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# Heigh Ho, Heigh Ho: flexible labor contracts with real option characteristics

**Authors:** Julie Byrne and Rowena A. Pecchenino

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**Abstract** What is the strategic value of flexible labor contracts to workers? To answer this question, we examine workers' labor supply decisions when choosing among alternative work arrangements ranging from permanent and pensionable to fixed-term, shift work, zero-hour, and on-call to gigs. We then introduce the concept of real options as a framework in which to analyze contract valuation from the workers' perspective. For a non-standard employment contract to have real option value, the contract must both lead to future choices and enable advantageous access to future opportunities. Using case studies from a diverse set of industries and guided by the real options framework, we examine when contract flexibility contains valuable real option characteristics for the utility maximizing worker, or the profit maximizing firm, or, surprisingly, both.

**Keywords** Alternative work arrangements \* Flexibility \* Gig economy \* Real options \* Standard labor contract

## 1 Introduction

The issue of standard--inflexible--versus alternative--flexible--work arrangements is not new. Both workers (Anderson et al. 2003; Euwals 2001; Blau and Shdyvko 2011; Gielen 2009; Drago et al. 2009; Skinner and Pocock 2010; Waterhouse and Colley 2010) and firms (Askenazy 2004; Connolly and Gallagher 2004; May et al. 2013; Hopkins and Fairfoul 2014; Berg et al. 2014) desire or require flexibility. Flexibility in any decision has value. Quantifying that value, whether from the perspective of the prospective McDonald's worker considering a zero-hours contract or McDonald's considering offering or withdrawing such contracts, remains a challenge. However, in many cases it can be done. Real option analysis, as developed in the finance discipline, provides a framework to evaluate the strategic impact flexibility has on the individual's labor supply or the firm's labor demand decisions.

In this paper, we contribute to the labor economics literature by using a real options framework to understand a worker's labor supply decision. To the extent that real option contracts in the labor market have been considered, it has been from the firm perspective, where human capital is viewed as an asset. Since the goal of a firm is wealth maximization, the firm takes its investment decisions to achieve this goal. Defining human capital as an asset rather than a person makes identifying the real option value in labor contracts to the firm relatively straightforward. For a non-standard employment contract to have real option value, it must both lead to future choices and enable advantageous access to future opportunities. Such contracts are valuable to firms when they give firms the flexibility to change decisions as new information reveals itself. Unlike the firm, individual workers do not consider themselves as assets whose value is to be maximized. Rather, they seek to maximize their overall utility by choosing the optimal combination of work and leisure. The concept of real options provides a useful framework for assessing the value of labor contract components to achieve this utility goal.

Using the real options framework, we argue that in many cases non-standard work contracts have real option value embedded in them for both the worker and the firm. The value is contingent on the type of non-standard labor contract being implemented. The reason there can be real option value to both worker and firm is due to the difference of the overall goal of the counterparties to the nonstandard work contract. Employers will issue non-standard employment contracts if they allow them to increase efficiency, limit losses and/or maximize gains, which is all in line with their wealth maximization goal. Workers may accept non-standard contracts if they enable them to choose work hours, where the work is done, the rate of pay, and/or when the contract is terminated. For such workers, these contract features can be far more valuable to their overall goal of utility maximization than a rigid fixed employment contract, despite the benefits traditionally associated with such contracts. We examine a series of case studies to illustrate our point and to identify who gets the real option value--the worker, the firm, or both.

The paper proceeds as follows. In Sect. 2, we explore labor contracting from a real options perspective, showing how a real options

framework can reveal implicit value, and then examine the evolution of labor contract flexibility from the supply side and the demand side. In Sect. 3, we examine the individual's labor supply choice when, given a fixed market wage, contracts are perfectly flexible, when contracts are perfectly inflexible, and when the wage is a random variable as in many gig economy settings, respectively. In Sect. 4, using our framework in the context of case studies, we characterize the option value of flexibility from the worker's as well as the firm's perspective. In Sect. 5, we address the difficulties inherent in empirically establishing a specific monetary value for the real option characteristics of flexible labor contracts and propose an indirect alternative. Section 6 concludes.

## 2 Real options and the market for labor

### 2.1 Real options: valuing flexibility

While it is now widely agreed that flexibility in any decision has value, identifying when that flexibility exists and which of the counterparties to the non-standard labor contract gets the value remains a challenge. Real option analysis provides a framework in which it is possible to value the impact flexibility has on allocating human or physical capital resources. Real options were adapted from financial options and originally applied to long-term investment decisions where the up-front costs of investment are high and optimal timing is of considerable importance. Traditionally, they have been used when making strategic research and development decisions, high cost facility production investments, and energy investment decisions. From a firm's perspective, real options are a particularly valuable decision-making tool under conditions where there is a high level of uncertainty. Real option analysis is now applied more generally to other strategic decisions.

At its most basic, the real options framework states that for a contract to have real option characteristics, the contract must both lead to future choices and enable advantageous access to future opportunities. Specifically, a real option is the right but not the obligation to undertake a business/investment decision. From a firm's perspective, the application and value attached to the real options framework in deciding what type of employment contract to issue is relatively straightforward. By hiring workers on temporary contracts, the firm undertakes no long-term obligation to retain these workers, thus providing flexibility and limiting obligations and costs associated with permanent contracts. If new information emerges, for example, with respect to increased demand or success of a product, or with respect to the quality and capabilities of the worker, the firm can exercise the option to expand, abandon, or delay as such uncertainties are resolved. Therefore, downside risks can be minimized while upside opportunities can be exploited.

In the literature, many authors have observed that nonstandard employment contracts can be viewed as a source of flexibility that can enable irreversible investment decisions to be delayed (see, for example, Van Emmerick and Sanders 2004; Musselin 2005). Foote and Folta (2002) argue and Bhattacharya and Wright (2005) confirm that there is more value to hiring workers using temporary contracts at greater levels of uncertainty and irreversibility.

As defined by the framework, the real option value to different types of employment contracts is not difficult to see from an employer's perspective. This is not the case from an employee's point of view. The general consensus appears to be that employers gain from using non-standard employment contracts at the expense of their employees. However, in a review of the effects of non-standard employment contracts on individual workers, Walker (2011) suggests this may not be the case. He observes that while some workers appear to be disadvantaged by nonstandard employment contracts, an argument that could be applied to standard contracts as well, others appear to be able to use them to their benefit. He notes that workers weigh up the costs and benefits of non-standard contracts. Non-standard employment contracts are typically viewed as costly to the worker due to limited jobs security, lower benefits, lack of career progression, uncertain hours, little legal protection, prohibitions on forming unions, and minimal access to some social welfare benefits. These costs are, however, offset by the strategic benefit to workers in terms of enhanced work/family balance, the ability to set their own hours, negotiate their own salaries and determine the other terms and conditions of their employment (Torpay and Hogan 2016), and increased career opportunities without necessarily requiring a decrease in income. The presence of competition affects the value of flexibility and, as a result, this enhanced bargaining power is likely to be restricted to those workers with greater and scarcer skills who are in high demand. Here, we can consider real options as choices a worker may take advantage of. Workers will make decisions that give them the greatest amount of potential benefit with respect to possible future decisions.

In order to determine whether there is a real option value to employees from undertaking non-standard employment contracts, it is necessary to identify sources of flexibility and uncertainty. Arguments in favor of such contracts include greater flexibility, an improved work-life balance, increased earning potential, greater control, and the ability to leave the employment quickly to avail of new, better, or different career and life opportunities. Considering these arguments, it is probable that many non-standard employment contracts have options embedded in them for workers. Given the inherent flexibility in some non-standard employment contracts and the opportunities these contracts may give workers in the future, they have real option characteristics that have value in that the contract may lead to both an expanded set of future choices and enable superior access to future opportunities. For example, a worker might consider taking on a temporary contract today to gain experience and establish networks which may lead to significant future opportunities, to gain access to a permanent contract, or to position herself to get a more desirable, higher paid job in the future. Alternatively, unlike some permanent contracts, most non-standard employment contracts do not have long minimum notice periods a worker has to give before leaving employment. This can make an otherwise unappealing job appealing as it allows a worker to leave immediately to undertake a better employment opportunity. Alternatively, if the costs of the job begin to outweigh the benefits, the worker can leave without incurring additional costs.

Not all non-standard employment contracts will have real option characteristics. Workers on non-standard employment contracts are not a homogenous group and whether there are valuable real options embedded in the contracts to the employee is dependent on what type of subset they belong to. The idea of there being value to employees of non-standard work contracts that is captured by real options and quantified using financial valuation models relies on requirements such that flexibility strategies are both creditable and executable and that individuals will be rational in deciding to execute real options. These requirements again reinforce the earlier claim that the individuals most likely to derive real option value from non-standard work contracts belong to a subset of workers that is

highly skilled, well compensated, and least likely to have the need to negotiate flexible work arrangements. Individuals who are most likely to have limited real option value with respect to their choice of work contract are lower skilled, lower paid workers who are generally seen not to offer such creditability. But, this is not always the case as we establish below.

## 2.2 Labor supply

What has come to be known as the standard labor contract is a product of the post-World War II era when political and labor union desires coalesced. The contract, a social and a labor contract facilitated by an internal labor market (Doeringer and Piore 1971), provided continuity of employment in the employer's place of business and under the employer's supervision. The contract required the employee to work full-time, while promising career advancement, compensated overtime, and benefits including paid vacations, health insurance, and a company pension. Married women were not expected to work, at least once their children were born, and were not expected to return to the labor force after their children had entered or finished school (Goldin 2006). This contractual structure provided income security to those lucky enough to be employed on such contracts at the cost of a lack of flexibility, both for workers and firms (Bosch 2004; Kalleberg 2000). Income of the breadwinner was expected to support a family, justifying differential pay rates for males and females.

In 1995, recognizing that the standard contract, while still dominant, characterized fewer employment relationships than in the past, the US Bureau of Labor Statistics conducted a survey to supplement its Current Population Survey to determine the prevalence and characteristics of non-standard employment. At that time, approximately 10% of the work force was in contingent employment where workers were either working as independent contractors, on-call workers, temporary help-agency workers or contract company employees (Cohany 1996). In 1995, most in contingent employment were prime-aged, college-educated white males working as independent contractors in construction or professional and business services.

Demographic changes brought about by married women re-entering the labor force (Anderson et al. 2003, Klerman and Leibowitz 1990) and older workers extending their working lives (Juhn and Potter 2006) increased the desire for alternatives to the standard contract (Schmid 2010; Blau and Shdyvko 2011; Gielen 2009). While important, this push for change came not from those who necessarily needed to work but from those who wanted to work in a way that best suited their needs while still availing of employment-related benefits either directly or through a spouse. The trend towards non-standard employment is clearly seen in the United States where, as Katz and Krueger (2016) show, almost all the net growth in employment in the 2005-2015 period can be attributed to increases in non-standard employment relationships. They find that the percentage of the labor force engaged on nonstandard/alternative work arrangements has risen from 10.1% in 2005 to 15.8% in 2015, with one in three workers earning some portion of their income from non-standard employment (Belman and Golden 2000; Cobble and Vosko 2000). The workers with alternative work arrangements in 2015 compared with those in 2005 were more likely to be female, older, college educated, in the higher wage quintiles, work for contract or temporary help firms, and work in professional and business services, health, education and other services rather than in construction or manufacturing.

It must be noted that flexible, alternative work arrangements reflect both choice and lack of choice. That is, while some actively seek employment opportunities that enable them to flexibly adjust their work hours, others find that alternative work arrangements are the default option when no other work or no other work that enables the worker to meet her/his non-work obligations is available (Golden 2001; Bernhardt and Marcotte 2000; Anderson et al. 2003). With the rise of alternative work arrangements has come the dismantling rather than the redesign of the internal labor markets, the institutional structure within firms that supported the standard contract's promise of within firm career advancement (Wilthagen and Tros 2004). This has, in turn, led to the reduction of opportunities for internal progression within firms (Davis-Blake et al. 2003). Now improving one's skills is left to each worker's individual initiative (Guidetti and Pedrini 2013) and career advancement takes place across rather than within firms. In some cases, to access flexible hours, a worker may have to work more or less and accept an unpredictable work schedule preferred by the firm (Danziger and Boots 2008; Waterhouse and Colley 2010; Askenazy 2004). The value of flexibility can depend on its effect on income security (Skinner and Pocock 2010; Horowitz 2000; Andersen et al. 2003), where the value of flexibility can fall as security decreases (Golden 2001). Thus, flexible alternative work arrangements, at least from the workers' perspectives, are perceived as a mixed blessing rather than a panacea (Hipp and Anderson 2015; Hopkins and Fairfoul 2014; Buddelmeyer et al. 2015), a perception we investigate more fully below.

## 2.3 Labor demand

The lack of flexibility of the standard labor contract, initially considered to be one of its better features, became a binding constraint in the 1970s. Increased competition and uncertainty, more rapid technological change, slower economic growth and high rates of unemployment all conspired to make more flexible work relationships necessary, feasible and desired by participants on both sides of the labor market. This coincidence of desire made their introduction possible, but not necessarily straightforward. Institutional structures, such as labor laws that supported the standard contract, required contractual innovation by firms to secure the flexibility they coveted.

If standard contracts are rigid, alternative work arrangements are flexible and diverse, with supervision and employment relationships often divorced from the place of work and for whom the work is done. Alternative work arrangements include part-time contracts, temporary agency contracts, short-term contracts, contingent work, such as zero-hours and on-call contracts, self-employment/independent contracting and online platform tethered gigs. Standard contracts, precisely because of the social contract under which they were established and the law and custom that supports them, provide job and income security, career progression, etc., but can be costly (Kalleberg 2003) to a firm that requires agility to compete. Alternative work arrangements, in contrast, provide flexibility both for employers and employees alike, but may be insecure (Drache et al. 2015; Wilthagen and Tros 2004; Berg et al. 2014). They allow firms to control costs, to improve efficiency and to match their just-in-time inventory systems or the peaks and troughs of retail foot traffic with just-in-time labor input (Kalleberg 2003). To achieve these ends firms often use scheduling software that removes local

managerial control over staffing decisions. To introduce alternative work arrangements effectively, firms dismantled their internal labor markets since these more flexible employment structures were incompatible with internal firm career paths (Giudetti and Pedrini 2013). Other internal restructuring by firms in search of enhanced efficiency is often required since fixed teams and other inflexible internal firm structures (Broschak and Davis-Blake 2006; Davis-Blake et al. 2003; Kalleberg 2003) may be incompatible with a largely transient workforce. When workers on alternative arrangements and permanent workers work together, the firm's human resource structure can create insiders and outsiders (Piore 1986; Lindbeck and Snower 1988) sometimes engendering conflict (Kalleberg 2003). A downside of the use of these arrangements, because workers' rights are not generally as well protected in non-standard contracting relationships, is the unethical yet legal treatment of the low skilled and the marginalized (Drache et al. 2015) as well as migrants (McCullum and Findlay 2015) who lack the support of labor unions and labor law (Wilthagen and Tros 2004; Berg et al. 2014). This behavior is rationalized in the quest for higher shareholder value.

### 3 Labor supply decisions

#### 3.1 Utility maximization and perfectly competitive labor markets

The complexity of real-world decision making can often hide the fundamental choices individuals must make. This is clearly the case in an individual's utility maximizing choice of whether and how much to work in the market. The individual or family's choice of market labor and private leisure is conceptually straightforward when there are no external constraints on choice. This remains the case even when leisure is constrained by unremunerated, fixed-time, but often uncertain activities. These activities include but are not limited to caring for a child or an aged parent, being in education or training, or commuting. Some of these activities can be outsourced to the market, should income be adequate, others may be provided by the state.

The ability to transfer unremunerated fixed-time activities to the market or to the state depends on the individual's socio-economic environment. This environment is described by the following long and incomplete list: where the individual lives, the market services that can be accessed, the presence or absence of a spouse, the labor force attachment of that spouse, the benefits linked to that spouse's employment, the informal networks to which the individual belongs, which can range from LinkedIn or other employment-related social network to a babysitting exchange, the proximity to and the relationship with his/her extended family, the availability and reliability of transportation, both public and private, government provided social services such as elder care and after school programs, which may be means-tested or universally provided, the number and age of children, the number, age and health status of disabled children and/or aged relatives, as well as the variability and skewness of other sources of income.

Even with all these considerations, the labor/leisure choice is a textbook utility maximizing labor supply decision. In this setting, labor supply is contingent on the realization of life-, rather than work-, related uncertainty. If labor markets are perfectly competitive in a microeconomics textbook kind of way, if a worker is willing to work at or below the equilibrium wage, even if for just a few hours on just a few days, she will be employed. The real world, unfortunately, does not conform to the model.

#### 3.2 Limits to contract flexibility

The labor market in which workers offer their human capital is beset with constraints in terms of the contracts on offer as well as workers' ability to negotiate alterations to those contracts to accommodate their individual needs. The contracts range from the "standard contract," to the zero-hours and on-call contract where workers agree to be available for work that they can choose to take if it is offered, in the case of the zero-hours contract, and must take, in the case of the on-call contract, to the independent contractor style "gig" where workers choose whether or not to work. The ability of workers to vary their hours at will or at all depends on the type of job: independent contract, gig or member of a team; the importance of the workers' skills to the organization: easily replaced or not; market rigidities: standard business hours, extended business hours, night shifts or split shifts, an hour here or there; administrative rigidities; worker protection legislation or union contract conditions. Further, in most cases, it is the employer rather than worker who determines, within reason and under the specific labor contract and within the confines of labor law, when and how much workers work (Lambert et al. 2014), subject to the workers' willingness to work under those conditions.

Consider the standard contract. In this case, the agent has constrained choice over when to work and leisure absorbs all the fixed-time requirements of all unremunerated activities that either are not provided by the state or cannot be outsourced to the market. Clearly, how well off the individual is under the standard (constrained) contract and her ideal (unconstrained) contract are not the same. A similar choice structure is faced by the agent who is presented with an array of work schedule constraints including fixed-term contracts, shift work, whether it be 9 to 5, 7 to 3, 3 to 11, 11 to 7 or some variation or combination thereof, part-time work with specific daily or weekly hours, part-time work with total hours specified and certain, or part-time work with labor hours unspecified and uncertain (possibly a zero-hours or on-call contract) making labor hours a random variable. In all cases, the shift structure and accompanying total remuneration on offer are contractually determined. Faced with such a set of contracts, the agent chooses which is constrained best, keeping in mind that withdrawing from the labor force is always an option.

#### 3.3 The gig economy

At the opposite extreme, consider the "gig" worker. For this worker, the wage received is random, depends on the time of day, the day of the week, on whom else is working and what gig is on offer. This wage is fully realized only after the work hours have been completed. Generally, there are no work-related benefits. In addition, there are fixed and variable costs that must be borne by the worker, leading to a random net wage. The gig worker is, or at least is seen to be by the online platforms, such as Uber and TaskRabbit, a sole proprietor who uses the platform's marketing services and agrees to certain work practices. Thus, for the Uber driver, labor choice is completely flexible, but income is uncertain.

### 4 Case studies

The labor market faced by most workers lies between the no flexibility standard contract and the complete flexibility gig economy. Neither the former nor the latter perfectly meet most workers' needs, yet individually optimal, rather than flexible, per se, work arrangements are valued by the worker. The value to the worker of being able to set her personally optimal schedule and to be strategically placed to avail of future choices and opportunities is likely to be contingent on her human and financial capital, the socioeconomic environment in which she lives, and the constraints imposed by unremunerated fixed-time activities.

A major unremunerated fixed, but variable, time activity is education. Many students need or want to earn money to pay for their education, to support themselves while in education, and/or to save. Because of their varied schedules, they require employers who are willing to accommodate their work and study schedules that can vary from day to day and week to week depending on classes, assignments, field trips and exams. McDonald's hires a very large number of students and, whether they are in high school, like the Langford sisters, or college, like David Sawiak, accommodates their schedules while giving them valuable work experience (D'Alessandro 2017) via zero-hour, or zero-hour like contracts, where shifts/hours can be refused. When McDonald's UK offered its workers fixed-time, part-time contracts, 80% of those offered the contracts chose to remain on their zero-hour contracts (Ahmed 2017).

In the case of the McDonald's worker on a zero-hours contract, in most cases there is likely to be real option value to both the firm and the worker. There is real option value to the firm as it minimizes the costs associated with fixed employment contracts, enables it to expand and contract operations, hire and fire flexibly and allow for managerial flexibility in decision making. All of these factors allow for wealth maximization. There is also clearly value of such contracts to employees, evidenced by the fact that such a large proportion of the workers offered more steady contracts in the UK turned them down. This is undoubtedly due to the fact that a large proportion of individuals likely to take such contracts are still in education or, alternatively, are retired and supplementing their retirement income. Those in education are incorporating their decision to work on a zero-hours contract with a long-term goal of maximizing overall utility. There is an abundance of empirical evidence to suggest a positive effect of education on wages. When such workers are using zero-hours contracts to provide additional income in the short-term, the flexibility of these contracts allows them to work when it is beneficial to them. This will lead to expanded opportunities in the future, namely in terms of both work experience and a higher education level. Thus, such contracts have real option value to workers. There is also a real option value to the education they are undertaking; the time spent in education has a real option value to delay/defer market entry to the labor market at a higher wage. Therefore, this particular set of workers is strategically making two decisions with real option value to them. For the retired, these contracts have strategic value by allowing them to work when they like, supplementing their income, but giving them the ability to take advantage of life opportunities and necessities, such as travel and caring for their grandchildren, as they arise.

Uber drivers, unlike McDonald's workers, choose when to work, rather than being offered hours they can refuse, but at fares set by Uber, less the Uber fees of 20-25% of the fare, less any car-related expenses, insurance and the like. Fares vary with rider demand, so at high demand times fares are higher. The net wage can, therefore, be less than minimum wage. In the case of the Uber Driver, the real option value lies with the firm. By employing gig workers firms transfer a large part of risk, costs and uncertainty from themselves to the worker. The quantity of gig workers available and the relatively low skill level required combined with the low fixed costs to the firm ensure that this type of arrangement provides maximum benefit to them, thus contributing to their goal of wealth maximization. They can choose to expand or to contract operations based on market demand with ease at very little cost, if any, to themselves, as expansion and contraction are algorithm driven. From the perspective of the gig worker, there is no real option value. By the very nature of gig type contracts, there are minimal barriers to entry, easy substitutions, few benefits, high uncertainty with respect to income and such contracts are unlikely to lead to advantageous access to future opportunities. While there is complete flexibility on the number of labor hours the worker chooses to supply, the uncertainty surrounding income means Uber gig-style non-standard employment contracts will not lead to utility maximization.

Those who work for TaskRabbit, Mechanical Turk or Wahve, or for an agency like Kelly Services, may take on this type of employment in preference to other work. Examples abound. Brian Schrier lives half the week on his boat in Napa, California, and works in San Francisco for TaskRabbit the other half of the week. David Cordova, who also uses the TaskRabbit platform, has found a niche in New York City for his services and relies on his wife for health insurance and other benefits (Zimmermann 2015). Others use these platforms in addition to their regular work, while in between jobs as they search for permanent employment, which the most usual case (Katz and Kreuger 2016), while in education or on an internship like Jonathan Lai (Zimmerman 2015), or after retirement from full-time employment, like William who, as a Tasker, assembles IKEA furniture (Carter 2016) or Karen Arnold who works from home as a Wahve worker in the insurance industry (Farrell 2015). All have the ability to determine how much and when they want to work at what tasks and, importantly for some, at what wage. Fixed-time activities can be worked around by, for those on TaskRabbit, specifying unencumbered hours. The Mechanical Turk allows the worker to choose her own schedule as long as she meets the deadline specified for the task, a task she freely accepted to do. While TaskRabbit jobs require the worker to go to the workplace, Mechanical Turk and Wahve jobs are done from home (Raphael 2014). While some of the jobs require physical strength and dexterity (Zimmermann 2015), others just require the right brain power.

The profile of the individuals likely to engage in such gig work is different than those on zero-hours contracts. Further, they have the ability to decide not only how much and when they want to work, but also at what wage. These individuals are likely to value flexibility and leisure time highly and therefore place extra value on contracts that allow them to choose their own work schedule (for example, retirees, remote workers, highly skilled niche workers). Clearly, the flexibility of choosing between work and leisure hours, as well as setting the wage at which they will work implies a real option value to this type of contract flexibility for many workers. Given that those employed under zero-hours and gig contracts can leave (abandon) such employment quickly, with little if any notice required, and with little cost to themselves, there is a value to such workers in terms of the flexibility to leave their employment for any reason including, for example, in order to take up a more suitable, or stable, or higher paid position elsewhere. The less rigid the employment contract type, the lower the cost to the worker of abandoning the contract and the more value there is to the option. Since these contracts both lead to future choices and enable advantageous access to future opportunities for workers, much of the real option value of zero-hours/gig contracts lies with the workers.

From a firm's perspective, there is real option value to TaskRabbit, Mechanical Turk and Wahve contracts just like the McDonald's type contracts, allowing for flexibility in managerial decision making as uncertainties surrounding the employee or market conditions resolve themselves over time.

At the other end of the income scale are high skill consultants, like IT contractor Andy D., with in demand specialist skills. He had a two-and-a-half hour commute, each way, by public transportation, and worked very long hours on a seven-month contract developing and integrating new software into the existing system for a London-headquartered international bank. This new software would be rolled out in the bank's offices worldwide. This required conversations with those who would be end-users at times that suited them. He billed the hours he worked, and he worked in an office with full-time permanent staff as part of a contract team. His pay rate was much higher than permanent staff members, but he and the other members of the contract team had to deliver the work contracted in the time specified requiring very long working days and weeks for the duration of the contract which, for operational reasons, gave the contract team a month off mid-contract which he spent vacationing in France (Quantnet.com 2010). Flexibility, for Andy, was achieved not on a day-today basis within a job, but over the course of the year and across contracts with different employers. For high-skill consultants and specialist contractors, choosing between work and leisure periods, deciding at what to work, as well as setting the wage at which they will work implies a real option value to this type of contract flexibility. The flexibility of these fixed-term consultancy contracts allows workers like Andy to work when it is beneficial to them knowing that each contract leads to expanded opportunities in the future via a greater network of contacts and industry experience. Thus, such contracts have real option value to workers. In addition, those employed under fixed-term contracts can leave (abandon) such employment quickly, since most contracts are for six months or less, there is a value to such workers in terms of the flexibility to leave their employment. The less rigid the employment contract type and lower the cost to the worker of abandoning the contract, the more value there is to the option. All the requirements for real option value are fulfilled here, confirming that much of the real option value of consultancy contracts lies with the worker.

## 5 Empirical valuation

While we have clearly shown in the context of the real options framework that many non-standard labor contracts have real option value to workers, it is not possible to put a precise monetary value on the real option component of a labor contract. This is because, while the methods used for valuing a real option are drawn from financial options valuation methodology, there are significant differences between real and financial assets that can make such an approach problematic. (1) Rather than referring to a derivative financial instrument, real options relate to actual choices a business or individual may exploit. The more a real option diverges in characteristics from a financial option, the more difficult it is to value. The Black-Scholes model (1973) is the first model widely used to value financial options. Inputs into the model are current stock prices, the strike price, expected volatility, interest rates, time to expiry of the option, dividends. Unfortunately, these inputs do not exist for most labor contracts.

There are many difficulties with using these approaches to compute a real option value to workers on non-standard employment contracts. In fact, the characteristics of a financial asset and a non-standard employment contract are very different meaning that any attempt at providing an actual value to such an option will likely lead to poor results. Some of the issues of adapting financial option valuation to real option valuation apply to all real options, whether it is a real fixed asset or a non-standard employment contract. First, unlike financial assets, the underlying assets on which the value is based are not tradeable; Black-Scholes models are developed on the assumption that a replicating portfolio can be created using the underlying asset combined with riskless lending and borrowing and this is not true when considering real assets. Second, the model also assumes that the variance, the measure for volatility, is known and does not change over the option life. This can be a particularly problematic assumption for real options that tend to be much longer term than financial options. Modified real options valuation methods, such as Monte Carlo and PDE (partial differential equation) methodologies have been developed to account for this, but they tend to be extremely complex. Third, the Black-Scholes model assumes the underlying asset's price contains no price jumps, an assumption often not justifiable with real options. Finally, with respect to real option value to non-standard employment contracts from the workers' perspective, the assumption is that individuals are trying to maximize their overall utility not their overall wealth.

Even if it were possible to overcome the obstacles related to valuation outlined above, it would still be impossible to value these contracts due to the data constraints. While it is feasible to estimate the future cash flows associated with working and forecast the volatility associated with the cash flows, it is not possible to get the data required to arrive at a value for workers' utility, which in this case we would be seeking to maximize. It may, however, be possible for a firm to infer the real option value of non-standard employment contracts from its perspective in a manner similar to that suggested in Nakamura et al. (2016) for valuing intangibles in GDP. The firm does this by equating the marginal revenue product of employees hired on standard contracts to those hired on non-standard contracts given its needs for flexibility. While it cannot directly assess the workers' utility from working on a standard or a non-standard contract, it can discern the workers' willingness, and thus indirectly worker utility, from their preference for one form of contract relative to another. From these decisions, the firm can assess the real option value of flexibility. (2) It must be noted, however, that constraints faced by prospective employees may cause this valuation deviate from the "true" real option value.

Although it is not possible to calculate a real option value directly, it is still possible to claim that there is real option value to many workers for undertaking non-standard contracts. Information and flexibility have real and often substantial value and real option theory can identify options embedded therein, which allows the real options framework to help individuals make better decisions.

## 6 Conclusion

This paper shows that because the overall goal of the firm and the worker is inconsistent--the former being wealth maximization, the latter utility maximization--nonstandard employment contracts can have real option value to both the firm and the worker. The traditional approach of viewing non-standard work contracts as having real option value only to the firm, by enabling employment cost reduction, efficiency improvements and precise matching of just-in-time inventory systems or the peaks and troughs of retail foot

traffic with just-in-time labor input, is too narrow. Such contracts can be mutually beneficial allowing both worker and firm to make strategic utility or wealth maximizing choices as to when and how to work and to avail of superior opportunities to expand, to abandon, to delay or to pursue other employment options as they arise. Using a series of case studies, we show who gets the real option value of non-standard work contracts, and, surprisingly, it is often both for the same contract. Interestingly, the shared real option value is not always embedded in the non-standard employment contracts where it might be expected. McDonald's zero-hours contracts provide significant real option value to both McDonald's employees and to the firm itself. Uber Driver's gig-platform contract assigns all real option value to the firm. Highly paid consultants on non-standard contracts absorb more of the real option value of the contract, essentially the rents for their niche skills, than does the firm. Thus, using the real options framework we can better understand how we work now and why we do so.

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(1) See Haahtela (2012) for an in-depth analysis of differences between real and financial options.

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Julie Byrne joined the UCD School of Business in January 2014 as a Lecturer in Banking and Finance. She obtained her PhD from National University of Ireland Maynooth. She previously worked as a Lecturer at Dublin City University and National University of Ireland Maynooth. Her main research interests are in corporate finance, international finance, and energy & environmental finance.

Rowena A. Pecchenino is a Graduate of Cornell University (BA Economics 1981), the London School of Economics (MSc Economics 1982), and the University of Wisconsin (PhD Economics 1985). In 1985, she was appointed as Assistant Professor at Michigan State University, and was promoted to Professor in 1997, becoming Department Chair in 2001. She is now Professor of Economics at the National University of Ireland, Maynooth, having served as Head of the Department of Economics, Finance & Accounting, and as Dean of the Faculty of Social Sciences. She has published and continues to conduct research in a number of distinct fields in economics including theoretical and empirical macroeconomics, the microeconomics and macroeconomics of banking, growth theory, defence economics, environmental economics, health economics, behavioral economics, the economics of aging, the philosophy of economics, and the conjunction of economics and theology. Her recent work explores hope and despair in economic thought.

Julie Byrne [1], Rowena A. Pecchenino [2, (iD)]

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[email] Rowena A. Pecchenino

rowena.pecchenino@mu.ie

Julie Byrne

Julie.byrne@ucd.ie

[1] Michael Smurfit Graduate School of Business, University College Dublin. Blackrock, Co. Dublin, Ireland

[2] Department of Economics, Finance and Accounting, Maynooth University, National University of Ireland, Maynooth, Maynooth, Co. Kildare, Ireland

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