitoring the use of investments and scrutinising their managerial performance they boost the operational efficiency of corporations, reducing waste and fraud and spurring growth;
- (3) by diversifying risk through the securities market, financial institutions are able to encourage investment in higher-return projects that would ordinarily have been shunned without effective risk management techniques; and
- (4) by lowering transaction costs, financial institutions facilitate trade and specialisation which are fundamental inputs into technological innovation and growth.

However, when financial systems perform poorly they tend to hinder economic growth and curtail economic opportunities. If financial institutions fail to allocate capital to innovative firms (which typically have higher returns), this leads to slower economic growth. If financial institutions fail to implement sound corporate governance, this makes managers pursue projects that benefit themselves rather than the firm and the overall economy. Thus, poorly functioning financial systems restrict credit and economic opportunity. Research suggests that the financial system promotes economic growth through the quality of capital allocation, not the overall rate of investment<sup>1</sup>. Thus, finance should not be viewed as a plumbing system, where pouring more credit in one end yields more growth at the other. Rather, finance functions as an economy's central nervous system, choosing where to allocate resources. It is the incentives

---

<sup>1</sup> See Levine, Ross (2005), "Finance and Growth: Theory and Evidence", Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (eds.), Chapter 12, pp 865 – 964.

shaping these choices that influence economic growth.

Thus, it is very important for sustainable economic growth for the financial system to fund high growth and innovative firms. The key for a financial system to support innovation is maturity transformation; that is, borrowing short and lending long. This requires trust, a lender of last resort, a wide diversity of assets, collateral and an appetite for risk: the more the system can provide finance for relatively illiquid assets whose pay-offs may be both risky and long-term (as innovations are), the more innovation there will be. There is evidence to suggest that the UK has a risk-averse financial system and is thus more innovation unfriendly than most. For instance, the UK's venture capital market provides 18% of total funds raised for seed capital and start-ups, whereas the US market targets 59% of all VC funds at the bottom end of the market<sup>2</sup>.

In this note, using Nesta's Innovation Index<sup>3</sup>, we estimate the amount of money raised on UK financial markets by businesses to map the proportion of the total capital provided by the UK's financial system to businesses in Britain over a decade. We also compare Nesta's Innovation Index with a more conventional measure for investment in innovation, i.e. R&D expenditures.

In section 2, we look at how UK firms at different stages of growth are financed and through which capital instruments. Finally, in section 3, we develop a time series set going back a decade to study how much capital is raised in the UK's financial markets. We then study how investment in innovation has varied over time as a proportion of total capital raised in the financial markets.

---

<sup>2</sup> Brinkley, Levy and Sameen (2012), Autumn Statement Submission, The Work Foundation.

<sup>3</sup> The framework for the Index and the Index itself along with R&D expenditures are reproduced in the Appendix.

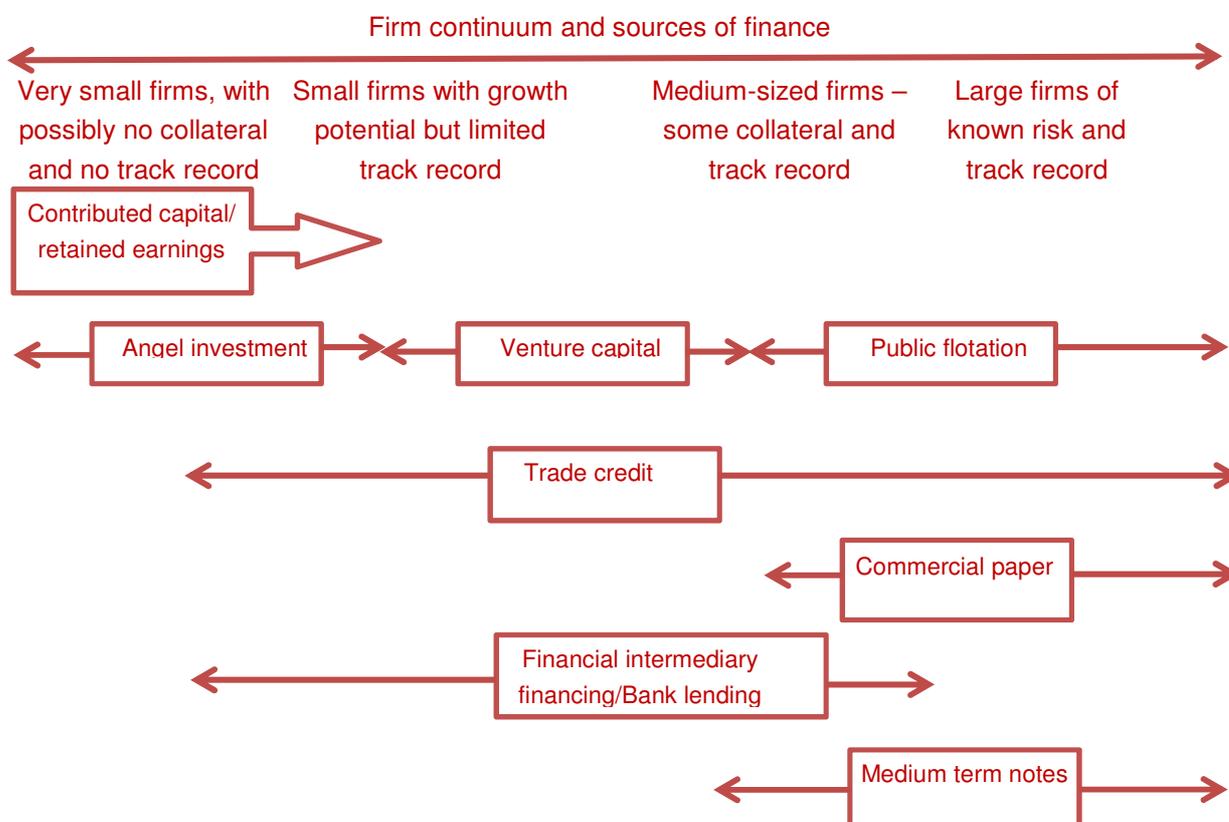
## 2. How are the UK's businesses financed?

In this section we summarise the different sources of finance available to firms at different stages of growth and how this finance flows from the financial system to businesses. This will enable us to develop an estimate of how much money has been raised in the UK's financial markets annually since 1997, to be able to see what volume of this financial activity is directed towards investment in innovation by UK businesses. One of the important functions of the financial system is to channel capital to innovative new uses – our analysis will present a rough and ready measure of the extent to which the financial system actually does this.

Financing innovative firms generally depends on the sector of activity and its growth cycle. In order to grow, a firm relies on equity and debt. Thus small businesses have a growth cycle in which financial needs and options change as the business grows and becomes more transparent.

Figure 2 shows this cycle in a stylised fashion, whereby firms lie on a size continuum. Typically, as a firm's size and age increase, more information about the firm becomes available; it builds a track record. Another reason is that older firms are more likely to have a larger number of assets, which lenders can use as collateral. It is therefore easier to assess the risk of larger or older firms. The figure seeks to give a general idea of which sources of finance are available to firms at different stages in the financial growth cycle and the points in the cycle at which different types of funding are shown to begin and end.

**Figure 2:** Stages of financing for businesses



Source: Adapted from Berger and Udell (1998)<sup>4</sup>

We now look to see how much capital flows through the UK financial system annually. Each of the funding instruments shown in Figure 2 above is included in the main components of the financial system we outline below:

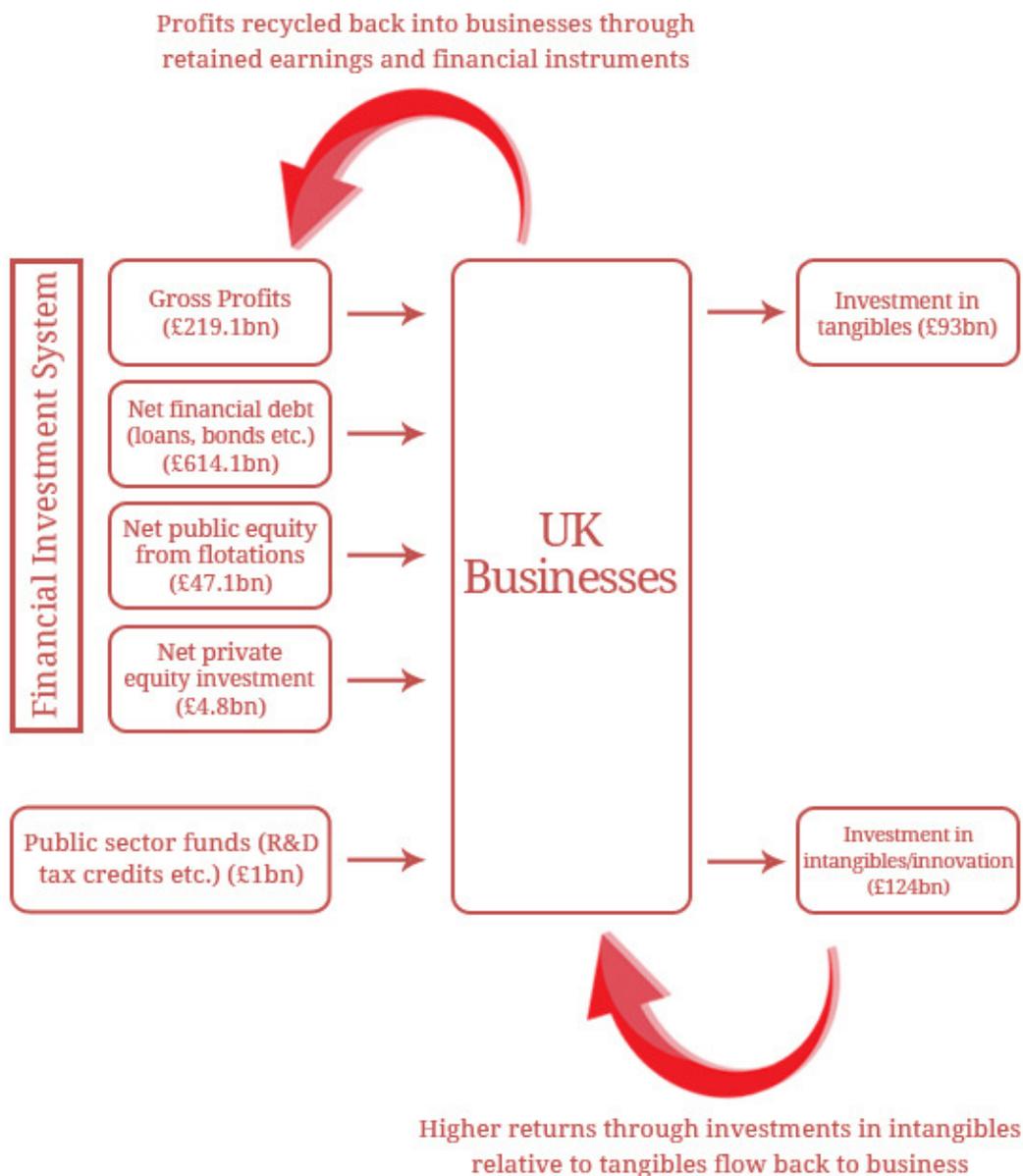
- Annual net financial debt acquisitions – this covers new debt taken on by businesses less retired debt covering currency and deposits, loans, securities and other money market instruments
- Retained earnings reinvested (internal finance) by UK private non-financial corporations and financial corporations (PNFCs and FCs) in the UK
- Estimating the net inflow from flotations to UK businesses (Main Market and AIM growth capital market)
- Annual net private equity investments minus inflow from flotations (early stage investment, venture and growth capital, MBOs etc.)

<sup>4</sup> N. Berger, Allen & F. Udell, Gregory, 1998. "The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle", Journal of Banking & Finance, Elsevier, vol. 22(6-8), pages 613-673, August.

Figure 3 shows how all these sources of investment flow through the financial system into businesses and then are recycled back into the financial system.

Businesses invest part of their financing in growth activities such as investments in tangibles and intangibles. Evidence from research indicates that investments in intangibles have higher returns than those in tangibles as they raise a firm’s productivity to a greater extent. Increased investments in intangibles flow back into the business as higher profits and then ultimately back into the financial system through increased retained earnings and more capital in the financial markets.

**Figure 3:** Flow of investment from the financial system to innovation through businesses in 2009<sup>5</sup>



<sup>5</sup> Funding amounts given in the figure are explicitly derived and sourced in the next section.

### 3. How well does the UK perform in financing innovation?

In this section we build a time series dataset to approximate the total financial flows through the UK's financial system to develop an understanding of what proportion of total capital raised in financial markets is spent on innovative activities and how it varies over time.

First we collate data on net debt, net private equity investments, net profits re-invested by UK businesses and net capital raised through flotations – the four components of the financial system we outline in the previous section

The table below shows the aggregates of each of these sources of capital flows. The first column includes all debt instruments – bank lending, bonds, securities and other money market instruments for lending. The second column gives net equity investments in UK businesses. The third column gives profits for all UK corporates, financial and non-financial, as well as retained earnings from foreign direct investment. Finally, in the fourth column we have net capital inflows to the UK from flotations and IPOs from the London Stock Exchange's main market and AIM capital growth market.

**Table 3:** Total capital raised/invested in the UK from 1997 – 2011

	Net financial acquisitions (debt, MMIs, securities) UK businesses <sup>6</sup> (£bn)	Net equity investment in UK businesses <sup>7</sup> (£bn)	Gross profits re-invested by UK businesses <sup>8</sup> (£bn)	Net inflow of capital from flotations <sup>9</sup> (£bn)	Total (£bn)
<b>1997</b>	597.2	4.2	164.7	55.5	821.5
<b>1998</b>	372.5	4.9	163.7	89.7	630.8

<sup>6</sup> UK Financial Accounts, from ONS UK Economics Accounts, Table A44 – includes loans, securities, deposits and other money market instruments for non-financial, financial and public corporations.

<sup>7</sup> Data from BVCA Investment Activity reports – includes all investments (early stage, venture capital, expansion, MBOs etc.) made in the UK by members of BVCA.

<sup>8</sup> Data series from ONS UK Economic Accounts, table A20 and X1 – UK PNFC profits and retained earnings from FDI for UK NFCs and FCs.

<sup>9</sup> Data obtained from the London Stock Exchange – net capital raised for UK companies through the Main Market and AIM growth capital market.

	Net financial acquisitions (debt, MMIs, securities) UK businesses <sup>6</sup> (£bn)	Net equity investment in UK businesses <sup>7</sup> (£bn)	Gross profits re-invested by UK businesses <sup>8</sup> (£bn)	Net inflow of capital from flotations <sup>9</sup> (£bn)	Total (£bn)
<b>1999</b>	479.4	7.8	168.9	232.2	888.3
<b>2000</b>	1041.0	8.3	170.3	119.2	1338.7
<b>2001</b>	707.6	6.2	164.4	49.6	927.7
<b>2002</b>	582.5	5.5	175.3	25.1	788.4
<b>2003</b>	900.1	6.4	188.5	34.6	1129.5
<b>2004</b>	1178.5	9.7	203.9	190.9	1583.0
<b>2005</b>	1385.3	6.8	212.8	73.4	1678.4
<b>2006</b>	1645.1	10.2	236.3	80.7	1972.3
<b>2007</b>	1890.2	12.0	246.2	98.4	2246.8
<b>2008</b>	265.5	8.6	240.5	83.0	597.5
<b>2009</b>	614.1	4.8	219.9	47.1	885.9
<b>2010</b>	339.0	8.2	235.5	97.8	680.5
<b>2011</b>	313.9	6.5	256.1	16.4	593.0

Source: calculated from ONS UK Economic Accounts, London Stock Exchange and BVCA Investment Activity reports

In table 4, we develop a time series, using Nesta's Innovation Index and the time series developed above to study the proportion of total capital invested in innovative activities over time. We compare Nesta's Innovation Index to traditional R&D measures of innovation. From the table below we can see that the series is affected by exogenous shocks from financial markets. This is mainly driven by the fact that total capital raised in financial markets is strongly pro-cyclical. Due to this we have broken the series into three sections - the first series break coincides with the dot com crash and US

recession of the early 2000s. The second series break occurs in 2008, with the onset of the financial crash and severe credit crunch.

**Table 4:** Investment in innovative activities falling as a proportion of the total in the lead up to the recession

Year	Investment in innovative activities / Nesta Innovation Index (£bn)	Total capital raised in the UK (£bn)	R&D Expenditure (£bn)	Proportion of capital invested in innovative activities (Nesta Innovation Index)	Proportion of capital invested in R&D
<b>1997</b>	74.1	821.5	9.0	6%	1.1%
<b>1998</b>	81.7	630.8	9.6	13%	1.5%
<b>1999</b>	88.8	888.3	10.6	10%	1.2%
<b>2000</b>	93.7	1338.7	10.9	7%	0.8%
<b>Series break 1: Dot com crash</b>					
<b>2001</b>	100.0	927.7	11.4	11%	1.2%
<b>2002</b>	103.5	788.4	11.6	13%	1.4%
<b>2003</b>	106.5	1289.5	11.6	9%	1.0%
<b>2004</b>	108.4	1583.0	11.5	7%	0.7%
<b>2005</b>	115.7	1678.4	12.5	7%	0.7%
<b>2006</b>	120.1	1972.3	12.9	6%	0.6%
<b>2007</b>	125.9	2246.8	14.2	5%	0.6%
<b>Series break 2: Credit crunch 2007/8</b>					
<b>2008</b>	128.4	597.5	15.1	21%	2.5%
<b>2009</b>	124.2	885.9	14.7	14%	1.7%

We see that in 1997, investment in innovation as a proportion of the total capital raised was already at very low levels, at 6%. For R&D expenditure the proportion is extremely low at 0.8% in 1997. With the onset of the dot com crash, this proportion rose due to the fall in total capital raised from the financial market shock of the dot com crash. Since the dot com crash, the proportion of capital invested in innovative activities falls to 4% of the total capital raised in the lead up to the financial crisis. The proportion invested in R&D relative to total capital raised is extremely low at 0.6%. For 2008 and 2009 we break the series again, as the proportion rises substantially due to deleveraging and the crunch in capital markets.

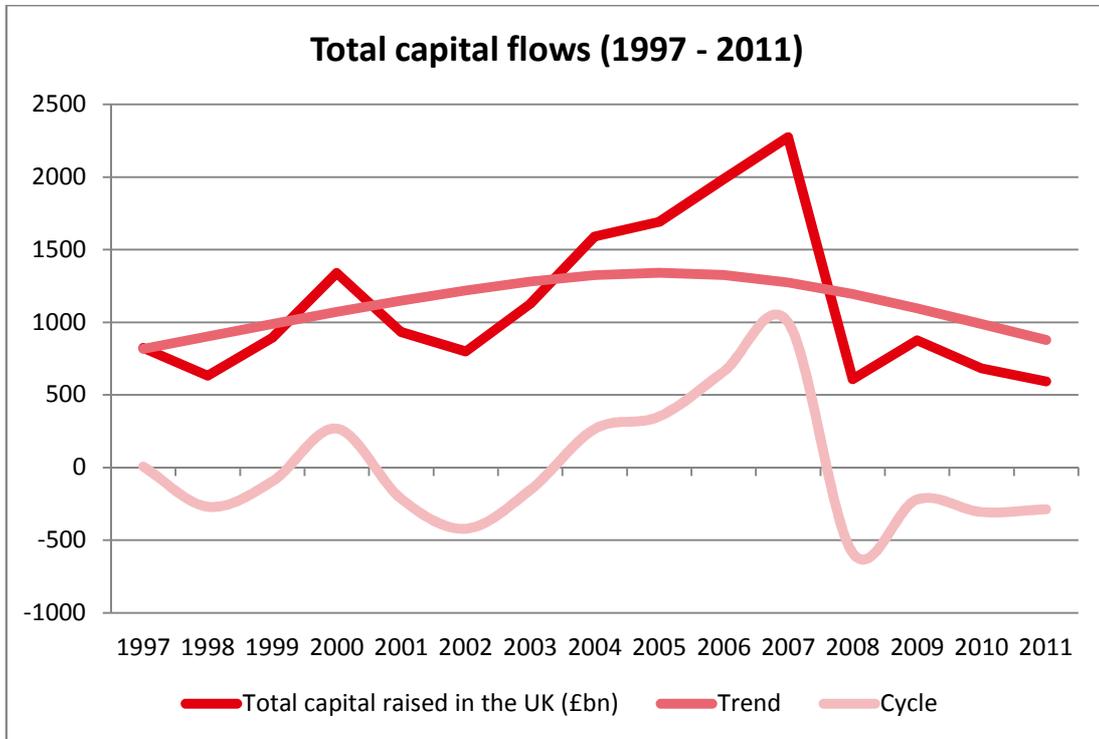
During a period when total capital raised more than doubled from £928bn to £2,247bn (2001 to 2007) innovation investment only rose by a quarter. When capital raised plunged to levels 25 per cent of those in 2007, intangible investment hardly fell. The financial and innovation systems appear to be almost completely disconnected.

In Figures 4 and 5, we take both series; total capital flows in the financial system, as well as investment in innovation, and use the Hodrick-Prescott filter<sup>10</sup> to remove the fluctuations in the series that are due to the business cycle. This decomposes the series into a long-run trend component and a cycle component of the original series, which are presented in the graphs below. We can clearly see that the total capital raised series is largely driven by changes in the cycle, whereas the innovation index appears to be largely impervious to the cycle, illustrating the two disconnected spheres of finance and innovation.

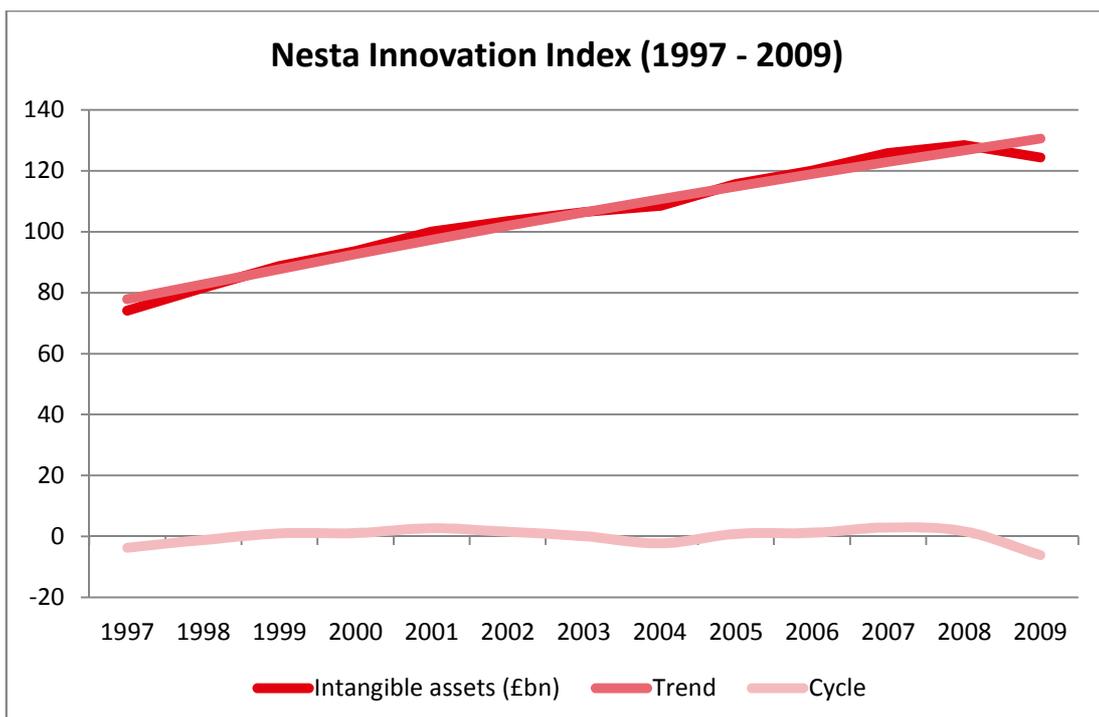
---

<sup>10</sup> Statistical method to convert time series data into its long term trend, removing the effects of the economic cycle from the data.

**Figure 4:** Total capital flows in the UK is highly pro-cyclical



**Figure 5:** Investment in innovation is unaffected by the economic cycle



**Table 5:** Proportion of investment in innovative activities

	1997 – 2000	2001 – 2007	2008 – 2009
Increase in total investment in innovation	£20bn	£26bn	-£4bn (decrease)
Increase in R&D expenditure	£2bn	£3bn	-£0.4bn (decrease)
Increase in total capital raised in the UK	£517bn	£1,319bn	-£288bn (decrease)

**The total increase in the financing of innovation between 2001 and 2007 was £26bn, whereas the total increase in capital raised over same time period was £1,319bn.**

Table 5 above summarises the data presented in Table 4 for each of the three sections of the full time series. The period between 2001 and 2007 stands out here – total capital raised in this period increased by £1,319bn whereas investment in innovation increased by only £26bn. R&D measures of innovation indicate that the problem could be far worse – between 2001 and 2007 investment in R&D increased by only £3bn.

## 4. Conclusions

The UK's financial and innovation systems appear to occupy two discrete spheres, operating largely independent of each other. Between 2001 and 2007, for instance, total capital raised increased by £1,319bn - investment in innovation increased just £26bn. Compared to conventional measures of innovation the contrast is even starker - R&D expenditures increased by only £3bn over the same time period.

Mapping the trend using Nesta's Innovation Index, we find that total investment in innovative activities accounted for 5% of the total amount raised by capital and lending markets in 2007, less than half of its peak in 1998. Conventional measures indicate that this value is even lower, at 0.6% of total capital raised in financial markets. The series is affected by exogenous financial shocks, due to the pro-cyclical nature of capital raised in the financial system.

### After script

This report gives a snapshot of the UK financial system and how it supports innovative activities. Clearly, the results show that financial institutions need to do better to support innovative activities. However, this work is only indicative - more research needs to be done to understand, in depth, at the firm level, the systemic barriers that innovative firms face in access to finance to develop better business models for financial institutions - models that encourage innovation and support sustainable growth. We also need to understand why the financial system in aggregate appears to be so innovation unfriendly, and develop better statistics than those currently available publicly.

The Big Innovation Centre will examine these issues in-depth with Experian in the near future. Using financial micro panel data, we will identify the systemic barriers that face SMEs in access to both debt and equity finance.

## Appendix: Nesta's Innovation Index

This section reproduces the conceptual framework and the results from the latest update of a broad measure of innovation that Nesta has developed, which is used in our analysis of how the financial markets perform in financing innovation. We also include a conventional R&D measure as comparison.

There is a particularly pressing need for good measures in the field of innovation. The most familiar and most widely accepted metrics of innovation still relate to a linear model of innovation based on science and technology and tailored to manufacturing industries. Despite the inclusion of aspects of non-technological innovation in surveys such as the EU's Community Innovation Survey, internationally agreed indicators such as expenditure on research and development (R&D), patent production, and numbers of science and technology graduates still loom large in public debate.

Nesta has developed an index measuring the level of investment in innovation in the UK by sector and industry. The index classifies a much wider range of activities as innovative than typically used. The results show that UK businesses invest heavily in innovation, far more than the traditional R&D expenditure measures indicate. This metric, in addition to traditional R&D, includes investment in design, organisational improvement, training, software development, market research and copyright development, etc. Table 1 describes the innovative activities included in this index.

**Table A1:** Nesta's Innovation Index

Innovative activity	Description
<b>R&amp;D</b>	R&D is 'classic' innovation investment: scientific research and development that produces new knowledge in the form of ideas or products that can be marketed by firms.
<b>Design</b>	Investment in design has been described by some macroeconomists as 'non-scientific R&D'. These designs may be critical in the innovation process, as they play an important role in new product and service development. This category is also assumed to include those investments aimed at developing new services and financial products.

Innovative activity	Description
<b>Organisational improvement</b>	Organisational innovation drives the efficiency and effectiveness of organisations. Investing in this type of knowledge is critical to staying competitive and being able to leverage innovative ideas and commercially exploit them.
<b>Training &amp; skills development</b>	Using our current definition, investment in workforce skills turns out to be the single most important source of investment in the UK. Therefore investment in training and skills development is critical to the innovative capacity of firms. It is particularly important for service innovations; the most significant investment to realise these may be in human capital.
<b>Software development</b>	Resources invested in developing software and databases create a valuable asset that prior to the 2007 Blue Book was not treated as such in the UK's national accounts.
<b>Market research &amp; advertising</b>	Market research is at the front end of innovation: to identify the market potential for new products, companies must at the outset anticipate future demand. This category captures other investments made to develop brands in order to take products to market. Both are strategic elements of the innovation process.
<b>Other (copyright development and mineral exploration etc.)</b>	Investment in new knowledge of exploitable mineral sources and copyrighted ideas both lead to assets that firms can commercially exploit and which are frequently capitalised in firms' financial accounts. These two apparently dissimilar types of asset are grouped together to reflect the way they are treated in the national accounts, but represent the smallest category of investment measured.

Source: The Innovation Index, Nesta, November 2009

Table 2 compares investment in tangible assets with Nesta's innovation index and traditional R&D measures of innovation.

UK investment in such intangible assets has been greater than that for tangible assets since the early 2000s. In 2009 (see Table 2 and Figure 1), investment in intangibles stood at £124 billion, as opposed to £93 billion for tangible investment (which includes

physical assets such as machines, equipment and buildings).

In 2008 and 2009, investment in tangible assets fell sharply, whilst investment in intangibles experienced a much smaller fall. Looking at the full decade reveals a steady decline in UK investment as a share of value added, falling from approximately 27 per cent in 1999 to 21 per cent in 2009 (23 per cent in 2007, prior to the recession). This decline is driven by investment in tangible assets, which declined from almost 15 per cent of value added in 1998 to 9 per cent in 2009 (11 per cent in 2007). Instead, investment in intangibles as a share of value added rose steadily throughout the 1990s, peaking at almost 13 per cent in 2001 and declining very slightly since then to 12 per cent in 2009.<sup>11</sup>

**Table A2:** Investment in intangibles is increasing relative to tangible assets

Year	Tangible assets (£bn)	Investment in innovative activities (£bn)	R&D Expenditure (£bn)
1997	79.00	74.14	8.99
1998	93.61	81.68	9.58
1999	91.96	88.79	10.59
2000	93.18	93.73	10.91
2001	90.31	100.06	11.37
2002	87.99	103.49	11.55
2003	84.57	106.51	11.25
2004	84.75	108.43	11.51
2005	87.83	115.73	12.53
2006	90.15	120.14	12.89
2007	101.02	125.85	14.21
2008	115.90	128.43	15.11
2009	92.70	124.25	14.74

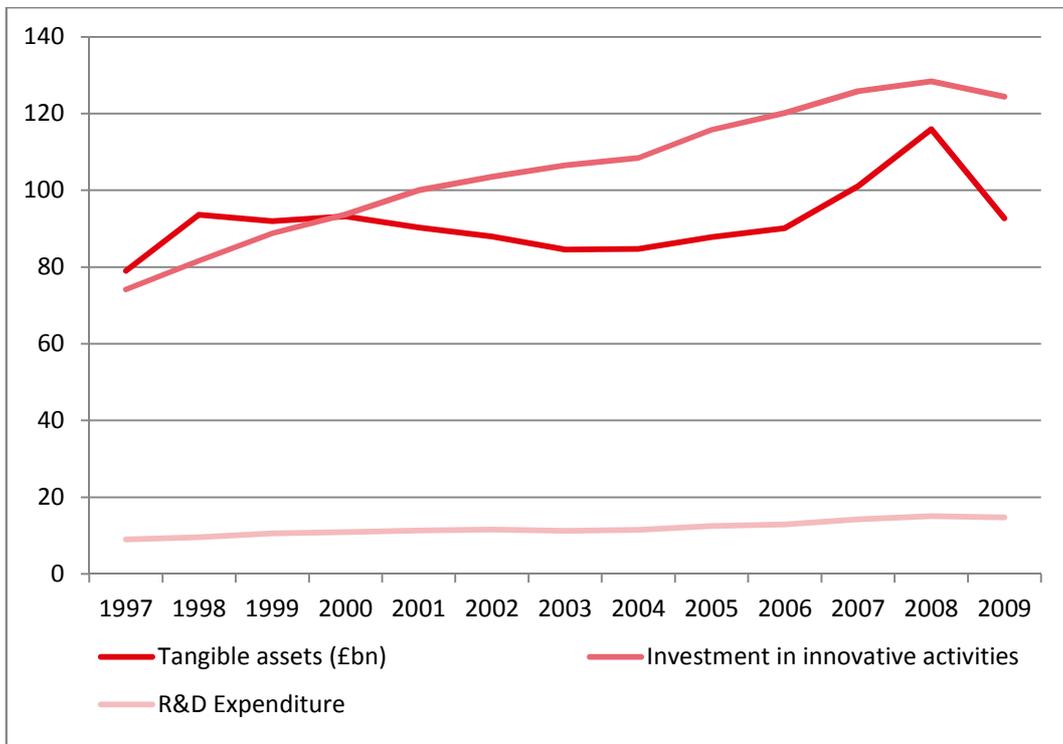
Source: Calculations by Nesta Innovation Index dataset, 2012

---

<sup>11</sup> Nesta Innovation Index 2012 -

[http://www.nesta.org.uk/library/documents/Innovation\\_Indexv2012.pdf](http://www.nesta.org.uk/library/documents/Innovation_Indexv2012.pdf)

**Figure A1:** The UK invested £124 billion in innovative activities in 2009, more than in tangible assets



## Acknowledgements

This report is a publication from the Big Innovation Centre, an initiative from The Work Foundation and Lancaster University. The content of this report reflects the opinions of its authors and not necessarily the views of the Big Innovation Centre or its supporters. The Big Innovation Centre is supported by the following companies, public bodies, universities and private trusts.



## Contact details

### **Big Innovation Centre**

The Work Foundation  
21 Palmer Street  
London SW1H 0AD

[info@biginnovationcentre.com](mailto:info@biginnovationcentre.com)

[www.biginnovationcentre.com](http://www.biginnovationcentre.com)

[www.theworkfoundation.com](http://www.theworkfoundation.com)

All rights reserved © Big Innovation Centre (The Work Foundation and Lancaster University). No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form without prior written permission of the publishers. Trading address: The Work Foundation, 21 Palmer Street, London SW1H 0AD. Registered address: The Work Foundation Alliance Limited (registered Charity no. 07746776), University House, Lancaster University, Lancashire LA1 4YW.