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How do Innovation Vouchers Influence Senior Managers' Attitudes to Innovation?

Gary Chapman
Queen's University Belfast
Queen's University Management School
gchapman04@qub.ac.uk

Nola Margot Hewitt- Dundas
Queen's University Belfast
Queen's University Management School
nm.hewitt@qub.ac.uk

Abstract

Senior manager innovation-orientated attitudes are key drivers of innovation within smaller firms. Despite this, little is known about the factors that determine the nature of senior managers' innovation-orientated attitudes. In this paper, we investigate whether innovation vouchers, a form of public innovation support predominately provided to micro and smaller firms, positively affects senior managers' innovation-orientated attitudes. To examine this, we use propensity score nearest neighbour matching on a U.K. dataset of firms that received an innovation voucher between 2012 and 2015, and a control group of those that did not. Overall, we find that innovation vouchers have a small positive effect on senior managers' support for innovation, risk tolerance, willingness to change, and openness to external knowledge. The largest impact is observed on senior managers' risk tolerance, followed closely by their openness to external knowledge. Our findings suggest that innovation vouchers are an effective mechanism to induce small improvements in senior managers' innovation-orientated attitudes. We discuss implications for innovation policy and practice.

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ABSTRACT

Senior manager innovation-orientated attitudes are key drivers of innovation within smaller firms. Despite this, little is known about the factors that determine the nature of senior managers' innovation-orientated attitudes. In this paper, we investigate whether innovation vouchers, a form of public innovation support predominately provided to micro and smaller firms, positively affects senior managers' innovation-orientated attitudes. To examine this, we use propensity score nearest neighbour matching on a U.K. dataset of firms that received an innovation voucher between 2012 and 2015, and a control group of those that did not. Overall, we find that innovation vouchers have a small positive effect on senior managers' support for innovation, risk tolerance, willingness to change, and openness to external knowledge. The largest impact is observed on senior managers' risk tolerance, followed closely by their openness to external knowledge. Our findings suggest that innovation vouchers are an effective mechanism to induce small improvements in senior managers' innovation-orientated attitudes. We discuss implications for innovation policy and practice.

Keywords: Senior Managers; Innovation Orientation; Attitudes; Micro Firms; Innovation Policy, Public Support, Behavioural Additionality.

INTRODUCTION

Senior managers¹ exert considerable influence on their firm's innovation activities (Galasso and Simcoe, 2011), particularly within micro and smaller firms where they are considered the key drivers of innovation (De Mel et al, 2009; Marcati et al, 2008). The extent to which senior managers' support and drive innovation within their firm largely reflects their innovation-orientated attitudes (Hambrick and Mason, 1984; Kraiczy et al, 2015a; 2015b; Rosenbusch et al, 2011). Innovation-orientated attitudes represents their disposition toward innovation and is comprised of four individual innovation attitudes, namely; support for innovation, risk tolerance, willingness to change, and openness to external knowledge use. These influence senior managers' information search and processing, and through this their firm's strategy and behaviour in relation to innovation. To date research has predominately focused on the consequences of innovation-orientated attitudes, with literature supporting the idea that each significantly influences firms innovation activities (e.g. Kraiczy et al, 2015a; Musteen et al, 2010). Yet, despite the benefits of senior managers' possessing innovation-orientated attitudes, little is known about factors that determine the nature of senior managers' innovation-orientated attitudes (Talke et al, 2011; Stock and Zacharias, 2011; Stock et al, 2013).

Attitudes are learned by individuals, meaning attitudes can be changed through the inducement of further learning processes that provide new evaluative information (Bohner and Dickel, 2011; Burcharth et al, 2014). Prior studies suggest that public innovation support induces learning within organisations, namely, experiential learning through the experience of doing the innovation project, and second, inter-organisational learning through interactions with funded collaborative partners (Autio et al, 2008; Clarysse et al, 2009; Breschi et al, 2009). Here, we examine whether the learning processes induced by innovation vouchers – a form of public innovation support targeted toward micro and smaller firms for them to engage in a short-term collaboration with a public or private organisation (Cornet et al, 2006) - translates into changes in the nature of senior managers' innovation-orientated attitudes.

We believe addressing this gap is important for three reasons. First, micro and smaller firms are often resource constrained, limiting their ability to fund internal interventions (e.g. training) that would induce the learning processes necessary to positively change their senior managers' innovation-orientated attitudes (Kotey and Folker, 2007; Burcharth et al, 2014). Hence, innovation vouchers, which in most cases fully fund the innovation project, may represent an important mechanism for such firms. Second, from an innovation policy perspective, scholars have continuously argued that a key objective of innovation policy interventions must be to positively change attitudes to innovation, yet we know little about their effectiveness here (Buisseret et al, 1995; Wong and He, 2003; DITRA, 2006; Afcha, 2011). This is particularly important, as through public innovation support inducing changes in senior managers' innovation-orientated attitudes, second-order and longer-term changes (Autio et al, 2008) may be induced in the firms' innovation strategy and behaviour (Hambrick and Mason, 1984). Finally, innovation vouchers constitute an increasingly prevalent aspect of the innovation policy mix targeted toward micro and smaller firms, yet we know little about their effectiveness (Sala et al, 2016; Bakhshi et al, 2015).

¹ Here we refer to senior managers' as the founder of the organisation (84% of cases) and individuals' who were indicated as members of the senior manager team (e.g. CEO; COO).

We empirically examine the impact of innovation vouchers upon senior managers' innovation-orientated attitudes, using a dataset of firms that received an innovation voucher between 2012 and 2015, and a control group of those that did not. Following previous studies (e.g. Karhunen and Huovari, 2015) we employ propensity score nearest neighbour matching to estimate our results. The matching estimator controls for the non-random self-selection process involved in obtaining an innovation voucher (Caliendo and Kopeinig, 2008). We also run a sensitivity analysis to assess the robustness of our results to the influence of unobserved characteristics, different matching estimators, and different attitudinal measurement scales. We find support for our hypotheses, with innovation vouchers inducing small positive changes in senior managers' support for innovation, risk tolerance, willingness to change, and openness to external knowledge use. Our results contribute to the literature on innovation orientation by providing new insights into the external determinants of senior managers' innovation-orientated attitudes and to the innovation policy literature by providing new empirical evidence on the effectiveness of innovation vouchers at inducing behavioural additionality at the individual level.

This paper proceeds as follows. First, we discuss the conceptual background to our study and develop our hypotheses. Next, we overview the dataset used and explain our methodology. Following, we present our results and robustness checks, before discussing our findings, outlining our contributions and highlighting managerial and policymaker implications.

CONCEPTUAL BACKGROUND

Senior Management Innovation-Orientated Attitudes

Senior managers are key drivers of innovation within firms, particularly within micro and smaller firms, where their influence on strategic and behavioural choices is significantly greater (Marcati et al, 2008; De Mel et al, 2009). Senior managers encounter vast amounts of information when making strategic choices and due to human limitations they can only perceive and interpret a limited portion of this information when making their choices (Hambrick and Mason, 1984). Which information senior managers perceive and interpret is a function of their attitudes (Hambrick, 2007). Attitudes limit senior managers' information search to that of (mostly) attitude congruent information and influence their interpretations of the information by attaching high importance and positive understandings to congruent information, and less importance and negative understandings to incongruent information (Finkelstein et al, 2009; Bohner and Dickel, 2011). Hence, senior managers' attitudes significantly influence their interpretation of the available strategic choices and through this, their firm's strategy, behaviour and performance (Kraiczy et al, 2015a; Hambrick and Mason, 1984).

While senior managers' innovation-orientated attitudes have been recognised as important determinants of firms' innovation activities (Kraiczy et al, 2015a; 2014; Burcharth et al, 2014; Rosenbusch et al, 2011; Musteen et al, 2010; Siguaw et al, 2006), we know little about the determinants of senior managers' innovation-orientated attitudes (Talke et al, 2011; Stock and Zacharias, 2011; Stock et al, 2013). Innovation-orientated attitudes refer to senior managers' general disposition toward innovation, with highly innovation-orientated attitudes reflecting a tendency to support innovative behaviours and ideas, tolerate risk, accept change, and be open to new ideas and knowledge from within and outside the organisation. Innovation-orientated attitudes are comprised of four

individual innovation attitudes; namely support for innovation, risk tolerance, willingness to change, and openness to external knowledge use. Support for innovation reflects senior managers' tendency to actively encourage creativity and seek new ideas within the firm, and offer support and provide adequate resources to their firms' innovation activities. Risk tolerance reflects senior managers' ability and willingness to tolerate and embrace the risks inherent in the innovation process. Willingness to change reflects senior managers' tendency to be open to and embrace change initiatives. Finally, openness to external knowledge reflects senior managers' tendency to regularly use and equally value external knowledge in their innovation projects.

In order to examine the determinants of innovation-orientated attitudes, we first need to understand how attitudes are changed. Attitudes are learned predispositions upon which senior managers act when confronted with particular stimuli. Attitudinal change occurs when senior managers are provided with new evaluative information which differs in valence from their current attitude (i.e. contradictory or reaffirming) (Crano and Prislin, 2006). When the new information is acquired through direct experience (i.e. experiential learning), it is more likely to result in attitudinal change, than if the information is acquired indirectly (i.e. reading secondary information) (Bohner and Dickel, 2011). Thus, through further learning processes that (in)directly provide new evaluative information, attitudes can be changed (Bohner and Dickel, 2011; Burcharth et al, 2014). These learning processes can be induced through internal (e.g. formal training programs) and external (e.g. public support) interventions (Burcharth et al, 2014; Clarysse et al, 2009). As micro and smaller firms are typically constrained in their financial resources (Kotey and Folker, 2007) - limiting their ability to fund such interventions internally - innovation vouchers may be a particularly important intervention, as they fund a high proportion of the interventions cost.

Innovation vouchers are a prevalent component of the innovation policy mix targeted to micro and smaller firms throughout Europe. They aim to incentivise firms to collaborate with a public or private organisation to address an innovation problem the firm is having (Cornet et al, 2006; Sala et al, 2016). Hence, they build on the increasing understanding that external collaboration with public and private partners is a key source of innovative knowledge and a key driver of innovation performance (Spithoven et al, 2013). In the U.K., innovation voucher programs provide organisations with a voucher that has a small monetary value (i.e. £5,000), which is then exchanged with a university, college or a private sector company, in return for short-term assistance (i.e. 6 months) with their innovation project. Other variations of innovation vouchers exist throughout Europe, with programs typically varying in the duration of support, partner types and value offered (see Schade and Grigore (2009) for an overview).

Undertaking an innovation voucher project may result in two types of learning (Breschi et al, 2009). First, experiential learning through senior managers' involvement in the innovation project, and second, inter-organisational learning through their interactions with the knowledge provider. While not a direct aim of the program, these learning processes may result in additional unintended impacts, such as changes in senior managers' innovation-orientated attitudes (Autio et al, 2008; Breschi et al, 2009). The concept of additionality assesses the extent to which innovation vouchers induce intended or unintended impacts (Buisseret et al, 1995). Specifically, additionality examines whether innovation vouchers result in any additional attitudinal change

occurring, when compared to the level of attitudinal change that would have occurred in the absence of support (Georghiou and Clarysse, 2006).

HYPOTHESIS DEVELOPMENT

Support for Innovation

Senior manager support for innovation is considered a key determinant of successful innovation (Felekoglu and Moultrie, 2014; Somech and Drach-Zahavy, 2013). This is particularly important in micro and smaller firms where senior managers are the key drivers of innovation and have high levels of decision-making discretion (De Mel et al, 2009). Support for innovation reflects senior managers' tendency to actively encourage creativity and seek new ideas within the firm, and offer support and provide adequate resources to their firm's innovation activities (Kraiczy et al, 2015a; Hurley and Hult, 1998; Green, 1995). These tendencies help to drive innovation within the firm, by fostering an innovation climate, encouraging the development of innovation competences, and senior managers actively contributing to and adequately resourcing the firm's innovation activities (Siguaw et al, 2006; Damanpour, 1991). In addition, they highlight the importance of innovation to the firm, which conveys signals to employees regarding expectations for innovation in their behaviour (Scott and Bruce, 1994). These signals influence employees' motivation and perception of the value of innovation within the firm, and thus, directs the innovativeness of employees' behaviour (Yuan and Woodman, 2010).

Given the significant evidence of public support inducing learning effects (e.g. Autio et al, 2008; Clarysse et al, 2009; Breschi et al, 2009), we propose that senior manager experience of an innovation voucher project will generate experiential and inter-organisational learning that positively influences their support for innovation (Crano and Prislin, 2006). Senior managers' gain additional experiences of the innovation process through undertaking their innovation voucher that may result in a greater understanding and improvements in their innovation competence (Knockaert et al, 2014; Radas et al, 2015). In addition, experiencing the value generated (e.g. new knowledge or improved competence) through the voucher project, may positively change their attitudes to innovation (Green and Cluley, 2014). Senior managers may also learn from their interactions with their knowledge provider, for example, they may gain a solution to or advice on how to tackle their specified problem, new ideas, new information on markets and technologies, and feedback regarding the efficacy of their project, which are not available within the firm (Laursen et al, 2011; Spithoven et al, 2013). As external collaborations are a key source of the new knowledge that enables organisations to enhance their innovative performance (Leiponen and Helfat, 2010), these interactions may result in senior managers' strengthening their support for innovation. Therefore, we suggest that the greater clarity of the innovation process and its value, improved innovation competence, and the new knowledge acquired through knowledge provider interactions, strengthens senior manager support for innovation. Thus:

H1: Compared to no treatment, innovation vouchers positively affect senior managers' support for innovation.

Risk Tolerance

Innovation requires upfront and ongoing investment of managerial attention and (non)financial resources. Yet, innovation is an extremely difficult and highly uncertain process, categorized by high failure rates and outcomes unknown ex-ante (Latham and Braun, 2009). This makes innovation a risky investment for senior managers, as the payback from their investments is highly uncertain. Whether senior managers decide to make these investments in innovation is closely related to their risk tolerance (Hurley and Hult, 1998; Greve, 2003). Senior managers with lower risk tolerances are likely to prefer to invest in established alternatives where the distribution of returns is more certain. Whereas senior managers with higher risk tolerances are more likely to invest in more innovative projects where larger variance exists in the potential distribution of returns (Kraiczy et al, 2015b; Greve, 2003). The tolerance senior managers' display toward risk will also convey signals to employees about how much 'risk' is appropriate for them to take (Scott and Bruce, 1994). That is, employees who perceive their senior managers to be less risk tolerant may prefer to continue to undertake established actions, instead of searching for more innovative alternatives.

Participation in an innovation voucher project enables senior managers to directly confront a moderately risky decision, as while the innovation voucher greatly reduces the financial risk, senior managers' still commit time and non-financial (e.g. materials) resources to the project². The experience of this decision and of managing the uncertainty associated with the process is likely to result in experiential learning that positively alters their perception of the risk, and hence their risk tolerance (Brachert et al, 2015; Bohner and Dickel, 2011; March and Shapira, 1987). Second, studies have shown that senior managers' experience of the outcomes of risky decisions influences their risk preferences (Latham and Braun, 2009). That is, the experience of positive outcomes from choices involving risk, results in individuals repeating that decision, i.e. becoming more risk tolerant (Denrell and March, 2001). Thus, given prior studies suggest significant value occurs through public innovation support (Foreman-Peck, 2013; Knockaert et al, 2014), we suggest that through experiencing a positive payback from their investment in the innovation voucher project, senior managers may strengthen their risk tolerance, as they now associate higher rewards and lower risks with these strategic decisions (Greve, 2003). Third, senior managers may also acquire new knowledge from their interactions with the knowledge provider that may enhance future innovative efforts. This may strengthen their risk tolerance due to the greater knowledge base upon which they can innovate in future. Overall:

H2: Compared to no treatment, innovation vouchers positively affect senior managers' risk tolerance.

Willingness to Change

Change is an intrinsic part of innovation (Damanpour, 1991). Throughout the innovation process changes may be induced in how the firm manages projects, organises work and allocates resources, as well as in their product/service offerings. Change offers opportunities for strategic renewal, but at the same time, is highly uncertain and challenges the organisational status quo. These attributes can cause senior managers to experience

² Senior managers also make a small financial investment to cover the project's tax. In the program under study here, this is 20% for U.K. value added tax.

uncertainty and stress about whether change is beneficial. This may result in attitudinal resistance to change that prevents innovation initiatives entirely or introduces costs and delays into the innovation process (Val and Fuentes, 2003; McGuirk et al, 2015). The degree to which senior managers resist change depends on their willingness to change. Willingness to change will shape how they assess change initiatives and the level of support and attention senior managers provide to change initiatives, with empirical evidence suggesting senior managers' willingness to change significantly influences the innovative activities of their organisation (Damanpour, 1991; Musteen et al, 2006; Musteen et al, 2010).

Participating in an innovation voucher project may result in experiential learning in terms of a greater understanding of the innovation process, a greater understanding of the value innovation can generate, and improvements in the senior managers' innovation competences (Georghiou and Clarysse, 2006; Breschi et al, 2009; Radas et al, 2015). In addition, the interactions with the knowledge provider may lead to inter-organisational learning in terms of new knowledge, solutions and ideas that can be applied in future innovation projects (Autio et al, 2008; Clarysse et al, 2009). These two new types of evaluative information likely reduce the uncertainty senior managers' associate with change and innovation, due to their greater understanding of it and their improved ability manage innovation processes in future, resulting in a strengthening of their willingness to change (Musteen et al, 2006). Thus, we hypothesize:

H3: Compared to no treatment, innovation vouchers positively affect senior managers' willingness to change.

Openness to External Knowledge Use

Successful innovation increasingly depends on firms' accessing external knowledge (Leiponen and Helfat, 2010). Senior manager openness to external knowledge significantly influences the extent to which companies can successfully access and make use of external knowledge in their innovation activities (Lichtenthaler and Ernst, 2006). When a negatively biased attitude to external knowledge exists (i.e. not-invented here), senior managers may not search (optimally) for external knowledge due to a belief that sufficient internal knowledge exists, and when senior managers' do access external knowledge they may process and interpret it with a negative bias in relation to internal knowledge (Mehrwald, 1999). This may result in senior managers' rejecting external knowledge to the detriment of innovation performance (Menon and Pfeffer, 2003; Burcharth et al, 2014). Senior managers' openness to external knowledge use may also influence the search behaviour of their employees' through signalling (Scott and Bruce, 1994).

Participating in the collaborative interactions funded by the innovation voucher may lead to experiential learning in terms of a greater understanding of how to interact with and manage external partners, as well as of the value that external collaborations can generate (Love et al, 2014; Breschi et al, 2009). Through the interactions senior managers' may also improve existing and develop new capabilities that enable them to better engage in and benefit from external collaborations in future (Love et al, 2014). Inter-organisational learning is also likely to occur, with senior managers acquiring new knowledge, ideas and solutions that may enhance their future

innovation efforts (Leiponen and Helfat, 2010). These mechanisms suggest that new evaluative information is provided to the senior manager in terms of their increased ability to participate in external collaborations, a greater understanding of the benefits associated with external knowledge, and new knowledge gained from the collaboration that may enhance the future innovative efforts of the organization. Thus, we hypothesize:

H4: Compared to no treatment, innovation vouchers positively affect senior managers' openness to external knowledge.

DATA AND EMPIRICAL STRATEGY

The dataset used here comes from a survey undertaken during 2015 in the United Kingdom. The survey was administered to organisations that received an innovation voucher from Innovate U.K. (IUK) between 2012 and 2015, and to a similar group of companies that had not received an innovation voucher from IUK during this period. IUK is the U.K. government's national innovation agency, responsible for providing approximately £500 million of innovation support to U.K. firms. They run the largest innovation voucher program within the U.K, supporting approximately 2,500 firms since 2012. In order to be eligible for the program firms must be a micro, small or (less prevalent) medium sized firm³ that requires assistance with a problem representing a significant challenge for the company (e.g. new product development). In addition, the firm cannot have previously worked with their proposed partner and can only receive one voucher (InnovateUK, 2012). Vouchers are awarded via random allocation among the firms that apply and meet these criteria (InnovateUK, 2012). Each voucher is worth a maximum of £5,000 and must be used within 6 months of approval.

Firms that had received IUK innovation vouchers were identified using IUK's register of public innovation support⁴. Between September 2012 and May 2015, 2541 firms were awarded an innovation voucher. The survey was administered via telephone to 1,073 of these firms, which had completed their innovation voucher and were contactable via telephone⁵. After removing observations with systematic missing data, 366 responses were received representing a response rate of 34.10%. For this study, we focus on a sub-set on the responses where the respondent was the founder (84% are founders) or it was indicated they were a member of the senior management team⁶. This leaves us with 323 (30.10% RR) in the treatment group. The sample is broadly representative of the population in terms of geographic region, firm size and amount claimed. For the control group, the sample was selected to mirror the distribution of size and industry characteristics. Email addresses were obtained from Kompass for the founder, CEO or a senior manager of each organisation. The same survey⁷ was administered to 3,256 firms' senior managers' via email in 2015, with two follow up reminders sent. After removing observations with systematic missing data, 297 responses were received representing a response rate of 9.12%. The control

3 Per EU Definition: 250 employees or fewer.

4 <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

5 Contact information for the firms was obtained via online searches. As most firms had a telephone number available, but not an email address, we decided to deploy the survey via telephone for the treated firms.

6 The remainder were predominately CEOs, COO, operations directors et cetera.

7 The only difference in the surveys was questions related to the innovation voucher (e.g. partner type) were not included for the control group.

sample is broadly representative of the underlying population, mitigating non-response bias. Of the total sample, 87.23% are micro firms, 10.61% are small firms and 2.15% are medium firms: 95.19% of the firms have 20 employees or less, hence, we are primarily concerned with very small firms here.

As the two surveys had a single respondent per firm, there is a need to check for common method bias. As our treatment variable is obtained from an external source (i.e. U.K. public support records) and not self-reported, common method bias is less of a concern. Nevertheless, we checked for common method bias using Harmon's one-factor test (Podsakoff and Organ, 1986). We performed a factor analysis for each dependent variable, including all explanatory and control variables. The factor analyses retained four factors with eigenvalues greater than 1 in all cases. The first factor explains approximately 34% of the variance in the unrotated and varimax rotated analyses, suggesting common method bias is not a significant problem.

Econometric Method

Public innovation support typically has two forms of selection. First, firms self-select into a program and second, policymakers select which to fund (Karhunen and Huovari, 2015). However, the innovation vouchers under study here are allocated in a random draw (InnovateUK, 2012). That is, firms self-select into the program and the innovation vouchers are awarded randomly. This allocation mechanism has been employed in other programs (e.g. Bakhshi et al, 2015); however, it is not common practice across innovation voucher programs within the U.K. (e.g. Interface Scotland). When comparing effectiveness across innovation voucher programs, it is necessary to account for these allocation differences. The self-selection mechanism means that firms who apply may differ in their underlying characteristics from those who do not. These differences may influence the outcomes of interest meaning the selection effect needs to be explicitly modelled. Matching estimators are a prevalent technique employed to estimate the effectiveness of public innovation support while accounting for selection bias (Karhunen and Huovari, 2015). Here we employ nearest neighbour propensity score matching to estimate our treatment effects (PSM). We chose PSM as it has been shown to generate estimates consistent with true experimental conditions (e.g. Dehejia and Wahba, 1999) and requires no assumptions regarding functional form and error term distributions (Caliendo and Kopeinig, 2008). However, a caveat is matching only controls for selection on observable characteristics; thus, we must maintain an assumption that we observe all important determinants in our models (Caliendo and Kopeinig, 2008). We examine the validity of this assumption in the robustness checks.

Our fundamental question refers to how much additional senior manager attitudinal change occurred when the firm received an innovation voucher, when compared to the counterfactual scenario of the same firm not receiving an innovation voucher. The below equation illustrates this question as the average treatment effect on the treated (ATT):

$$ATT = E(A^T|V = 1) - E(A^C|V = 1) \tag{1}$$

Where V refers to treatment status; V=1 for the treatment group and V=0 for the control group. A^T refers to the outcome variable and A^C the potential outcome realised if the same participant had not been treated. However, as A^C cannot be directly observed - cannot participate and not participate simultaneously - it has to be estimated

from a control group that did not receive an innovation voucher. However, due to the selection bias outlined above, it cannot simply be the mean difference in the outcomes of participants and a general sample of non-participants (Caliendo and Kopeinig, 2008). We employ Rubin’s (1977) conditional independence assumption (i.e. potential outcome and participation are statistically independent for those with the same set of exogenous characteristics) to overcome this selection bias. This allows us to estimate the counterfactual outcome from a control group of non-treated that are similar in exogenous characteristics. Matching enables us to identify those with the same set of exogenous characteristics by finding in a group of nonparticipants those who are most similar to the treated firms. If the matching is successful:

$$E(A^C | V = 1, X) = E(A^C | V = 0, X) \quad (2)$$

and the ATT becomes:

$$ATT = E(A^T | V = 1, X = x) - E(A^C | V = 0, X = x) \quad (3)$$

Here, we conduct nearest neighbour propensity score matching, that is, we pair each treated firm with their closest non-recipient⁸. The pairs are selected based on their similarity on the propensity score, that is, their probability of receiving an innovation voucher conditional on their characteristics (Rosenbaum and Rubin, 1983). The propensity score stems from a probit model, with the dependent variable a dummy indicating receipt of an innovation voucher, and the independent variables, the firm and senior manager background characteristics that determine receipt of an innovation voucher (Caliendo and Kopeinig, 2008). We match on the propensity score to overcome the “curse of dimensionality” (see Rosenbaum and Rubin, 1983).

In matching, a key assumption is that sufficient overlap exists between control and treated groups (i.e. common support). We estimate the area of common support using the pscore program (Caliendo and Kopeinig, 2008). Here this equates to 0.06927708 and 0.96424645. Observations with propensity scores outside this region are dropped, removing one observation. Since, the number dropped is small this poses few problems. Second, we examine the density distribution of the propensity scores in the treated and control groups (Figure 1) (Caliendo and Kopeinig, 2008) to understand if within the region of common support, the two groups display similar distributions. Further, even when the overlap assumption is satisfied, it remains that large gaps may exist between the propensity scores of the two closest firms available for match. This would lead to poor matches and bias evaluation results, as the two firms being compared are not that comparable. To avoid ‘bad matches’ we implement a caliper restriction (Caliendo and Kopeinig, 2008), which imposes a threshold to the maximum distance allowed between matched firms. If the distance is above this threshold, the treated observation is dropped from the sample to avoid biasing the estimates (Caliendo and Kopeinig, 2008). Here, we follow best practice in the additionality literature (e.g. Czarnitzki and Delanote, 2015) by implementing a 0.05 caliper.

⁸ We use the `teffectspsmatch` command in Stata 14. Number of matches requested is one. However, `teffectspsmatch` matches to all firms that are tied for the closest propensity score. This means in some cases two matches are used.

Treatment Variable

We consider whether the firm has received an innovation voucher from IUK between the years 2012 and 2015. This takes the form of a dummy variable, equal to 1 if the firm received an innovation voucher and 0 otherwise.

Dependent Variables

We use four attitudinal variables as our outcome variables, namely; support for innovation, risk tolerance, willingness to change, and openness to external knowledge use. To measure each of these factors, we adapted four items for each attitude from previously deployed scales (Hurley and Hult, 1998; Kraiczy et al, 2015a) (Table 1). Respondents indicated on a five-point Likert-scale the extent to which they agreed or disagreed with each statement. Exploratory factor analysis was undertaken to understand if the four measures for each attitude could be reduced to one variable; one-factor solutions are suggested in all cases per eigenvalues and scree plots⁹. All items load highly (>0.35) onto their respective factors. To generate the factors, we add the four scores together and divide by four (e.g. $4+4+4+4=16/4=4$)¹⁰. A high score on the variable indicates a highly positive attitude (e.g., a five would indicate very strong support for innovation). Cronbach's Alpha for the four outcome variables; support for innovation was .896, risk tolerance was .753, willingness to change .692 and attitude to external knowledge .762, suggesting internal validity of our measures.

**** INSERT TABLE 1 HERE ****

Control Variables

We include a number of firm and senior manager level variables in our probit model that are likely to influence treatment status and senior managers' innovation-orientated attitudes. First, we include firm age as older firms are often more reluctant to pursue innovation (Balasubramanian and Lee, 2008). We also allow for a potential non-linear relationship by including firm age squared. Second, we include firm size measured as the number of employees in 2012, to control for size influences. Third, we include R&D active, which is a dummy variable indicating whether the firm had any R&D employees during 2012. We would expect R&D active firms to possess greater levels of absorptive capacity, improving their ability to benefit from the collaborative relationship funded by the innovation voucher (Leiponen and Helfat, 2010), and thus, increasing their likelihood to apply. In addition, such firms are likely more innovative, and hence their senior managers' may possess more innovation-orientated attitudes. Fourth, we include human capital, measured as the percentage of employees that had a third level degree or higher in 2012. Higher levels of human capital may result in higher innovativeness and thus, a higher likelihood to apply for an innovation voucher and for their senior managers' to possess more innovation-orientated attitudes (McGuirk et al, 2015). Fifth, we include export, a dummy variable equal to one if the firm exported during 2012. Firms that engage in export markets are more innovative, potentially due to the learning that occurs from participation in export markets, and thus, may be more likely to apply for innovation vouchers and for their senior managers' to possess more innovation-orientated attitudes (Golovko and Valentini, 2011). Following matching

⁹ Results available upon request.

¹⁰ We adopt the simple-sum approach to generating factor scores as this maintains the variation in the original data and enhances interpretability of the results. To ensure the robustness of our results, we also ran the main models using a "refined" factor scores, namely Barlett Scores. In this, the factor score remains highly correlated to the corresponding factor and the factor loadings are accounted for (See Distefano et al (2009). The results hold when Barlett scores are used as the dependent variables. Results available upon request.

best practice, as size, human capital, R&D active and export may be affected by treatment – thus, obscuring some of the treatment effect - we measure them at the beginning of the voucher period to avoid endogeneity (Caliendo and Kopeinig, 2008).

We also include NTBF, a dummy variable equal to one if the firm is a high or medium technology firm that is less than five years old. Prior studies have found NTBF firms to have higher innovative performance and growth, and to benefit more from participation in public support programs (Czarnitzki and Delanote, 2015). Finally, at the firm level we include five industry dummy variables, high-technology manufacturing, medium-technology manufacturing, low-technology manufacturing, knowledge intensive business services, and primary and other industries, to account for industry effects. At the individual level of the senior manager, we first account for their human capital, captured via an ordinal education variable ranked between 1 and 3: less than higher education, bachelors degree and postgraduate degree. Those with more advanced levels of education may be more likely to invest in R&D and support innovation, thus, increasing the firm’s likelihood of applying and senior managers’ possessing more innovation-orientated attitudes (Barker and Mueller, 2002; Honjo et al, 2014). We also include other career experience, an ordinal variable indicating how many different industries the senior manager has worked in scaled between 1 and 5. Those with a greater diversity of career experiences may be proficient in multiple knowledge domains, have greater diversity of knowledge and higher absorptive capacities, increasing their propensity to apply and possess more innovation-orientated attitudes. Further, we account for their enterprise tenure, an ordinal variable indicating how many years they have been at the enterprise, as prior studies have found senior managers’ with longer tenures are less inclined to innovate (Barker and Mueller, 2002). We also account for the senior managers’ age, measured via a dummy variable equal to one if the senior manager is 55 years or older. We choose this measure as past studies indicate that older senior managers’ are more conservative, and hence less innovative (Hambrick and Mason, 1984; Barker and Mueller, 2002). Finally, we account for the senior managers’ functional background measured by a dummy variable, equal to one if the senior manager has a science, engineering or technology background. Senior managers with this background have been found to invest more in R&D, and hence be more innovative (Barker and Mueller, 2002)¹¹.

Descriptive Statistics

Table 2 presents the descriptive statistics. As can be seen, most means of our dependent and independent variables differ meaningfully between the treated and control firms. Treated firms on average seem to be younger, smaller, more R&D and export active and have greater human capital. Treated firm senior managers also seem to have a higher level of education, greater other career experiences, shorter tenures and possess more innovation-orientated attitudes.

**** INSERT TABLE 2 HERE ****

RESULTS

We first run a probit model to estimate the predicted probability of a firm selecting into an innovation voucher (i.e. propensity score). As shown in table 3, R&D and export active are positive predictors of selection into an

¹¹ Multicollinearity was assessed, with a mean VIF of 2.10 and no variables exceeding the 10 threshold. Firm age and firm age squared were 8.01 and 5.99 respectively; these high VIFs are not a concern for multicollinearity given one is a power product of the other. Thus, no multicollinearity issues were detected.

innovation voucher program. Senior managers having a science, engineering or technology background is a significant positive driver, while enterprise tenure is a significant negative driver of selection. Contrary to expectations, the remaining firm and senior manager level characteristics are all insignificant.

**** INSERT TABLE 3 HERE ****

Second, we match firms based upon the propensity score using the nearest-neighbour method (Rosenbaum and Rubin, 1983). Before we examine our results however, it is imperative to examine how effective the matching has been in balancing the distribution of characteristics in the treatment and control groups. We do this by graphing the density scores pre and post matching (Caliendo and Kopeinig, 2008). As can be seen in figure 1, differences in the density scores prior to matching have largely been removed, with both samples post-matching displaying very similar density distributions. Standardised mean differences and t-tests also indicate little difference remaining post-matching¹². Thus, we can conclude the matching was successful in balancing the distribution of relevant covariates and the innovation voucher caused the remaining differences in our outcome variables.

**** INSERT FIGURE 1 HERE ****

Our results are shown in Table 4 as ATT. We find support for hypothesis 1, as innovation vouchers have a small positive impact on senior managers support for innovation, strengthening their attitude by 0.202 points or 4.04% ($p < 0.01$). We also find support for hypothesis 2, as innovations vouchers have a small positive impact on senior managers' risk tolerance, strengthening their attitude by 0.307 points or 6.15% ($p < 0.01$). Further, we find support for hypothesis 3, as innovation vouchers have a small positive impact on senior managers' willingness to change, strengthening their attitude by 0.157 points or 3.14% ($p < 0.01$). Finally, we find support for hypothesis 4, as innovation vouchers have a positive impact on senior managers' openness to external knowledge, strengthening their attitude by 0.268 points or 5.36% ($p < 0.01$).

**** INSERT TABLE 4 HERE ****

ROBUSTNESS CHECKS

We test the robustness of our results against three scenarios. First, prior innovation studies suggest respondents have difficulty making fine-grained distinctions on Likert scales, for example between agree and strongly agree, which may introduce measurement error (Leiponen and Helfat, 2010). To examine if this influences our results, we generate new dummy variables for each of the 16 attitudinal measures, equal to one if the respondent agreed or strongly agreed, and zero otherwise. We then sum the 16 attitudinal measures into their four respective attitudinal variables; these form a score between 0 and 4. We re-estimate our models with the new variables as our dependent variables. As seen in table 5, we again find small statistically significant positive impacts, indicating the robustness of our results.

**** INSERT TABLE 5 HERE ****

¹² Available from the authors upon request.

Second, while different matching estimators generate the same results when undertaking exact matches with growing samples, when the sample is smaller, treatment estimates may differ by matching estimator (Caliendo and Kopeinig, 2008). To understand how sensitive our results are to our choice of matching estimator, we re-estimate our treatment effects using three other matching estimators. First, radius matching, which matches only those control and treatment firms within a pre-defined range on the propensity score¹³. Second, stratification matching, which divides the propensity score into a set of intervals and within each interval estimates treatment effects using the mean difference between the control and treatment groups¹⁴. Finally, kernel matching which uses a weighted average of all control firms to construct the counterfactual¹⁵. As can be seen in figure 2, kernel and stratification matching estimators find broadly similar results to our main estimates, while, radius matching seems to slightly overestimate the treatment effects. Thus, our estimates appear robust across matching estimators.

**** INSERT FIGURE 2 HERE ****

Finally, matching relies on the conditional independence assumption, yet only controls for observable characteristics, meaning some unobservable characteristics (i.e. hidden bias) may exist that would violate this assumption. As this assumption is directly untestable, a sensitivity analysis can provide insight about whether plausible hidden bias exists that would undermine the implications of our matching results (Caliendo and Kopeinig, 2008). We implement a simulation based approach (Nannicini, 2007; Binder and Coad, 2013)¹⁶ that assesses sensitivity by including simulated dummy variables in the propensity model that each represent different severities of hidden bias (See Ichino et al (2008) for a detailed explanation of this approach)¹⁷. First, we simulate a variable that mimics senior managers' postgraduate education (Nannicini, 2007), which represents hidden bias in terms of senior managers' ability that would influence their treatment status and innovation-orientated attitudes. Second, we follow Nannicini (2007) by generating two variables; the first considers the presence of a neutral hidden bias (i.e. occurs equally in all groups) and the second, a hidden bias that occurs much more when the firm is treated or has above median innovation-orientated attitudes (i.e. strong confounder). If our treatment estimates go to zero under any plausible scenario, then our results are not considered robust to hidden bias (Nannicini, 2007). As seen in Table 6, the treatment estimates are similar to our main estimates when considering the presence of a neutral hidden bias and hidden bias that mimics senior manager ability (i.e. postgraduate education). A strong hidden bias roughly halves the treatment estimates for support for innovation, and reduces it by approximately 60-65% for the other three attitudes. As none of the treatment estimates reach zero, we can conclude that hidden bias would not significantly influence the implications of our results (Nannicini, 2007; Ichino et al, 2008).

**** INSERT TABLE 6 HERE ****

13 We apply a 0.05 radius in line with the 0.05 caliper restriction used in our main estimations.

14 The number of strata comes from pscore in Stata.

15 We implement a Gaussian Kernel, as standard in the `attk` Stata program.

16 We use the `sensatt` program in Stata (Nannicini, 2007) to run this analysis.

17 The sensitivity analysis is conducted on a binary transformation of the outcome variables (Nannicini, 2007). We use the median as it is the program standard.

DISCUSSION AND CONCLUSIONS

This paper has examined how innovation vouchers influence the nature of senior managers' innovation-orientated attitudes within micro and smaller firms, thus, providing new insights into the determinants of senior managers' innovation-orientated attitudes. We hypothesised that through participation in innovation vouchers, senior managers experience experiential and inter-organisational learning that results in positive changes in their innovation-orientated attitudes. We find that innovation vouchers induce small statistically significant positive changes in senior managers' support for innovation, risk tolerance, willingness to change, and openness to external knowledge use. Our results suggest that innovation vouchers are an important external determinant of senior managers' innovation-orientated attitudes.

Our results contribute to the innovation orientation and innovation policy literatures. First, we contribute to the innovation orientation literature by providing new insights into the determinants of senior managers' innovation-orientated attitudes. Specifically, we demonstrate that innovation vouchers are an external determinant of senior managers' innovation-orientated attitudes, thereby, responding to the lack of knowledge on the determinants of senior manager innovation-orientated attitudes (Talke et al, 2011; Stock and Zacharias, 2011; Stock et al, 2013). In addition, our results extend prior studies which have focused on innovation orientation in large firms and SMEs (e.g. Kraiczy et al, 2015a), by examining innovation orientation in a sample of predominately micro firms. For micro and smaller firms aiming to enhance their innovation activities, our results suggest that innovation vouchers represent an important mechanism to induce the learning processes that result in positive changes in their senior managers' innovation-orientated attitudes. As such firms are often resource constrained, inhibiting their ability to induce these learning processes through internal interventions (e.g. training) (Kotey and Folker, 2007), innovation vouchers may be a particularly important mechanism.

Second, we offer a series of contributions to the innovation policy literature. First, we contribute new empirical evidence on the effectiveness of innovation vouchers at inducing behavioural additionality (Sala et al, 2016; Clarysse et al, 2009). Our results offer support to previous findings of innovation vouchers having small positive impacts on firms innovativeness (e.g. Bakhshi et al, 2015; Sala et al, 2016), and add to our understanding by demonstrating that innovation vouchers induce small positive changes in senior managers' support for innovation, risk tolerance, willingness to change and openness to external knowledge. While, the magnitude of the impacts (i.e. 3.14% to 6.15% increase) observed here on innovation-orientated attitudes and in other studies (Bakhshi et al, 2015; Sala et al, 2016) on innovation intentions and collaboration is small; a small benefit would be expected given the short duration of the support and the limited resources provided. The magnitude of the effect also aligns with a recent meta-analysis on the impacts of public innovation support, where Dimos and Pugh (2016) found small positive impacts. Overall, our results strengthen the rationale for future innovation voucher interventions by empirically demonstrating innovation vouchers induce small positive changes in the innovation-orientated attitudes of senior managers. For policymakers, our results suggest innovation vouchers are a useful instrument to increase the innovativeness of micro firms, which are increasingly viewed as a key future source of innovation within economies (Roper and Hewitt-Dundas, 2015; Baumann and Kritikos, 2016).

The small positive influence on senior managers' innovation-orientated attitudes also suggests that innovation vouchers may induce second-order impacts on firm's innovation activities, through their influence on senior managers decision-making and behaviour (Hambrick and Mason, 1984; Kraiczy et al, 2015a). For example, innovation vouchers strengthening senior managers' innovation-orientated attitudes may result in senior managers' forming stronger strategic intentions to innovate and utilising greater amounts of external knowledge in their future innovation activities. This demonstrates the importance of incorporating the under-developed attitudinal component of behavioural additionality into the design and evaluation of public innovation support (Buisseret et al, 1995; Wong and He, 2003; DITRA, 2006; Afcha, 2011); as by influencing the attitudes of senior managers and other organizational members (e.g. unit heads), public support may induce the longer-term changes in innovation strategy and behaviour sought by policymakers (Roper and Hewitt-Dundas, 2016). This potential influence on firms' future innovation activities highlights the need for more longitudinal evaluation designs when examining the impacts of innovation vouchers, and public innovation support more generally.

Third, while prior studies examining the effectiveness of public support (Karhunen and Huovari, 2015; Afcha, 2011) and innovation vouchers (Sala et al, 2016; Bakhshi et al, 2015) have focused on firm level implications, we respond to calls for greater examination of behavioural additionality within the organisation (e.g. Gok and Edler, 2012). We add to the literature by demonstrating that innovation vouchers induce behavioural additionality through individuals. Broader strategic management and innovation literature increasingly recognises that to gain more granular understandings of organisations we need to examine the individuals that comprise those organisations (e.g. Felin and Foss, 2005). Our findings support this idea, highlighting the need for policymakers and scholars to consider the individual level impacts of public innovation support, if more accurate and comprehensive understandings of its effectiveness are to be obtained. The individual perspective may also offer a potential explanation for the heterogeneous impacts of public innovation support observed across firms, in that the individuals participating in the programs on behalf of their organisation differ in their cognitions, abilities and knowledge, resulting in them responding differently to treatment. Finally, the probit model indicating that senior manager level factors drive participation into the program highlights the need to account for individual level factors in future matching studies if they are to successfully satisfy the conditional independence assumption central to matching validity.

Our study also has several limitations. First, our study is limited to examining the impact of IUK innovation vouchers. While this was advantageous in enabling us to control for across program differences (e.g. length of support, selection vs no selection and funding conditions), further studies could examine the impact of other innovation voucher programs, and compare these results across program iterations to gain a better understanding of innovation voucher effectiveness and the impact of program design. Second, as our data is cross-sectional and we employ propensity score matching methods, we are only able to control for observable differences in one period. While we find our results are generally robust against unobserved heterogeneity, future studies should strive to collect and use panel data, with before and after observations, to control for selection on (un)observables, and gain a better understanding of innovation voucher effectiveness (over time). Moreover, these datasets would enable the examination of the second-order impacts we theorised. Third, here and in the few past studies on innovation vouchers, only the effectiveness from the firm perspective is examined. All innovation vouchers

involve the participation of a knowledge provider, who likely obtains some benefit – for example, additional publications, new connections, learning et cetera. Omitting this perspective under-estimates the effectiveness of innovation vouchers, hence future research could examine whether (and how) knowledge providers benefit from innovation vouchers.

APPENDIX

Table 1: Dependent Variable Measures

Variables	Measures
Support for Innovation	<p>I encourage creativity</p> <p>I actively seek innovative ideas</p> <p>I try to assist in developing new ideas</p> <p>I want to provide adequate resources to innovative activities.</p>
Risk Tolerance	<p>I frequently venture into unknown territory on projects.</p> <p>I strongly encourage employees to take risks.</p> <p>I perceive innovation as too risky and resist it ®</p> <p>I am willing to stick my neck out and take risks.</p>
Willingness to Change	<p>All organisational structures become redundant in time and need to be revitalised.</p> <p>I often resist change ®</p> <p>I feel that change is generally beneficial</p> <p>I am open to change</p>
Attitude to External Knowledge	<p>I regularly use knowledge from external partners in innovative projects.</p> <p>The application of external knowledge to our innovation projects is as valuable as the application of knowledge generated internally.</p> <p>Knowledge from external sources significantly contributes to our innovative efforts.</p> <p>I have more trust in knowledge generated internally, than in knowledge generated externally.</p>

*® means reverse scored

Table 2: Descriptive Statistics

Variables	Treated		Control		T-Test
	Mean	Std. Dev	Mean	Std. Dev	
<i>Dependent Variables</i>					
Support for Innovation	4.61	0.50	4.23	0.78	***
Risk Tolerance	4.04	0.62	3.58	0.83	***
Willingness to Change	4.10	0.50	3.81	0.66	***
External Knowledge Use	3.93	0.63	3.47	0.74	***
<i>Independent Variables</i>					
Firm Age	10.69	16.33	12.57	14.20	
Firm Age Square	380.28	2223.11	359.29	1636.18	
Employment	5.28	11.49	7.03	23.75	
R&D Active	0.69	0.46	0.48	0.50	***
Human Capital	53.17	43.74	39.48	42.96	***
Export	0.32	0.47	0.22	0.41	***
High-Tech	0.05	0.22	0.10	0.30	**
Med-Tech	0.15	0.36	0.05	0.23	***
Low-Tech	0.15	0.36	0.12	0.33	
KIBS	0.43	0.49	0.23	0.42	***
Primary and Other	0.04	0.20	0.05	0.22	
NTBF	0.28	0.45	0.12	0.33	***
SM Education	2.27	0.74	2.01	0.83	***
SM Enterprise Tenure	2.40	1.10	2.73	1.16	***
SM Other Career Experience	3.02	1.37	2.77	1.31	**
SM Science, Engineering or Tech Background	0.49	0.50	0.30	0.46	***
SM Age	0.23	0.42	0.35	0.47	***

*** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.10$

Table 3: Probit Model Results

Variables	Coeff.	Std. Err.	Z
Firm Age	-0.004	0.010	-0.42
Firm Age Square	0.000	0.000	0.91
Employment	-0.005	0.003	-1.42
R&D Active	0.500***	0.142	3.51
Human Capital	0.000	0.001	0.55
Export	0.314**	0.144	2.18
High-Tech	-0.157	0.249	-0.63
Med-Tech	0.855***	0.231	3.70
Low-Tech	0.641***	0.184	3.47
KIBS	0.705***	0.164	4.29
Primary and Other	0.498*	0.273	1.83
NTBF	0.316	0.193	1.64
SM Education	0.131	0.082	1.60
SM Enterprise Tenure	-0.130*	0.072	-1.79
SM Other Career Experience	0.063	0.044	1.44
SM Science, Engineering or Tech Background	0.229*	0.124	1.84
SM Age	-0.184	0.132	-1.39
Constant	-0.932***	0.292	-3.19
Observations	562		
Log-Likelihood	-321.97		
Chi-square	131.38		
McFadden R2	0.1694		

*** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.10$

Table 4: Propensity Score Nearest Neighbour Matching Results

Variables	Observations		Treated (Max 5)	Control (Max 5)	Difference	AI Robust S.E.	Difference as %	Z
Support for Innovation	561	ATT	4.61	4.41	0.202***	0.063	4.04%	3.19
Risk Tolerance	561	ATT	4.04	3.73	0.307***	0.079	6.15%	3.86
Willingness to Change	561	ATT	4.11	3.95	0.157***	0.058	3.14%	2.67
External Knowledge	561	ATT	3.93	3.66	0.268***	0.072	5.36%	3.68

*** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.10$

Table 5: Robustness Check - Propensity Score Nearest Neighbour Matching Dummy Dependent Variables

Variables	Observations		Treated (Max 4)	Control (Max 4)	Difference	AI Robust S.E.	Z
Support for Innovation	561	ATT	3.80	3.57	0.236***	0.084	2.82
Risk Tolerance	561	ATT	3.04	2.47	0.572***	0.123	4.63
Willingness to Change	561	ATT	3.27	3.00	0.274**	0.115	2.37
External Knowledge	561	ATT	2.84	2.40	0.434***	0.146	2.96

*** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.10$

Table 6: Sensitivity Analysis for Influence of Unobserved Characteristics

	Outcome Effect¹⁸	Selection Effect¹⁹	ATT	S.E.
Support For Innovation				
No Cofounder			0.202	0.063
Neutral Cofounder	1.063	1.020	0.205	0.102
Strong Cofounder	4.181	6.476	0.101	0.135
Postgraduate	2.594	1.478	0.189	0.108
Risk Tolerance				
No Cofounder			0.307	0.079
Neutral Cofounder	1.077	1.023	0.237	0.120
Strong Cofounder	4.143	6.618	0.110	0.158
Postgraduate	1.982	1.473	0.223	0.126
Willingness to Change				
No Cofounder			0.157	0.058
Neutral Cofounder	1.058	1.017	0.156	0.091
Strong Cofounder	4.257	6.568	0.055	0.123
Postgraduate	1.803	1.500	0.148	0.097
External Knowledge				
No Cofounder	1.051	1.021	0.229	0.104
Neutral Cofounder	4.234	6.388	0.108	0.136
Strong Cofounder	2.119	1.454	0.215	0.108
Postgraduate	1.051	1.021	0.229	0.104

¹⁸ The outcome effects refer to the average odds ratio of the simulated variable occurring when the firm is not treated and the senior manager has an above median innovation-orientated attitude.

¹⁹ The selection effects refer to the average odds ratio for the firm receiving the treatment when the simulated variable occurs.

Figure 1: Density Distributions of Propensity Score Pre and Post Matching

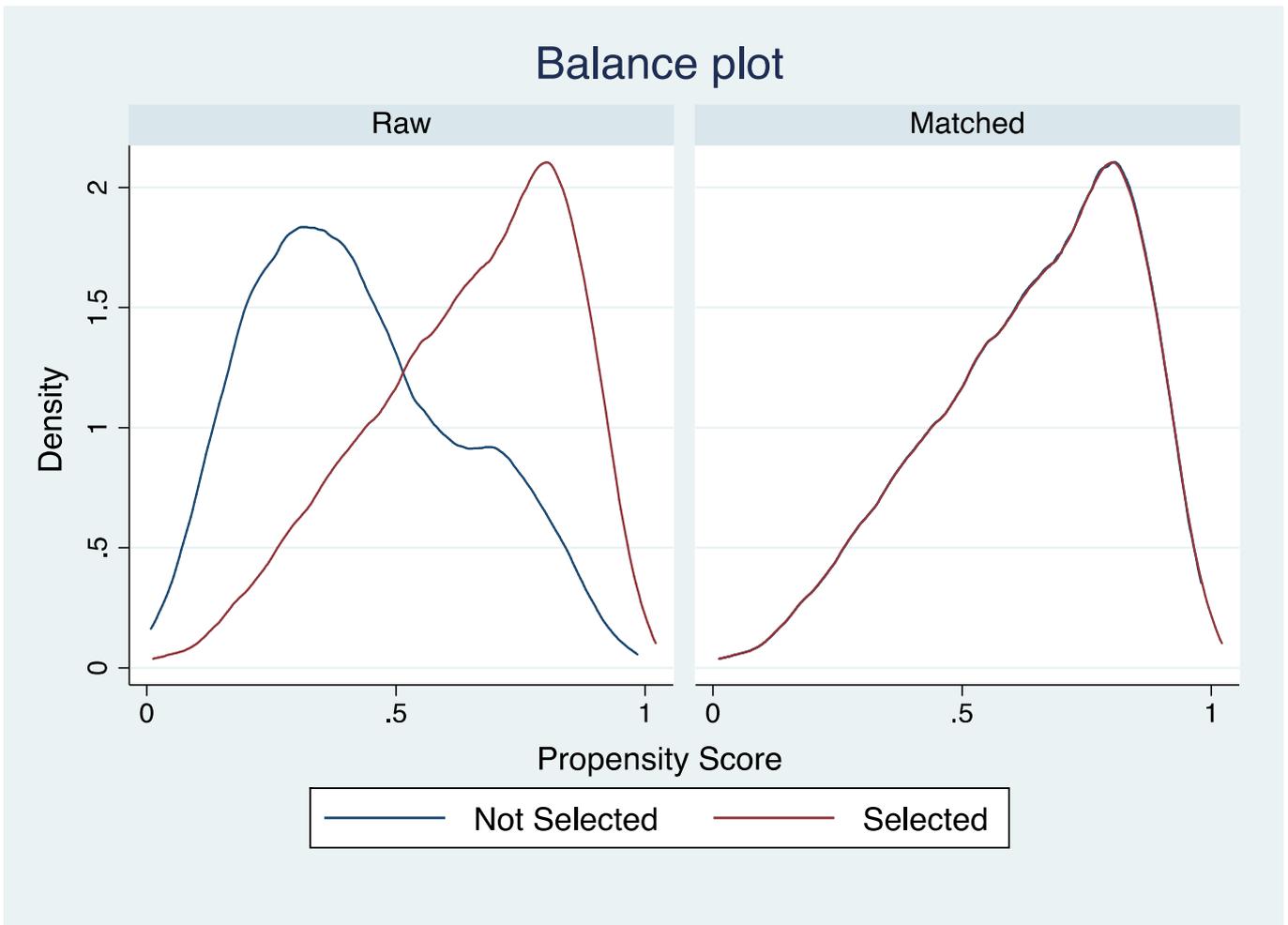
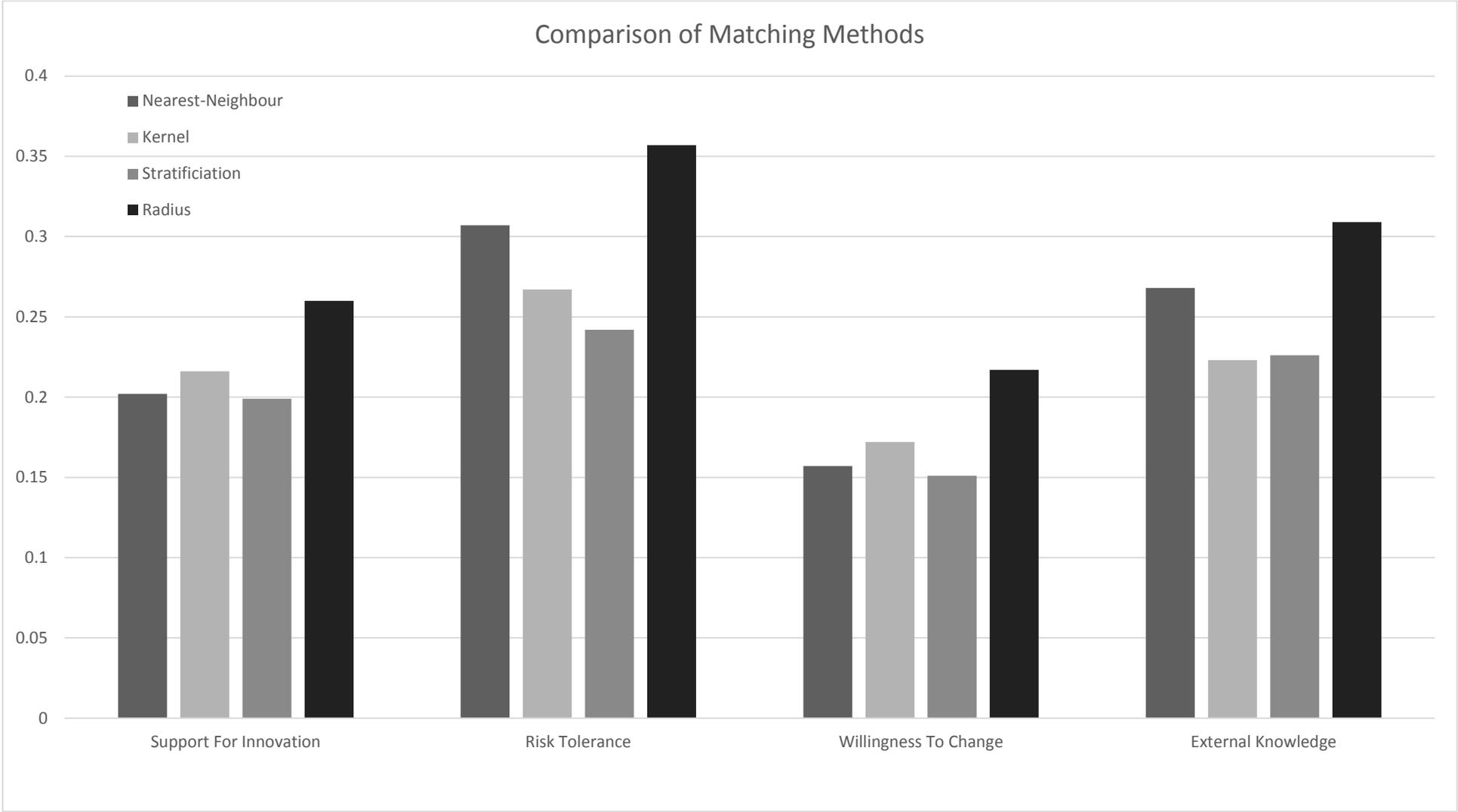


Figure 2: Robustness Check – Treatment Effect Estimations by Different Matching Approaches



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