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?Content to be sad? or ?runaway apprentice? ? The psychological contract and career agency of young scientists in the entrepreneurial university

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Abstract

This study examines employee agency in psychological contracts by exploring how young scientists proactively shape their careers in response to unmet expectations induced by academic entrepreneurialism. It uses the lens of social exchange to examine their relationships with the professors engaged in two types of activities: collaborative research characterized by diffuse/reciprocal exchange and commercial ventures, restricted/negotiated exchange. The comparison of the two categories illustrates how the enactment of particular types of agency is related to forms of exchange underlying individuals' psychological contracts which influence their agentic orientations and career adaptive behaviours. Those involved in collaborative research experienced a relational psychological contract and responded to unfulfilled promises by ?extended investment? in their current jobs. They use ?proxy agency? by enlisting the support of their professors. However, some become ?trapped? in perennial temporary employment and are ?content to be sad?. By contrast, those involved in commercialization experienced a transactional contract and assert ?personal agency? by crafting their own entrepreneurial careers. They are ?runaways? who seek autonomy. The evidence is based on interviews with 24 pre-tenured researchers and 16 professors from three leading UK universities. The study extends psychological contract theory by highlighting career agency and sheds new light on changing academic careers.

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‘Content to be sad’ or ‘runaway apprentice’? The psychological contract and career agency of young scientists in the entrepreneurial university

Introduction

In a period of rapid organizational change, career expectations are often disappointed. Psychological contract theory has much to say about employee reactions to unmet expectations or psychological contract breach (Morrison and Robinson, 1997; Robinson and Rousseau, 1994), however, most research has focused on the withdrawal of goodwill, such as reduced commitment, poor job performance and turnover (Zhao et al., 2007). The image of an employee depicted in the literature is one of passivity and dependency on organizational career arrangements, with limited scope for choice or career agency. While this pattern may be associated with jobs that give employees relatively little autonomy, the same cannot be said for those in professional knowledge work who often enjoy a high degree of work autonomy and dispose of considerable resources that provide scope for more proactive responses. Employee agency has been widely debated in career studies (Tams and Arthur, 2010) but overlooked in mainstream psychological contract theory.

This paper contributes to our understanding of employee agency in psychological contracts and how it manifests itself in career adaptive behaviours. It explores how young scientists have sought to re-craft their careers in response to unmet expectations caused by the transformation of academic careers induced by university entrepreneurialism. Academics are archetypal knowledge workers operating in a sector where pressures for greater organizational flexibility and growth of contingent work have profound implications for early career progression. In recent years, a growing number of early career researchers has been squeezed by increased supply and declining job opportunities (Harney et al., 2011; Dany and Mangematin, 2004). This has been exacerbated by the rise of the entrepreneurial university (Etzkowitz, 2003) which encourages use of large numbers of doctoral and postdoctoral researchers in temporary positions to support their professors’ external funding and industrial engagement activities (Bozeman and Corley, 2004; Slaughter et al., 2002). In the past, the majority of those who progressed to postdoctoral research could expect to obtain permanent posts after a few temporary contracts. However, the shortage of tenured posts due to ‘steady state science’ since the early 1990s (Ziman, 1994) has made it increasingly difficult for professors to reward the cooperative efforts of young scientists by offering them long-term academic posts. These trends are likely to have profound effects on the

psychological contracts of young scientists with many experiencing the frustration of unfulfilled expectations.

This study uses the lens of social exchange (Blau, 1964; Uehara, 1990) and psychological contract (Robinson et al., 1994; Rousseau, 1995) to examine the relationship between young scientists and professors, comparing those engaged in collaborative research and commercial ventures. The former represents diffuse exchange governed by reciprocity rules and the latter, restricted exchange governed by negotiated rules (Uehara, 1990). Drawing on agency theories (Bandura, 2001; Emirbayer and Mische, 1998; Sewell Jr, 1992), the study postulates that career agency varies in extent and form, and individuals may respond differently to unfulfilled expectations according to the relational context in which their psychological contracts evolve. It examines the psychological contracts of young scientists engaged in the two types of activities and explores how the varied relational and cognitive resources associated with them influence their agentic orientations and career adaptive behaviours.

The empirical evidence is based on individual interviews with academic scientists from three leading U.K. research universities. The interview sample of 40 includes doctoral students/post-docs (24) and their professors (16) of whom four-fifths were matched pairs. A novel finding is the divergent responses of young scientists to unmet expectations. Those involved in collaborative research experienced a relational psychological contract and responded by 'extended investment' in their current jobs. They use 'proxy agency' by engaging in a form of gift-giving exchange behaviour, investing heavily in their work in order to oblige their professors to reciprocate. We find that some become 'trapped' in perennial temporary employment but are '*content to be sad*' (interview quote). By contrast, those involved in commercialization experienced a transactional turn in their psychological contracts and sought independence by crafting their own entrepreneurial careers. They assert 'personal agency', using the relationships with their professors to build up the necessary knowledge and contacts in order to breakaway. They are '*runaways*' who seek autonomy¹.

Our study extends the psychological contract framework to incorporate career agency and account for the varied ways in which individuals react to unfulfilled expectations. It also sheds new light on the contemporary debate about the changing nature of academic careers. The entrepreneurial university may have strengthened the two-tiered career structure and limited the possibilities for upward mobility for many. However, it has also expanded the institutional

context in which scientific careers develop and offers scope for some to craft entrepreneurial careers.

The paper is structured as follows. The next section presents the conceptual framework guiding the study. Section three sets out the background and empirical context of the study. Section four describes the research methods and data analysis. Sections five and six present the empirical findings focussing on how young scientists' psychological contracts evolve over time and their divergent career adaptive behaviours: 'extended investment' vs. 'career crafting'. The paper concludes with theoretical and practical implications.

The conceptual framework

The psychological contract and unmet expectations

Rousseau (1989) defines the psychological contract as an individual's belief regarding the terms and conditions of reciprocal exchange agreement between themselves and the employer. It emerges when individuals believe that their employer has promised future benefits in exchange for their contribution. Social exchange theory posits that balance in exchange relationships is expected (Blau, 1964) and therefore unfulfilled promises made by employers can adversely affect employees' attitudes and behaviours (Robinson et al., 1994). The notion of psychological contract breach is commonly used to describe employees' beliefs that their employer has failed to fulfil its promised obligations and the resulting negative reactions (Morrison and Robinson, 1997). A large body of research has shown that when promissory expectations are unfulfilled, employees are likely to experience negative attitudes (e.g. reduced organisational commitment) and work behaviours (e.g. poor performance, absenteeism and turnover) (see meta-analysis Zhao et al., 2007). It stresses employee disengagement and focuses predominately on organizationally relevant outcomes. There has been scant research on individuals' career adaptive behaviours. One notable exception is the work of Sturges et al. (2010) which examines how psychological contract fulfilment or breach in terms of perceived organizational support (POS) and leader-member exchange (LMX) affects employees' career self-management behaviour. According to the authors, high levels of POS and LMX encourage employees to engage in internal career self-management whereas the absence of which is associated with external career self-management. Although this work shows the link between the psychological contract and career self-

management, it stresses organizational commitment as a mediating factor. As such, employee career behaviour is viewed as a form of reciprocation to the action of employers or supervisors, and not self-directed.

The psychological contract literature is predominately organization-focused and overlooks individual proactivity in career shaping. This is somewhat surprising given that the psychological contract has been regarded as one of the most useful concepts for understanding contemporary employment relationships where the breakdown of the ‘old deal’ based on stable organizational careers is seen as giving way to a ‘new deal’ characterised by greater reliance on individual initiative (Briscoe et al., 2012; De Vos and Soens, 2008). The notion of ‘boundaryless careers’ (Arthur and Rousseau, 1996), for example, highlights a wider range of career forms beyond a single organization, the scope for choice and proactive role of individuals in managing their own careers. Further, Briscoe et al (2012) argue that employees’ self-directed protean attitudes may motivate them to engage in active coping strategies in uncertain employment contexts. One can expect greater use of career agency in professional knowledge work wherein employees have a high degree of work autonomy and are more likely to assert their preferences.

Three dimensions of career agency: objective, subjective and projective

Extant literature on career agency has focused predominately on how individual action and social structure jointly shape careers (Duberley et al., 2006; Dany et al., 2011). Our perspective goes beyond this duality argument to explain how and why employee agency varies in extent and form, and to illuminate the social psychological processes that influence the enactment of career agency. Building on sociological (Emirbayer and Mische, 1998; Sewell Jr, 1992) and socio-cognitive theories of agency (Bandura, 2001), this study conceptualizes career agency as comprising three constitutive elements: objective (socio-relational), subjective (socio-cognitive) and projective (temporal orientation). It postulates that individual agency is relationally and temporally embedded, and that socially patterned selves (e.g. motivations and preferences) and their temporal orientations interact within relational contexts to shape agentic orientations and behaviours.

From an ‘objective’ perspective, agency is about the capacity to exert some control over social relations in which one is enmeshed (Sewell Jr, 1992). In career terms, it refers to

individuals' ability to mobilise the necessary resources for career development, and to eliminate environmental constraints to realise their career goals. The notion of career self-management (King, 2004) emphasises the control-producing responses of employees to career threats. It involves the execution of various types of control behaviours such as influencing the decisions of key gatekeepers and positioning oneself for advancement through investment in human capital and network development. In a similar vein, the concept of 'job crafting' (Wrzesniewski and Dutton, 2001) emphasises the proactive role of employees in changing the task and relational boundaries of their work which, in turn, shape their own role requirements and career trajectories.

Agency also entails a 'subjective' component because motivations and preferences of individuals influence action and outcome. Bandura's (2001) socio-cognitive theory of agency emphasises the self-directedness of action driven by agents' motivation and efficacy beliefs. Research which informs our understanding of career agency from a subjective perspective points to the influence of individuals' self-defined goals and sense of identities on the way they enact their careers and respond to career barriers (Briscoe et al., 2012). By linking agency to identity and self-actualization, the subjective perspective of career agency accords employees a much higher degree of psychological autonomy than is often assumed in psychological contract theory.

Agency is also temporally embedded and has a 'projective' dimension in that imagining possibilities for future action may regulate and motivate current behaviour. Emirbayer and Mische (1998: 963) conceptualize human agency 'as a temporally embedded process of social engagement, informed by the past, but also oriented toward the future and toward the present'. While they assert that actors are always living simultaneously in the past, future and present, it is possible to speak of one element being predominant. The temporal perspective highlights the projective capacity of human agency which can powerfully influence individuals' ability to make choices at turning points. Sullivan and Arthur (2006), for example, contend that individuals' 'psychological mobility', defined as the capacity to move on, may influence their response to career interruptions. The notion of 'future work selves' (Strauss et al., 2012) suggests that actors' beliefs about future possibilities can provide motivational resources for current agentic choices.

Agency can be expressed in diverse empirical forms: it can be more, or less socially mediated or self-referenced and it may have a stronger focus on the present or future. Bandura (2001) distinguishes between 'personal' and 'proxy' agency: the former is rooted in people's

efficacy beliefs and aspirational pursuits whereas the latter relies on others to act on one's behalf to secure desired outcomes. These two modes differ in their interaction with structural conditions and engagement with future possibilities. Actors who display personal agency regard structural conditions as resources and seek to exploit them for self-development and the creation of new possibilities. In contrast, proxy agency involves the strategy of influencing those who control the structures to secure the needed resources. Unlike personal agency which operates more directly through individuals' motivational and choice processes, proxy agency relies on social efficacy for enlisting the mediative efforts of others. It may result in increased dependency and diminish self-efficacy to engage imaginatively with future opportunities.

Social exchange, the psychological contract and career agency

This study extends the psychological contract framework by incorporating career agency for understanding variation in employee responses to unmet expectations. At present, the main sources of variation are seen as contingent on the quality of exchange relationships. Typically, psychological contract theory concerns breach in relation to relational or transactional exchange. It is commonly argued that relational exchange allows actors to be more trusting of one another and encourages cooperation whereas transactional exchange tends to be more quid-pro-quo and is prone to tension (Rousseau, 1995), and therefore unmet expectations will elicit different reactions from employees involved in the two types of exchange. For example, Morrison and Robinson (1997) argue that employees are more likely to perceive unmet expectations as psychological contract breach and respond more intensely and negatively when the exchange is transactional rather than relational.

The agentic perspective argues that types of exchange not only influence individuals' perception of unmet expectations, but may also endow them with varied relational and cognitive resources for the enactment of agency. Uehara's (1990) dual exchange theory links forms of social exchange with the dynamics of social support and exchangers' resource mobilization strategies for problem adaptation. It distinguishes two types of social exchange: 'diffuse' and 'restricted' which vary in their norms and degree of relational embeddedness. Diffuse exchange is governed by reciprocity norms and embedded in dense networks of social relationships in which particularistic and symbolic resources (e.g. emotional support and status) are exchanged in

addition to tangible resources (e.g. money and labour). It engenders a high degree of solidarity and individuals are more likely to mobilize relational resources for problem solving. By contrast, restricted exchange is more dyadically-based and involves specific form of relationships in which tangible resources are exchanged in a negotiated fashion. It is characterized by a higher degree of accountability in each partner's behaviour and partners tend to adopt a more guarded approach in their transaction. Individuals in restricted exchange do not enjoy the same kind of social support as in the case of diffuse exchangers. They tend to be more self-reliant and may seek to draw on personal resources for problem adaptation. Accordingly, we expect individuals involved in different exchange relationships to develop different agentic orientations: diffuse exchange may encourage proxy agency whereas restricted exchange may foster personal agency.

Forms of exchange, notably supervisory and mentoring relationships can also affect career agency through socialization and learning which provide individuals with cognitive resources and competences for career development. The psychological contract literature stresses the influence of the quality of supervisory support on organizational commitment which mediates the effects of psychological contract breach on individuals' response actions (Sturges et al., 2010; Zagenczyk et al., 2009). The agentic perspective argues that individuals' career goals and professional self-identity can also powerfully influence their career behaviours. Mentoring exchange can impact on individuals' career orientations and identity construction through role-modelling and socialization. Gibson (2004) distinguishes 'global' and 'specific' role modelling which differ in the extent to which individuals acquire a wide or narrow set of traits associated with a role model. Global role modelling may result in fuller socialization and individuals may develop a custodian role orientation and job commitment whereas specific role modelling may result in partial socialization and individuals may develop more varied career orientations. Whether individuals engage in internally- or externally-oriented career self-management may reflect their career preferences, and not simply organizational commitment.

The psychological contract literature has focused predominately on how employees' perception of breaches of past promises made by employers affects their attitudes and behaviours. The agentic perspective directs attention to the effect of individual's future time horizon and projective capacity on their career behaviours. The psychological contract is not made once and for all, but rather it evolves over time. Its direction of change and how individuals react to unfulfilled promises are influenced not only by their assessment of past or

present experience, but the anticipation of future benefits (Ng and Feldman, 2012). Some employer obligations (e.g. career development and job security) may be on-going and may not be perceived by employees as fully discharged at any particular point in time (Coyle-Shapiro and Kessler, 2002). Individuals may reciprocate future benefits as a way of creating a positive imbalance in the exchange to ensure the realization of future benefits. However, the extent to which employer obligations represent anticipated future benefits is contingent on employees' career stages and their perceived future prospects. Individuals at early or transitional career stages are more likely to reciprocate anticipated future fulfilment of promises than those in late careers. Moreover, their capacity to envision alternative options may also influence their career behaviours.

Individuals are capable of exercising agency in defining their roles and obligations rather than simply reciprocating the exchanged behaviours of their employers. The conceptual framework conceives individuals' psychological contracts and career adaptive behaviours as situated within the relational and temporal contexts which create variability in agentic orientations and capacities, and hence different reactions to unmet expectations.

The empirical study

Young scientists in the entrepreneurial university

University scientists serve as an 'extreme case' (Eisenhardt, 1989) for examining career agency in its three constituent forms. They enjoy great autonomy in their work and possess considerable knowledge resources which enable them to assert control over their work relationships and environments. This is so even for junior scientists. One can expect 'objective' career agency to be quite visibly played out in their work. Moreover, scientific researchers often display strong commitment to their work and anchor their self-identity in their profession. For many, science is a 'vocation' (Weber, 1958) imbued with personal and social meaning. They are likely to be motivated to craft their jobs and careers in ways that fit their professional goals, and hence 'subjective' agency can also be central to their career actions. We focus on early career scientists in order to examine their future orientation and shed light on the 'projective' dimension of career agency. Academic careers in natural sciences are marked by distinct stages and place

great emphasis on the attainment of benchmarks at each stage. A typical career path involves obtaining a doctoral qualification followed by a postdoctoral phase which serves as a critical transition to standard academic employment. Actors at crucial turning points in their life course tend to exert greater agentic effort than at other points of time (Hitlin and Elder, 2007). The choice of young scientists as the subject of our investigation enables us to examine how they enact career agency at critical junctures.

The study examines young scientists in the entrepreneurial university where growing pressures for external funding and research commercialization has dramatically reshaped academic work and the relationship between junior and senior scientists. In traditional scientific career, the interface between young scientists and their professors is governed by the norm of reciprocity embedded in the scientific community. Professors, as teachers, mentors and collaborators, play a pivotal role shaping the skills and early careers of junior scientists (Long and McGinnis, 1985). Young scientists are ‘apprentice-learners’ who provide research assistance in return for mentoring and career support. The arrival of the entrepreneurial university with its emphasis on industrial engagement and the dual role of professors as scientist-entrepreneurs is altering these relationships. Professors who are heavily engaged in industrial projects often need a large army of doctoral students and postdoctoral researchers to provide support (Bozeman and Corley, 2004). These young scientists, with their short-tenure and complementary research skills, provide a flexible and highly trained workforce for the academic laboratories. The entrepreneurial university may transform young scientists from ‘apprentice learners’ into ‘research workers’ or even ‘business partners’ in commercial ventures. Intense industrial engagement may also restrict scientific development, diminishing their chances of permanent academic positions. Many are likely to find their academic career expectations unfulfilled and may seek to re-craft their careers.

This context provides an excellent opportunity for studying the changing dynamics of psychological contracts and career agency.

Modes of industrial engagement and exchange relationships: collaborative vs. commercial

To examine how different types of exchange influence young scientists’ psychological contracts and agentic behaviours, we distinguish two types of industrial engagement: collaborative

research and commercial ventures. They entail different exchange relationships between professors and young scientists, and provide different socialization and learning opportunities to the latter. Collaborative research is an open-science channel of industrial engagement governed by an established academic framework and scientific norms of exchange. It is a relational-based, diffuse exchange relationship which builds on the flow of knowledge resources between the parties involved. In most cases, private firms engage in collaborative research with academics in order to gain access to new knowledge. Academics are usually given a high degree of autonomy in conducting the research. Involvement of young scientists will not necessarily undermine the teaching/mentoring role of professors (Bozeman and Corley 2004). Indeed, the provision of funding resources may reinforce the mentoring exchange and generate a cooperative dynamic in the relationship.

Commercial research, by contrast, is governed by the norm of proprietary science with the aim of generating specific outputs which can be appropriated for financial gain (e.g. patenting and spin-off company formation). Industrial sponsors often exert a direct influence on the research conducted and may restrict the opportunities for open dissemination and publication. The relationship is governed by negotiated rules and it involves the flow of financial resources in addition to knowledge. Commercial engagement adds a transactional element to the master-apprentice relationship between professors and young scientists. It also entails more complex role relationships between them (MacDonald and Williams-Jones, 2009). The role of the professor as business person/entrepreneur may conflict with that of teacher/mentor. The interface in commercial ventures is more dyadic and occurs at the boundary between science and business. Commercial engagement may create restricted exchange and undermine trust. It also exposes young scientists to greater scientific career risks, while also providing opportunities for entrepreneurial learning (Azoulay et al., 2009).

These two types of activities illustrate the different norms and structures governing the exchange between young scientists and professors. Collaborative research represents diffuse exchange whereas commercial engagement entails restricted exchange.

Mutual obligations and the psychological contract: from training to work

The psychological contract framework can be readily applied to the relationship between young scientists and professors where research collaboration builds on an exchange based on a shared understanding of mutual obligations (Wade-Benzoni et al., 2006). Researchers have emphasised that psychological contracts are held by employees (Morrison and Robinson, 1997). In this paper, the concept is employed to examine the perceptions and expectations of young scientists regarding training and career development in their relationships with the professors. It adopts the widely used distinction between 'relational' and 'transactional' contracts (Rousseau, 1995).

We examine young scientists at different stages of their careers: doctoral students, junior and senior postdoctoral researchers. The first two categories are primarily student/learners in training whereas the last category refers to more experienced researchers in full-time employment as contract researchers. Although the transition from training to employment is gradual, the psychological contract governing the two differs. In a training context, the mutual obligations between professors and young researchers are loosely specified in an open, mentoring exchange. Doctoral students and junior researchers are at the beginning of their research careers and may not have clear career projects in mind. For these young scientists, the acquisition of knowledge and skills that are useful to future careers are central to their psychological contracts. Moreover, given the imbalance of knowledge and power between the two parties, the expectations for exchange symmetry may also be low. The psychological contract is a nascent one, developing but not fully formed.

In an employment relationship, the interface between the two parties builds on a more developed psychological contract. Professors, as principal investigators and laboratory managers, are the primary contract makers responsible for the performance and career development of postdocs. The postdoc period is a crucial transitional phase during which young scientists are expected to gain independence to become fully-fledged researchers. Postdocs usually aspire to an academic career and see the position as a bridge towards tenured academic posts. They are intensely dependent on their professors for career support in return for their cooperative efforts. The academic career promise looms large in their psychological contracts. Prolonged industrial engagement may further increase mutual obligations between the two parties and strengthen young scientists' psychological contracts. However, it can also make the

fulfilment of the perceived career promise more difficult because industrial engagement, notably commercial research, may restrict scientific development needed to obtain tenured positions. Many are likely to find their academic career expectations unfulfilled.

The empirical study examines the shift in the young scientists' psychological contracts as they make the transition from student-learners in training to postdoctoral researchers in employment and their career adaptive behaviours. We expect young scientists engaged in collaborative research and commercialization to respond differently to unmet expectations due to the different relational contexts in which their psychological contracts evolve, and the varied resource opportunities and constraints associated with the two types of activities.

Research methods and data

Data collection

Primary data collection involved semi-structured interviews with 40 academics in natural sciences (biological, computer/engineering and physical sciences) from three major UK research universities where academic entrepreneurialism has been actively pursued. The sample consists of 24 doctoral students/postdocs and 16 professors of whom 13 were supervisors of these young scientists. Given that the study concerns exchange relationships, we conducted individual interviews where possible, with matched pairs of professors-students/researchers. In some cases, we interviewed more than one researcher linked to the same professor. Out of the 24 students/postdocs it was possible to interview the corresponding professors in 20 cases and in the other 4 cases, the professors were not available. The professors, who all had extensive industrial links, were identified mainly through searches on the universities' websites. The doctoral students and postdocs were identified either from the interviews with the professors or through web searches. A snowball method was also used to obtain additional names. Among the 24 young scientists interviewed, 15 were involved in collaborative research and 9 were engaged in commercial projects. These two groups gave us two distinct windows through which to observe the different exchange relationships with their professors.

The young scientists studied consists of 13 doctoral students/junior postdocs (in their first or second employment contracts) and 11 senior postdocs who had been working as contract

researchers for the duration ranging from 10 to 23 years. The sample composition introduces a temporal dimension to the data which is needed for understanding how accumulated experience affects psychological contracts. The time perspective was also facilitated by using the retrospective accounts of the individuals' career histories, and subsequent tracking of their career moves based on web searches. The interviews were conducted during 2006-07 and we tracked the career moves/destinations of the young scientists up until 2012.

Although we modified the interview questions during the course of data collection to take advantage of emerging themes, each interview covered a set of common questions on the following areas: training experience and career history, work roles and relationships, involvement in their professors' research and industrial activities, learning experience, work motivation, career expectations and preferences (before and after doctoral training, and at the time of the interview), perceived mentoring and career support; perceived future prospects and actions taken to realize career goals. For the interviews with the professors we asked about their industrial activities, funding sponsorships for students/ postdocs, the role of these young scientists in their laboratories, and evaluation of the influence of industrial engagement on their role as mentors/supervisors. Each interview lasted for about 60-90 minutes and all were recorded and transcribed verbatim.

Table 1 shows the profiles of the 24 students/postdocs and their corresponding professors.

Table 1 about here

Data analysis

We went through three main stages of data analysis, using an iterative process by moving back and forth between the data and concepts (Eisenhardt, 1989). In the first stage, we used open coding to develop first order codes and provisional categories. We used a coding summary sheet for each respondent to record their views and responses. It became clear early on that there were significant differences in the experiences of young scientists: those engaged in collaborative research generally reported positive relationships with their professors whereas those involved in commercial activities experienced tension. It was also notable that the differences became more apparent as they progressed from students/junior postdocs to senior postdocs.

In the second stage, we conducted more systematic comparisons of the two groups by returning to the transcriptions and also the literature on psychological contracts and career agency. In analysing their relationships with the professors, where possible, we adopted a dyadic perspective by incorporating the views of the professors. We extracted all the interview quotes relating to the attitudes and feelings of both parties towards each other, and any incidents or events that appeared to have influenced their perceptions of the relationships. We inferred the properties of the exchange relationships based on the assessments of both parties, and those of the psychological contracts, based on the perceptions of the young scientists. This analysis allowed us to detect the variation in the psychological contracts and career behaviours between the young scientists involved in the two types of exchange. Two distinct patterns emerged: those involved in collaborative research continued to invest in their relationships with the professors in the face of uncertainty whereas those engaged in commercial ventures showed a desire to exit the relationship and proactively sought career opportunities outside academia. At this point, we returned to the literature and looked for relevant concepts to capture the divergent career behaviours. We used the term ‘extended investment’ (van Dam, 2005) to describe the former and ‘career crafting’ (Wrzesniewski and Dutton, 2001) to reflect the latter. We returned to the data to identify the key factors and relational processes that were connected to these two distinct patterns of agentic behaviour. We extracted the relevant evidence and quotes illustrating career agency and matched them with the three constituent elements: objective, subjective and projective.

In the final stage, through writing draft versions and revisiting the literature, we refined our understanding of the connections between the conceptual categories and developed a conceptual model to explain the relationships between forms of exchange, psychological contracts and career agency. The model suggests that diffuse exchange engenders a relational psychological contract and encourages proxy agency; whereas restricted exchange creates a transactional psychological contract and induces personal agency. Once we had identified this pattern, we re-examined the data to check for the accuracy and consistency of our interpretation.

In what follows, we present the two main findings. First, we discuss the divergent patterns of exchange relationships and show how the psychological contracts of young scientists evolve over time. Second, we look at how the two groups enact career agency and respond to unmet expectations by taking two different courses of action: ‘extended investment’ vs. ‘career crafting’.

Young scientists in collaborative research and commercial engagement: relationships with professors and the psychological contract

For analytical purposes, we classify the young scientists into four categories based on the type of activity (collaborative vs. commercial) and career stage (students/junior postdocs vs. senior postdocs) (Figure 1). The *'learner apprentices'* (8 cases) are the students/junior postdocs involved in collaborative research as part of their scientific training. The *'extended apprentices'* (7 cases) are the senior postdocs involved in collaborative research well beyond their initial training, often working with the same professors for over 10 years. The *'exploited apprentices'* (5 cases) are the students/junior postdocs conducting research in their professors' commercial laboratories which may or may not be directly related to their scientific training. The term 'exploited' is used to denote their vulnerability to intellectual and labour exploitation commonly associated with research commercialization (Slaughter et al., 2002). The *'runaway apprentices'* (4 cases) refer to the senior postdocs who had longstanding involvement in commercial activities but experienced considerable strain and subsequently sought to break away from their professors.

The analysis shows that those engaged in collaborative research held a 'nascent' relational psychological contract while they were 'learner apprentices' which developed over time into a 'strong' one experienced by the 'extended apprentices' who continued to cooperate with their professors in the face of career uncertainty. By contrast, the 'exploited apprentice' involved in commercial activities showed an emerging quid-pro-quo mentality; the transactional turn in their psychological contracts became more apparent overtime as some became 'runaways' who sought independence.

Figure one about here

From 'learner' to 'extended' apprentice: diffuse exchange and relational psychological contract

The relationship between the learner apprentices and their professors is close to the traditional 'master-apprentice' model of reciprocal exchange where flows of knowledge, provision of funding and socio-emotional support create a social bond between them. The interviews suggest that professors with extensive industrial links were often regarded as 'strong mentors' by their

students/researchers. Their laboratories were usually well-funded and they were in a position to provide collaborative opportunities to the learner apprentices who reported positive learning experiences and mentoring support. For example, a recent doctoral graduate described his professor as ‘very supportive and at the same time honest and guiding...’ (case 5). Another saw his professor’s reputation and contacts as important assets for his future career:

‘I think Prof X is a very effective academic... He has been extremely good at producing opportunities for me, first of all he has been very good at getting me the money to do this PhD. And he has got me involved with this project work... *who knows he might create more opportunities for me in the future in terms of helping me to secure a permanent position on my PhD*’ (case 3; emphasis added).

While the ‘learner apprentices’ are the dependent partners, they are not merely passive recipients of mentoring support. They provide research assistance in return and help networking with firms. One of the professors (D) described the links between his doctoral students and industrial networks as a kind of ‘food chain’ because many of his industrial contacts were his former students. Another stressed the importance of having ‘good relations’ with his students/researchers and getting them ‘good jobs’ for the benefit of future collaboration (Professor B). Thus, in the truest sense of an exchange relationship, both parties are dependent on each other for valued resources and provide mutual support. This anticipation of future contributions and fulfilment of obligations building on the norm of reciprocity is indicative of a relational psychological contract.

For those who aspired to an academic career and continued as postdocs beyond the transitional phase, the relationship with their professors evolved from reciprocal dependence to reciprocal inter-dependence as they took on more laboratory duties. The seven extended apprentices interviewed had been involved in long-standing collaborative research with their professors and reported having trusting relationships. Over the years, the scope of their responsibility expanded from scientific laboratory work to cover a wide range of technical (e.g. grant writing and supervision of doctoral students) and non-technical support tasks (e.g. laboratory administration). They were compliant and willing to go an extra-mile to help their professors and worked flexibly across different projects in return for collaborative opportunities

and career support. For example, two who were publicly funded quite happily provided ‘free labour’ to work on their professors’ industrial projects. One stressed the ‘symbiotic relationship’ with his professor:

‘I realised that, you know, he would be instrumental in allowing me that chance to develop so I’ve never felt restricted in any of my research whilst I’ve been doing it... I have a commitment to make sure I deliver on what we need to do, you know. And to be absolutely honest you’re often, hopefully, deliver far more than you’re asked to do’ (case 15).

Another described himself as the ‘pseudo principal investigator’. He wrote the proposals, supervised the doctoral students and wrote the reports while the professor remained as the formal principal investigator. He reckoned that this was ‘quite good training because hopefully in the not too distant future I’ll be in a position of my own...’ (case 14).

The professors also recognised the value of these experienced postdocs and had strong incentives to retain them. The following remark is illustrative: ‘They know the work and they know the system. They are experts. And the temptation is to try and retain them’ (Professor H). Although some expressed concern about the lack of long-term career prospects for the postdocs, many also felt obliged to get more grants to maintain the staff in their labs. In line with Blau’s (1964) social exchange theory, the evidence suggests that both parties strived to create a positive balance in the exchange by engaging in a repetitive cycle of conferring benefits on each other. This leads to increased mutual dependency over time and further strengthens the extended apprentices’ psychological contracts. One, for example, commented on the mutuality of the relationship: ‘I was happy to stay and they were keen to keep me so...’ (case 15). Another said, ‘He wouldn’t look after me if I wasn’t worth being looked after. So it is a mutual thing...’ (case 20). The professor (A) who employed this researcher described him as ‘absolutely invaluable’.

However, the extended apprentices expressed pessimism about the possibility of securing tenure, unlike the optimistic learner apprentices. Several pointed out that the short-duration of employment contracts and fragmented nature of research had made it difficult for them to build up their own research profiles. Some felt that prolonged postdoctoral employment had significantly reduced their chance of obtaining tenured positions and closed alternative options. A sense of insecurity and disappointment permeated the interviews. One lamented: ‘... there are

no guarantees, each time you keep wondering why you're doing it because of that uncertainty, so I think I am getting too old to carry on being somebody else's research postdoc...' (case 15). This sentiment is echoed by another: 'I am not exactly sure how the future is going to go...' (case 14). Some in their late careers concluded that they were unlikely to realize their intended career goals but took comfort from being able to remain in academia (cases 16, 17 and 19).

The extended apprentices appear to have become trapped in perennial temporary employment. However, they remained committed to an academic career and their intrinsic interest in scientific research did not seem to have diminished over time. Many reported high job satisfaction. Case 14 quoted above said, 'I love my job. I enjoy being here and I think it is a good lab'. Case 15 expressed his commitment to the university and affective regard for his professor: 'I'd be happy to commit my sort of medium term to University X ...because I'm excited by the work that I do, you know professor H is a great colleague, a great collaborator...'. These postdocs have clearly developed strong commitment to their jobs and socio-emotional ties with their professors. Their work commitment and perceived continuity of the relationships are indicative of a strong relational psychological contract.

From 'exploited' to 'runaway' apprentice: restricted exchange and transactional psychological contract

Those engaged in commercial activities reported more tension-ridden relationships. Among the five exploited apprentices interviewed, two were doctoral students part-funded by their professors' spin-off companies (cases 9 and 10). Others were paid wages as contract researchers (cases 12, 13) to conduct relevant research for their professors' commercial projects. One publicly funded junior postdoc (case 11) worked alongside other privately funded researchers but without any additional compensation. In all but one of the cases, the industrial sponsors were the professors themselves who had dual roles as teachers/mentors and managers/business entrepreneurs.

The ambiguous boundary between 'academic' and 'commercial' research generated conflicting obligations of various kinds for the professors. One commented on the complex role relationships with his student with whom he had co-founded a company: 'There was a time in which he was both my Co-Director and an employee and a student, so I had a relationship with

him at all of those levels and had to be very careful about making quite sure that that was dealt with appropriately...’ (Professor C). Others felt the overlap between academic and commercial research was convenient for flexible utilisation of student researchers. For example, one professor who had employed a doctoral student to provide part-time technical support in his company, joked about the fact that the amount of time the student could be expected to spend on company activities could be ‘anything between 0-100%’ because of the co-location of the two activities.

The interviews reveal ample evidence of what might be considered as ‘labour’ and ‘intellectual’ exploitation of junior researchers. The exploited apprentices reported excessively long working hours and having to perform a wide range of support tasks related to their professors’ commercial projects in addition to laboratory work. One expressed his discontent: ‘I worked incredibly long hours and I used to run all the computers for them... I wasn’t paid to do that at all’(case 13). The classic problem of publication restriction was reported by all the interviewees who could not freely disseminate their research results until the patents were issued. None of them had a share of patent ownership generated from the research. Although patent ownership did not appear to be a major issue for them, they were aware of the potential financial returns based on the collective research outputs. One junior postdoc (case 11), for example, talked about the ‘dollars’ that the professors were getting and was adamant that she was not offered any company shares despite the ‘extra work’ that she had to do for the company. One doctoral student, who co-founded a company with his doctoral supervisor and another professor, complained that the distribution of the company shares did not fairly reflect his contribution:

‘Now, as it turns out for years this equity style does not reflect equal involvement with the company. Me, I am doing almost all of the work. Professor C contributed a little bit but Professor Y was so busy with his other interests that he had time to contribute with nothing. So I wouldn’t say that the structure is very equitable anymore...’ (case 9).

Perceived unequal exchange may prompt the development of a more vigilant and transactional attitude (Morrison and Robinson, 1997). There is evidence of a *quid pro quo* mentality developing among the exploited apprentices. The aforementioned doctoral student (case 9), for example, negotiated for the position of ‘technical director’ in the co-founded company in return

for overseeing technological matters. The junior postdoc (case 11), also quoted above, subtly voiced her discontent by pointing out to the professors that it was not within her contractual terms to work for the spin-off company. These incidents suggest the tension lurking within the cooperative relationship. However, in an unequal dependent relationship, the weaker actors cannot afford to adopt too tough a stance. The ‘exploited apprentices’ may display occasional discontent but were mindful to avoid overt conflict. Moreover, it also appears that the perceived unfair exchange was offset by the commercial learning opportunities. For example, the same student (case 9) who complained about inequity in share distribution emphasised his positive learning experience and believed that the commercial expertise and contacts acquired would be instrumental for his future career: ‘The experience and contacts are worth more in the long term. You know as soon as you’re introduced to contacts, they are your contacts, you can then use them to your own career, right’.

However, the senior postdocs in this category were far less upbeat about their experience. There is clear evidence of a transactional turn in their psychological contracts as they accumulated experience and as conflicts over fairness of exchange frequently occurred. The interviews reveal three factors underlying this shift. The first is that they had become more ‘powerful’ employees and sought greater recognition for their contributions as they acquired technical expertise and entrepreneurial acumen. The three postdocs who remained in the relationships at the time of interview believed that their contributions to the work of their professors far outweighed the benefits that they had received. One of the postdocs expressed his anger and frustration over the unequal exchange:

‘You know he has benefited more from me than I have from him, Definitely... Well he has got two strands to his research group, bio responsive polymers and everything else, and the bio responsive polymers count for over half of his research but done by me. And one of the reasons that I was looking to get out of university... I mean this is true I would say of every post doc that they have been undervalued, under appreciated, certainly underpaid... if you are not very careful about it then you end up losing out...’ (case 21).

Another talked about the competitive tension in the relationship with his professor as he sought a more equal partnership:

‘I think he had a vision of me as being somebody whose role was to provide him with support. And to begin with that was fine, because that was what I did... But I got to the point where I wanted to stand on my own two feet...to have my own networks and grant writing, and he found that very, very difficult... He wanted to keep me as a support and I wanted to build myself up and build my own pyramid’ (case 22).

A second factor which triggers an instrumental turn in the relationship is the frequency of disputes over the share of financial rewards. For example, case 21 whose relationship with his professors was clearly under great strain, described his professor as ‘*a user*’ and talked about how he was ‘*ripped off*’ by him over the payment for the joint consultancy work which led to the dramatic deterioration of their relationship.

Finally, the realisation that the academic career path might be closed to them further fuels the tension. Commercial engagement can easily jeopardize the academic career of young scientists by diverting their time away from scientific research and also dampen peer learning. Several reported tension in the laboratory and isolation from their colleagues. Overtime, these postdocs perceived continued association with their professors’ commercial activities to incur high opportunity and investment costs, and sought to redefine their roles. Having worked hard on their professors’ projects and compromised their own research, the realisation that their contributions might not be rewarded in career terms aroused feelings of injustice and betrayal: ‘There has been very little interest in this department in terms of advancing my career. In fact there is none. They have actively blocked it...’ (case 21). This quote is indicative of the emotion of anger and outrage associated with psychological contract violation (Robinson and Rousseau 2004).

The transactional turn in their psychological contracts ultimately triggers their desire to exit the relationship. At the time of the study, one postdoc had gained independence by obtaining a five-year personal fellowship (case 24), and the three who remained in the relationships were planning their ‘escape routes’. One declared that he no longer wanted an academic career and channelled his effort into the spin-off company as an avenue for future employment (case 21). Another actively pursued consultancy to build his ‘portfolio’ career (case 22). The third postdoc (case 23) negotiated a ‘special deal’ with his department enabling him to be on half-time

secondment to the spin-off company while retaining his research position. These examples illustrate the active role of the runaways in career shaping and gaining autonomy.

Unmet expectations and career agency: ‘extended investment’ vs. ‘career crafting’

The contrast between the experience of young scientists engaged in collaborative research and commercial ventures is striking. Both categories experienced the frustration of unfulfilled expectations but responded differently. The extended apprentices remained committed to an academic career and continued to collaborate with their professors. We adapt van Dam’s (2005) concept of ‘extended investment’ to describe their attempt to influence their own careers by investing heavily in the relationships with their professors in order to oblige them to reciprocate. The runaways’ desire to pursue an academic career diminished over time and they sought independence by exploring alternative options. We employ the notion of ‘career crafting’ (Wrzesniewski and Dutton, 2001) to indicate their proactive stance in redefining their work. Both courses of action entail career agency albeit expressed in different ways. We argue that the divergent exchange relationships with their professors and the associated psychological contracts influence their adaptive behaviours. Diffuse exchange in collaborative research engenders a relational psychological contract and encourages ‘proxy’ agency whereas restricted exchange in commercialization fosters a transactional contract and induces ‘personal’ agency. As will be shown below, the two distinct patterns are manifested in the objective, subjective and projective dimensions of the young scientists’ agentic behaviours.

Objective career agency: relational vs. personal resources

The extent to which individuals are embedded in networks of social relations influences their strategies for mobilizing relational or personal resources for problem adaptation (Uehara, 1990). As has already been shown, young scientists engaged in collaborative research were more deeply embedded in reciprocal exchange with their professors than those involved in commercialization. As a result, they drew on different types of resources to ameliorate career barriers.

The extended apprentices used an influencing strategy in order to garner the relational resources for ensuring career security. In the interviews, they stressed the importance of ‘being

cooperative', having a 'symbiotic relationship' with their professors and the 'support of peers' in order to advance their academic careers. Evidence of influencing strategy includes organizational citizenship and ingratiation behaviours such as performing extra-duties and favour doing by taking over some of their professors' teaching duties and administrative chores. One commented in the interview that these were considered 'any other duties' which was 'not an obligation and you don't have to do it all' but his professor 'is a busy chap and so we're contributing...' (case 15). Another said, 'there are things I don't want to do but I consider it within my job description to do them so I get on and do it to the best of my ability as always...' (case 14). He also quickly pointed out, 'you know, it is promoting my career as well'. These postdocs were willing to go the extra-mile and some operated like 'helpers': 'you know, professor A says to me you sort that out and I will sort that out.... I'll do bits and pieces...' (case 20). By being exceptionally cooperative, they sought to induce a sense of indebtedness on the part of the professors and also make themselves indispensable. This supervisor-focused influence strategy is a form of 'proxy' agency whereby actors rely on significant others to secure their desired career outcomes.

In contrast, the runaways relied on personal resources by actively engaging in self-directed learning and network development for enhancing their employability outside academia. Although commercial engagement had constrained their scientific training, it also provided them with opportunities to redefine their job boundaries - a form of career crafting which can be used as a means of acquiring new skills (Wrzesniewski and Dutton, 2001). One common strategy was to manage their role transition by gradually reducing the amount of laboratory research and allocate more time and effort to managerial tasks. Some negotiated for special hybrid roles combining research with commercial activities so as to keep future options open. One, for example, recounted how he went about crafting his own job by establishing a translational research unit linked to the start-up companies which he set up in parallel: '...you just write your own job description, just write exactly what you'd like to do and then take it to somebody and convince them that they really want somebody like that ...' (case 24). Forming start-ups, which was initially used as a means of off-setting employment insecurity had subsequently become the focus of sustained learning and career building. One pointed out that he attended more business meetings than anyone else in the team because it was his goal 'to learn as much as possible during this very lucky period...' (case 23). Another exploited the 'freedom' of his commercial

role to build extended external contacts and acquired an MBA qualification to enhance his mobility preparedness (case 21). These are examples of career positioning and mobility-oriented behaviours. The runaways are ‘career crafters’ who displayed ‘personal agency’ and took self-responsibility to open up new opportunities.

Subjective career agency: ‘internal’ vs. ‘external’ career orientations

Both categories engaged in career-self management but the focus of their actions differed. The extended apprentices’ action was internally-focused whereas the runaways’ was externally-oriented. Our analysis suggests that the divergent mentoring relationships and socialization influence their career preferences and actions taken. Young scientists’ academic career aspirations can be strengthened or weakened as a result of early socialization. Professors, as mentors and supervisors, are the primary socialization agents who transmit scientific knowledge and professional values to young scientists through role-modelling and integrating them into the academic community. Young scientists involved in collaborative research developed strong scientific and social bonds with their professors and academic peers, and were exposed more fully to ‘global role modelling’ (Gibson, 2004) and academic socialization. In addition to scientific knowledge, they acquired role expectations and academic ways of life which defined their professional selves. For example, one doctoral student commented: ‘I definitely learned an awful lot about the way academics work and what you are expected and required to do, to be a successful academic’ (case 3). For those who progressed to postdocs, their academic career orientation was strengthened. With the exception of case 20 who was a former industrial scientist, all the others aspired to an academic career when they embarked on their doctoral studies and this remained unchanged at the time of the interview. Despite career uncertainty, their intrinsic interest in scientific research remained strong. For example, one said, ‘I have never seemed to have lost my interest and motivation to do research’ (case 15). Others stressed the ‘intellectual challenge’ of research (case 17) and ‘the excitement that you are going to discover something new’ (case 19) as the main motivational drivers sustaining them over the years. The extended apprentices sought to maintain their preferred jobs by engaging in internal career self-management. They risked becoming ‘trapped postdocs’ but their career actions were also guided by personal goals.

Those involved in commercialization were exposed to the kind of socialization which enabled them to develop more varied self-identities and career orientations that deviated from established norms. Commercial activities usually took place outside the academic laboratories. These young scientists were relatively isolated from their academic peers and had less opportunity for academic acculturation. However, they were exposed to the ‘specific role modelling’ (Gibson, 2004) of their entrepreneurial professors and had contacts with many non-academic agents (e.g. business partners and industrial researchers). The early imprinting of academic entrepreneurialism appears to have re-oriented their career aspirations from employment in academia towards start-ups or industry. Many pointed out that an academic career was what they had initially expected but having worked on commercial projects, they would now consider an industrial or hybrid career bridging science and business. One doctoral student said: ‘...the work that I did in the [spin-off] company might have changed my career expectations more than the PhD itself’ (case 9). Previous research suggests that conducting commercial research during the formative years can significantly influence young scientists’ motivation and academic identity (Hakala, 2009). The narratives in the interviews show the formation of an entrepreneurial role identity most notably among the postdocs. One declared, ‘I am very comfortable with the entrepreneurial side of things...’ (case 21). Another envisaged his future hybrid career: ‘...the way I am seeing my future I am going to say I’ve got these patents, I’ve got these publications, I’ve got these consultancies...’ (case 22). Entrepreneurial career imprinting encourages these young scientists to explore new options by engaging in externally-oriented career activities.

Projective career agency: present vs. future

The career actions of the two categories also differ in their temporal focus and projective capacity. The accumulation of past experience and direction of change in their psychological contracts influence their future expectations and motivations for current agentic choices. The extended apprentices experienced a relational shift in their psychological contracts and continued to invest in their work in anticipation of possible future benefits. They did not regard employment outside academia as a viable option. For example, one said: ‘There’s none ... well there’s nothing else that I could probably apply my skills directly to...’ (case 15). Another

echoed a similar sentiment: ‘...the expertise I have got isn’t sellable. I can’t go round ...’ (case 20). The perceived lack of alternatives coupled with their commitment to academic research prompted them to act agentially with regard to temporally proximate goals in maintaining their current jobs. In doing so, they also increased their dependency on their professors and encapsulation within the established system. Although happy to remain in their preferred jobs, the extended apprentices were saddened by the poor prospect for attaining their desired career outcomes. The following quote vividly illustrates this sentiment: ‘...I am happy, you know, I wouldn’t recommend it to anybody but *I’m content to be sad*’ (case 15; *emphasis added*). The ability of the extended apprentices to distance themselves from the present and engage with future possibilities is constrained by their desire to maintain current jobs.

The runaways were less constrained by relational obligations and established role expectations and displayed a more projective, future-focused orientation. They experienced a transactional turn in their psychological contracts and no longer anticipated future benefits from the relationships with their professors. The shift in their career preferences away from academia towards private industry enabled them to see alternatives. Moreover, active engagement in self-directed learning enhanced their efficacy beliefs and motivations for exploring new possibilities. For example, one expressed his confidence in managing a career transition: ‘I know I could leave tomorrow and do something else completely. I have, you know, a great knowledge of my transferrable skills...’ (case 23). Their psychological mobility (Sullivan and Arthur, 2006) and imaginative engagement with future work selves (Strauss et al., 2012) gave them a sense of renewed optimism. This quote is illustrative, ‘So I don’t have any worries about jobs now because *I will be able to do something...*’ (case 21; *emphasis added*). The runaways’ focus on future possibilities drives their proactive behaviours in career crafting.

Figure 2 summarizes the main findings, showing the two patterns of responses and their links to forms of exchange and types of psychological contracts which create variability in agentic orientations and capacities.

The divergent patterns are also reflected in the young scientists’ subsequent career trajectories which we tracked over time. The great majority of those involved in collaborative research (13 out of 15 cases) remained in academia whereas all but two of the nine cases engaged in commercialization sought employment outside academia (six in start-ups and one in a private firm). Although career outcomes are influenced by a variety of personal and

environmental factors, individuals' agentic effort plays a crucial role in shaping them. The emphasis on career agency by no means suggests that individuals are able to escape precarious employment or dependency on organizations. Proxy agency is socially mediated which may result in actors' over-reliance on those who are in positions of control and the restriction of one's own efficacy (Bandura 1982). A potential outcome is entrapment within the established system as illustrated by the extended apprentices. Personal agency, by contrast, builds on actors' self-efficacy beliefs and is effectuated more directly through their personal choice processes. While this enables them to assert greater individual autonomy as in the case of the runaways, the intended career outcomes cannot be assured.

Figure 2 about here

Conclusions

The comparison of these two groups of young scientists illustrates how the enactment of particular types of agency is related to forms of exchange underlying individuals' psychological contracts which influence their agentic orientations and capacities, and reactions to unmet career expectations. The study contributes to the psychological contract and career literature in three ways. First, in contrast to mainstream psychological contract theory which stresses employee disengagement when career promises are unfulfilled, our findings present a more varied picture and highlight the scope for proactive career shaping. The extended apprentices responded by 'scaling up' their contributions; the runaways did not just exit the relationship but sought to craft new careers by drawing value from existing relationships. Both categories assert career agency albeit in different ways, reflecting the contrasted relational contexts within which their work experience and psychological contracts evolve over time.

Second, the framework developed in this paper integrates the theories of psychological contract and career agency to account for the varied ways in which individuals react to unfulfilled expectations. Although the psychological contract literature recognizes variation in employee responses, it stresses the influence of exchange relationships on organizational commitment which mediates the effects of unmet expectations on employee attitudes and behaviours. This paper stresses individual agency as a source of variation and explains how

different forms of exchange endow individuals with varied relational and cognitive resources for the enactment of career agency.

Third, our conceptualization of career agency directs attention to the temporal context in which it is situated. The psychological contract is a temporally embedded concept but extant research has focused largely on the influence of past experience on employees' current behaviours and dealt mainly with objective time in terms of the change in their perceptions over time. Our study highlights the importance of the future-oriented (projective) dimension and subjective time by examining how individuals' perceived future prospects and salient time horizon influence their current agentic behaviours. A more adequate theorization of the temporal nature of human experience will greatly enhance our understanding of the relation between the psychological contract and career behaviour.

The study also sheds new light on the contemporary debate about the changing nature of academic careers and its implications for early career researchers. The existing literature has highlighted the plight of the 'trapped postdocs' and portrays young scientists as victims of the entrepreneurial university. However, our analysis suggests that the career trajectories of young scientists have become more diverse and fluid. Moreover, young scientists are not just resources for the entrepreneurial efforts of their professors or universities, but are active agents in promoting the new knowledge regime. The transition of the 'runways' towards entrepreneurial start-ups is a case in point. The entrepreneurial university has expanded the institutional context in which scientific careers develop and offers scope for some to craft their hybrid careers at the intersection of science and business. Empirical evidence elsewhere shows a growing trend of young scientists pursuing careers in start-ups (Roach and Sauermann, 2010). This suggests that one possible way for ameliorating the crisis in career expectations might be to broaden the career promises by including opportunities outside academia.

The study has a number of limitations which revolve around the nature of the sample used. First, we examined one particular group of knowledge workers, academic scientists in major research universities, who enjoy considerable freedom in their work and hence the scope for exercising individual agency is great. Findings based on those working in a more constraining environment may differ. Second, the analysis was based on a small sample of 'pre-tenured' researchers in transitional positions whose psychological contracts included an expectation of academic careers. Individuals who do not have fixed or strong initial career expectations may not

exhibit the same level of agentic behaviours. Future research could include knowledge workers from less permissive work environments and individuals at different stages of the whole career spectrum to explore more fully the relational and temporal contexts that influence the psychological contract and career behaviour.

Table 1 Interviewee profile

Case no.	Discipline	Age group	Employment status (duration and no. of contracts)	Mode of industrial engagement	Corresponding professor case code*
Student/junior postdoc					
1	Biosciences	25-30	Student	Collaborative	A
2	Biosciences	31-35	Contract researcher 7 yrs (2 contracts)	Collaborative	B
3	Computer science	25-30	Student	Collaborative	Not interviewed
4	Computer science	<25	Student	Collaborative	D
5	Computer science	25-30	Contract researcher 3 yrs (1 contract)	Collaborative	D
6	Chemistry	25-30	Student	Collaborative	G
7	Physics	25-30	Contract researcher 2 yrs (1 contract)	Collaborative	G
8	Engineering	31-35	Contract researcher 6 yrs (2 contracts)	Collaborative	L
9	Computer science	<25	Student /employee	Commercial	C
10	Physics	25-30	Student/employee	Commercial	E
11	Biosciences	31-35	Contract researcher 3 yrs (1 contract)	Commercial	F
12.	Chemistry	31-35	Contract researcher 4 yrs (2 contracts)	Commercial	G
13	Physics	36-40	6 yrs (2 contracts)	Commercial	Not interviewed
Senior postdoc					
14.	Biosciences	36-40	Contract researcher 15+ yrs (numerous)	Collaborative	H
15.	Biosciences	36-40	Contract researcher 10+ yrs (6 contracts)	Collaborative	H
16	Biosciences	40+	Contract researcher 17 yrs (5 contracts)	Collaborative	I
17	Engineering /Physics	40+	Contract researcher 23 yrs (numerous)	Collaborative	Not interviewed
18	Chemistry	36-40	Contract researcher 15+ yrs (numerous)	Collaborative	G
19	Biomedicine	40+	Contract researcher 18 yrs (5 contracts)	Collaborative	K
20	Biosciences	50+	Contract researcher 10 yrs (20+ yrs as industrial researcher)	Collaborative	A
21	Chemical engineering	31-35	Contract researcher 10 yrs (5 contracts)	Commercial	Not interviewed
22	Biosciences	36-40	Contract researcher 14 yrs (5 contracts)	Commercial	M
23	Biosciences	36-40	Contract researcher 10 yrs (3 contracts)	Commercial	F
24.	Biomedicine	36-40	Contract researcher 14 yrs (numerous)	Commercial	Not interviewed

*13 out of the 16 professors were supervisors of the students/postdocs interviewed; three (not listed) were in similar roles but not directly linked to the students/postdocs.

Figure 1 Four categories of young scientists: exchange relationships and psychological contracts

Mode of industrial engagement \ Career stage	Training (Students/junior postdocs)	Work (Senior postdocs)
Collaborative (Diffuse/reciprocal exchange)	<i>‘Learner apprentice’</i> (Cases 1-8) <i>Relational PC (nascent)</i>	<i>‘Extended apprentice’</i> (Cases 14-20) <i>Relational PC (strong)</i>
Commercial (Restricted/negotiated exchange)	<i>‘Exploited apprentice’</i> (Cases 9-13) <i>Transactional PC (nascent)</i>	<i>‘Runaway apprentice’</i> (Cases 21-24) <i>Transactional PC (strong)</i>

Figure 2 The psychological contract and career agency: two patterns of responses to unmet expectations

	Diffuse/reciprocal exchange (Collaborative)	Restricted/negotiated exchange (Commercial)
Psychological contract <ul style="list-style-type: none"> • Mutual obligations • Time frame 	Relational <ul style="list-style-type: none"> • broad, open-ended; trust and loyalty • long-term; anticipation of future benefits 	Transactional <ul style="list-style-type: none"> • specific, limited involvement; instrumentality • short-term; perceived limited future benefits
Agentic capacity and orientation <ul style="list-style-type: none"> • Objective • Subjective • Projective 	Proxy agency <ul style="list-style-type: none"> • relational resources • internal orientation • present continuity 	Personal agency <ul style="list-style-type: none"> • personal resources • external orientation • future possibilities
Career agency and response action <ul style="list-style-type: none"> • Focus of career self-management 	Extended investment <ul style="list-style-type: none"> • Internal: supervisor-focused influencing strategy 	Career crafting <ul style="list-style-type: none"> • External: mobility-oriented strategy

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Notes

¹ This term has been used by Hamilton (1995) to refer to trainees who ran away from their masters in late 18th century North America which subsequently led to the breakdown of apprenticeship there.