

Human resources, temporary employment contracts and strategic use of real options

The option to delay a decision that is difficult to reverse, and to wait for new information to arrive, provides an organization with some flexibility in dealing with environmental uncertainty (Pindyck, 1991). This paper examines the strategic use of temporary employment contracts as a means of dealing with uncertainty in the form of unrevealed employee ability. The paper puts forward a model of a temporary contract as a real option¹, specifically as a combination of a put option and a stock. The paper takes into account both a US and a European perspective. While temporary contracts have been discussed as real options by a number of authors (Foote and Folta, 2002) and others have examined the use of HR practices as real options (Bhattacharya and Wright, 2005) only a small number of authors, mainly labor economists, have put forward formal models of temporary employment contracts as real options (Gete and Porchia, 2011; Chou, 2011; Lotti and Viviano, 2012). Introducing a micro-level model of a temporary employment contract as a real option that provides additional flexibility in dealing with an uncertain environment and using it to tease out implications for academic recruitment in regard to lecturers and post-doctoral researchers, and in regard to research intensive and teaching intensive institutions, is the main contribution of this paper. The model has relevance more generally in employment situations where there is a large time-lag between recruitment of the employee and revelation of ability. The paper also highlights some idiosyncrasies of human-based real options.

1. Temporary employment contracts

Temporary² contracts are used for two main purposes: to fill a short term gap, and to mitigate uncertainty³. The first purpose is largely operational and can be to fill a position for a short period of time or to carry out a well-defined role on a project. Filling a short term gap may be, for example, to replace an employee who is taking maternity leave. There is no uncertainty here: the leave period is well-known and the duties to be carried out during the temporary contract are also well-known. There is also little uncertainty in a project role; projects are usually professionally planned and the duties

¹ The term 'real option' is attributed to Stewart Myers who used it in his 1977 paper in the Journal of Financial Economics. Since then a burgeoning technical and managerial literature has developed: See for example Trigeorgis (1996), Amram and Kulatilaka (1999), Sanchez (2003), Janney and Dess (2004), Adner and Levinthal (2004), McGrath et al. (2004).

² Also called fixed-term or closed-end contracts.

³ Güelle and Petrongolo (2007) refer to these two uses of temporary contracts as cover for casual/seasonal work and as screening devices. They also suggest that temporary contracts are used to lower costs and increased flexibility but warn that these advantages are traded off against employees quitting early. Connelly and Gallagher (2004) put forward four categories of contingent workers: those who work for temporary staffing agencies, those directly hired to carry out temporary assignments, independent contractors on fixed-term or project work, and those who carry out seasonal work.

and duration of resource roles well-specified. Even if something unanticipated happens the role is linked to a project which will ultimately end, and the role with it.

The second purpose is largely strategic and is to deal with uncertainty of some kind, usually uncertainty in demand⁴ or in supply. Examples of demand uncertainty are when an organisation launches a new, relatively untried, product or when a university launches a new program. At the outset it is not known whether the program will be successful or not, nor how long it will last. One way that organizations cope with such demand uncertainty is to take on employees for a specified period and see how demand evolves. The employer is 'hedging its bet' by employing workers on a temporary basis until demand reveals itself. If demand turns out to be sufficient to continue the program then the temporary employees will be offered further employment; if demand is insufficient to continue then the employees are let go at the end of the temporary contract. Demand uncertainty is to a large extent exogenous to the firm; the firm has little control over the nature of the uncertainty but is still subject to it.

An example of supply uncertainty is the hiring of an employee when that employee's true ability is not well known or not yet fully revealed. This type of supply uncertainty is somewhat endogenous to the firm: the firm has some control and can take precautions to reduce the uncertainty. One means of taking control is for the employer to offer the employee a temporary contract during which the employee is given the opportunity to reveal his or her true ability. This type of uncertainty is also endogenous to the employee who also can take measures to reduce or increase the nature of the uncertainty.

Use of temporary or non-tenured⁵ contracts is widespread in academia (Robin and Cahuzac, 2003). Temporary contracts are used strategically as 'substitutes of permanent contracts' providing the university with a 'source of flexibility' by 'delaying an irreversible decision' while 'assessing the competence of the temp' (van Emmerik and Sanders, 2004). Temporary contracts are also used to keep costs down in light of massification⁶ of higher education and tightening university budgets. Use of temporary contracts to reduce costs and achieve flexibility comes at a price: authors warn that extensive casualization may lead to a two-tier system of protected core academic staff and an insecure periphery (Bryson, 2004;), work intensification, self-exploitation and a hollowing out of teaching quality (Brown, Goodman & Yasukawa, 2010).

⁴ See Pinker and Larson (2003) for a model relating contingent labour and uncertain demand. Lotti and Viviano's (2012) model shows that firms use temporary workers as a buffer to deal with unexpected fluctuations in demand.

⁵ Kaplan (2010) reports that tenure levels are falling in the US and use of adjuncts increasing.

⁶ A 'move from an élite to a mass system of education' (Bryson, 2004:38).

2. A real option model of temporary employment contracts

This paper looks at the strategic use of temporary contracts in academia as a mechanism to allow employees reveal their true research ability prior to the university making the irreversible decision to offer a permanent position. The paper suggests that a temporary employment contract can be modelled as a combination of a put option and the purchase of a stock. This combination is shown graphically⁷ in figure 1. A put option provides the right but not the obligation to sell an asset⁸. Both the purchase of the asset and the put option are written on the same day – the start day of the temporary employment contract. The put option is exercised on the day that the temporary contract expires. The value of the put option increases as the option price decreases below the exercise price as shown by the line sloping diagonally to the left. Above the exercise price the value of the put option is zero. The kink in the line⁹ is the key to providing the option's flexibility.

The value of the asset is always equal to the asset price and is represented by the line sloping diagonally to the right. The combination of the put and the asset is shown by the dotted, kinked, line. Below the exercise price (i.e. to the left) the value of this combination is close to zero; above the exercise price the value increases as the asset price increases, as shown by the dotted line sloping diagonally to the right. Such a combination limits the organization's exposure at lower asset prices while accepting slightly reduced value at higher asset prices (Elton and Gruber, 1995:576). In options terminology this combination is known as a protective put (Options Playbook, 2013). It is used when the buyer expects that the asset will be of high value, but puts a limit on losses should the asset value turn out to be lower than expected (Kolb, 1997:373).

Figures 1 and 2 approximately here

The academic recruitment situation can be modelled as a real option similar to a protective put as shown in figure 2. It can be explained as follows. The organization wishes to recruit an academic¹⁰ but is not certain about the ability of the academic; in particular the organization is unsure about the academic's research ability. Furthermore it may take several years before this ability is revealed^{11,12,13}.

⁷ For an explanation of the graphical convention see Elton and Gruber (1995:576) or Brealey and Myers (1996:560-561).

⁸ The asset on which an option is taken out is referred to as the underlying asset.

⁹ i.e. non-linearity.

¹⁰ The words academic, lecturer and employee are used interchangeably in the text as are the words organization, institution and employer.

¹¹ Note that this model applies to early career academics; late career academics, who have fully revealed their research ability through extensive publication, are usually offered permanent contracts from the outset.

So, the organization offers the academic a temporary contract, say for five years, and indicates that if the academic performs well, i.e. produces say five publications¹⁴, then at the end of the temporary contract the academic will be retained by the organization¹⁵. The exercise price of the put option would therefore be five publications and its expiration date is the date of the end of the temporary contract. When time has moved on to the contract end date the publication record of the employee is reviewed and, if the person is found to have produced five publications, the temporary contract is converted into a permanent contract. If the person has produced less than five publications then the put option (an option to sell i.e. let go the employee) is exercised by allowing the temporary contract to expire naturally. Let this combination of a temporary contract and the purchase of an asset be referred to as a protective recruitment contract. This suggests the following two propositions:

Temporary employment contracts can be used strategically to protect the organization (Proposition 1).

The strategic use of a temporary employment contract can be modelled as the purchase of an asset and the purchase of a put option (Proposition 2).

The protective contract corresponds to two kinds of real option¹⁶: the option to invest in stages and the option to defer investment (Trigeorgis, 1996:10-11). It corresponds to the staged project because the employment contract is broken into two stages: an early, temporary, stage and a later, permanent, stage. This provides flexibility¹⁷ to the employer because at the end of stage one the organization now has two choices, not one; these are: to retain the employee or to let go the employee. The protective contract also corresponds to the deferral option in that the organization delays making a final decision until more information¹⁸ becomes available; note however that the correspondence is not complete because the organization cannot defer its entire investment: it must make some investment during the initial temporary contract period.

¹² Note also that revealed performance plays a major role in promotion in academia: the promotion decision is hugely influenced by past, i.e. revealed, performance (evidenced by publication lists). In contrast, promotion in industry is strongly influenced by the candidate's suitability to take on additional responsibility in the future.

¹³ It is assumed that teaching ability will be revealed within the usual employment probationary period.

¹⁴ This implies a common rubric of one publication per year.

¹⁵ Note that this model does not take into account the employee's option to quit. See Güell and Petrongolo (2007) for an econometric model that takes into account the employee's option to quit.

¹⁶ It is not unusual in the real world for options to overlap or their values to interact (Trigeorgis, 1996:227).

¹⁷ Adner and Levinthal (2004) suggest that an 'investment's flexibility is revealed in the project abandonment decision'.

¹⁸ Mittendorf (2004) suggests that information revelation can form the basis for a real option.

Note that the combination of a stock and a put option is equivalent to a call option¹⁹. This is clear graphically as the dotted kinked line in figure 2 has the same shape as a call option. This would imply that a temporary employment contract could also be modelled as a call option. This is indeed true: taking out a call option on an employee for some future date is theoretically possible. The call would only be exercised at some future date if the employee had revealed him or herself to be a satisfactory researcher. In real options terminology this is an option to defer investment. An example of this is where an organization owns land but defers building a hotel on it until a national recession ends. However, in the recruitment situation the organization has no means of binding the potential employee to the organization in the meantime. In order to earn a living the employee will have joined another employer and so is likely to be unavailable at the time of exercise of the call. And, given that these are real options and not moderated by an exchange or other legal mechanism, the call option is unenforceable by law. Again, while it is theoretically possible that such a call option could be written up as a legal document, it is not customary to do so in recruitment situations. In contrast, in the protective contract model the temporary contract binds the employee to the organization for an interval sufficiently long for the employee's true ability to be revealed.

If the employee produces much more than the five publications required then the employer will have received very good value for purchasing²⁰ the asset (i.e. employing the employee): the organization could be viewed as being 'in the money'. On the other hand the employee has over-delivered and possibly has put in more work than was necessary during the temporary contract: in this respect the employee could be viewed as being 'out of the money'. However, this is not necessarily the case: the additional publications have other career benefits for the employee so it may still be in the employee's best interests to over deliver. In financial options the two parties to the option contract must have different expectations about the future in order for the transaction to take place; by way of contrast in real options it is possible for the two parties to hold similar expectations. In the academic employment situation it is in the interests of both the organisation and the employee that five or more publications are produced.

It is worthwhile reconsidering the different motives firms have for using temporary contracts. When a temporary contract is used for operational reasons no option is created. The employee is simply contracted to carry out well-defined work, either replacing an employee or taking a well-specified project role. The employee does their work and is paid for their work. Let us call this 'current' work, i.e. work that is carried out during the contract as part of the contract. On the other hand when the

¹⁹ For a discussion of put-call parity see Elton and Gruber, 1995:579; note that the relationship between a put and a call is slightly more complex than suggested here: the price of the call is related to the price of the stock, the price of the put and the present value of the exercise price of the put.

²⁰ Technically the human asset is rented, not purchased: ownership of the employee does not pass to the employer. Although in previous eras it was possible to purchase human assets the practice has long been discontinued.

temporary contract is used to give an employee time to reveal their true ability then the employee is being employed both to carry out 'current' work and for the employee's potential to carry out future work. To expect an employee to carry out a full load of 'current' work and also expect an employee to reveal their future potential is asking quite a lot of the employee. Many employers therefore reduce the amount of 'current' work expected from the employee. For example, in the US, academics on 'tenure track' are often given a reduced teaching load in order to allow them reveal their potential as researchers²¹. The organisation therefore bears a cost in offering such a strategic temporary contract to the employee: it must employ someone else, possibly on a non-strategic temporary contract, to carry out the teaching not undertaken by the 'tenure track' employee. This additional cost is the price to the employer of buying the put option²². This suggests the following propositions:

Strategic use of a temporary employment contracts allows the employee time to reveal strategically important but time-lagged abilities (Proposition 3).

The more strategic the use of temporary employment contracts the more the organization is prepared to trade off 'current' work for revealed future potential (Proposition 4).

In academic institutions: the more strategic the use of temporary contracts the more the institution is prepared to reduce teaching expectation in order to reveal research ability (Proposition 5).

When an employee sells the put option then the employee knows that he or she will have to work diligently in order to produce the five publications required at the expiration date of the option. If the employer has paid a good price for the put then the employee will have a reduced teaching load and can use the teaching time saved for research purposes. However the employee may well have to use this time and more in order to produce the requisite research output. Any hours over and above the normal contract hours represent a price paid by the employee for the opportunity to pitch for a possible long term contract. Assume that the likelihood of producing publications is in proportion to the time spent on research. The less time spent on teaching then the more time that is available to research. A consequence of this is that the less time that is spent on teaching then the more publications the academic is likely to produce. The corollary also holds: the more time spent on

²¹ Technically 'tenure track' does not exist in Europe; however European institutions often initially employ academics on temporary contracts in order to test out the academic; temporary contracts used in this way serve a purpose similar to 'tenure track'. Tenure is important in the 'hire and fire' approach to employment in the US as it represents permanency. Tenure is less relevant in Europe where all permanent employees could be regarded as having tenure as firing of a permanent employee is a relatively rare occurrence.

²² In non-academic sectors employees may be paid a premium for taking on a temporary contract. The premium is an additional payment to the employee to compensate for increased uncertainty and represents the price of the put. Academics accept teaching relief rather than payment because the time gained for research represents an investment in their career.

teaching then the fewer publications the academic is likely to produce²³. This is still the case even if synergies exist between teaching and research²⁴ and diminishing returns apply.

This consideration provides a mechanism for relating teaching effort and research effort. Let us assume that the organization requires the employee to teach four modules each year and to produce five publications over the course of the, say, five year temporary contract²⁵. For this effort the organization pays the employee an annual salary. Let us assume that employee effort is equivalent to employee pay and express this relationship as follows:

$$n.S = n.m.T + j.J \quad \dots (1)$$

where S represents annual employee salary, T represents the cost of a taught module, n is the number of years under consideration, m represents the number of modules taught each year, J represents the value of a publication, and j represents the standard number of publications expected to be produced by a lecturer over the course of n years. Let j^* be the actual number of publications produced by the lecturer during the period of the temporary contract. Let the exercise price of the put option (X) be expressed in publications, say k publications. The decision rule for the exercise of the option therefore is:

$$\text{Option Value} = \text{MAX} (0, (j^*-k)J)$$

Let the price of the put option (P) be expressed in modules, say w modules for each year of the contract where $w \leq m$. These two relationships can be expressed as follows:

$$X = k.J$$

and

$$P = w.n.T$$

Note that as w increases more time is available for research and so the likelihood of achieving the requisite k publications also increases i.e. $w \uparrow \Rightarrow k \uparrow$; on the other hand the price of the put increases and consequently the value of the protected put decreases. This can be envisaged graphically: in figure 1 as the option price increases then the dotted kinked line representing the protected put shifts vertically downwards indicating a decrease in value at all points.

Now use equation 1 to express the value of teaching (T) in terms of the value of publications (J) to get:

²³ Of course, the academic may make up for this by using personal time for research.

²⁴ Indeed, the existence of synergy between teaching and research is a basis for the existence of universities.

²⁵ Many universities also require academics to carry out 'service' or 'committee' activities in addition to teaching and research. For convenience service and committee activity is not included in this model.

$$T = (n.S - j.J) / n.m$$

Now express the price of the put option (P) in terms of publications (J) to get:

$$P = w (n.S - j.J) / m$$

Using the linear relationship implicit in figure 2 we can determine the impact of a change in option price on the option value. For every module of teaching relief given to the lecturer on a temporary contract the organization will need to obtain additional publications (A) above the exercise price to the value of P before it starts to achieve positive value for its protective approach to recruitment. Therefore:

$$A = P$$

and the proportion of additional publications required (y) is:

$$y = A/J = w (n.S - j.J) / m.J = (w/m).(n.S/J - j)$$

The ratio w/m can be regarded as teaching relief: the number of relief modules divided by the standard teaching load. The ratio S/J can be regarded as the number of publications represented by salary, and j is the expected number of publications. It is clear that the additional number of publications required for the protected employment contract to break even is proportional to teaching relief. If the organisation gives no teaching relief then no additional publications are needed but then the probability of the employee achieving the exercise number of publications is reduced.

Applying numbers to these parameters may help to make the discussion more realistic. For a temporary contract of five years, salary of 100,000 monetary units per year, exercise price of five publications, put price of one taught module per year, cost of a taught module of 10,000 monetary units, standard teaching load of four modules per year, and an expectation of an average of one publication per year, expression 1 becomes:

$$5*100,000 = 5*4*10,000 + 5*J$$

$$\Rightarrow J = 60,000$$

and

$$P = A = 50,000$$

and

$$y = A/J = 0.83$$

This represents an additional publication requirement of just less than one publication during the course of the contract for the protective contract approach to break even. The above parameter values are indicative of a research intensive university. In a teaching intensive university annual teaching load is higher and expected research publication lower. For example, for a teaching load of 8 modules, and using a publication value J of 60,000 monetary units²⁶, the expected number of publications j over the five year period of the contract can be calculated from expression 1 to be 1.67 i.e. 0.34 publications per year (other parameter values are assumed to remain the same²⁷). The price of the put option with one module of teaching relief (i.e. $w = 1$) at 50,000 is the same as for a research intensive university as is the additional number of publications required for the protective contract to break even (0.83). Even with one module teaching relief the high teaching load mitigates against the lecturer achieving this additional publication requirement. Also, the additional publication requirement, at 50% (i.e. $0.83 / 1.67$), represents a significant portion of the normal publication expectation in a teaching intensive institution. This is in contrast to the research intensive university where the additional requirement at 17% (i.e. $0.83/5$) is a much smaller proportion of the research norm.

Figure 3 approximately here

The contract situation for a teaching intensive institution is shown graphically in figure 3. The exercise price is likely to be much less at such an institution and is represented as say one publication over the course of a three year contract. The asset value is shown as a diagonal line to the right but the intercept with the vertical axis is much closer to the horizontal axis. The downside risk here is therefore quite small. This is because the organization (the buyer) will receive positive value at a much lower level of publication than would a research intensive institution. Comparing this figure with figure 2, it is clear that the protection offered (the area between the two horizontal lines to the left of the exercise price) is much less and the loss in value (the area between the two diagonal lines to the right of the exercise price) is much greater²⁸ than is the case for research intensive institutions. The one module of teaching relief provides much less protection in this case than it did for the research intensive institution. Intuitively, because the research expectation is so much less so too is the value of the protection. Also, given that research is less strategically important in a teaching intensive

²⁶ This assumes that the value of a publication is the same for a teaching intensive and a research intensive university. It is argued that the effort required to achieve a publication is independent of the institution to which the academic belongs although this may not be true: there may exist endogenous factors that make it easier, and therefore cheaper, to publish from one institution rather than another, for example factors related to collegial support, organizational ethos or institutional reputation.

²⁷ Employee salary and the cost of teaching a module are assumed to be the same in teaching intensive as in research intensive institutions.

²⁸ This holds in the range under consideration i.e. up to about 10 publications.

institution, it may be the case that so too is the importance of the employee revealing their research ability. Hence it is likely that less time will need to be provided to the employee to reveal their research ability and so contract durations can be shorter. These arguments suggest the following propositions:

Protective contracts are more likely to be used in research intensive institutions than in teaching intensive institutions (Proposition 6).

The more teaching intensive is the institution, the shorter is the duration of the temporary contract (Proposition 7).

Returning to the research intensive institution, as additional teaching relief is offered to the lecturer the price of the put goes up accordingly. At the limit, the lecturer does no teaching at all as shown in figure 4. This would be the case for a post-doctoral position where the employee is effectively a full-time researcher. The put option is now quite expensive as the employee's output must reach twice the exercise price (in the example used above this is equivalent to 10 publications) before the protective option breaks even. This is a large number of publications and the organization may consider this to be unlikely to happen. Also, the protection provided by the put is zero as its lower bound is at no point higher than the value of the asset itself. As the protection is costly and largely defunct, this argument suggests that organizations are not likely to use the protective contract option when recruiting post-doctoral researchers. Temporary contracts alone are used, without the implied option to convert to a permanent contract. The employment therefore ends for certain at the contract end date and the organization receives whatever number of publications that the researcher has produced. The organization accepts the risk of losing a high output employee and avoids the risk of holding onto to a low output employee. These arguments suggest the following proposition:

Institutions are more likely to use standard temporary contracts than protective contracts when employing post-doctoral researchers (Proposition 8).

Figure 4 approximately here

Another situation to consider is the research intensive institution that offers teaching relief but has a greater research expectation of employees on 'tenure track' than it has of normal employees. Here the exercise price is greater than the normal publishing expectation i.e. $k > j$. This has the effect of pushing the exercise price, asset, put and protective put lines all to the right in figure 2. This makes the protective put even more valuable as it now protects an even greater possible loss in value.

However, the higher exercise price may be less likely to be achieved by the employee: the organization must take care not to set the bar so high as to be unachievable. Even if achievable the employee may be forced to draw on their own personal time in order to achieve the target number of publications. This logic suggests the following proposition:

The more aggressive the target number of publications the more likely it is that the institution will use the protective contract approach (Proposition 9).

A further situation to consider is that where the organization pays no price for the put option i.e. the institution offers a temporary employment contract with the implied option to continue provided a specified number of publications are produced during the contract period; however the institution offers no teaching relief to the lecturer. The situation is shown in figure 5²⁹. It is clear that the institution is fully protected: it cannot achieve a negative outcome for the protected contract. However it is also less likely that the exercise price will be achieved, and it may even be unachievable³⁰. Full protection such as this may not be in the institution's best interest. Unlike in the case of financial options, the value of the real option here can be influenced by the institution. If the institution does not provide the time or the incentive for the lecturer to fully reveal his or her research potential then it risks losing an employee that, if it had full information, it would prefer to keep. The institution must make a trade-off between fully protecting itself by paying as little as it can for its real option and providing sufficient opportunity for the asset to show its true value. This can be expressed as the following proposition:

The institution must trade off gain in the short run (saving taught modules) against gain in the long run (publication potential of lecturer fully revealed) (Proposition 10).

A final situation to consider is that of the employee taken in on a teaching only contract or visiting professorship³¹. In this case the lecturer is asked to carry out a relatively large amount of teaching, up to eight modules, but is not expected to produce any research output. There is no uncertainty here and so no option is in play: the temporary contract is operational rather than strategic in nature.

Note that this model assumes European style options which are exercised on a single day, known as the exercise date. However similar logic could be applied to convert the model to an American style option; in that case the exercise date for the put option could be any date on or before the end of the temporary contract. However, there is generally no advantage to employers to bring forward the end of a temporary contract unless the employee has already fully revealed their ability and there is a danger of the employee being poached by another institution. In that circumstance, in order to retain

²⁹ If the price of the put is zero then the put, asset and combination lines overlap. For clarity reasons the lines are shown not to overlap in figure 5.

³⁰ Unless of course the employee resorts to using personal time to carry out research.

³¹ Visiting professorship is the term used in the US.

the employee, it may make sense for an employer to offer the employee a permanent contract before the temporary contract has lapsed.

Figure 5 approximately here

3. Discussion

The above model demonstrates that using a real option provides more flexibility to an employer than does a standard employment contract, and that this flexibility is especially useful when an employee's true ability takes time to reveal itself. This is particularly true in the case of research work where the time lag between starting and publishing a piece of work is measured in years, or even decades. In a standard contract both parties are committed to fulfilling the contract: there is no way out. This can work out well or badly depending on whether or not the asset turns out to be worth more than expected. For example, if an organization agreed to take on an academic under a standard contract it is committed to retaining the employee irrespective of the number of publications that the academic produces. If the academic produces ten papers in five years then the organization has done exceptionally well; if the academic produces zero papers then it has done badly. The organization is clearly taking a risk³²; use of the put option mitigates the risk by ensuring that the organization retains the employee only if the requisite number of publications is produced in the requisite time.

Note that there are a number of differences in nature between this type of real option and a financial option. Generally speaking for a financial option to be viable there must exist varying expectations about the future: the buyer and seller must hold different views. For example for a call option to be viable the buyer must expect the asset, at the time of exercise, to be of higher value than the exercise price and the seller must expect the asset to be of lower value than the exercise price. Otherwise the conditions for an option transaction to take place do not exist. On the other hand, in the real option under discussion in this paper both parties may hold largely the same view of the future. Both parties expect that five publications will be achieved and it is in the interests of both parties that five publications be achieved. In contrast to financial options the payoffs of real options to buyer and seller may not necessarily be mirror images of each other. Nor are payoffs in real options necessarily a zero sum game: there may be opportunity for increased gain through a synergy or cooperation effect. An area of active investigation is the combination of game theoretic thinking with real options thinking (Chevalier-Roignant and Trigeorgis, 2011). A particular avenue for exploration is to consider whether

³² Jacob's (2007) points out that '[h]uman capital investments are both risky and largely irreversible'.

or not there are ways in which temporary contracts can be devised so as to increase the gain for both parties.

The second significant difference is that the human real asset is teleological in nature: it can create and follow its own destiny. Neither financial nor property based assets can do this; they are passive recipients of market changes. Also unlike many financial assets, human resources are not Markov processes: they are path dependent, their history counts. Two people in the same career position with the same qualifications are not of the same value: even though they have arrived at the same end point they will have learnt different things along the way. This is what makes humans difficult to evaluate, and explains why organisations resort to option contracts to assist in evaluation.

The third significant difference between this type of human-based real option and a financial option is that one of the parties to the transaction is also the underlying asset: the employee. In financial options, once the agreement is made, the asset plays no formal role and acts only passively i.e. its price goes up and down according to the vagaries of the marketplace. In this paper the asset is a person and is active, not passive. The human asset can hugely influence the outcome of the option through their behaviour. An employee could choose to work harder, or gain access to a network of colleagues, in order to boost the number of publications produced. On the other hand the employee could also choose to appropriate some of the value of the option by accepting a lower teaching load but then not producing an acceptable number of publications, or producing publications in journals of more interest to the employee than to the employer; in this case the put option will be exercised and the relationship with the employee will be ended, although typically the employee has anticipated this action and has already planned to move elsewhere. Such agency or moral hazard issues do not arise in financial options. Clearly careful ex-post management of temporary contracts is crucial to a successful outcome for employers.

For employees the implied option also poses difficulties. Because the option contract is implicit³³ rather than explicit there is a danger that the employee could fulfil the implied contract, i.e. produce the requisite number of publications, and find that the employer reneges on it. For example, if at the time of exercise of the option the employer chooses to employ another academic with a stronger publication record. This poses a particular difficulty for employees as they do not know at what price the option will be exercised. This danger can be mitigated somewhat by the employee by keeping close to their employer throughout the period of the temporary contract and by observing how other academics on temporary contracts are treated by the institution. If the employer is seen to renege or is found to have a reputation for renegeing, then the astute temporary employee will put in place an alternative plan for the future in case when the time comes the outcome of the put option is not in his

³³ There exists a large literature on implied and psychological contracts in employment. See Rousseau (1989) for a discussion.

or her favour. Employees can also make exceptional efforts to reveal their true ability to the employer during the course of the temporary contract, for example by working over and above normal hours, by taking on additional responsibilities, by achieving teaching awards, by engaging with colleagues. On the other hand, if employees realise during the contract period that their true ability lies below the exercise price then they may take different actions: they may choose activities that will build up their CV to be of interest to new employers rather than to their current employer. Also, the employee may realise that the organization is behaving opportunistically: that it is dangling the carrot of permanency in front of the employee but with little intention of ever offering it. Such a realisation may cause the employee to review their activity. For these various reasons, careful ex post management of the temporary contract is also critical for a successful outcome for the employee.

The strategic view of the employment situation is also quite different to the legal view. From a legal point of view the two contracts are two separate events. The first contract, the temporary one, has a clear start and end date and does not per se contain any option to continue. The second contract, assumed to be a permanent contract, is a new legal event and largely unrelated to the first contract; it has a start date but the end date is left open-ended. However, from a strategic point of view the two contracts are two stages of the one employment event, with an option to continue or abandon at the end of the first stage. Indeed the put option is generally implied or commonly understood by both parties and not as such a written or legal agreement. The employer indicates that the employee may be kept on permanently provided the employee meets a certain quantity and quality of publication output, thereby implicitly introducing the put; the employee understands that this is the case, thereby tacitly writing the put. The put option is close to but not exactly the same as the temporary employment contract; rather it is an implied addendum to the contract. The put is the difference between a temporary contract put in place for operational reasons and one put in place for strategic reasons.

4. Conclusion

The paper suggests that employers make strategic use of temporary contracts when a significant time lag exists before an employee's true ability is fully revealed. In academia research ability is slower to reveal itself than is teaching ability. For this reason temporary contracts are used in academia to reveal research ability. The paper puts forward a simple but formal real option model of a temporary employment contract as a combination of the purchase of an asset and the purchase of a put option. The paper uses this real option model to derive a relationship between teaching and research effort. The paper suggests that institutions may strategically reduce their teaching expectation in order to provide opportunity for academics to reveal research ability.

The paper extended the basic model to examine the contract situation for lecturers in research intensive and in teaching intensive institutions and also to examine that of full-time post-doctoral researchers. The paper concluded that research intensive institutions are more likely than teaching

intensive institutions to use temporary contracts strategically. The paper also concluded that institutions are more likely to employ full-time post-doctoral researchers on standard temporary contracts, that is, contracts without an implied option to continue.

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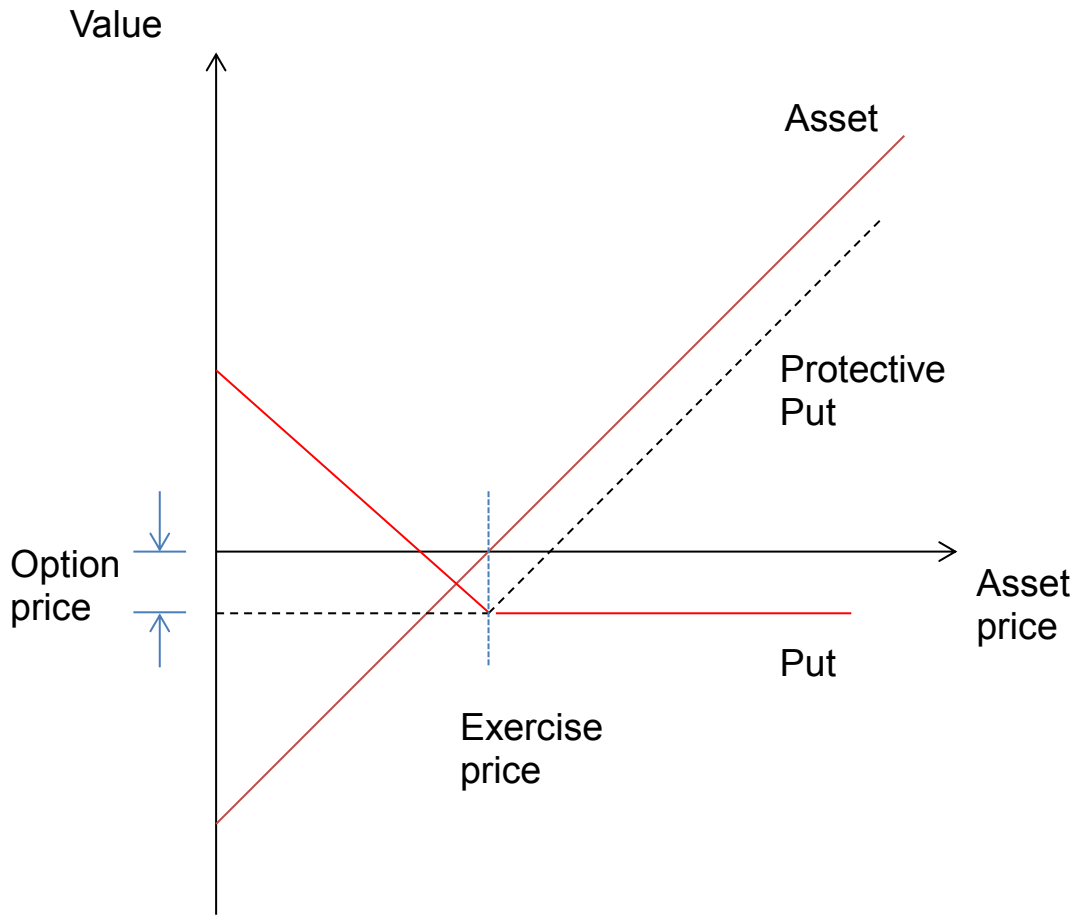


Figure 1. Protected put: a combination created by purchasing a stock and purchasing a put

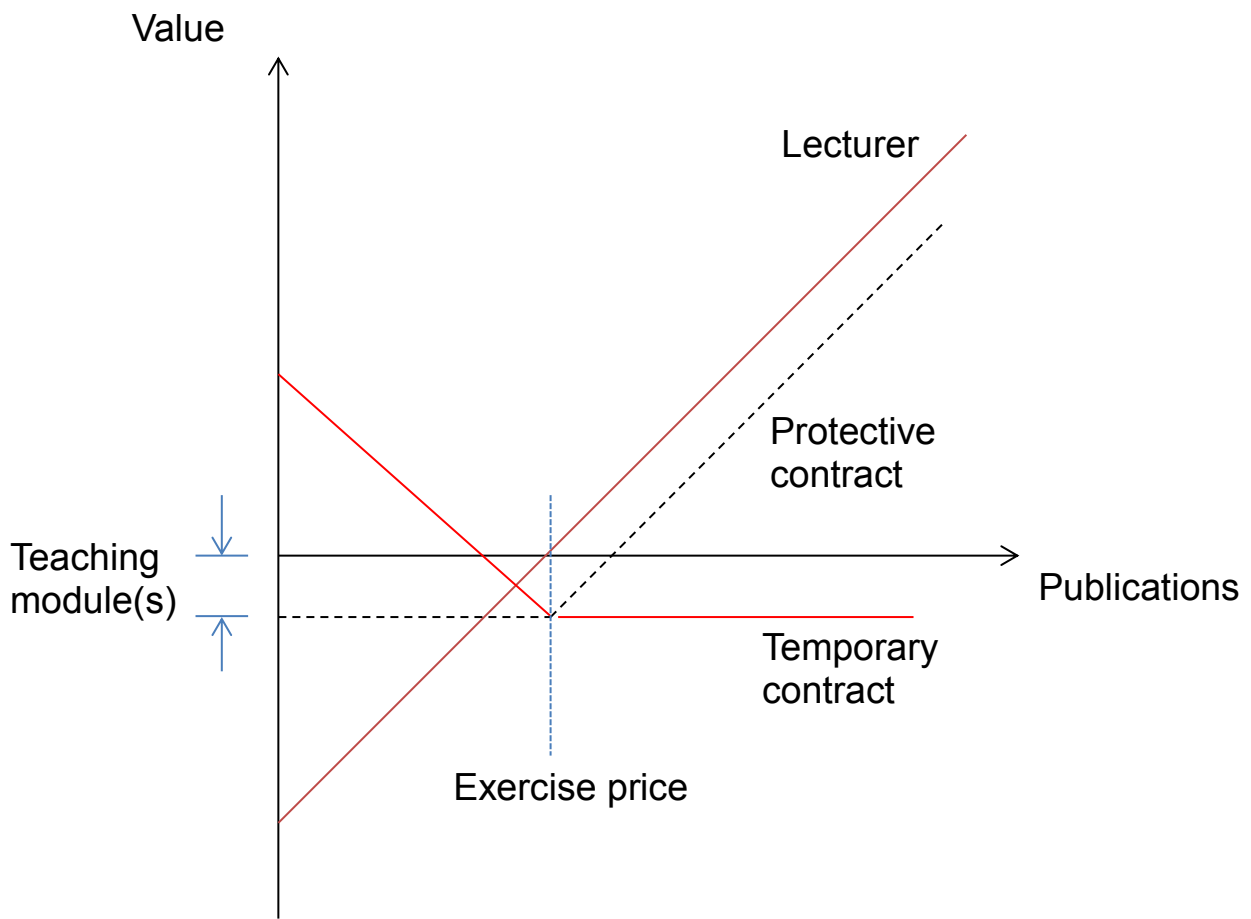


Figure 2. A temporary employment contract as a protected put

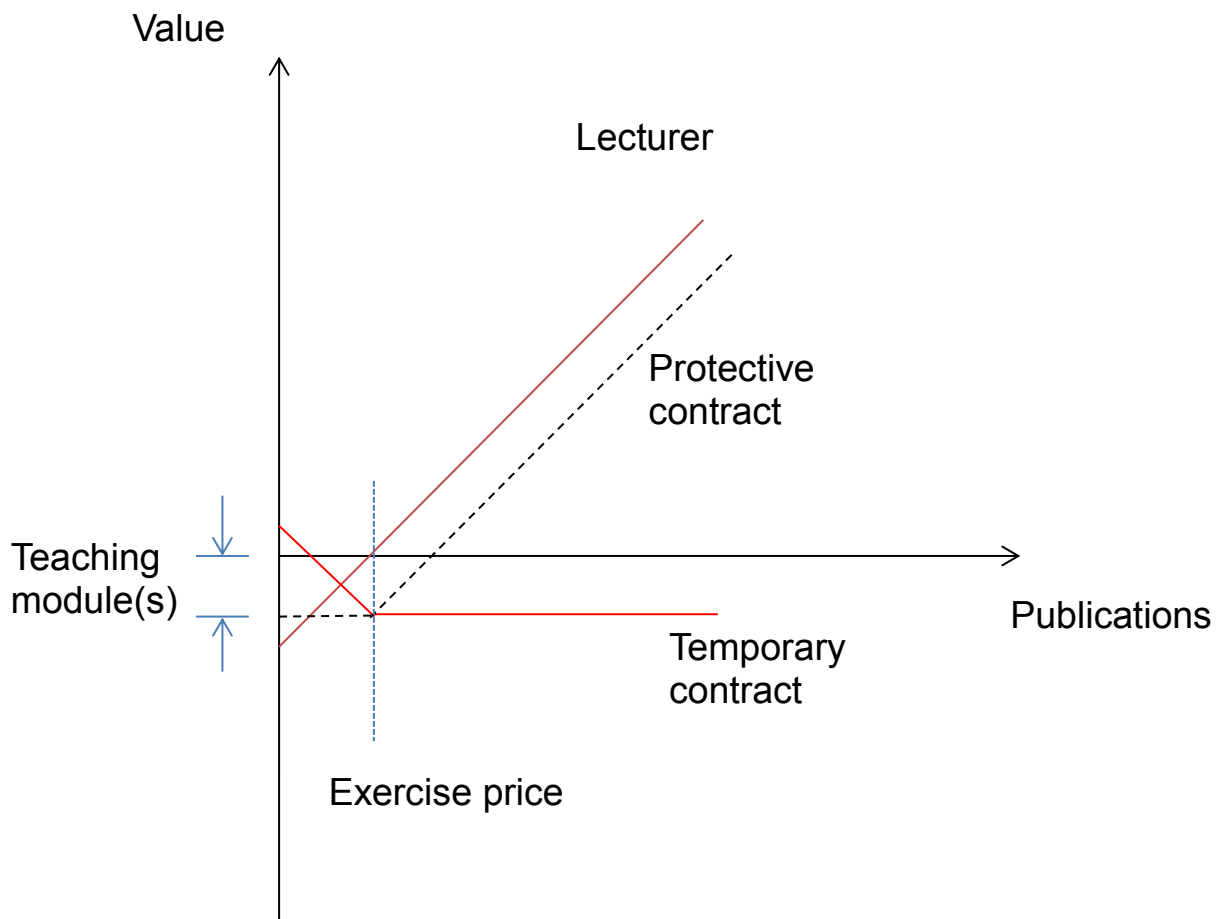


Figure 3. Protective contract for teaching intensive institution

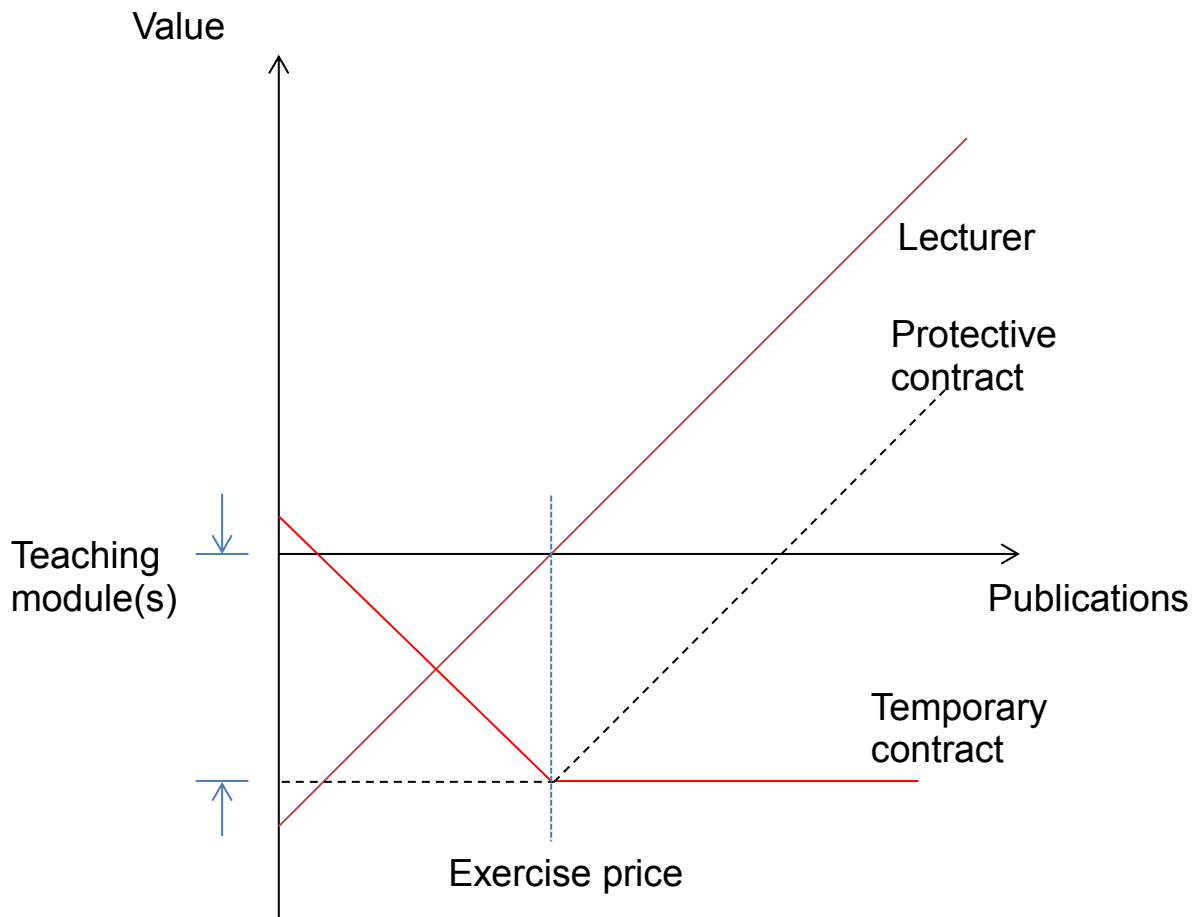


Figure 4. Post-doctoral researcher situation

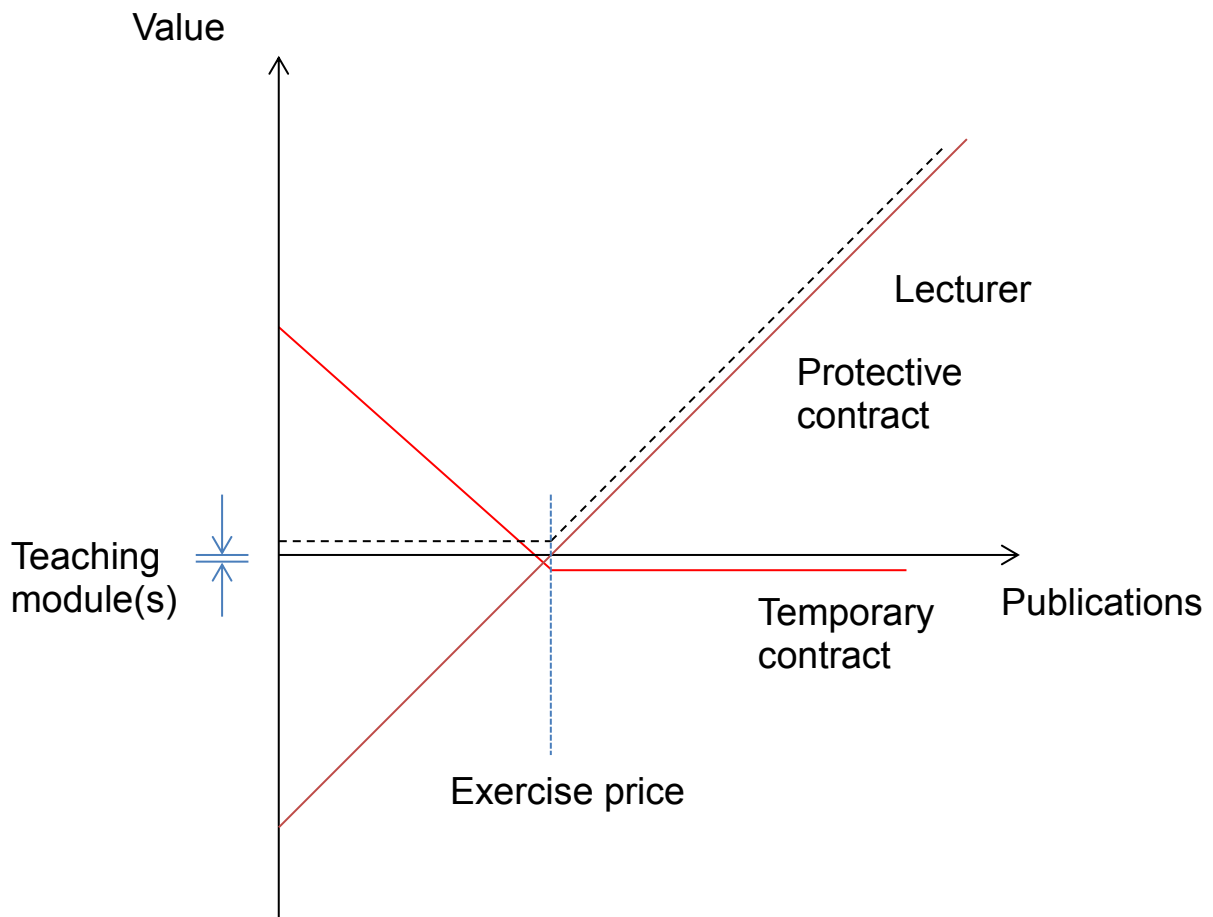


Figure 5. Situation where no teaching relief given