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**The shaky start of the UK Small
Business Research Initiative (SBRI) in
Comparison to the US Small Business
Innovation Research Programme
(SBIR)**

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Abstract:

In this paper a comparison is made between data on the US Small Business Innovation Research programme (SBIR) and UK Small Business Research Initiative (SBRI) (Tredgett & Coad 2013). Quantitative data on the first three years of the UK SBRI (2009 – 2013) was compared to data on the first three years of the US SBIR (1983 – 1987) from the US Small Business Administration. The data includes numbers of competitions, applicants and money spent on research contracts.

Some key differences in implementation of the two initiatives are identified and discussed in relation to the quantitative data. Quantitative data shows that while the US SBIR had steady growth, the UK SBRI has had a shaky start. Possible explanations for these results are suggested. Further work to strengthen the data and improve the validity of the evaluation is then outlined.

Keywords: Small Business Research Initiative, Small Business Innovation Research Program, SMEs, innovation policy.

1. Introduction

In recent times a growing policy interest has focused on the vital role played by high-impact innovative firms. Veugelers and Cincera (2010) observe that Europe lags behind the US in terms of 'yollies' – that is, Young Leading Innovators. These dynamic young fast-growth firms generate enormous economic benefits, although they face a number of challenges to develop their business ideas (in particular here, problems obtaining finance).

As a response to interest in innovative SMEs, public policy has sought to provide assistance to these firms during the times when they can be expected to be most vulnerable. These policies are not guaranteed success however – the returns to innovation are highly skewed (Coad and Rao, 2008), with most attempts ending in failure. The design of appropriate policy support for innovative SMEs remains problematic.

In recent times the UK has attempted to imitate the Small Business Innovation Research (SBIR) program which was introduced by the US government just over two decades ago in 1983. The UK version of the program, which was called the Small Business Research Initiative, was run from 2001, but was later labelled a failure in evaluations in that it did not reflect the performance in terms of participation by government departments or spending on contracts of the similar policy in the US (Connell, 2004; Connell, 2006). At the end of 2007 calls for improvements on the UK's SBRI program were made in the Sainsbury Review, and a new reformed version of the initiative was created upon these recommendations and run in pilot form in 2008. This new version of the SBRI has now been running since 2009 and it has been evaluated more positively since. However, there are still issues being brought forward which may prevent the scheme from living up to its US counterpart. In this paper we focus mainly on SBRI Mark II as opposed to SBRI Mark I.

Previous research has used the US SBIR as a benchmark for evaluation because it is considered by many to be successful. The US SBIR, however; was established back in 1983 and so it can be argued that it is not fair to compare it to the relatively new UK version. The previous research does not make a comparison between the initial years of the exemplar initiative in the US with that of the UK SBRI.

In this paper we present new evidence on the UK SBRI scheme, from data obtained from the Freedom of Information Act. We compare the initial years of the UK SBRI and US SBIR schemes and highlight their similarities and differences, and discuss how the SBRI might be refined to make it more effective.

In Section 2 and 3 we provide a literature review surrounding the US SBIR and the UK SBRI. In section 4 we describe our methodology and data. Section 5 compares these two schemes, and Section 6 concludes and offers some policy recommendations.

2. Literature review: The US Small Business Innovation Research (SBIR)

The US SBIR first came into being as a scheme run by the National Science Foundation (NSF) in 1977. The NSF brought in the program in response to the lack of funding available by them to small businesses. The small business community had complained that they were at a disadvantage when competing for funding, and represented an untapped resource. It was thought that small businesses could also carry out the high quality research required, and then have the ability to commercialise the product. In strong contrast to the usually academically-oriented NSF, the SBIR program was created; the idea being to fund small businesses with innovative research ideas, especially if they had the potential to be commercially viable (NRC, 2008). The scheme was recognised as a useful method of innovation procurement by the government and it was established as part of Innovation law at Congress as The Small Business Innovation Development Act of 1982. This 1982 act states that all departments with external research budgets of over 100 billion dollars must operate their own SBIR program which requires 0.2% of their external research budgets. Despite the rhetoric of free markets and government disengagement, the SBIR can be seen as part of the “hidden developmental state” (Block, 2008).

In 1982 the following objectives were published for the SBIR (Small Business Administration, 2012):

- “to stimulate technological innovation,
- to use small business to meet Federal research and development needs,
- to foster and encourage participation by minority and disadvantaged persons in technological innovation, and
- to increase private sector commercialization of innovations derived from federal research and development.”

(Note that employment growth is not an explicit objective of the SBIR (Link and Scott, 2012).)

Since this act was passed it has been reauthorized twice, both times to increase the amount of external budget that needs to be put aside by government departments for their SBIR programs. The budgets were first raised in 1992 to 1.5% and second in 1997 to 2.5% and this is where the benchmark has stayed. These increases in budget were justified by support for the SBIR's apparent early success: “[SBIR] has effectively stimulated the commercialization of technology development through federal research and development, benefiting both the public and private sectors of the Nation” (as quoted in Audretsch et al, 2002, p147).

For a company to participate in the SBIR programme they must adhere to the following requirements (SBA, 2014):

- “A company must be organized for profit, with a place of business located in the United States;
- At least 51 percent owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States

Or

- At least 51 percent owned and controlled by another for-profit business concern that is at least 51% owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States

and;

- Of no more than 500 employees, including affiliates.”

Below is a summary of the SBIR process adapted from the SBA website (SBA 2014):

1. Competition opened by government agency supported by the Small Business Administration Board.
2. Proposals received from companies.
3. Applications given ranked priority label (outstanding – do not fund) and picked by panel for Phase 1 – demonstration of technical merit, feasibility, and commercial potential (Lasting 6 months and not usually exceeding \$150,000).
4. The progress of Phase 1 projects in terms of technical merit, feasibility, and commercial potential are assessed and successful projects given Phase 2 funding (lasting two years and not usually exceeding \$1 million). This is the product development stage.
5. If Phase 2 is successful then projects may move to Phase 3 – pursuit of commercialization activities. No further SBIR funding is offered, just the suggestion that

some federal agencies may provide non-SBIR funding for R&D or production contracts for products/processes/services intended for government use.

2.1 Deviation in government agency use of the SBIR guidelines:

The SBIR process above is generally adhered to by government agencies, but they are viewed more as baseline recommendations and are sometimes exceeded. A less defined aspect of the process is the way in which competitions are offered. Some agencies offer competitions for innovative solutions to very specific topics requiring innovations, agencies such as the National Institutes of Health (NIH) may also require a specific form of solution e.g. research carried out and not necessarily a new technology. Other agencies like the Department of Agriculture will only identify an area of interest, and this allows companies to pick both the problem and solution they would like to provide within that area

Some agencies like the NIH often provide larger than the standard Phase 2 funds and prefer companies to make more 'realistic' bids on what they can provide and how much it might cost. This approach means that more money can be spent if necessary, some projects may not otherwise be affordable, it also helps avoid companies offering less than realistic prices for their work and then requiring more money to complete the project later on (Connell, 2006).

Agencies like DARPA have also offered fast track SBIR contracts, also known as the Phase 2 Enhancement Program. This version of the contracts is available to companies whose projects have already secured some funding, either from other government sources or the private sector, and require extra funding for the Phase 2/product development stage (DARPA, 2012).

Phase 3 is an ill-defined stage - they state that no SBIR funding is offered – however, some assistance may be offered with commercialisation. Projects that successfully complete Phase 2 are then considered eligible for Phase 3. Agencies can choose to fund the companies further with non-SBIR money, they can also provide the company with connections with other useful contacts. Phase 3 status shows a good level of competence from the participating small company and may make it attractive to private sector investment. Phase 3 status is still valid even if the product is supplied through a sub-contractor or the small company is brought by a larger company. An example of this is from 2004 when QinetiQ brought the small company Foster-Miller; QinetiQ could then assume sole supplier status for all of the many technologies developed for the government from Foster-Miller's hundreds of SBIR awards.

Aside from the above, there are also additional forms of funding in the form of one-off grants outside the normal guidelines. One type is “Phase 0” funding, this is a small grant of up to \$5000 to assist with SBIR application preparation costs (to be eligible, the company must be able to put the same amount of money towards the preparation costs as the government gives them).

A second form of pre-Phase I funding is “Seed Grants” which are for up to \$10,000. This funding is to provide support for early stages of planning or development of a technology and like the Phase 0 funding the company must match the amount of funding donated with the same amount of their own funds.

One last additional support fund is the Accelerated Commercialisation Fund, this involves a company receiving an investment from the government which matches the investment the company has received from the private sector. This way private sector investors have an extra incentive to invest in a project (Connell, 2006).

Overall it can be said that the SBIR process is adaptable for use by each individual agency and there are additional support options to make the programme more accessible.

2.2 SBIR political, social and economic environment

Since the SBIR's establishment in 1982, there have been many events which may have affected its performance over the last three decades. Prior to the SBIR's establishment, there had been periods of recession and unemployment as well as the “Reaganomics” era of policymaking (starting in 1981) which promoted deregulation. Evaluations of the effects of these years of policy are mixed; some goals of the policy were not exactly achieved but the developments were not necessarily detrimental to the SBIR program. This was not exactly the case as government spending was not reduced, rather it was reallocated from civilian purposes to the defence budget, and so may have actually boosted funding for SBIR from agencies like DARPA. Tax reductions did occur and this may have boosted private sector business. It is thought that these policy changes caused mostly positive economic effects with reduced unemployment and increased GDP per working adult of 1.8% in comparison to the previous government (0.8%) (Niskanen, 2002).

During Bush's government in the 1990s, it is thought that there is a continuation of Reagan's policies except for an increase in taxes. During the 1960s and 70s, the shift from industry to services can be thought of as a positive development except for the effects of globalisation in the

years since. Competition from other countries due to increased trade and higher corporate taxes has caused US companies to shift departments like manufacturing to other countries with lower labour costs and looser regulations. This may not directly affect the SBIR programme, except for the general economic environment for the companies involved being affected negatively by higher taxes, and perhaps finding it harder to compete in open markets, and so some may no longer reside in the US.

During the 1990s and early 2000s, the US went through a period of high economic growth in terms of GDP and stock markets, however; government debt increased by 75%. The seemingly successful housing market made the economy seem to be secure during the early 2000s until finally in 2008 a recession affected the US and many other countries in Europe, mainly due to a failure in the way the housing market was handled (Hodgson, 2009). In 2009 Barack Obama signed the American Recovery and Reinvestment Act. This act involves government tax cuts and increased spending in order to help recovery. Although this policy may lead to higher debt in future, for the SBIR it could cause a positive effect after the recession. A US government report from the end of 2011 has concluded that the 2009 Act has had a positive effect on the recovery from recession, the "Real GDP" has increased steadily since the lowest point in 2009 and unemployment has also reduced (CEA, 2011).

2.3 SBIR performance

Over the last three decades there have been issues raised with how the SBIR works. The first question to be raised concerned the commercialization rate for the SBIR. The second question concerned multiple award winners. In 1992 it had been noticed that certain firms were able to apply and win many SBIR contracts at once, not only this but only a third of applicants to the programme between 1993 and 1997 were new applicants. The idea of "SBIR Mills" was introduced as a name for firms which generally carry out research and do not carry out much commercialisation activity. These mill firms rely on SBIR to be operational. Due to this issue, and that it is difficult to judge the direct effects of the SBIR, it is difficult to evaluate the SBIR performance. In 1999, however, this question was answered with a favourable review stating that on average one in four projects resulted in the commercialisation of a product or process. Another critique of the SBIR programme has been the concentration of contracts awarded to certain states (with the largest portions of SBIR contracts going to California and Massachusetts (SBA, 2014)). To combat this latter issue, the SBA has an outreach office to help publicize the opportunities to under-served areas.

More recently in 2001 the dispute surrounding the Venture Capital Problem re-emerged. Complaints were made about small firms who were mainly owned by other large companies and so perhaps less in need of the funding were being able to win contracts. This caused issues in the relationship between the SBA and venture capitalist firms and so a compromise was achieved in 2005; small firms owned by venture capitalist firms can apply for SBIR funding as long as no one VC firm holds the majority stake (COS, 2005).

More recently an external assessment of the SBIR was called for by the US government in order to evaluate whether it was achieving its goals. The goals of the SBIR are summarised in this evaluation (Wessner, 2008) as:

1. "Supporting the commercialization of federally funded research.
2. Supporting the agency's mission.
3. Supporting small business and, in particular, woman- and minority-owned businesses.
4. Expanding the knowledge base.

In Wessner (2008), evaluations of success were mainly made by comparisons between SBIR programmes of different agencies and states, although it is noted that these observations should be viewed with caution, since most agencies hold their own individual goals for their SBIR programmes. It is also worth noting that the problem of bias encountered when interviewing different actors in the SBIR process (including successful and non-successful applicant companies). There were problems with gathering comparable data for relevant indicators from all agencies. Despite methodological challenges overall the study emphasizes that it is the most comprehensive to date (2008) and that this is due to its empirical multifaceted approach. The key findings of the study was that the SBIR programme is sound in theory and effective in practice, it is fulfilling most of its goals, although there is room for improvement. Seven key recommendations are made from the study (Wessner, 2008):

1. To retain programme flexibility
2. Conduct regular evaluations
3. Process improvements
4. Adjust award sizes for inflation
5. Keep focusing on private sector
6. Improve participation by women and minority groups
7. Increase funds dedicated to management, evaluation and improvement of the SBIR program.

These case studies are only a few examples of the large number of contracts that have been awarded over the last three decades, and they only detail contracts that have been successful, and so they do not give an unbiased view of the general results of the SBIR.¹ They nevertheless are examples of how the theory behind the SBIR programme can lead to success in some contracts.

Most recently in 2011 a revision of the law surrounding the SBIR was agreed (due to be published and put into practice in August 2012). The following changes are to take place (Office of Innovation, 2012):

1. Increased SBIR set asides for agencies, from 2.5% to 3.2%.
2. Requirements for simplifying and streamlining the program.
3. Caps on the amounts of individual contracts.
4. More support for Phase 3 transitions and commercialisation.
5. Greater level of reporting from agencies for better accountability.
6. Stronger measures to prevent abuse of the programme.
7. Funding for the administration to initiate the above improvements.

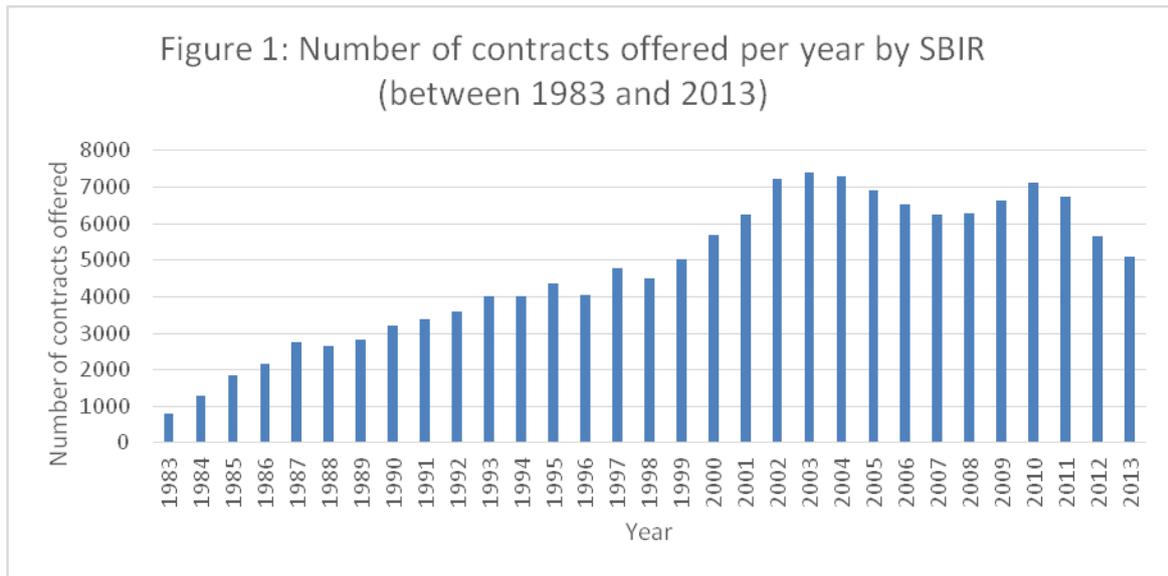
2.4 SBIR data

There is a good level of basic quantitative data available for the SBIR between the years of 1983 and the present.

Perhaps the most useful data for evaluating the investment and growth of the SBIR programme over the years is the data concerning the number of contracts issued per year and how much each is worth. Figure 1 shows the number of contracts offered per year (SBA, 2014), where we can see that since 1983 the total number of contracts awarded has increased dramatically; however, there was a noticeable dip between 2005 and 2008 which has only begun to recover in 2009. The number of contracts offered has also begun to decrease in the most recent years (2010 – 2013).

¹ Further information in the form of contract case studies is available on the SBIR government agency websites.

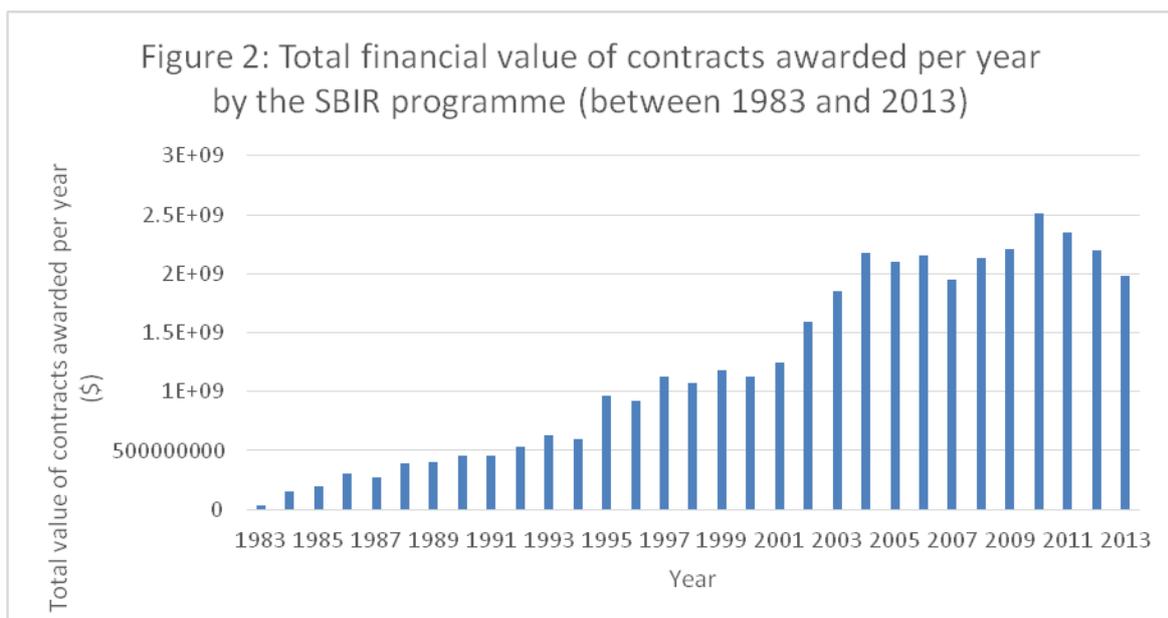
Figure 1: Number of contracts offered per year, 1983-2013.



Source: SBA, 2014

Figure 2 shows the total amount of money being spent per year by agencies using the SBIR program has generally increased over time. The spread is similar to that of the previous chart in that it dips down slightly between 2006 - 2008 and then again after 2010.

Figure 2: Total financial value of contracts awarded per year (1983 - 2013)



Source: SBA, 2014.

3. Literature review: The UK Small Business Research Initiative (SBRI)

The US SBIR is widely thought of as successful,² and as the UK's procurement abilities have been ranked as low as 40th worldwide, it is no wonder that a UK version of the programme came into being (Bound and Puttick, 2010). The Technology Strategy Board (TSB) is responsible for overseeing the UK version of the SBIR with a similar name: the Small Business Research Initiative (SBRI). The TSB is funded by the UK Government Department for Business, Innovation and Skills. The purpose of the TSB is similar to that of the US SBA in that it is responsible for a range of innovation programmes, although unlike the SBA it is not restricted to small business innovation programmes. The UK SBRI was first established in 2001 almost two decades since the US version. In the beginning the idea was that government departments would set aside 2.5% of their R&D budgets for the SBRI (although this was not mandatory). UK departments did not take to the new initiative, and some even saw the SBRI as a kind of "Small business tax" – they were not open to the possible benefits of the program and just saw it as an unnecessary drain on funds (Connell, 2006). This resulted in almost all departments not participating for the first few years. It was not until 2005 that the government made it mandatory for all departments to participate in the SBRI (Sainsbury, 2007). Another problem was that only 1% of departments were using the contracts for their intended purpose, the rest were just being used to carry out academic research and development that they would carry out anyway (Connell and Probert, 2010).

In a further blow to the performance of the SBRI, research began to emerge that UK entrepreneurs and small companies were going elsewhere to find pre-commercial funding. The Connell (2006) report revealed that start-ups in the US can receive ten times the amount of government financial support as their equivalent in the UK. For example, start-up company 'Diagnostics for the Real World' was established on work carried out at the University of Cambridge and owner Dr. Lee decided to set it up in the US instead of the UK, giving the statement: "We would all have preferred to establish the company in Cambridge, rather than California, because Cambridge is where the research and development has taken place but the funding gap for start-up biotechnology companies in the UK is such that we did not have a choice".

² While Wallsten's (2000) empirical analysis is unfavourable for SBIR (suggesting that SBIR 'crowds out' private investment), other authors such as Audretsch et al (2002) are more favourable.

In 2007 Lord Sainsbury published his report "Race to the Top"; the UK's poor procurement abilities were outlined and the US SBIR praised as a success story. Several recommendations were suggested (which originate from David Connell and Anne Campbell) for a reformed version of the SBRI that would be a much better replica of the US SBIR (Sainsbury, 2007):

1. Government departments must interact with companies in order to make the best use of their procurement abilities and achieve departmental objectives.
2. Departments should advertise clearly, simply and regularly the areas of interest they wish to be investigated.
3. SBRI awards should be arranged in a two phase structure in order to minimize risk.
4. These awards must be in the form of contracts and not one off grants, so as to reassure private sector investors that the firm is capable and eligible for considerable funding.
5. SMEs should keep the intellectual property of the result of the contract as an incentive.
6. Awards should only be given for projects relating to the kinds of research which this initiative was intended to encourage.
7. It was also suggested that the TSB resemble the US DARPA in terms of human resources (i.e. include a mixture of academics and industry specialists) and that it is now be responsible for the running of the SBRI.

Around 6 months later in 2008 a response to the Sainsbury report was published by the department for Business, Innovation and Skills detailing that the government would be implementing the recommendations. In addition the report suggested that government departments should twice yearly notify the TSB of the technological areas in which they would like to fund projects, and this way SMEs would be able to find all of the competitions advertised in one place. The assessment of proposals should then be made jointly between the department and TSB. SBRI research and development budget set-asides were said to build up over the first three years, starting at 1.5% and then reaching 2.5%. The pilot of the new SBRI was to be piloted in 2008, ready to be officially launched in 2009 (BIS, 2008).

3.1 SBRI Political, Social and economic environment

The UK SBRI was first established in 2001 with the goal to replicate the success of the US in stimulating innovation from the ample supply of SMEs available in the country (Sainsbury, 2007). Between 1993 and 2007 the UK economy was very stable; the economy grew for the

longest interrupted length of time for 200 years and inflation was low (CBI, 2011). The evaluation of the original SBRI occurred during this positive economic period and so the issues with the SBRI identified then were unlikely due to the wider economic environment. From 1997 onward the Government changed to Labour and the success of the previous conservative government seemed to continue. Most of the issues with the original SBRI concerned streamlining the process and UK Government Departments not participating in the SBRI programme.

The stable economic period masked background problems that would soon be the cause of the 2008 recession which mainly affected the US as well as the UK and other areas of Europe (from which the UK is only arguably recovering from now in 2013). The reformed SBRI was launched in 2009. The Labour policies supported education, innovation and strong competition which should have supported initiatives like the SBRI. The issues came from the poor regulation of finance and public debt (Corry et al, 2011). This environment may have negatively affected the amount of money made available to the reformed SBRI after public finance and spending came under scrutiny.

3.2 The reformed SBRI

The process of the reformed SBRI is shown in Table 1, alongside that for the US SBIR.

One major difference is that the UK SBRI does not have a Phase 3. After Phase 2 the company is expected to commercialise the product/process themselves and then it may be procured by the government or other entity. The other difference is the UK's lack of size restriction on who can apply for the contracts. Unlike the US who reserve their contracts for smaller companies, the UK offers them to many institutions, and just expects most applicants to be SMEs as it shouldn't be as attractive to larger companies. The UK SBRI also does not have the kind of support funds that the US scheme has for bridging any extra gaps which may occur in making their application e.g. Phase 0 fund. The UK does have similar grants available where the company must be able to match the funds they are looking for via another source in order to obtain the funding e.g. SMART grants (TSB, 2014).

Table 1: Summary of SBIR and SBRI competition and funding processes.

	US SBIR	UK SBRI
Competition opened by whom?	The Small Business Administration Board.	The Technology Strategy Board.
Who can apply?	Companies with 500 employees or less and at least 51% commercially owned.	Any company, including pre-start up, universities and charities.
How are applications evaluated?	Applications given ranked priority label (outstanding – do not fund) and picked by panel for Phase 1 – demonstration of technical merit, feasibility, and commercial potential (Lasting 6 months and not usually exceeding \$150,000).	Most “interesting” applications chosen by panel to go through to Phase 1 – demonstration of feasibility (Lasting up to 6 months and £50-£100k).
How are Phase 1 projects assessed?	In terms of technical merit, feasibility, and commercial potential are assessed and successful projects given Phase 2 funding (lasting two years and not usually exceeding \$1 million).	The progress of Phase 1 projects are assessed to decide if they will continue to Phase 2 – development of prototype (lasting about 2 years and worth between £250,000 and £1 million).
What happens beyond Phase 2?	If Phase 2 is successful then projects may move to phase 3 – pursuit of commercialization activities. This phase does not appear to give any assistance and seems like more of a goal stage. No funding is offered.	No further assistance past Phase 2.
Is there a Phase 3?	Yes	No

Source: SBA and TSB, 3013.

In 2010 a review (Bound and Puttick, 2010) was carried out to gauge how successful the reform had been. The review highlighted that, in its first year, 74% of contracts awarded by the SBRI were given to SMEs. The new SBRI has also received positive feedback from government departments who now view it as a useful tool for innovative ideas and also providing access to a

wide variety of companies. The downside is that it is still thought that support still needs to be won over from people in some departments, especially as cut-backs begin to happen (as R&D will be the first to be cut).

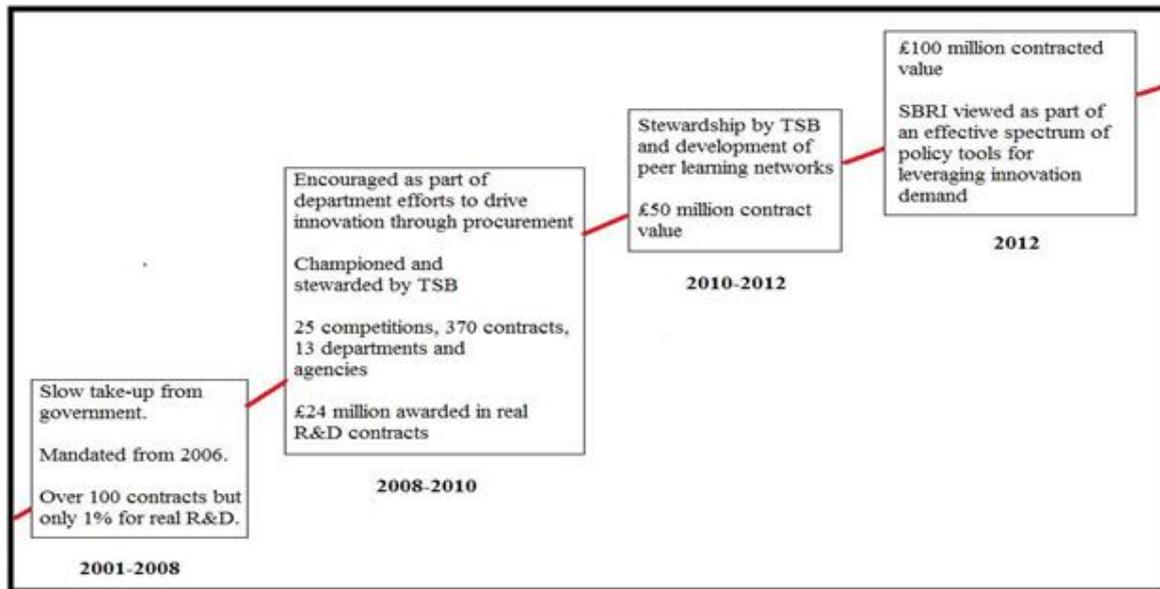
In interviews with companies and entrepreneurs, there were also mainly positive reviews of the reformed scheme. Improvements suggested by the Peer review included:

- A clearer structure of who deals with the SBRI between departments and the TSB.
- Clarification of what Phase 3 could look like, as the end of Phase 2 is a worrying period for involved companies.
- Continuity in budget could be improved, as departments are suggesting funding may be cut due to the recession.

In contrast to the Bound and Puttick (2010) review, Connell and Probert (2010) did not find such positive results when carrying out interviews with companies about the reformed SBRI; some contrasting issues were brought forward such as: the contracts still being too academically orientated, the application process being too slow and unclear and also departments like the NHS being too slow in taking on innovations. Connell and Probert summarise that many firms do not see the public sector as innovative and also that very few competitions had been run. It should be noted that the Bound and Puttick review was carried out within the previously publicly run organisation NESTA and so a more positive view may have been taken on the progress of the SBRI than would a non-government associated body.

Since the reformed version of the SBRI began, it has been suggested that it is too soon to judge its performance, although forecasts have been made. For example, the diagram below (Figure 3) taken from "Buying Power?" by Bound and Puttick (2010) offers a forecast that, with the benefit of hindsight, looks overly optimistic (as we shall see).

Figure 3: Forecast made in 2010 for the SBRI's progress over the next two years.



Source: Adapted from: Bound and Puttick, 2010.

4. Methodology and data

4.1 Methodology

At present, there is data on the first five years of SBRI, which we will use to compare the first five years of the two programs – that is, 2009-13 for the UK SBRI and 1983-87 for the US SBIR.

Information on the US SBIR is available from the Small Business Administration (SBA, 2014). This information includes details of the number of SBIR contracts awarded per year and their combined value for each year since 1983. This data includes number of awards per competition phase, per government department or to companies within a particular state. There is also additional information on awards to ethnic minorities and women.

For the UK SBRI information was requested from the Technology Strategy Board (TSB; the administrative body for the SBRI). The request was made under the terms of the Freedom of Information Act, and the TSB were very accommodating with the request; first discussing the limitations of the data they could provide and then promptly sending what data they had.

To compare 1983-87 US dollars with 2009-2013 UK sterling, the US data are deflated using the Consumer Price Index (CPI) obtained from the US Department of Labor Bureau,³ and then converted into pounds using historical exchange rate records.⁴ We then adjust for the difference in population size between UK and the US. This method is outlined below.

A case study comparison is made of the US SBIR and UK SBRI (Tredgett & Coad, 2013). The methodology of each are compared using freely available qualitative data.

Method for making financial statistics from 1983-87 comparable with statistics from 2009-13

In order to show the method of conversion an example will be used. The following data is shows the total annual financial value of Phase 1 and 2 contracts awarded by the US SBIR and the UK SBRI in the first five years of each program:

Example raw data:

	Year 1	Year 2	Year 3
US SBIR Phase 1 (\$K)	38058.76	49335.838	74479.345
UK SBRI Phase 1 (£K)	12706	6360.37	19242.454
US SBIR Phase 2 (\$K)	0	100571.7	121014.328
UK SBRI Phase 2 (£K)	2808.34	17457.217	1930.084

Source: UK Technology Strategy Board/US Small Business Administration, 2013

Inflation rate conversion:

As the first five years of the US SBIR were in 1983-87 we need to account for inflation rate before the older values from 1983-85 can be compared to the first five years of the UK SBRI in 2009-11.

To do this we can use the American historical records of the Consumer Price Index provided by the US Department of Labor Bureau (BLS, 2014) to work out what the worth of the money (\$) spent in 1983-87 would be in 2009-13. To do this the online resource "US Inflation Calculator" was used which works by using the US government CPI records to calculate the results of historical and current inflation rates. The following is an example of how the calculator uses the CPI to covert a cost by inflation (CoinNews, 2012):

³ See the US Inflation Calculator from the Bureau of Labor Statistics Consumer Price Index History Table available from: <ftp://ftp.bls.gov/pub/special.requests/cpi/cpiiai.txt>.

⁴ More specifically, currency conversion was done by referring to the HMRC website on foreign exchange rates (see <http://www.hmrc.gov.uk/exrate/usa.htm>). The relevant annual exchange rate averages for converting dollars into sterling for the years 2009-11 were 0.63967; 0.6387 and 0.6435 respectively.

“Let’s say you spent \$20 to buy some goods or services today. How much money would you have needed in 1980 to buy the same amount of goods or services?”

The average CPI for 1980 = 82.4

The average CPI for 2011 = 224.9

The following formula is then used to calculate the price:

$$2008 \text{ Price} \times (1980 \text{ CPI} / 2011 \text{ CPI}) = 1980 \text{ Price}$$

Using the actual numbers:

$$\$20.00 \times (82.4 / 224.9) = \$7.33$$

In order to convert the older SBIR data, firstly input the data of the first year of the US SBIR along with it’s year (1983) and the first year of the UK SBRI (2009) as this is the year I want the inflation rate to be converted to. This was done for each year e.g. 1984 + financial data + 2010 and then 1985 + financial data + 2011.

Inflated data:

	1	2	3
US SBIR Phase 1 (\$K)	81978.03	103,541.16	155,699.91
UK SBRI Phase 1 (£K)	12706	6360.37	19242.454
US SBIR Phase 2 (\$K)	0	211,069.89	252,981.81
UK SBRI Phase 2 (£K)	2808.34	17457.217	1930.084

Currency conversion:

Secondly, in order for a more direct comparison we can convert the financial results from each program into one currency – For this it was chosen to convert the US data into UK £.

To do this I need to use exchange rates which were valid for the years in which we are comparing the data within (2009-13). Historical exchange rate records (both year average rates and spot rates) can be found at HM Revenue and Customs website (HM Revenue and Customs, 2014). From there the relevant annual exchange rate averages for the years 2009-13 were used to convert the US \$ financial data to UK £:

- Average 2009 exchange rate: 1 USD = 0.63967 Pound
- Average 2010 exchange rate: 1 USD = 0.6387 Pound
- Average 2011 exchange rate = 1 USD = 0.6435 Pound
- Average 2012 exchange rate = 1 USD = 0.6152 Pound

- Average 2013 exchange rate = 1 USD = 0.6038 pound

Example inflated and currency converted comparable data:

	1	2	3
US SBIR Phase 1 (£K)	52438.88645	66,131.74	100,192.89
UK SBRI Phase 1 (£K)	12706	6360.37	19242.454
US SBIR Phase 2 (£K)	0	134,810.34	162,793.79
UK SBRI Phase 2 (£K)	2808.34	17457.217	1930.084

Figures taking into account population size

In order to see the effect of the US's larger population size on the figures we calculate how many times larger the US population is versus the UK population and divide the US figures by that number (ONS 2014/Multpl 2014).

	UK population (millions)	US population (millions)	Number of times US population is larger than UK population
2009/1983	62.3	233.79	3.752648475
2010/1984	62.8	235.82	3.755095541
2011/1985	63.3	237.92	3.758609795
2012/1986	63.7	240.13	3.769701727
2013/1987	64.1	242.29	3.779875195

4.2 SBRI Data

The SBRI data were obtained under the Freedom of Information Act from the Technology Strategy Board, and includes data for each month from Dec 2008 – Dec 2013. An overview of the data can be found in Table 2. In the first five years of the SBRI there has been an overall increase in competitions offered despite a small decrease in 2010 (from 23 in 2009 to 32 in 2011). The number of applicants has also increased in non-monotonic fashion; despite a small decrease in 2010 and 2013, there is a general increase in numbers (1091 in 2009 to 1445 in 2012). The

number of Phase 1 contracts awarded by the SBRI began reasonably high in 2009 at 328, dropping to 124 in 2010 before rising to 272 in 2011 but never again reaching the levels of 2009. Regarding the number of Phase 2 contracts - it may seem strange that in the first official year of the SBRI in 2009 that there had already been five Phase 2 contracts awarded, however; these were only awarded at the very end of the year (and so this makes sense when we consider the TSB state that Phase 1 generally only lasts between 2 and 6 months). Interestingly the number of Phase 2 contracts increases to 104 in 2010 – perhaps due to the high number of Phase 2 contracts beginning in 2009 but then in 2011 the number of Phase 2 contracts drops back down to only 13. The drop in Phase 2 contracts in 2011 may be due to the drop in Phase 1 contracts awarded in 2010 as the results of this would lag – not to mention this may also reflect the failure of projects to progress from Phase 1 to Phase 2. The number of phase 2 contracts awarded continues to fluctuate.

The total financial value of contracts seems to fluctuate with the number of contracts awarded as expected (the financial value increases with a higher number of contracts and vice versa).

Table 2: Summary of annual SBRI data.

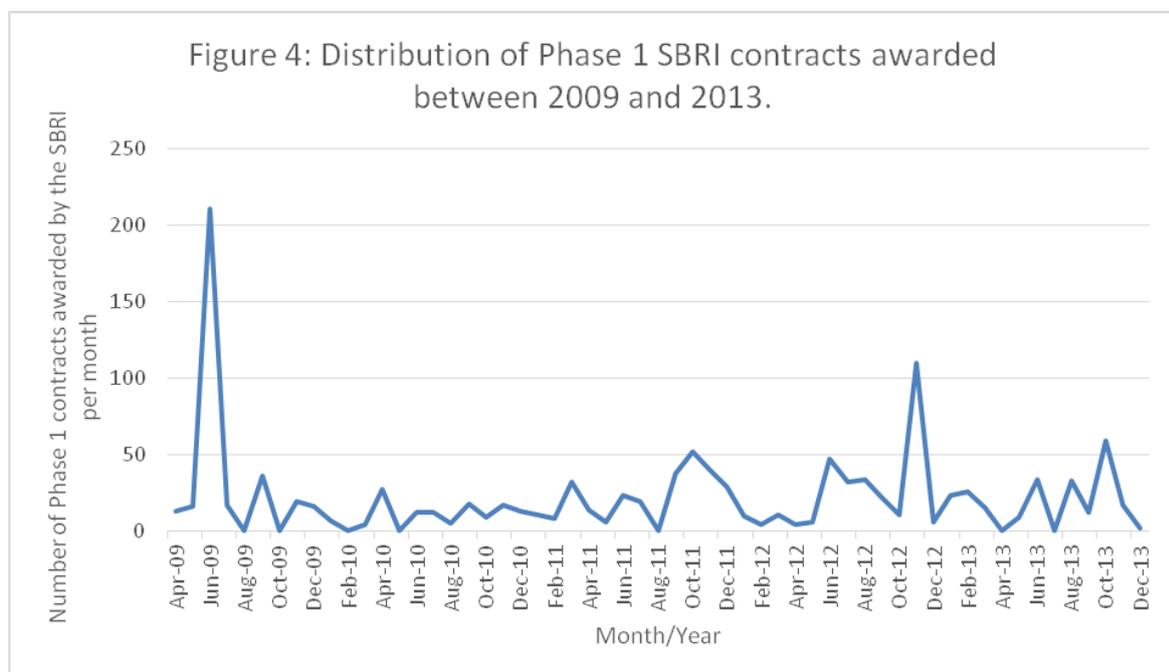
	2009	2010	2011	2012	2013
New Competitions	23	21	32	38	59
New Applicants	1091	920	1420	1445	1381
Phase 1 Contracts awarded	328	124	272	297	230
Success rate (P1/applicants)	30.06%	13.47%	19.15%	20.55%	16.65%
Phase 2 Contracts awarded	5	104	13	94	49
Continuation rate (P2/P1)	1.58%	83.87%	4.77%	31.60%	21.30%

Financial value of Phase 1 Contracts (£)	12,706,000	6,360,000	19,242,000	16,469,000	18,910,000
Financial value of Phase 2 Contracts (£)	2,808,000	17,457,000	1,930,000	23,985,000	46,390,000

Source: TSB, 2014.

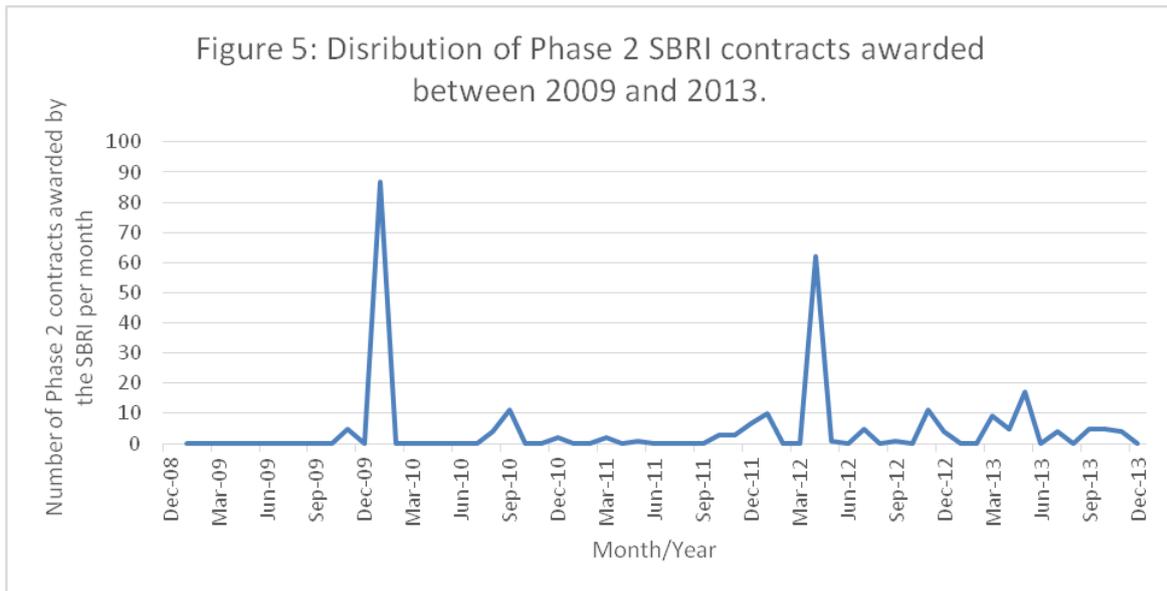
The Monthly data gives a more detailed idea of how contracts are distributed, from the graphs below (Figures 4 and 5) we can see that there is one large spike of Phase 1 contracts and Phase 2 contracts in 2009, after which the levels of contracts awarded for both phases plateaus. There is another spiked increase of Phase 2 contracts in March 2012 but interestingly there was not much of an increase in Phase 1 contracts before that, it seems that there may just have been a higher number of Phase 1 contracts upgraded to Phase 2 and this is confirmed by the continuation rate shown in table 2 for 2012.

Figure 4: Distribution of Phase 1 SBRI contracts awarded between 2009 and 2013.



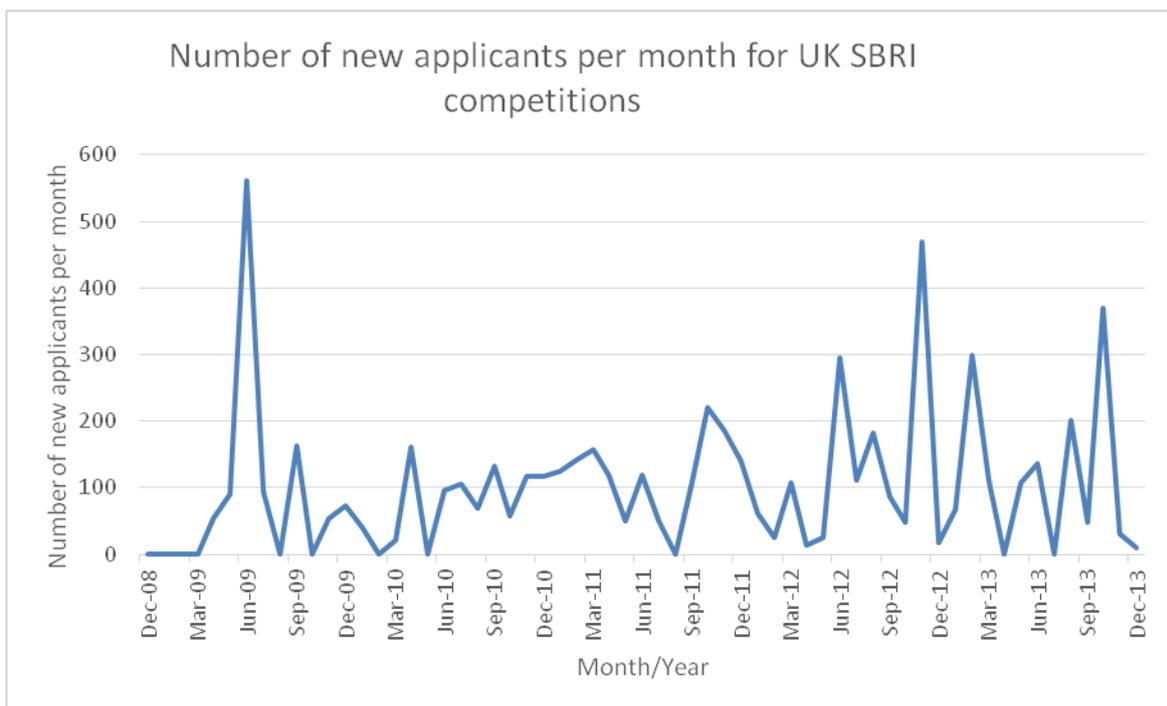
Source: TSB, 2014.

Figure 5: Distribution of Phase 2 SBRI contracts awarded between 2009 and 2013.



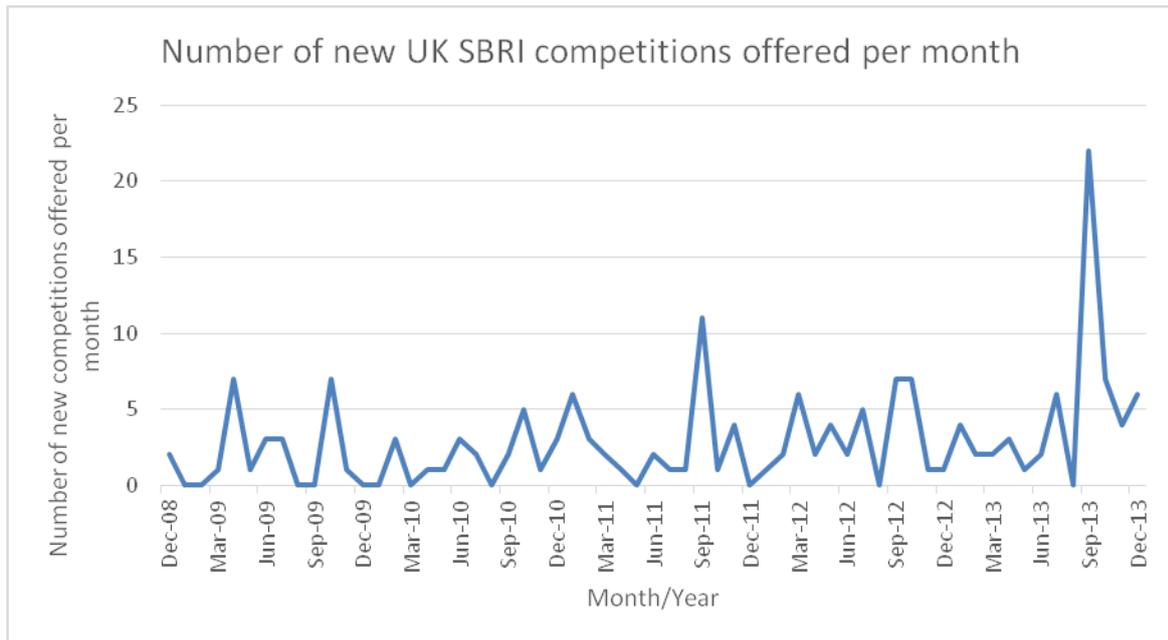
Source: TSB, 2014. As can be seen in Figure 6, the number of applicants also follows the same pattern of distribution as the number of contracts awarded. To see if the number of competitions seems to be related to the number of applicants, the distribution of competitions is shown in Figure 7.

Figure 6: Distribution of new applicants to SBRI contract competitions between 2009 and 2011.



Source: TSB, 2014.

Figure 7: Distribution of SBRI competitions offered per month between 2009 and 2011.

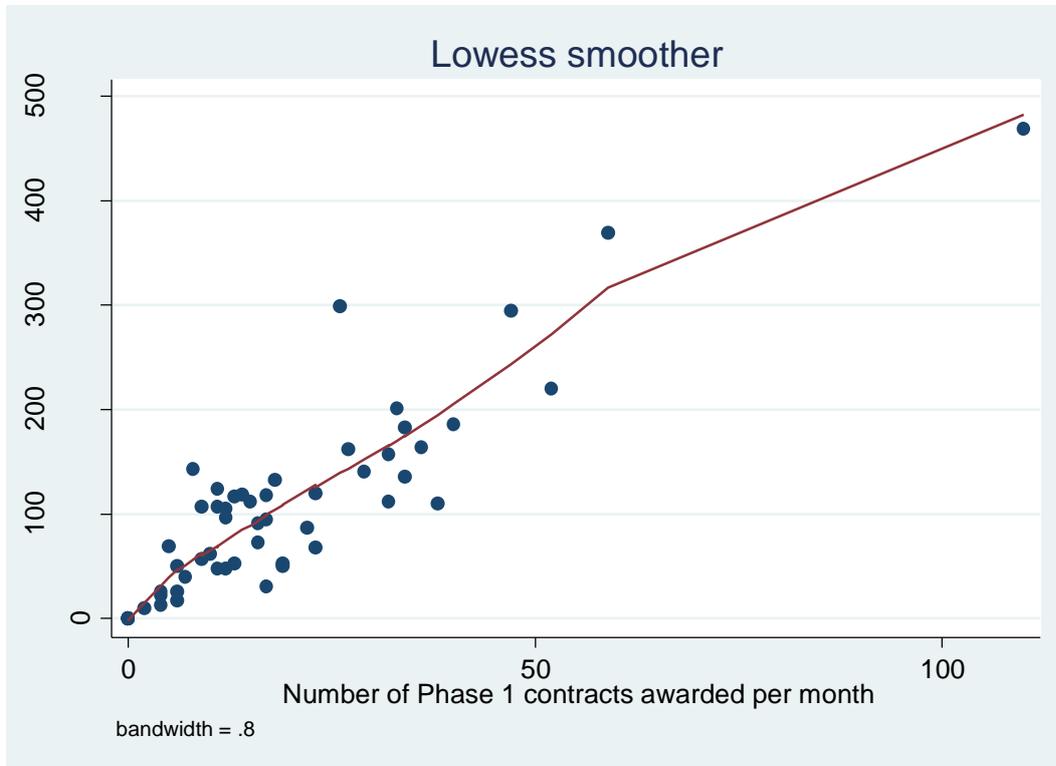


Source: TSB, 2014.

Comparing the distribution of the number of SBRI competitions offered to the number of new applicants, we can see that the number of competitions does not seem to affect the number of new applicants. The number of applicants levels off after the initial levels of 2009, however; they appear to be increasing again after 2012.

Figure 8 plots the relationship between the number of applicants and the number of Phase 1 contracts awarded, at the monthly level. The positive correlation suggests that many applicants are awarded (or declined) their contracts within the same month. This is consistent with the explanation that there is no 'bureaucratic bottleneck', since applicants seem to get processed rather fast. Instead, if the number of awards is deemed to be too low, this is not necessarily due to an inefficient selection process, or a lack of funds, but perhaps because of a small number of high-quality innovative firms (Nightingale et al, 2009).

Figure 8: Relationship between total number of applicants and total number of Phase 1 contracts awarded. One data-point could not be plotted on these axes (June 2009, 562 new applicants, 211 new P1 contracts awarded).



Source: TSB, 2014.

One last feature of this data which could be of interest is that we can work out an applicant and Phase 1 – Phase 2 progression continuation rates (see Table 2). This data shows a relatively stable rate of initial applicant success ranging from 13.47% to 30.06%. The continuation rates for progression to Phase 2, however, seem to include one very high success rate in 2010, it may be more useful to observe this data in later years to see whether this is an anomaly.

5. Comparison of UK SBRI data with US SBIR data

If the raw data on the reformed UK SBRI and US SBIR are compared it seems as though the US SBIR is out performing the UK version of the policy (see table 3 below).

Table 3: Raw data from the last five years of the US SBIR and UK SBRI.

		Number of contracts	Financial value of contracts (£)
2009	US SBIR	5816	1,190,165,950.53
	UK SBRI	333	23,817.00
2010	US SBIR	6195	1,416,986,865.00
	UK SBRI	228	23,817.00
2011	US SBIR	5398	1,269,680,066.00
	UK SBRI	285	21,172.00
2012	US SBIR	5005	1,239,671,478.00
	UK SBRI	391	40,454.00
2013	US SBIR	4451	1,133,345,293.00
	UK SBRI	279	65,300.00

Source: SBA & TSB, 2014.

In order to better evaluate the performance of the reformed UK SBRI in its first five years, we can compare its data with that of the first five years of the US SBIR. A comparison of the US SBIR and UK SBRI is presented in Table 4.

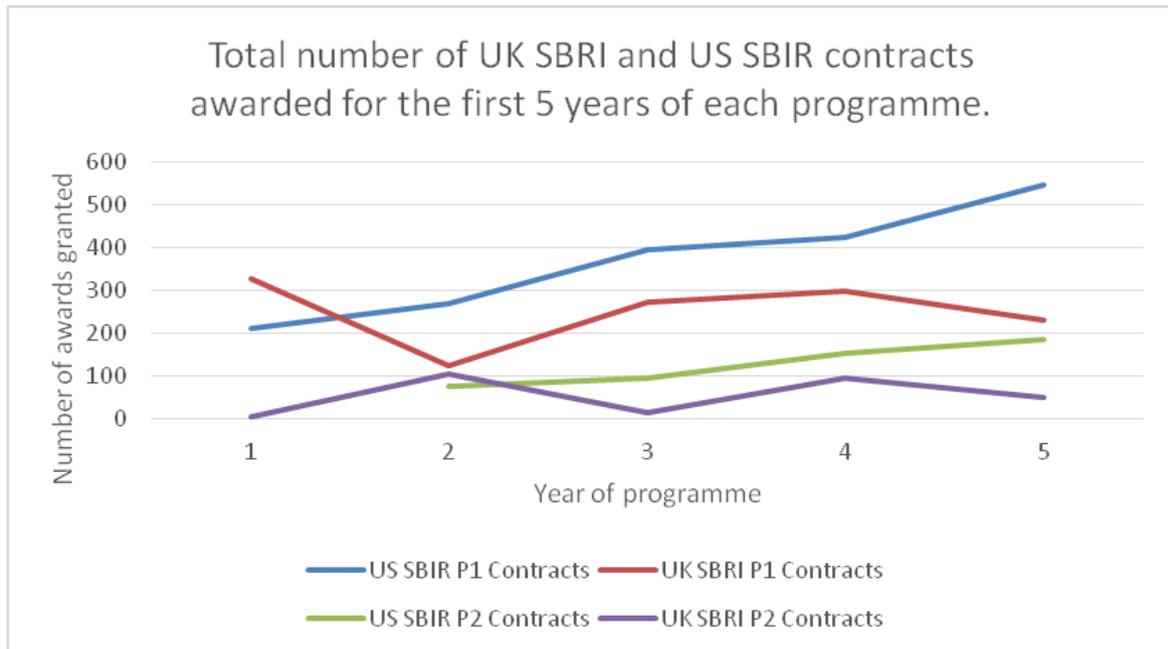
Table 4: SBRI/SBIR number of contracts and their total and mean financial values per year (US data adjusted for inflation, exchange rate to £ and population size).

	Year 1	Year 2	Year 3	Year 4	Year 5
US SBIR P1 Contracts	210.2515078	270.3	394.6	424.2	546.3143341
UK SBRI P1 Contracts	328	124	272	297	230
US SBIR P2 Contracts	N/A	73.8	94.4	152	185.4558587
UK SBRI P2 Contracts	5	104	13	94	49
US SBIR Continuation rate (P2/P1)	N/A	27.30%	23.92%	35.83%	33.94%
UK SBRI Continuation rate (P2/P1)	1.58%	83.87%	4.77%	31.60%	21.30%
<i>Financial value of contracts</i>					
US SBIR P1 (£)	13,973,833.85	17,593,353.69	26,656,900.29	28,016,568.28	33,986,540.15
UK SBRI P1 (£)	12,706,000	6,360,000	19,242,000	16,469,000	18,910,000
US SBIR P2 (£)	N/A	35,900,641.89	43,240,356.41	76,490,273.40	55,039,272.78
UK SBRI P2 (£)	2,808,000	17,457,000	1,930,000	23,985,000	46,390,000
<i>Mean value of contracts</i>					
US SBIR Phase 1 (£)	66,462.47	65088.4	67,554.23	66,050.10	62,210.59
UK SBRI Phase 1 (£)	33,737.80	51,290.32	70,742.65	55,451.18	82,217.39
US SBIR Phase 2 (£)	N/A	486,679.93	458,058.62	503,225.48	296,778.29
UK SBRI Phase 2 (£)	561,600	167,855.77	148,461.54	255,159.57	946,734.69

Source: SBA and TSB, 2014. Notes: Years 1-5 correspond to 1983-87 for the US and 2009-2013 for the UK.

Figure 9 shows that there are consistently more contracts being awarded by the US SBIR than the UK SBRI. The difference between the two is most evident for Phase 1 contracts – the US SBIR awarding at least twice as many, and at most over four times as many. There is not as much of a difference between the numbers of Phase 2 contracts awarded by each program, however, it is also evident that the US SBIR data increases at all points, whereas the UK SBRI data fluctuates as well as not growing at the same rate.

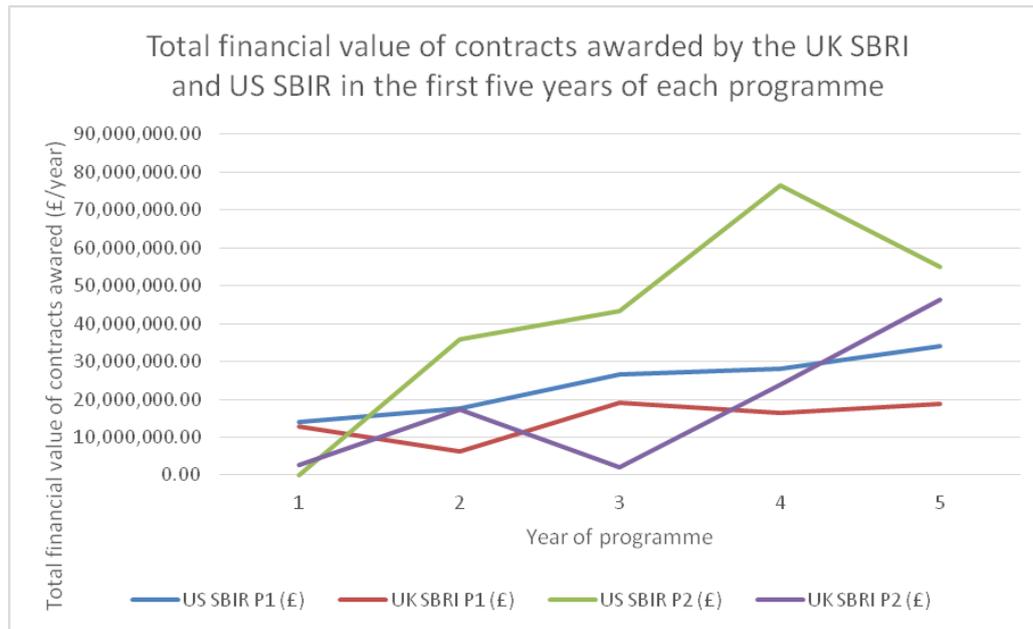
Figure 9: Number of SBRI and SBIR contracts awarded.



Source: SBA and TSB, 2014.

The money spent on US SBIR Phase 1 and 2 contracts is comparatively higher than that spent on UK SBRI contracts at all points except for one (Figure 10) – Phase 2 of UK SBRI is higher at year 1 and this is because the UK SBRI has slightly more on Phase 2 contracts in the first year (there are no SBIR Phase 2 contracts recorded for 1983). Another notable feature of this data is that there is not much difference between money spent on Phase 1 and Phase 2 contracts in the case of the UK SBRI, whereas the data for the US SBIR shows that a much higher amount of money is being spent on Phase 2 contracts than on Phase 1.

Figure 10: Total financial value of contracts: SBRI and SBIR.



Source: SBA and TSB, 2014.

A comparison of the mean financial values of SBRI and SBIR contracts is provided in Table 3. Although we don't have information on the distribution of contract sizes, it gives a rough idea on the amounts spent per contract. Higher amounts of money are being spent on Phase 2 contracts than their Phase 1 counterparts, as expected. The first and last mean values for UK SBRI phase 2 contracts are strangely much higher than that of all points of mean spend by the US SBIR. The mean spend of the US SBIR on Phase 1 contracts has remained much the same whereas that of the UK has been near the same amount but has fluctuated as either higher or lower the US amount. The mean spend of the US on its phase 2 contracts appears relatively consistent when compared to the UK who generally have spent less on average except for two very large spikes of phase 2 spending at years 2 and 5.

Finally, we compute what we call the 'continuation rate' which is a rough proxy for progression from Phase 1 to Phase 2 (calculated as number of Phase 2 contracts divided by number of Phase 1 contracts for each year). As mentioned previously in regards to the UK SBRI the 'continuation rate' to Phase 2 has fluctuated between very low scores to average scores when compared to the relatively stable figures for the US SBIR.

6. Discussion and Conclusions

If the raw data on the reformed UK SBRI and US SBIR are compared it seems as though the US SBIR is out performing the UK version of the policy (see table 3 above). In this study we attempt to give a more valid comparison by comparing statistics from the first five years of each programme in order to gauge whether the UK SBRI is on track to be as successful. To do this the US statistics have been adjusted quite dramatically due to the time gap in between the beginnings of the two programmes and also due to the large population differences, they may affect the validity of the resulting data (population size doesn't necessarily gauge how much money a country has to spend). The US data was adjusted for inflation, exchanged to £Sterling and also divided by population size (in relation to the UK) and so it should be noted that these conclusions are based upon this adjusted comparison and not the raw data.

Another major factor to be taken into account is that the US SBIR was started almost three decades before the UK SBRI, and the intervening time periods have seen substantial changes in the modern economy (such as the rise of venture capital and the ICT sector). Many other contextual differences exist. As a result, it is natural to expect the UK SBRI to differ considerably in terms of scope, scale, and objectives. For example, while government procurement was one of the objectives of the US SBIR, procurement is less meaningful in the UK context because procurement opportunities are limited by European competition law. While 'clawback' of funding by firms that leave the country or are acquired by multinationals is less of an issue in the US (The US SBIR makes no attempts at clawback), it has been applied by some countries (such as Israel) and might be a sensible policy for the UK considering the small scale of the UK economy, and also the fact that successful UK firms often choose the US for their IPO (Mason and Brown, 2012).

Another central feature of our analysis is that we focus on the first five years only. Although there is not much data available yet, nonetheless we consider it an important opportunity to take stock of what has happened so far and think about how the SBRI can be improved. Three periods is the minimum number of data points needed to observe non-monotonic relations – and we do indeed observe non-monotonicity as opposed to the smoothly-increasing trends observed at the start of the US SBIR. After interest from the first wave of applications, it seems that the interest from relevant groups in applying for the competitions may have stagnated. This 'shaky start' could be due to the 'law of large numbers' dampening the volatility of US statistics, although it could also signal that UK policy makers are being 'jumpy' or agitated. We suggest that policy-makers should commit to creating a stable policy environment where they can learn

together with firms and other actors how to make the SBRI policy work (Avnimelech et al, 2010).

To be cost-effective, the UK SBRI needs to think beyond merely handing out taxpayer's money and consider other options that might treat particular concerns more effectively. One option would be to emphasize peer-reviewed development of business ideas - following more closely the US SBIR which relies heavily on peer-review of grant applications. It would also be beneficial to better understand the complementarity of the SBRI with venture capital markets (in the US, VC investors often advise firms to first go through SBIR to develop their ideas before returning to VC for further funding).

There is already a large number of pro-SME policies in place in the UK, and the combined cost is huge. Storey (2006, p248) writes that "in the UK, the annual total financial support for small business is equivalent to a public expenditure of GBP7.9billion... To contextualize that expenditure, each year the UK spends more money on small businesses than it spends on the police force." (See also Hughes, 2008.) Such estimates of these costs are not easy to obtain, however: "the total public budget devoted to funding SME and Entrepreneurship policy is rarely quantified, primarily because there are so many of these public programmes, and they are delivered by a multitude of different agencies." (Storey, 2006, p270). One of the problems hindering the coherence and effectiveness of these programmes is that they are spread across a number of departments, and that the objectives of such programmes are not explicitly stated. Therefore, it would be worth explicitly stating why the SBRI is different from other UK SME (and innovation) policies, and also allowing for evaluation of the SBRI, and updating the SBRI to take into account policy-learning.

Unlike the US SBIR, the UK SBRI does not seem to have a clear set of goals. In order to evaluate whether it is performing well, some clear objectives such as those set by the US would be useful. From the data in this study we can get an idea of the scale of the UK SBRI in comparison to the US SBIR when it began. It does seem that after examining the evidence that the SBRI has not reached the same level as the SBIR at this time. It shows that although the SBRI has been reformed to be more like the SBIR, there are further problems in implementing the same policy in the UK which may require further adjustments to the SBRI.

The way in which the two programs were implemented is generally similar, but one major difference is that the UK program is not just aimed at small businesses. This implies a larger target audience for the scheme, although the number of applicants remains small. In fact, our analysis suggests that the problem is not a lack of funding (supply of finance) but small numbers of high-quality applicants (demand for finance). As such, the SBRI only appears to have a limited

(although crucial) role to play in the UK economy. SBRI will not in itself guarantee UK economic growth, although it will be a valuable ingredient. Even if the SBRI is observed to be successful, it is not sensible to quickly scale up by doubling the available funds, because the critical factor is the limited availability of high-quality innovative firms as 'inputs'.

The reformed UK SBRI has been praised for its smooth operation, although some companies have been put off by the procedure, in interviews opinions have been expressed that the SBRI is still too academically-oriented and not as flexible or user-friendly (Connell, 2010). This is not helped by the UK government's departments initial attitudes to the SBRI (seeing it as a 'tax' on their budgets) – even though it is now compulsory and departments see its benefits more than before, some have expressed views that SBRI will suffer from austerity cuts (Connell and Probert, 2010). Another point is the lack of additional funding help to increase access to the SBRI – in the US there are many different funds which help in preparing a company even before it applies for a SBIR contract to increase its chances of success.

There could be many reasons for the fluctuating number of applicants, such as: i) lack of competitions relevant to the industries and research interests of companies (in terms of topic or perhaps how the research is to be carried out, academic or applied etc.); ii) Reputation of the old SBIR; iii) expectations of the SBIR process being unclear (for example, a clear guide to what happens after Phase 2 may help, if it is possible for UK government departments to aid in bringing about commercialisation of a product they wish to purchase then perhaps a Phase 3 should be added – otherwise the company needs to know this won't be a risk and waste of time); and iv) there is the possibility that the calls for applications were not well designed or weren't compelling or were badly advertised. The results show that the numbers of applicants are beginning to recover, however and so perhaps some of the stigma of the problems listed above have lessened.

Future work would benefit from richer data. It would be helpful to find out how many applications are received by the US government to see how this relates to the number of contracts awarded. Furthermore, interviews with companies in the potential interest group could be carried out to find out if there are any factors that discourage them from applying.

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