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## Does massive funding support of researchers work?: Evaluating the impact of the South African research chair funding initiative<sup>☆</sup>

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### ABSTRACT

In this study we evaluate whether a substantial increase in public funding to researchers is associated with a material difference in their productivity. We compare performance measures of researchers who were granted substantial funding against researchers with similar scholarly standing who did not receive such funding. We find that substantial funding is associated with raised researcher performance – though the increase is moderate, is strongly conditional on the quality of the researcher who receives the funding, and is greater in some disciplines than others. Moreover the cost per additional unit of output is such as to raise questions about the usefulness of the funding model. The implication is that public research funding will be more effective in raising research output where selectivity of recipients of funding is strongly conditional on the established track record of researchers.

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### 1. Introduction

Strategic funding of research and development by public entities continues to be viewed as important to the ability of both business and other types of organization to innovate.<sup>1</sup> This makes funding for science of perennial concern, since the financial requirements of projects that carry scientific merit outstrips both public and private budgetary provision, and faces significant competition from other social spending priorities. In such a context, it is important to understand which funding mechanisms of science are effective, and which are not.

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<sup>1</sup> See for instance the discussions in [Fagerberg \(1994\)](#), [Mowery and Rosenberg \(1989\)](#), [Nelson and Wright \(1992\)](#) and [Nelson \(1992, 1996\)](#).

This raises a fundamental management issue. Like many other investment projects, investment in research and development may require substantial up-front outlays on the promise of future success and returns in the form of increased knowledge. Yet investment in innovation represents commitment of resources to projects with an uncertain rate of return in knowledge. While any investment faces uncertainty,<sup>2</sup> where investment is in knowledge creation, uncertainty is magnified.<sup>3</sup> The management difficulty is that if research funding is organized so as to front-load the funding commitment to the researcher, the feasibility of relying on incentive mechanisms that reward research based on the delivery of successful innovations becomes limited. As such, reliance on standard reward structures to incentivize productivity becomes severely constrained.

In a market setting some recent research provides insights into efficient approaches to resource allocation. For instance, [Klingebiel and Rammer \(2013\)](#) in a study of innovation drawing on firm level evidence present results that support funding allocation

<sup>2</sup> See the seminal discussion in [Dixit and Pindyck \(1994\)](#).

<sup>3</sup> The high uncertainty and hence risk attaching to innovation and research and development is the subject of a substantial literature. See for instance the introductions in [Mokyr \(2002\)](#) and [Rosenberg \(1994\)](#).

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across a broad range of projects as more successful than a more focussed resource-intensive allocation, since winners are difficult to predict.<sup>4</sup> The effectiveness of the broad-based funding allocation is found to be enhanced if coupled to monitoring tied to later-stage selection of successful innovations.<sup>5</sup>

In a public funding context, there are additional difficulties. Price mechanisms provide a disciplining device on market-based agents such as firms that are not present for public funding agencies devoted to the management of research. Firms can signal their prospects of successful innovation in capital markets through the return on financing that they are prepared to offer. Researchers applying for funding from public agencies have no equivalent price mechanism at their disposal. What is more, there is no reason to believe that the standard problems of moral hazard and adverse selection that characterize capital markets, would be absent from the signalling that researchers engage in when submitting funding proposals to public research funding agencies.

Problems associated with public research funding are not restricted to the difficulty of correctly assessing noisy signals received from applicants for funding. A number of empirical research findings show that public funding agency evaluations of researchers are often only weakly tied to the objective output and impact performance of researchers, and that funding allocations are similarly weakly correlated with research output and impact measures, in part because of inherent conservative risk-averse biases in public funding agencies that inhibit innovation.<sup>6</sup> The fundamental difficulty is that absent objective performance based output measures as the criterion of merit and funding allocation, there is an irreducible subjective element in the assessment process.<sup>7</sup> An alternative approach that has been suggested to circumvent these difficulties faced by public funding agencies, is the explicit use of performance-based output measures. Structuring recognition on objective output measures reduces conservative and subjective biases, and reduces the risk of adverse selection and moral hazard problems in the distribution of resources.<sup>8</sup>

Such complex and multi-faceted difficulties confronting public research management make it difficult to isolate the relative empirical significance of the various aspects of the challenges. In this paper we make use of a policy intervention, that initiated a very

resource-intensive investment in research through a public agency targeted at a small group of researchers. We track the research output and impact of the group of researchers who receive substantial public funding in the form of a research chair, against a set of control groups of researchers of equivalent scholarly standing, who do not receive such funding.

Our findings suggest that while the performance of research chair holders does improve after the funding allocation, the improvement is moderate, strongly conditional on the research standing of the awardee at the time of the award, and differentiated across disciplines. Moreover, per additional unit of research output, research chairs prove very expensive.

While we present a range of policy inferences, there are two core implications that we emphasize. First, funding allocations should be selective in the sense of being responsive to past research performance. Our results show that highly rated researchers who receive funding show stronger productivity increases than those with low ratings, suggesting that productivity increases will be greatest when focussed on researchers with strong track records. Second, since the cost per additional unit of research output rises dramatically even for the most productive research chair holders relative to equivalent researchers without chairs, suggests a strongly decreasing marginal productivity of increases in research funding. The policy inference we draw is that smaller funding grants to more researchers with strong track records is therefore likely more effective than massive funding concentrated on a few researchers alone. Conditionally strictly on the demonstration of adequate performance increases after the initial funding allocation, funding can always subsequently be scaled upward, and concentrated on successful research initiatives.

Central to such an approach is the need for revealed productivity to be transparently and objectively monitored. The growing number of objective bibliometric measures, whose collection is greatly facilitated by the growth in information technology, offers an immediate means of doing so.

We proceed as follows. In Section 2 we provide a precise statement of the research question and explain the associated modeling strategy. Section 3 details data sources, Section 4 presents results, while Section 5 concludes.

## 2. The research question and methodology

In this study we empirically examine whether a substantial increase in public funding allocations to researchers is associated with a material difference in their productivity. To do so, we compare the scholarly performance, in terms of both output and impact as measured by objective bibliometric measures under the Thomson ISI Web of Science citations database, of a body of researchers who were granted substantial research funding, against the performance of a body of researchers of similar inherent scholarly standing, who did not receive such funding.

Our focus is on South African data. The reason for this is that in 2008–2009, the National Research Foundation of South Africa (NRF) awarded a total of 80 research chairs, each of which was endowed with substantial research funding (approximately US\$300,000 per annum) guaranteed over a period of 5 years, renewable for up to 15 years.<sup>9</sup> The stated goal of the NRF research chairs is to improve South Africa's competitiveness in the international knowledge economy by expanding scientific research and innovation

<sup>4</sup> See also [Leiponen and Helfat \(2010, 2011\)](#). The literature has also considered a range of additional determinants such as openness – see [Aghion et al. \(2013a,b\)](#) at an aggregate level and [Laursen and Salter \(2006\)](#) at micro level – and other features of strategic management and organizational structure – see [Aghion et al. \(2013b\)](#), [Cassiman and Veugelers \(2006\)](#), [Garriga et al. \(2013\)](#), [Leiblein and Madsen \(2009\)](#) and [Li and Atuahene-Gima \(2001\)](#). Approaches that tie inputs to research and development success are the subject of a literature in their own right – see for instance [Crépon et al. \(1998\)](#), [Mairesse and Mohnen \(2002\)](#) and [Van Reenen \(2011\)](#).

<sup>5</sup> [Klingebiel and Rammer \(2013\)](#) also discuss the dangers associated with broad-based allocation mechanisms – particularly the dissipation of resources, lack of strategic focus, and diminished incentives.

<sup>6</sup> On the poor correlation of evaluation and funding with objective performance see [Fedderke \(2013\)](#) and [Grimpe \(2012\)](#). On the conservative biases in public funding agencies see [Braun \(1998\)](#).

<sup>7</sup> See the discussion in [Moxhan and Anderson \(1992\)](#) and [Horrobin \(1990\)](#).

<sup>8</sup> See for instance the discussion in [Abramo et al. \(2009\)](#), [Butler \(2003\)](#) and [Hicks \(2012\)](#). There are also dangers to the approach. [Butler \(2003\)](#) indicates that it may favour quantity over quality. [Hicks \(2012\)](#) notes that performance-based reward structures focus specifically on excellence. [Van Raan \(2005\)](#) reports concerns regarding the lack of homogeneity in coverage of different scientific areas, and sensitivity to starting data bases. [Korveaar and Moed \(1996\)](#) point to the significance of potential disciplinary differences. However, these are limitations that can be overcome by the use of multiple measures of performance, and careful bottom-up construction of data. See the discussions in [Abramo and D'Angelo \(2007\)](#), [Aksnes and Taxt \(2004\)](#), [Martin \(1996\)](#), [Oppenheim \(1997\)](#) and [Rinia et al. \(1998\)](#). [Ederer and Manso \(2012\)](#) present experimental evidence demonstrating that reward for performance does not carry the disincentive effects feared in applied psychology, conditional on the correct design of the reward structure (mitigation of risk is important).

<sup>9</sup> See <http://www.nrf.ac.za/sarchi/index.stm> for a full description of the initiative. In 2012 the NRF awarded an additional set of chairs. These are not included in our analysis, since not enough time has passed to assess the impact of the new chairs. Not all research chairs necessarily received the full funding quota available – but even the minimum funding granted (\$150,000) was considerably larger than that granted non-chair researchers.

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