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# Flexibility or certainty? The aggregate effects of casual jobs on labour markets

Rachel Scarfe\*

August 2019

## Abstract

There is much debate about the extent to which governments should regulate labour markets. One discussion concerns casual jobs, where firms do not need to guarantee workers certain, fixed, hours of work and instead “call-up” workers as and when needed. These jobs, sometimes known as “zero-hours”, “contingent” or “on-demand”, provide flexibility for firms to change the size of their workforce cheaply and quickly and for workers to choose whether to supply labour in every period. This flexibility comes at the expense of certainty for both firms and workers. In this paper I develop a search and matching model incorporating casual jobs, which I use to evaluate the effect of labour market policies on aggregate outcomes. I find that a ban on casual jobs leads to higher unemployment, but also to higher production and aggregate worker utility. I also consider the effect of a higher minimum wage for casual jobs. I find that the effects are limited. These results are due to an offsetting mechanism: although higher wages lead to higher unemployment, as firms offer more full-time jobs, the number of workers actually called-up to work increases.

**Keywords:** unemployment; welfare; minimum wages; contingent work; on-demand work; policy

**JEL classification:** E24; J21; J48; J64

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This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research. The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute.

# 1 Introduction

From the agricultural day labourers of the nineteenth century to the agency and gig-economy workers of the modern day, casual work has long been a feature of labour markets around the world. Casual jobs, including “zero-hours”, “contingent”, “on-demand” or “on-call” jobs, provide flexibility to firms who do not need to guarantee casual workers certain, fixed, hours of work, and so can vary the size of their workforce cheaply and quickly. They also provide flexibility to workers, who are generally not required by law to accept any work they are offered. Both workers and firms therefore face a trade-off. In a casual job, firms can choose whether to “call-up” a worker (i.e. whether to offer them work) and workers can choose whether to supply labour at the beginning of every period. In a standard job, firms must offer work (and pay wages) in every period, and workers must supply labour, unless one party chooses to terminate the employment relationship.

Casual jobs are used around the world. Although exact regulations differ across countries, it is estimated that approximately 4% of British, and 5% of Irish employees have “zero-hours” contracts and 3% of American and 6% of Dutch employees are classified as “on-call” (Datta, Giupponi and Machin, 2018). Other countries which allow this form of casual work include Austria, Australia, Canada, Finland, Norway and New Zealand.<sup>1</sup> There is some evidence that the incidence of casual work is increasing, particularly in the UK (Datta, Giupponi and Machin, 2018; Farina, Green and McVicar, 2019) and the Netherlands (Burri, Heeger-Hertter and Rossetti, 2018).

These jobs have proved controversial and are the subject of much policy debate, particularly in the UK, with some commentators calling for an outright ban on casual work. Their proponents consider that their availability increases labour demand, by decreasing the risk firms face that future changes in demand will make extra workers unprofitable. They also consider that they increase labour supply, particularly amongst those with other responsibilities (such as studying or caring for relatives) who do not wish to commit to fixed hours of work. However, their critics argue that uncertainty about the availability of work is detrimental to employees, who would prefer a steadier income. Others consider that the availability of casual workers encourages firms to maintain low productivity jobs, lowering average aggregate productivity. There is also debate about whether casual jobs provide “stepping stones” to regular employment, or whether workers can become “trapped” in them.

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<sup>1</sup> The percentage of workers with casual jobs in Australia is much higher than in other countries. I discuss the Australian case in more detail in Section 2.

In this paper I set out a search and matching model incorporating casual jobs that enables me to compare aggregate outcomes in a “casual” regime (where casual work is legal) with a “standard” regime (where it is banned). The goal of this paper is to fill a gap in the current literature, by analysing the trade-off that both firms and workers face between the certainty of regular jobs and the flexibility of casual jobs. This allows me to consider the following key question: what are the effects of the availability of casual contracts on aggregate production, welfare and unemployment? I also consider the effect of another policy experiment: varying the minimum wage for casual jobs relative to regular jobs. This experiment is based on proposals under discussion in the UK for a higher minimum wage for casual jobs (Taylor, 2017). Some empirical work has suggested that increases in the minimum wage in the UK did cause employers to offer more zero-hours contracts (Datta, Giupponi and Machin, 2018). However, there has not yet been any analysis of the effect of different minimum wages for different types of job.

I model the trade-off that firms face between casual and regular jobs by incorporating uncertain productivity. I assume that firms draw a permanent, match-specific, productivity when they meet a worker and a separate transitory productivity shock at the beginning of each subsequent period. After drawing the permanent productivity the firm must decide whether to offer a regular or casual job. Firms that offer a regular job must pay the worker in every period, regardless of the realisation of the transitory productivity shock. Firms that offer a casual job need only call-up the worker, and pay them a wage, in periods when it is optimal to do so. This structure ensures that the proportion of casual jobs is endogenous, and may change when labour market regulations, including minimum wages, change.

I incorporate different worker preferences for flexibility by assuming there are two types of workers: those who wish to supply labour in every period, and those who prefer the flexibility to turn down work. In regular jobs, all workers are constrained to supply labour in every period. In equilibrium some workers take a casual job who would prefer a regular job, and vice versa. My model therefore allows me to consider “mismatch” between workers and jobs, in a similar way to Albrecht and Vroman (2002) and Dolado, Jansen and Jimeno (2008). I also incorporate on-the-job search, allowing me to analyse the length of time workers spend in a casual job before finding a regular job. Under certain conditions, I am able to show that there exists a unique reservation value of the permanent productivity component. Firms that draw a permanent productivity value greater than this reservation value will offer workers a regular job and firms that draw a permanent productivity lower than

the reservation value will offer a casual job. Thus, in equilibrium the two types of contract will coexist.

I solve the model numerically in steady state, and calibrate to moments of Australian data.<sup>2</sup> I find that in the casual regime, the number of workers actually producing in any one period is lower than in the standard regime, as firms only call-up casual workers in periods when it is profitable to do so. Similarly, since workers are not required to accept offers of work, they only do so when disutility of labour is low. Thus in the casual regime there will be some workers employed in a casual job who are not actually supplying labour and hence producing and earning wages. This offsets lower unemployment in the casual regime so that, aggregate production and worker utility are slightly lower than in the standard regime. In addition, in the casual regime workers search on the job for a match with higher permanent productivity that will offer work more frequently. In a model with search frictions, this makes it harder for unemployed workers to match with a firm. This crowding-out effect further offsets some of the benefits of the casual regime.

I find that the effects of an increase in the minimum wage for a casual relative to a regular job are limited. As the casual minimum wage rises there is an increase in unemployment and decrease in the job-finding rate. This is intuitive: as the minimum wage rises the expected value of a filled job decreases and so firms create fewer vacancies and choose to destroy matches with a very low permanent productivity rather than offering the worker a casual job. Surprisingly, however, there is little change in the measure of workers who are actually working and aggregate production or utility. This is due to the mechanisms described above.

There is some empirical analysis of casual work in Australia (e.g. Buddelmeyer and Wooden (2010), I. Watson (2005) and I. Watson (2013)); of zero-hours jobs in the United Kingdom (Datta, Giupponi and Machin, 2018; Farina, Green and McVicar, 2019); and of on-call work in the Netherlands (Burri, Heeger-Hertter and Rossetti, 2018). However, to my knowledge, theoretical analysis of casual work is almost non-existent. An exception is concurrent, ongoing, work by Dolado, Lalé and Turon (2019). They develop a search and matching model incorporating zero-hours contracts and risk adverse workers with heterogeneous labour supply preferences. As wages in the model are fixed, some workers will only take zero-hours jobs and will not work at all if zero-hours jobs are banned. In my model wages are a function of

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<sup>2</sup> I use Australian data as there are concerns that data from other countries may not capture casual workers accurately.

productivity, and even workers who prefer flexibility will take a regular job with a wage high enough to compensate for the disutility of labour. In addition, workers in casual jobs can choose whether to supply labour in each period. This allows analysis of the aggregate effects of a ban on casual work by taking account of the disadvantages of regular jobs to workers who prefer flexibility and the disadvantages of casual jobs to firms with a very productive match, who would prefer that the worker always supply labour. In addition, firms draw a permanent match quality and, in equilibrium, firms with a low match quality offer casual jobs. Thus both the coexistence of casual and regular jobs, and mismatch between workers and jobs, is an equilibrium outcome of the model.

There is some empirical analysis of casual work in Australia (e.g. Buddelmeyer and Wooden (2010), I. Watson (2005) and I. Watson (2013)); of zero-hours jobs in the United Kingdom (Datta, Giupponi and Machin, 2018; Farina, Green and McVicar, 2019); and of on-call work in the Netherlands (Burri, Heeger-Hertter and Rossetti, 2018). However, to my knowledge, theoretical analysis of casual work is almost non-existent. An exception is concurrent, ongoing, work by Dolado, Lalé and Turon (2019). Like my model, they develop a search and matching model incorporating zero-hours contracts and workers with heterogeneous labour supply preferences. Workers in their model are risk averse, allowing them to consider the negative effect of casual work on workers who dislike uncertainty. However, as wages in their model are fixed, some workers will only take zero-hours jobs and will not work at all if zero-hours jobs are banned. In my model wages are endogenous, and even workers who prefer flexibility will take a regular job if the wage is high enough to compensate for the disutility of labour. In addition, workers in my model with casual jobs can choose whether to supply labour in each period. This allows analysis of the aggregate effects of a ban on casual work by taking account of the disadvantages of regular jobs to workers who prefer flexibility and the disadvantages of casual jobs to firms with a very productive match, who would prefer that the worker always supply labour. In my model, firms are heterogeneous in permanent match quality. As a result, in equilibrium, firms with a low match quality offer casual jobs. Thus both the coexistence of casual and regular jobs and mismatch between workers and jobs are equilibrium outcomes of my model.

This paper is related to models where firms adjust the size of their workforce along the intensive margin rather than along the extensive margin (such as Trapeznikova (2017) and Cooper and Willis (2009)). It is also related to previous work on non-standard contracts, which has focused mainly on temporary jobs. In particular,

Berton and Garibaldi (2012), Galdon-Sanchez, Fernández-Villaverde and Alonso-Borrego (2004) and Cao, Shao and Silos (2010) develop models where firms choose whether to offer permanent or temporary jobs based on match productivity. The model in this paper has two key differences. Firstly, workers have different labour supply preferences, whilst in these papers all workers would prefer permanent or full-time jobs. Secondly, I focus on the ex-ante choice of contract made by firms facing uncertain demand, rather than an ex-post decision after a productivity shock.

The paper proceeds as follows. Section 2 discusses available sources of data on casual work, and Section 3 documents some broad findings about the characteristics of casual workers and jobs. Section 4 sets out the model, Section 5 discusses the calibration and Section 6 presents the results. Section 7 concludes.

## 2 Data

There are several issues with currently available data on casual work. The percentage of casual workers in most countries is small, and there are concerns that survey data may not capture the full extent of casual work. This is the case in the United Kingdom, where respondents to labour market surveys must self-report that they have a zero-hours contract. As Farina, Green and McVicar (2019) discuss, changes in the survey method and low public awareness of zero-hours contracts may have led to under-counting of zero-hours workers in the UK Labour Force Survey. Other countries with small numbers of casual workers do not collect data systematically (e.g. Finland, Norway), or may not have a legal definition that can be used to consistently identify casual workers (e.g. the Netherlands, Canada). Finally, several countries have regulations that differ across states (e.g. the USA), or that have changed significantly in the last few years (e.g. Ireland, New Zealand). As a result, survey data on casual work in most countries may not give an accurate picture.

However, in Australia casual work is a more entrenched, and wider spread, phenomenon than in other labour markets. Since casual work is more widely spread and better understood, data from Australia is less likely to be subject to some of the issues described above. Data about casual work in Australia has been collected since 2001 in the annual Household, Income and Labour Dynamics in Australia Survey (HILDA). This is a panel survey, with information about transitions between different types of work and unemployment. It can therefore provides data moments that



can be used to calibrate the model in Section 4. A further advantage of the HILDA data compared to other sources is that it includes more questions about workers' labour supply preferences, including preferred hours of work and level of satisfaction with their working schedule.

Although the greater incidence of casual work in Australia may mean that data is more reliable, it could also mean that conclusions from a model calibrated using Australian data may not be applicable to other countries. This is especially likely if the high use of casual contracts in Australia is due to specific labour market regulations, such as firing costs or regulations on the use of other non-standard contracts. However, Australia and the UK are considered to have similar levels of labour market regulation (for example, they score similarly in the OECD's Employment Protection Index). In addition, a comparison of Australian and UK data suggests that casual workers in the UK have similar characteristics to those in Australia.

## 2.1 The Australian HILDA survey

The HILDA survey is an annual household survey, covering all individuals over the age of 15 in each household. Children who were under 15 in the early waves are included when they reach the age of 15. In the first wave of the survey, in 2001, the sample consisted of 19,194 individuals in 7,682 households. The most recent wave, in 2017, consisted of 23,496 individuals in 9,750 households. During the survey, individuals are asked about the type of job that they hold at each survey date, and how long they have been employed in that job. They are also asked whether they have moved to a new job, and the length of time they have spent unemployed or out of the labour force during the year. I use this information to calculate the mean spell lengths of unemployment, regular and casual jobs. These data moments are used in the calibration of my model.

It is important to define casual work clearly in order to identify casual workers in the data consistently. In Australia, casual work is a legally recognised state, where the worker

- (i) has no guaranteed hours of work
- (ii) usually works irregular hours (but can work regular hours)
- (iii) doesn't get paid sick or annual leave
- (iv) can end employment without notice, unless notice is required by a

registered agreement, award or employment contract (Australian Government, 2015).

To compensate workers for the lack of sick and holiday pay, firms must pay casual workers a “casual-loading”, a premium of 15-25% above the wage of regular workers doing the same job. It is therefore possible for firms to designate workers who usually work full-time as “casual” in order to avoid paying for these benefits. This may also benefit a worker, who may prefer to receive the casual-loading instead (see Campbell (2018) for a more detailed discussion). Thus someone who works standard, full-time hours may appear as “casual” in the data. In my analysis I distinguish between “regular” workers who are guaranteed certain hours of work (although they may work overtime), and “casual” workers, who are not. I therefore relabel any casual workers who usually work over 35 hours a week, and whose hours do not vary as regular workers. The percentage of casual workers using the definition above (15% of employed workers) is thus slightly lower than the percentage reported in official statistics (between 20-25% over the period of the survey). I include part-time workers in my sample, but exclude those with other types of non-standard jobs, such as flexitime or job sharing, and those who are self-employed.

## **2.2 The UK LFS**

I compare Australian data with the data from the UK Labour Force Survey (LFS). The LFS is a quarterly survey, with a sample size of approximately 40,000 households, and covers the employment and personal characteristics of all the individuals in a household. In my sample I include all adults aged 16 or over. Since 2000 the Spring and Autumn editions of the LFS have included a question asking whether or not each individual has a zero-hours contract. They are also asked whether their weekly hours vary.

There was a large increase in respondents with a zero-hours contract between the Spring and Autumn 2013 editions. The ONS attributed this to measurement issues in previous editions, and to the increase in awareness of zero-hours contracts following media coverage (Chandler, 2014). I therefore use data from Autumn 2013 to Autumn

2017.<sup>3</sup> Unlike the HILDA survey, the LFS relies on workers self-identifying as zero-hours workers. I once again relabel any casual workers who usually work over 35 hours a week, and whose hours do not vary, as regular workers.

### 3 Descriptive statistics

In this section I compare casual and regular jobs, providing evidence for four key differences between them. First, casual jobs are concentrated in certain industries and occupations, particularly in low-skilled or service occupations and in industries with relatively large and frequent changes in demand. Second, there are differences in the characteristics of casual workers and jobs relative to regular workers and jobs. Casual workers are generally younger, with fewer years of education and shorter job tenure. They work fewer hours and for smaller firms. Third, casual workers are generally paid less than regular workers. Finally, they are more likely to transition to regular work than regular workers are to transition to casual work.

Although calibration of the model uses Australian data, since the incidence of casual work in Australia is much higher than in other countries, it is possible that conclusions drawn from Australian data may not be applicable to other countries. However, the key differences described above are also observed in the UK LFS. This section compares results for both countries, as far as is possible given the different survey designs.

#### 3.1 The distribution of casual jobs

Figure 1 below shows the percentage of all jobs in each industry grouping (panel (A)) and occupation (panel (B)) that are casual. Although there are differences in the level of casual work in Australia and UK, the distribution of casual jobs is similar.<sup>4</sup>

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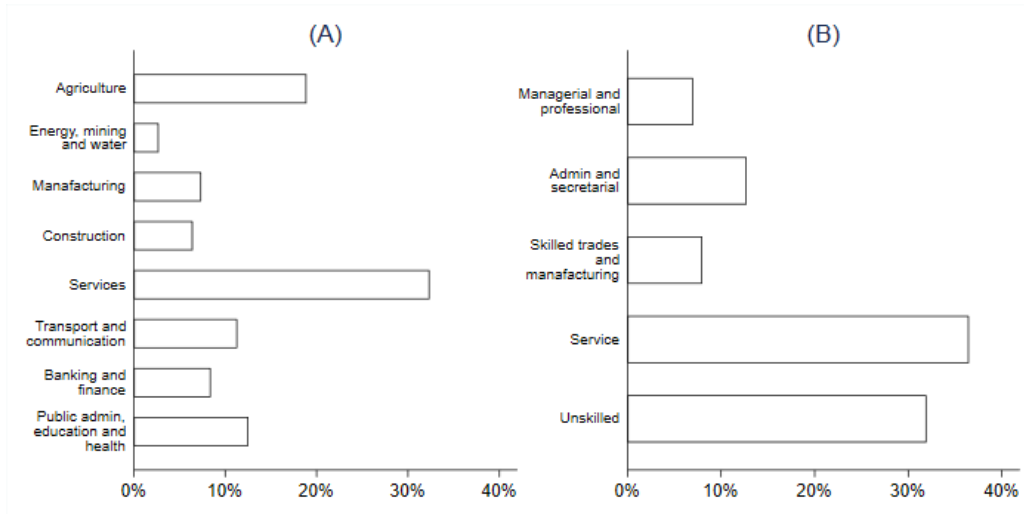
<sup>3</sup> It is possible to link some observations into a five-quarter panel. However, as not all questions are asked in each quarter, it is only possible to observe zero-hours workers at two points over the five quarters, and the number of zero-hours workers in this dataset is very small (fewer than 100 workers with zero-hours contracts).

<sup>4</sup> In the UK a higher percentage of jobs in the Public Administration, Education and Health group are casual than in Australia. This is due to the higher number of care workers (most of whom have casual jobs) in the UK compared to Australia.

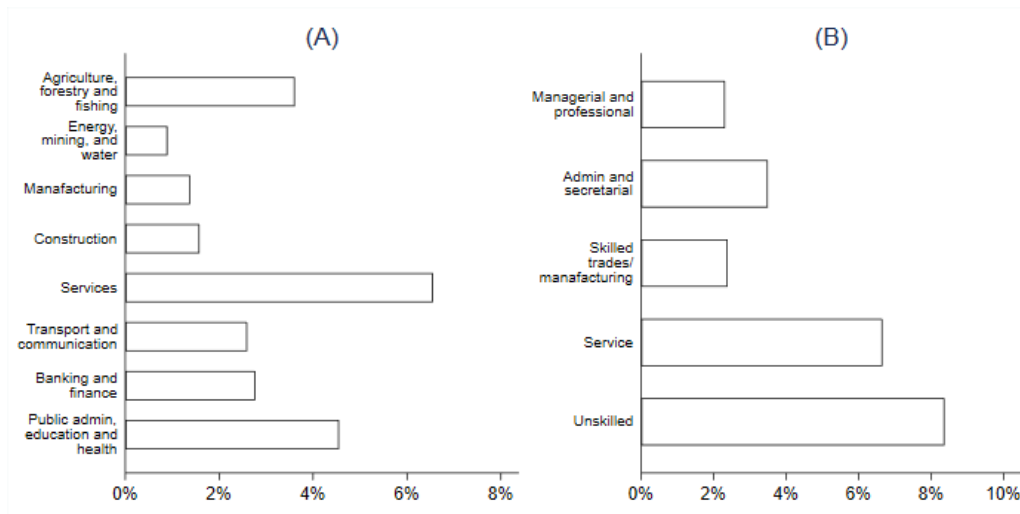
In both countries, jobs in the Agriculture and Services industry groups are more likely to be casual. Jobs in Unskilled and Service occupations are also much more likely to be casual. These are industries and occupations that are likely to be subject to relatively large and frequent changes in demand.

Figure 1: Distribution of casual and regular jobs (% of all jobs that are casual)

(1) Australia



(2) UK



Source: HILDA and LFS survey.

## 3.2 Characteristics of casual jobs and workers

Figure 2 shows some of the characteristics of casual jobs and regular workers. Panels (A) and (B) show the actual usual weekly working hours of casual workers and the number of hours they would like to work. Casual workers generally work fewer hours than others, and are often offered no work at all. However, they would also prefer to work fewer hours in general, suggesting that they may have different labour supply preferences. This is supported by the proportion of casual workers with other commitments: in Australia 24% are currently studying and 16% have another job, compared to 9% and 7% of regular workers respectively.

Panels (C) and (D) show the percentage of casual workers in each age group and with each level of qualification, compared with the percentage of regular workers. They show that casual workers are generally younger, and have fewer years of education than regular workers. These differences are more pronounced in Australia, but are also observable in the UK.

Panel (E) shows the job tenure (in years) of casual and regular workers.<sup>5</sup> Casual workers generally have much lower tenure in their jobs, perhaps partly because they tend to be younger. Finally, Panel (F) shows the percentage of casual and regular workers split by the size of the firm they work for. As the graph shows, casual jobs are concentrated in smaller firms.

## 3.3 Wages of casual workers

The median hourly wage for a casual worker in Australia in the 16 years of the HILDA survey, at 2001 prices, was AUD 14.71, inclusive of the 25% pay premium for casual jobs. Over the same period, the minimum wage for casual jobs ranged from AUD 13.59 to AUD 15.14. The median wage for regular jobs was AUD 19.21, compared to a minimum wage for regular jobs between AUD 10.87 and AUD 12.11.<sup>6</sup>

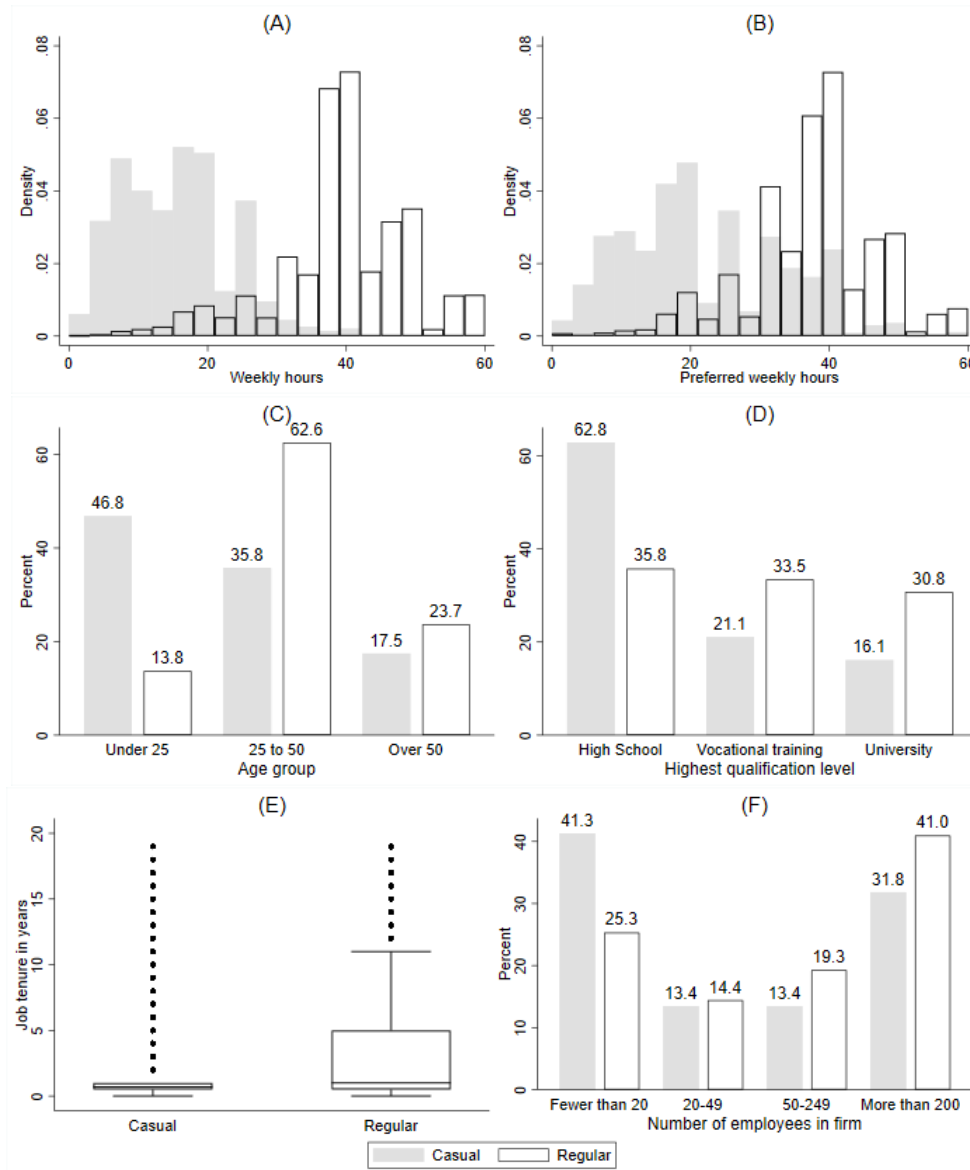
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<sup>5</sup> Note that job tenure in Australia and the UK are not comparable. In the UK, unlike in Australia, the LFS only includes information about tenure at current firm, without taking account of job changes within the firm. For this reason, reported tenure in the UK is longer.

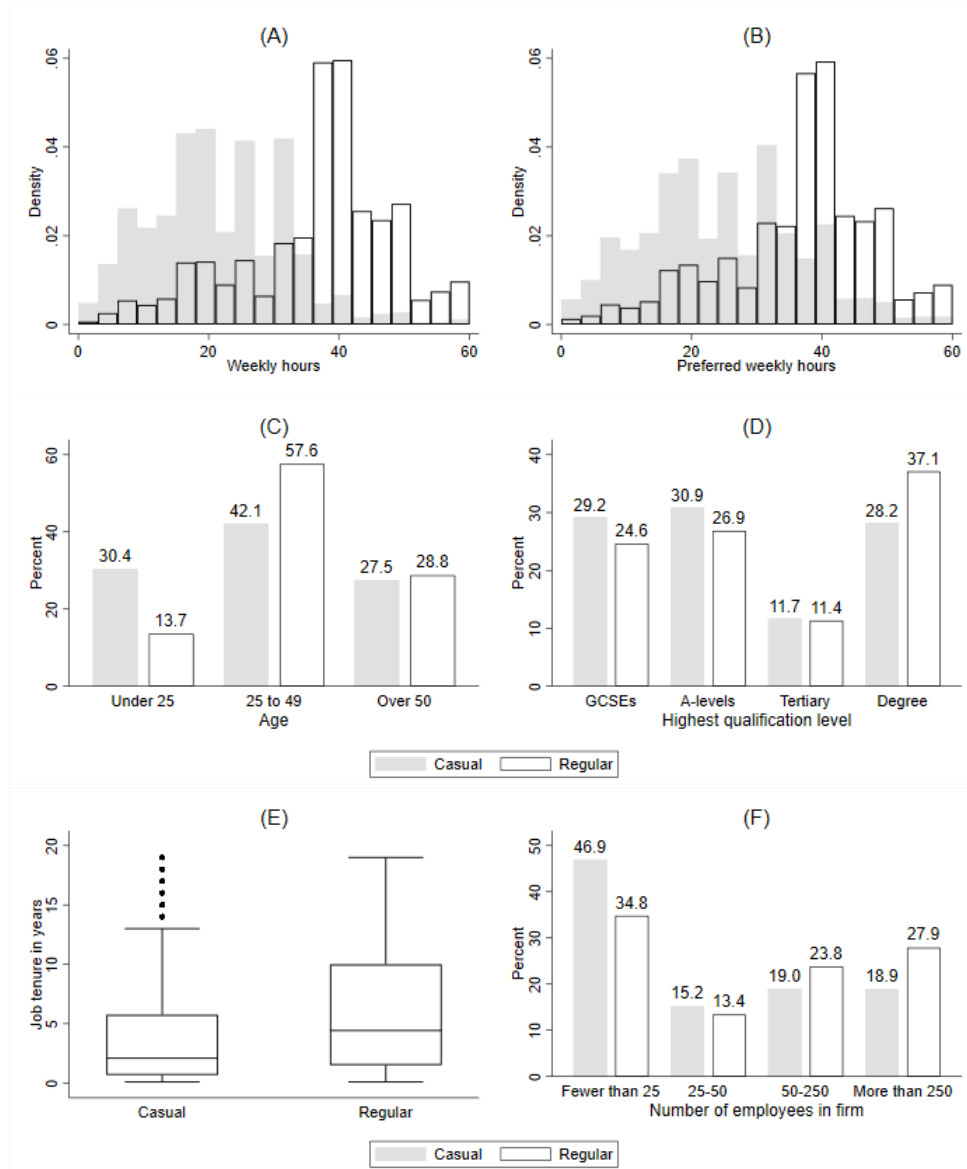
<sup>6</sup> These minimum wages are approximate as minimum wages in Australia vary across industries. This figure is the average federal minimum wage at 2001 prices, assuming that the minimum wage for casual jobs is 25% higher than for regular jobs.

Figure 2: Characteristics of casual jobs and workers

(1) Australia



(2) UK



Source: HILDA and LFS survey. Note: for ease of display, Panel (E) excludes workers with a job tenure of more than 20 years. This excludes fewer than 1% of observations.

The hourly wage in the UK is also lower for casual jobs; the median wage for casual workers was GBP 5.69, compared to GBP 7.60 for regular workers (in 2001 prices). Over the same period, the minimum wage ranged from GBP 4.86 to GBP 5.50.

### 3.4 Labour market transitions of casual workers

The table below shows the workers’ average annual transition probabilities in the Australian HILDA survey. 29% of casual workers move to regular jobs within a year, but only 3% move in the other direction. This provides some support for the argument that casual contracts can provide a “stepping stone” to regular jobs.<sup>7</sup>

Table 1: Average transition probabilities

<b>Year T+1</b>	Not in labour force	Unemployed	Casual	Regular	Total
<b>Year T</b>					
Not in labour force	88%	3%	4%	5%	100%
Unemployed	26%	29%	16%	28%	100%
Casual	14%	4%	54%	29%	100%
Regular	4%	2%	3%	91%	100%
Total	36%	4%	9%	51%	100%

Source: HILDA survey.

## 4 Model

In this section I introduce a model of the labour market in which firms decide whether to offer regular or casual jobs. I refer to this as the “casual” regime. I also set out a version of the model in which firms can only offer regular jobs, which I refer to as the “standard” regime. In order to compare aggregate unemployment, production and worker utility in the casual and standard regimes, the model should include some key features, reflecting the data discussed in Section 2. The aim of this section is to set out a model that incorporates these, whilst remaining as simple and tractable as

<sup>7</sup> Although the LFS does have a panel version, the sample size of casual workers is much smaller.



possible. The four features are as follows: (1) Casual and regular jobs must coexist in equilibrium; (2) The model must allow for workers to transition from casual to regular jobs; (3) The model must incorporate workers with different labour supply preferences. The data described in Section 2 suggests that many workers in casual jobs value the flexibility they provide, and prefer their jobs to a regular job. A model that did not incorporate these preferences would underestimate the positive effects of casual jobs; and (4) The data also suggests there is some mismatch between workers and jobs, in the sense that some workers in casual jobs would prefer to work more hours and vice versa. The model equilibrium must allow this mismatch.

## 4.1 Model setup and main assumptions

The model is based on the Mortensen and Pissarides (1994) model in discrete time. Firms and workers search in a single labour market, and, on matching with a worker, a firm can offer either a casual or a regular job, denoted  $j = \{c, r\}$ . In a regular job, it must “call-up” the worker in every period (and pay them a wage), unless the job is destroyed. Similarly, the worker must supply labour in every period. In a casual job, the firm can choose whether to call-up the worker at the beginning of each period. If the worker is not called-up then the firm does not need to pay them a wage. If called-up, the worker can choose whether to supply labour or not. Below I explain the assumptions that are necessary in order to ensure that the model incorporates the four features described above.

### Coexistence of regular and casual jobs

To ensure firms wish to offer both types of job in equilibrium, I assume that the productivity of worker-job match has two components: a permanent productivity component ( $z$ ) that is drawn once when the worker and firm match, and a temporary shock to productivity ( $x$ ) that is drawn from the same distribution in each period, with no persistence, and which is independent of  $z$ . Total match productivity is  $xz$ . This generates a channel of demand for casual contracts amongst firms that draw a low permanent productivity.<sup>8</sup> The permanent component of productivity has

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<sup>8</sup> As Galdon-Sanchez, Fernández-Villaverde and Alonso-Borrego (2004) note, the productivity shocks can be thought of as the reduced form of other shocks affecting firm profits, such as demand shocks.

distribution  $F(z)$  and bounded support  $[\underline{z}, \bar{z}]$ , and the temporary component has distribution  $G(x)$  and bounded support  $[\underline{x}, \bar{x}]$ . I assume that the mean of  $x$  is one. It acts as a multiplier of the permanent productivity  $z$ , so that productivity is “high” in periods when  $x > 1$  and “low” in periods when  $x < 1$ .

## Transitions

To allow for transitions between different types of job, casual workers can search on the job. Employed workers can only search when they are not called-up to work, so that regular workers do not search. This means that search intensity is in some sense endogenous. For simplicity, I assume that firms are not able to renegotiate with workers who have been offered another job by offering a higher wage or more hours of work.

## Heterogenous labour supply preferences

I assume that there are two worker types  $i = \{H, L\}$ . “High Labour Supply” (type H) wish to work in all periods as they have no disutility of labour, so that their per-period utility if they are working is given by  $u(w) = w$ , where  $w$  is the wage they earn. “Low Labour Supply” (type L) experience shocks to their disutility of labour, so that their per period utility of working is  $u(w) = w - \epsilon$ .  $\epsilon$  is their disutility of labour, and has distribution  $H(\epsilon)$ . It captures any other commitments that workers may have, such as caring or studying commitments. For simplicity I assume that  $\epsilon = \{0, \bar{\epsilon}\}$  with  $Pr(\epsilon = 0) = \phi$ , where  $w - \bar{\epsilon} < b$ , where  $w$  is the wage, and  $b$  is the per-period value of unemployment.<sup>9</sup> Therefore, if type L workers accept a casual job, the probability that they will turn down an offer of work is  $1 - \phi$ .<sup>10</sup> A fraction  $\gamma$  of workers are type L, and workers do not change types. In other respects, workers are ex-ante identical. The cumulative distribution of type  $i$  workers with type  $j$  jobs with permanent match productivity  $z$  is denoted  $N_{ij}(z)$ .

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<sup>9</sup> I discuss further conditions for  $\bar{\epsilon}$  in more detail below.

<sup>10</sup> This is a simplifying assumption, in practice it is not certain that casual workers are always able to refuse work without fear of reprisals, as I assume (Ball et al., 2017; Taylor, 2017).

## Mismatch

In the search and matching framework, search frictions generate unemployment. In a single labour market without directed search, if a type H worker is offered a casual job, they may accept in order to avoid unemployment, although they would prefer a job where they are called-up in every period. Similarly, a type L worker may accept a regular job, although they would prefer the flexibility of a casual job. In this model workers search in a single labour market, so that workers who prefer one type of job may accept the other type if it is the first job they are offered.

## Wage determination

In order to simplify the model as much as possible, I make some further assumptions. I assume that wages are set by bargaining between firm and worker over the surplus from a match, after learning  $z$ . How to model wages in a search model with on-the-job search is an open question, as higher wages both decrease the firm's markup and decrease turnover.<sup>11</sup> I follow Hall and Milgrom, 2008, who show that a breakdown in negotiations will lead to a delay of production rather than a permanent suspension, so that workers and firms share the expected flow surplus from a match. I also assume that there is a minimum wage  $\underline{w}$  for both types of job i.e.  $w(z) = \max\{\eta z + (1 - \eta)b, \underline{w}\}$ .

In this setting there is a further complication as workers must make decisions about which type of job to accept based on two dimensions: expected hours of work and wages. This specification ensures that, provided that  $\underline{w}$  is large enough, an unemployed type H worker will take the first job offered whether regular or casual. It also ensures that a type H worker will always prefer a regular job to a casual job.<sup>12</sup> I assume that a firm is not able to renegotiate the wage if the worker is offered another job. Therefore a worker will always quit if they are offered a job with a higher  $z$ .

Finally, I assume that there is no endogenous job destruction. This is equivalent to assuming that there is a firing cost large enough that the firm will never wish to fire a worker.

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<sup>11</sup> As a result, the set of feasible payoffs to firm and worker is non-convex (Shimer, 2006).

<sup>12</sup> In Online Appendix A I discuss the choice of  $\underline{w}$  that satisfies these conditions.

### 4.1.1 Model timing

The model timing is as follows:

1. Firms decide whether to pay a cost to enter the labour market.
2. Workers and firms meet randomly, subject to a matching function.
3. Upon meeting a worker, firms and workers learn the permanent match productivity. Firms observe the type of the worker, and decide whether to offer a casual or regular job.
4. Workers decide whether to accept the job they are offered.
5. If the worker accepts the job, at the beginning of each subsequent period the temporary productivity shock for the period is drawn. Type L workers learn their disutility of working for the period.
6. Production occurs. Regular jobs produce and workers are paid in every period. Casual jobs only produce if it is optimal for both worker and firm to do so. Otherwise the worker is (i) not called-up by the firm, or (ii) decides not to supply labour in this period. In either case, the worker earns  $b$ . Unemployed workers also receive  $b$ .
7. During the production phase employed workers who are not called up for work can search for a new job in the same labour market as unemployed workers.
8. At the end of each period, a job is destroyed with exogenous probability  $\delta$ . Alternatively, a worker searching for another job may match with a new firm, and may quit for a new job.

## 4.2 Workers

Workers and vacancies meet randomly in a single labour market. There is a matching function  $m(v, s)$  which governs the number of matches in the market, where  $s$  is the measure of workers searching for a job and  $v$  is the measure of vacancies. I make the standard assumptions that the matching function is increasing in  $s, v$ , concave,

and has constant returns to scale. The probability that a firm with a vacancy and a worker match is

$$q(\theta) = \frac{m(s, v)}{v} = m\left(\frac{s}{v}, 1\right)$$

where  $\theta = v/s$  is the market tightness. The probability that an unemployed worker matches with a vacancy is:

$$f(\theta) = \frac{m(s, v)}{s} = m\left(1, \frac{v}{s}\right) = \theta q(\theta).$$

### High labour supply (type H)

In each period unemployed workers earn the value of home production and unemployment benefits,  $b$ , and with probability  $f(\theta)$  they match with a firm. The value of unemployment to a type H worker is

$$U_H = b + \beta \left( f(\theta) \int_z^{\bar{z}} \int_x^{\bar{x}} (\mathbb{1}_{j=r}(z') W_H(r) + \mathbb{1}_{j=c}(z') W_H(c, z', x')) dG(x') dF(z') \right. \\ \left. + (1 - f(\theta)p) U_H \right) \quad (1)$$

where  $\mathbb{1}_{j=r}(z), \mathbb{1}_{j=c}(z)$  are indicator functions that equal one if the firm offers the worker a regular or casual job respectively.<sup>13</sup>  $p = \int_z^{\bar{z}} (\mathbb{1}_{j=r}(z') + \mathbb{1}_{j=c}(z')) dF(z')$  is the probability that the firm chooses to offer the worker a job. Online Appendix A discusses the minimum wage that ensures a type H worker will always accept a casual job if offered one.

A worker with a regular job will earn  $w(z)$  with certainty in each period. At the end of each period the job is destroyed with probability  $\delta$ . Since regular workers are always working, they do not search on the job. Thus the value of a regular job to a type H worker is

$$W_H(r, z) = w(z) + \beta((1 - \delta)W_H(r, z) + \delta U_H). \quad (2)$$

The value of a casual job depends on the realisation of  $x$ , as it effects whether the firm calls-up the worker. If the casual worker is called-up then they are unable to

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<sup>13</sup> Since  $x$  is i.i.d and independent of  $z$ , these will only depend on  $z$ .

search on the job. Otherwise, they earn  $b$  and can search on the job. The value of a casual job to the type H worker is:

$$W_H(c, z, x) = \begin{cases} w(z) + \beta((1 - \delta) \int_{\underline{x}}^{\bar{x}} W_H(c, x', z) dG(x') + \delta U_H) & \text{if called-up to work;} \\ b + \beta(f(\theta)\Psi(z) + (1 - \delta - f(\theta)) \int_{\underline{x}}^{\bar{x}} W_H(c, x', z) dG(x') \\ + \delta U_H) & \text{else.} \end{cases} \quad (3)$$

$\Psi(z)$  is the expected value of a match with a new firm, given by

$$\begin{aligned} \Psi(z) = & \int_z^{\bar{z}} \int_x^{\bar{x}} (\mathbb{1}_{j=r}(z') \max\{W_H(r, z), W_H(c, z, x')\} \\ & + \mathbb{1}_{j=c}(z') \max\{W_H(c, z', x'), W_H(c, z, x')\}) dG(x') dF(z'). \end{aligned} \quad (4)$$

### Low labour supply (type L)

The value of unemployment to a type L worker is

$$\begin{aligned} U_L = & b + \beta \left( \phi f(\theta) \int_z^{\bar{z}} \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} (\mathbb{1}_{j=r}(z') \max\{W_L(r, z, \epsilon'), U_L\} \right. \\ & \left. + \mathbb{1}_{j=c}(z') W_H(c, z', x', \epsilon') \right) dH(\epsilon') dG(x') dF(z') + (1 - f(\theta)p) U_L \end{aligned} \quad (5)$$

where  $p$  again denotes the probability that the firm chooses not to dispose of the vacancy after matching with the worker. Note that a type L worker may turn down a regular job if the wage is not sufficiently high to compensate for the disutility of labour. The value of a regular job to a type L worker depends on the realisation of  $\epsilon$ , so that

$$W_L(r, z, \epsilon) = w(z) - \epsilon + \beta \left( (1 - \delta) \int_0^{\bar{\epsilon}} W_L(r, z, \epsilon') dH(\epsilon') + \delta U_L \right). \quad (6)$$

As long as  $\bar{\epsilon} > \underline{w}$ , a type L worker in a casual job will only agree to work in periods when their disutility of labour in that period is low, i.e. if  $\epsilon = 0$ . If  $\epsilon = \bar{\epsilon}$  then the

type L worker will turn down an offer of work so that

$$W_L(c, z, x, \epsilon) = \begin{cases} w(z) + \beta((1 - \delta) \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} W_L(c, z, x', \epsilon') dH(\epsilon') dG(x') \\ + \delta U_L) & \text{if the worker is called-up and if } \epsilon = 0; \\ b + (\phi f(\theta) \Psi(z) + (1 - \delta - \phi f(\theta)) \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} W_L(c, z, x', \epsilon') dH(\epsilon') dG(x') \\ + \delta U_L) & \text{else.} \end{cases} \quad (7)$$

$\Psi(z)$  is again the expected value of a match with another firm, given by

$$\begin{aligned} \Psi(z) = & \int_z^{\bar{z}} \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} (\mathbb{1}_{j=r}(z') \max\{W_L(r, z, \epsilon'), W_L(c, z, x', \epsilon')\} \\ & + \mathbb{1}_{j=c}(z') \max\{W_L(c, z', x', \epsilon'), W_L(c, z, x', \epsilon')\}) dH(\epsilon') dG(x') dF(z'). \end{aligned} \quad (8)$$

**Proposition 1** *If the minimum wage  $\underline{w}$  is high enough, then (i) an unemployed type H worker will always accept a regular job; and (ii) for a given  $z$ , a type H worker will always prefer a regular job to a casual job.*

See Online Appendix A for a proof. As a result, a firm that meets an employed type H worker may be able to poach them from their current firm if it can offer them a regular job, even if it draws a match quality  $z$  below the  $z$  of their current match. To simplify the exposition, in what follows I restrict attention to scenarios where all casual jobs are paid the minimum wage. If this is the case, then a type H worker will prefer a regular job to a casual job, regardless of the match productivity  $z$  of the current or new match.<sup>14</sup>

**Proposition 2** *The expected value of a casual job to both types of worker after learning  $z$  is weakly increasing in  $z$ .*

See Online Appendix A for a proof. Thus, a firm that meets an employed worker and draws a higher  $z$  than their current match will always be able to poach the worker.

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<sup>14</sup> Relaxing this assumption does not change the qualitative results that follow.

### 4.3 Firms

A firm can post a vacancy with per-period cost  $k$ . With probability  $q(\theta)$  the firm matches with a searching worker. After matching, the firm draws permanent productivity  $z$ . The value of a vacancy to a firm is therefore

$$V = -k + \beta \left( q(\theta) \int_z^{\bar{z}} \left( u_H \Omega_{Hu}(z') + u_L \Omega_{Lu}(z') + \int_z^{\bar{z}} s_H(z) \Omega_{Hc}(z, z') dz \right. \right. \\ \left. \left. + \int_z^{\bar{z}} s_L(z) \Omega_{Lc}(z, z') dz \right) dF(z') + (1 - q(\theta))V \right). \quad (9)$$

$s_i(z) = (1 - \mathbb{1}_{\text{work}}(z))n_{ic}(z)$  is the measure of type  $i$  workers in a casual job who are searching for another job, where  $\mathbb{1}_{\text{work}}(z)$  is an indicator function that equals one if the firm chooses to call up the casual worker, leaving them no time to search, and zero otherwise. I assume free disposal of matches before the firm offers the worker a job so that if a firm draws a very low  $z$ , it can dispose of the match and create a new vacancy in the next period without paying any extra costs beyond  $k$ .

$\Omega$  captures the firm's decision about the type of job to offer the worker. An unemployed type H worker will take either type of job, so that

$$\Omega_{Hu}(z') = \int_x^{\bar{x}} \max\{J_H(c, z', x'), J_H(r, z', x'), V\} dG(x') \quad (10)$$

An unemployed type L worker will always accept a casual job, and may accept a regular job, depending on the wage, relative to  $\bar{\epsilon}$ .

$$\Omega_{Lu}(z') = \begin{cases} \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} \max\{J_L(c, z', x', \epsilon'), J_L(r, z', x'), V\} dH(\epsilon') dG(x') \\ \text{if } \int_0^{\bar{\epsilon}} W_L(r, z', \epsilon') dH(\epsilon') \geq U_L; \\ \int_x^{\bar{x}} \int_0^{\bar{\epsilon}} \max\{J_L(c, z', x', \epsilon'), V\} dH(\epsilon') dG(x') \text{ else.} \end{cases} \quad (11)$$

If the firm meets a type H worker in a casual job, it will offer the worker a job that induces them to quit their current position, if possible. Since the value of a casual job to the worker is increasing in  $z$ , a worker will always quit for a job with a higher  $z$ . By Proposition 1, an employed type H worker will also quit a casual job if offered a regular job.

$$\Omega_{Hc}(z, z') = \begin{cases} \int_x^{\bar{x}} \max\{J_H(r, z', x'), V\} dG(x') \text{ if } z' < z \\ \int_x^{\bar{x}} \max\{J_H(c, z', x'), J_H(r, z', x'), V\} dG(x') \text{ else.} \end{cases} \quad (12)$$



If the firm meets a type L worker in a casual job, it will again offer a job that induces them to quit their current position. A type L worker will always quit for a casual job with a higher  $z$ . They may quit for a regular job, depending on the wage and value of  $\bar{\epsilon}$ .

$$\Omega_{Lc}(z') = \begin{cases} \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} \max\{J_L(c, z', x', \epsilon'), J_L(r, z', x'), V\} dH(\epsilon') dG(x') \\ \text{if } \int_0^{\bar{\epsilon}} W_L(r, z', \epsilon') dH(\epsilon') \geq \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} W_L(c, z', x', \epsilon') dH(\epsilon') dG(x'); \\ \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} \max\{J_L(c, z', x', \epsilon'), V\} dH(\epsilon') dG(x') \text{ if } z' \geq z; \\ V \text{ else.} \end{cases} \quad (13)$$

The value of a filled regular job is the same for both types of worker

$$J_i(r, z, x) = zx - w(z) + \beta \left( \delta V + (1 - \delta) \int_{\underline{x}}^{\bar{x}} J_i(r, z, x') dG(x') \right) \quad (14)$$

The values of a casual job filled with a type H and L worker are

$$J_H(c, z, x) = \begin{cases} zx - w(z) - k_c + \beta (\delta V + (1 - \delta) \int_{\underline{x}}^{\bar{x}} J_H(c, z, x') dG(x')) \\ \text{if worker called-up;} \\ -k_c + \beta ((\delta + f(\theta)(1 - F(\hat{z}_r)))V \\ + (1 - \delta - f(\theta)(1 - F(\hat{z}_r))) \int_{\underline{x}}^{\bar{x}} J_H(c, z, x') dG(x')) \text{ else} \end{cases} \quad (15)$$

and

$$J_L(c, z, x, \epsilon) = \begin{cases} zx - w(z) - k_c + \beta (\delta V + (1 - \delta) \\ \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} J_L(c, z, x', \epsilon') dH(\epsilon') dG(x')) \text{ if worker called-up and } \epsilon = 0; \\ -k_c + \beta (\delta + f(\theta)(1 - F(z)))V + (1 - \delta - f(\theta)(1 - F(z))) \\ \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} J_L(c, z, x', \epsilon') dH(\epsilon') dG(x')) \text{ else.} \end{cases} \quad (16)$$

$k_c$  is the (small) administrative cost of a casual job that must be paid, even if the firm does not call-up the worker.<sup>15</sup>

<sup>15</sup> This could be a cost to manage a more complicated schedule, for example.

**Proposition 3** *The expected value of a casual job to the firm is increasing in  $z$ .*

See Online Appendix A for a proof. This is intuitive: as  $z$  increases, the productivity of the job increases. In addition, the firm is more likely to offer work, so the worker will have less time to search for a new job. If the worker does match with a new firm, there is a smaller probability that they will accept the new job.

### 4.3.1 Reservation productivities

Assuming free entry, the firm will be indifferent between offering a regular or casual job when the following conditions hold

$$\int_{\underline{x}}^{\bar{x}} J_H(r, z, x) dG(x) = \int_{\underline{x}}^{\bar{x}} J_H(c, z, x) dG(x) \quad (17)$$

$$\int_{\underline{x}}^{\bar{x}} J_L(r, z, x) dG(x) = \int_{\underline{x}}^{\bar{x}} \int_0^{\bar{\epsilon}} J_L(c, z, x, \epsilon) dH(\epsilon) dG(x) \quad (18)$$

In Online Appendix A I show that, given a value for  $\theta$ , there exists an interior value of  $z$  which satisfies this condition. Proving uniqueness is only possible after specifying properties of  $F(z)$ , or under certain circumstances, such as in a case with no on-the-job search. I refer to this reservation productivity as  $z_i^*$ . If the firm draws  $z < z_i^*$  then the value of a casual job to the firm is higher, and the firm will offer the worker a casual job. Conversely, if  $z \geq z_i^*$  the firm will offer a regular job, as shown in Figure 3.<sup>16</sup> This reservation productivity is decreasing in the market tightness,  $\theta$ , as when  $\theta$  increases workers find jobs more easily and are more likely to quit a casual job. The firm therefore offers more regular jobs in order to retain workers.

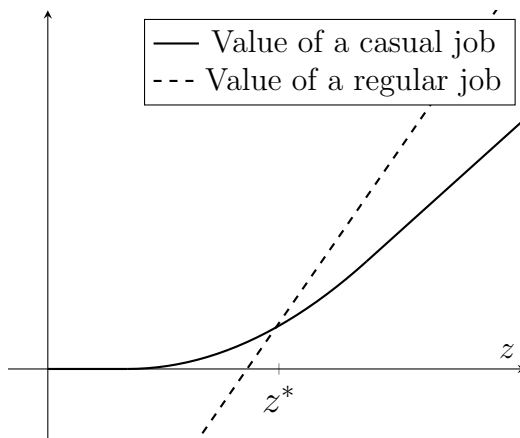
For very low  $z$  the value of a casual job is bounded below by zero (as the firm can always choose never to call-up the worker). I assume that in this case the firm will destroy the match.  $\hat{z}_c$  denotes the largest value of  $z$  where the firm is indifferent between destroying the match and offering the worker a job. When  $z$  is low the value of a regular job can be negative.  $\hat{z}_r$  is the smallest value of  $z$  where the value of a regular job is positive.<sup>17</sup> A firm that meets an employed type H worker in a casual

<sup>16</sup> If the firm meets an employed worker its decision about the type of job to offer will depend on the worker's current job.

<sup>17</sup> Note that  $\hat{z}_r = w/E[x]$ .

job and draws  $z \geq \hat{z}_r$  can offer the worker a regular job in order to poach them from their current firm.<sup>18</sup>

Figure 3: Reservation productivity  $z^*$



## 4.4 Equilibrium

An equilibrium consists of a market tightness  $\theta^*$ , steady state stocks  $\{u_H^*, u_L^*\}$ , distributions  $\{N_{Hc}^*(z), N_{Hr}^*(z), N_{Lc}^*(z), N_{Lr}^*(z)\}$  and reservation productivities  $z_H^*, z_L^*, \hat{z}_c, \hat{z}_r$  that satisfy the following conditions:

1. For each  $z$ , the flow of type H and L workers into casual jobs with productivity  $z$  is equal to the flow out of casual jobs with productivity  $z$ .
2. For each  $z$ , the flow of type H and L workers into regular jobs with productivity  $z$  is equal to the flow out of regular jobs with productivity  $z$ .
3. After meeting an unemployed worker of type  $i$ , a firm that draws  $z = z_i^*$  is indifferent between posting a casual or regular job.
4. A firm that draws  $z = \hat{z}_c, z = \hat{z}_r$  is indifferent between offering the worker a casual or regular job respectively, and destroying the match.

<sup>18</sup>  $\hat{z}_r \geq \hat{z}_c$ , as the value of a casual job to the firm is bounded below by zero, but the value of a regular job is not.

5. Free entry implies that  $V = 0$ .

From Equation (9), the equilibrium  $\theta^*$  must solve

$$k = \beta \left( q(\theta) \int_{\hat{z}_c}^{\bar{z}} \int_{\underline{x}}^{\bar{x}} \left( u_H \Omega_{Hu}(z') + u_L \Omega_{Lu}(z') + \int_{\hat{z}_c}^{\bar{z}} s_H(z) \Omega_H(z, z') dz \right. \right. \\ \left. \left. + \int_{\hat{z}_c}^{\bar{z}} s_L(z) \Omega_{Lc}(z, z') dz \right) dG(x') dF(z') \right). \quad (19)$$

Since the right-hand side of Equation (19) is decreasing in  $\theta$ , and the left-hand side is constant, then there must exist an equilibrium value  $\theta^*$ .<sup>19</sup> However, as well as appearing explicitly in  $q(\theta)$ , the values  $J_H(c, z, x)$ ,  $J_L(c, z, x, \epsilon)$  and the stocks  $u_i, S_i(z)$  are also functions of  $\theta$ . As Albrecht, Navarro and Vroman (2009) note, proving uniqueness in a model with heterogeneous workers (which requires that the right-hand side of Equation (19) decreases monotonically) is more difficult. From the definition of the matching function  $q(\theta)$  is monotonically decreasing in  $\theta$ . Similarly, from Equations (15) to (16), it is clear that  $J_H(c, z, x)$ ,  $J_L(c, z, x, \epsilon)$  are monotonically decreasing in  $\theta$ . Intuitively,  $u_i, s_i(z)$  are decreasing in  $\theta$ , since more workers will find jobs in a tighter market and there will be fewer workers searching for a job. However, as I discuss below, solving for  $u_i, s_i(z)$ , and thus proving uniqueness, requires a functional form for  $F(z)$ .

Given  $\theta^*$ , it is possible to find  $z^*$  from Equations (14) to (16), and thus recover the stocks  $u_i$  and distributions  $N_{ij}(z)$ . The algorithm for finding  $\theta^*$  is set out in Appendix B.

#### 4.4.1 Worker stocks in steady state

The steady state distributions of workers employed in a casual job,  $N_{ic}(z)$ , solve

$$f(\theta) \min\{F(z) - F(\hat{z}_c), F(z_H^*) - F(\hat{z}_c)\} u_H = \delta N_{Hc}(z) + f(\theta)(1 - F(\hat{z}_r)) S_H(z) \\ \phi f(\theta) \min\{F(z) - F(\hat{z}_c), F(z_L^*) - F(\hat{z}_c)\} u_L = \delta N_{Lc}(z) + \phi f(\theta)(1 - F(z)) S_L(z). \quad (20)$$

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<sup>19</sup> The right-hand side tends to zero as  $\theta \rightarrow \infty$ . Provided that the expected value of a job after matching with a worker is greater than  $k$  then the right-hand side will tend to a value greater than  $k$  as  $\theta \rightarrow 0$ .

where  $S_i(z)$  is the cumulative distribution of searching workers of type  $i$ . The distributions of workers employed in a regular job,  $N_{ir}(z)$ , solve<sup>20</sup>

$$\begin{aligned} f(\theta) \max\{F(z) - F(z_H^*), 0\}u_H + (F(z) - F(\hat{z}_r))S_H(z) &= \delta N_{Hr}(z) \\ \phi f(\theta) \max\{F(z) - F(z_L^*), 0\}u_L &= \delta N_{Lr}(z) \end{aligned} \quad (21)$$

The steady state measures of unemployed workers solve

$$\begin{aligned} f(\theta)(1 - F(\hat{z}))u_h &= \delta(N_{Hc}(\bar{z}) + N_{Hr}(\bar{z})) \\ \phi f(\theta)(1 - F(\hat{z}))u_l &= \delta(N_{Lc}(\bar{z}) + N_{Lr}(\bar{z})) \end{aligned} \quad (22)$$

It is not possible to solve this system of equations analytically without specifying a simple functional form for  $F(z)$ . However, it is possible to solve them numerically by iterating over a grid of values for  $z$ , starting with the lowest value at which the firm chooses not to dispose of the vacancy,  $\hat{z}_c$ , at which point  $S_i(\hat{z}_c) = 0$ . I use Equation (20) to find  $N_{ic}(z)$  at this value, and find  $S_i(z)$  for the next value of  $z$ . This process can be repeated for all values of  $z$  on the grid.

In equilibrium there are  $N_{Hc}(\bar{z})$  type H workers in a casual job who can be considered mismatched, as they would prefer a regular job. All else equal, on-the-job search reduces the extent of mismatch, since type H workers can use a casual job as a stepping-stone to a regular job.

## 4.5 Standard regime

In my policy experiment I compare the labour market outcomes in the “casual” regime described above with a “standard” regime, where casual contracts are banned, and firms can only offer regular, full-time contracts. The timing of the model remains the same: firms first pay a cost  $k$  to create a vacancy and upon matching draw a permanent match productivity  $z$ . Workers search for regular vacancies subject to the same matching function,  $m(s, v)$ . However, in this version only unemployed workers search since all employed workers are called-up to work in every period, so  $s = u_H + u_L$ . After matching and drawing  $z$ , firms can choose to dispose of the match freely, or offer the worker a regular job. Production happens in every period until the job is destroyed, which happens at the end of each period with probability  $\delta$ .

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<sup>20</sup> The equations differ because employed type L workers will not accept a regular job.

### 4.5.1 Workers

The values of a regular job to a type H and L worker are<sup>21</sup>

$$W_H(r) = w(z) + \beta((1 - \delta)W_H(r) + \delta U_H) \quad (23)$$

$$W_L(r, \epsilon) = w(z) - \epsilon + \beta((1 - \delta) \int_0^{\bar{\epsilon}} W_L(r, \epsilon') dH(\epsilon') + \delta U_L). \quad (24)$$

### 4.5.2 Firms

The value of a filled regular job to the firm is

$$J(r, z, x) = xz - w(z) + \beta((1 - \delta) \int_x^{\bar{x}} J(r, z, x') dG(x') + \delta V). \quad (25)$$

The value of a vacancy becomes

$$V = -k + \beta(q(\theta) \int_{\bar{z}}^{\bar{z}} (u_H \Omega_{Hu}(z') + u_L \Omega_{Lu}(z')) dF(z') + (1 - q(\theta))V) \quad (26)$$

Once again,  $\Omega$  captures the firms decisions. A type H worker will take any job offered, so that

$$\Omega_{Hu}(z') = \int_x^{\bar{x}} \max\{J(r, z', x'), V\} dG(x'). \quad (27)$$

A type L worker will only take a job with a wage high enough to offset their disutility of labour,<sup>22</sup> so that

$$\Omega_{Lu}(z') = \begin{cases} \int_x^{\bar{x}} \max\{J(r, z', x'), V\} dG(x') & \text{if } z \geq \frac{\bar{\epsilon}}{1-\phi} + b; \\ V & \text{else.} \end{cases} \quad (28)$$

### 4.5.3 Equilibrium

An equilibrium in the standard regime consists of steady state values  $\{\theta^*, u_L^*, u_H^*, N_{Hr}(\bar{z}), N_{Lr}(\bar{z}), \hat{z}_r\}$ , that satisfy the following conditions:

<sup>21</sup> The condition that ensures a type L worker will take a regular job, rather than choosing to remain unemployed is  $\bar{\epsilon} \leq (w - b)/(1 - \phi)$ .

<sup>22</sup> If  $z$  is too low, the expected per period value of a job to a type L worker will be below the value of unemployment,  $b$ .

1. Free entry (i.e.  $V = 0$ ).
2. The flow out of unemployment for each type of worker is equal to the flow into unemployment
3. A firm that matches with a workers and draws  $z = \hat{z}_r$  is indifferent between destroying the match and offering the worker a regular job.

Rearranging Equation (26), the free entry condition becomes

$$k = \beta q(\theta) \int_{\bar{z}}^{\hat{z}} (u_H \Omega_{Hu}(z') + u_L \Omega_{Lu}(z')) dF(z'). \quad (29)$$

Since  $q(\theta)$  is monotonically decreasing in  $\theta$ , this has a unique solution for the equilibrium  $\theta^*$ . The steady state measure of unemployed workers is

$$u_H = \frac{\delta(1 - \gamma)}{\delta + f(\theta)(1 - F(\hat{z}_r))} \quad u_L = \frac{\delta\gamma}{\delta + \phi f(\theta)(1 - F(\hat{z}_{Lr}))}. \quad (30)$$

where  $\hat{z}_{Lr} = \bar{\epsilon}/(1 - \phi) + b$  The measure of employed workers of each type is

$$\begin{aligned} N_{Hr}(\bar{z}) &= \frac{f(\theta)(1 - F(\hat{z}_r))u_H}{\delta} \\ N_{Hc}(\bar{z}) &= \frac{\phi f(\theta)(1 - F(\hat{z}_{Lr}))u_L}{\delta} \end{aligned} \quad (31)$$

## 5 Calibration

In this section I set out an indicative calibration of the model, in order to compare labour market outcomes in the casual and standard regimes. The benchmark economy is calibrated to match features of the Australian data. It is not possible to find closed form results for this model, so instead I solve the model numerically, using the parameters set out below, and the solution algorithm described in Online Appendix B.

I calibrate the model under the assumption that the economy is in steady state. The length of a time period is one week. As labour demand and supply in my model are binary (a worker supplies one unit of labour in each period if they are offered work)

it makes sense to choose a shorter period. The HILDA survey includes questions about weekly working hours, and so I use a period length of one week.

With a model in discrete time, it is necessary to ensure that the worker-finding probability  $q(\theta)$  and job-finding probability  $f(\theta)$  are bounded above by one. The standard Cobb-Douglas matching function, which is often used in continuous models, can admit a probability greater than one. I therefore use the matching function suggested by den Haan, Ramey and J. Watson (2000):

$$m(s, v) = \frac{sv}{(s^\alpha + v^\alpha)^{1/\alpha}}. \quad (32)$$

As required,  $m(s, v)$  is increasing in  $s, v$ , concave and has constant returns to scale.

## 5.1 Pre-determined parameters

Table 2 summarises pre-determined parameters and their sources.

Table 2: Pre-determined parameters

Parameter	Value	Source
Weekly interest rate, $r$	0.1%	Yearly interest rate of 5%
Weekly minimum wage $w$	1	Normalised to one
Per period value of unemployment, $b$	0.22	Average replacement rate in Australia (Nickell, Nunziata and Ochel, 2005)
Proportion of type L workers, $\gamma$	0.109	HILDA survey
Probability type L worker wishes to supply labour, $\phi$	63%	HILDA survey
Weekly job destruction probability, $\delta$	0.5%	Average length of a regular job, HILDA survey
Per period cost of a casual job to the firm, $k_c$	0.01	

An important aspect of the quantitative analysis is the division of workers into two types, H and L, based on their labour supply preferences. The HILDA survey includes



questions about working hour preferences that I use to calculate an approximate proportion of type L workers. These are discussed in more detail in Online Appendix C. Using usual weekly working hours from the HILDA survey, I find that, on average, type L workers with casual jobs work 68% of the weekly hours of type H workers. I therefore set  $\phi$ , the probability that a type L worker wishes to supply labour, to 68%.

Another important element is the parameterisation of the distributions  $F(z), G(x)$ . I assume that the permanent productivity distribution  $F(z)$  is lognormal, so that  $\ln(z) \sim N(\mu, \sigma^2)$ . This is a common assumption, motivated by evidence that firm productivity is distributed lognormally (Oulton, 1998; Cabral and Mata, 2003). For tractability, I assume that  $x$  has a uniform distribution so that  $x \sim U[x, \bar{x}]$  with  $m_x = \bar{x} - x$ , and a midpoint of one.

It is not possible to associate each parameter in the model with a separate data moment. Instead, I choose the remaining parameters simultaneously to minimise the percentage distance between the models' predictions and the following moments:

- The measure of type H and type L unemployed workers, and of type H and type L casual workers, calculated from the HILDA survey.<sup>23</sup>
- A job finding rate of 6.3%, from Elsby, Hobijn and Şahin (2013).<sup>24</sup>
- The average working hours of type H casual workers of 41% relative to regular workers, calculated using the HILDA survey.<sup>25</sup>
- The average length of a casual job of 62 weeks, calculated using the HILDA survey.

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<sup>23</sup> This figure excludes anyone not searching for a job in the last 4 weeks and anyone in another type of non-standard job (e.g. flexitime), and so it is slightly higher than published unemployment figures in Australia.

<sup>24</sup> This is higher than the implied job finding rate of 3.8% given by the average unemployment spell length in the HILDA survey. However, the HILDA data includes some respondents who claim to have been unemployed and still searching for a job for a very long time (over ten years in some cases).

<sup>25</sup> In the model labour demand is binary, so that a firm either wishes a worker to supply one unit of labour or none. In practice weekly hours vary among workers, but this provides a simplification that can be used to parametrise the distribution  $G(x)$ .

Table 3: Calibrated parameters

Parameter	Value	Description
$\mu$	0.03	Mean of the distribution of $\ln(z)$
$\sigma^2$	0.3	Variance of the distribution of $\ln(z)$
$m_x = \bar{x} - \underline{x}$	3	Width of the distribution of $x$
$k_v$	3	Per period vacancy cost
$\alpha$	0.32	Matching function parameter
$\bar{\epsilon}$	2	Disutility of labour for type L workers
$\eta$	0.65	Coefficient of $z$ in the wage equation

## 5.2 Outcomes in the benchmark economy

Table 4 summarises the labour market outcomes in the benchmark economy described above.

Table 4: Outcomes in the benchmark economy

	Model value	Data value	Source
<b>Outcomes used in calibration</b>			
Measure of unemployed workers (type H), $u_h$	0.05	0.04	HILDA survey
Measure of unemployed workers (type L), $u_l$	0.01	0.02	HILDA survey
Average job finding rate	7.2%	6.3%	Elsby, Hobijn and Şahin (2013)
Measure of casual workers (type H), $N_{Hc}(\bar{z})$	0.08	0.08	HILDA survey
Measure of casual workers (type L), $N_{Lc}(\bar{z})$	0.07	0.07	HILDA survey
Average spell length casual job	62	62	HILDA survey
Average probability casual worker offered work	44%	41%	HILDA survey

The model matches the data moments reasonably well, given the data limitations and the model’s simplifications, especially the division of workers into two discrete types, although both the job-finding rate and the probability that the firm calls-up a casual worker are slightly too high.

## 6 Results

This section presents a comparison of aggregate labour market outcomes in the casual and standard regimes described above, using the indicative calibration in Section 5. I also show the results of a policy experiment, varying the exogenous minimum wage for casual jobs relative to regular jobs.

### 6.1 Comparison of casual and standard regimes

Table 5 compares the steady states of both regimes. The standard regime is equivalent to a ban on casual work. Such a ban has already been implemented, at least partially, in some countries, including Belgium, France and Germany.

Table 5: Steady state comparison

	<b>Casual regime</b>	<b>Standard regime</b>
Measure of unemployed workers	0.06	0.07
Job-finding rate	7.2%	6.8%
Average measure of workers who are called-up and accept work	0.79	0.93
Average production	1.14	1.38
Average production, less vacancy costs	1.00	1.13
Average workers’ per period utility (type H)	0.87	0.99
Average workers’ per period utility (type L)	0.05	0.04
Average workers’ per period utility (total)	0.92	1.03

**Result 1: Unemployment is higher, and the job-finding rate is lower in the standard regime**

The intuition behind this result is simple: in the standard regime, if a firm draws a very low  $z$  it can no longer offer a casual job, and instead may dispose of the job. Thus the unemployment rate is higher. This illustrates the effect that casual jobs have on firm demand, as increased flexibility for firms increases their expected profits and they do not destroy low productivity matches.

**Result 2: The average measure working is higher in the standard regime**

This metric consists of all regular workers, plus casual workers who are called-up by the firm and accept the offer of work. This result initially appears counter-intuitive. However, it illustrates an important effect of casual jobs on labour supply. In the standard regime, employed workers are always called-up to work and must supply labour. In the casual regime, 15% of the workforce have casual jobs. These casual jobs are mostly those with low  $z$ , and hence casual workers are called-up infrequently (44% of the time, on average). In addition, type L workers in casual jobs only supply labour 63% of the time. On average, more workers are working in the standard regime, although the measure of unemployed workers is higher.

**Result 3: Production is higher in the standard regime**

This result is related to Result 2. In the standard regime, all workers have regular jobs, and are thus called-up to work in every period. In addition, in the standard regime type L workers are unable to turn down work. Since more workers are actually working, and the average productivity of a filled job is higher, production is higher in the standard regime. This effect is offset by a higher measure of vacancies in the standard regime. Overall, there is little difference in production less vacancy costs.

**Result 4: Worker utility is (very slightly) higher in the standard regime**

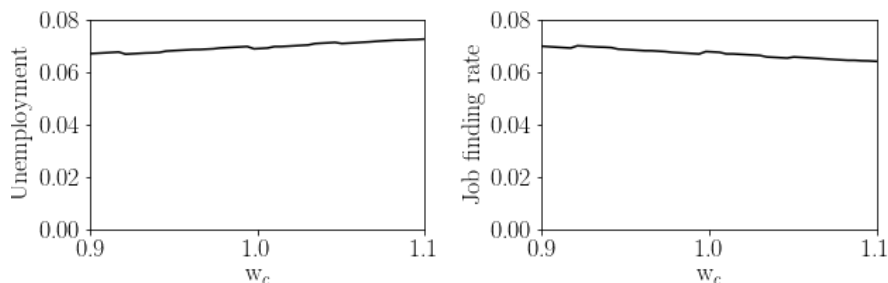
This result is also related to Result 2. Although the utility of type L workers is lower in the standard regime (since they would prefer a casual job), the utility of type H

workers is much higher (since they prefer regular jobs). The overall result is higher utility in the standard regime, as the type H workers are more numerous.

## 6.2 Varying wages

In this section I evaluate the effect of varying the minimum wage for casual jobs relative to regular jobs, so that for casual jobs,  $w_c(z) = \max\{\eta z + (1 - \eta)b, w_c\}$ , where  $w_c$  is the minimum wage for a casual job. The minimum wage for a regular job remains at  $\underline{w}$ . This policy has been proposed in the United Kingdom where it was recommended by the authors of a report commissioned by the government on non-standard work (Taylor, 2017). Figures 4 to 6 below show aggregate outcomes as  $w_c$  increases.<sup>26</sup>

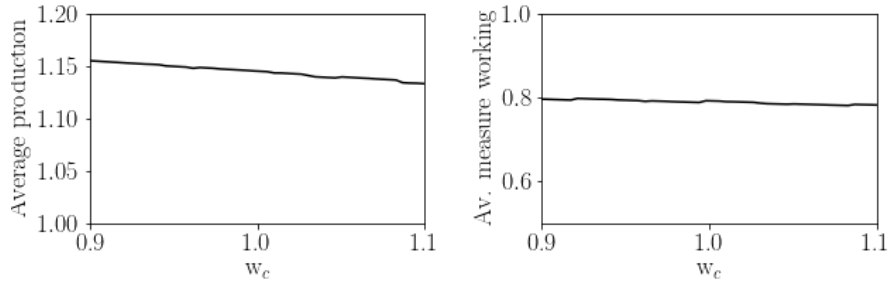
Figure 4: Effects of varying  $w_c$  on unemployment and the job-finding rate



As the relative wage for casual jobs increases, unemployment increases and the job-finding rate decreases. However, the increase in unemployment is fairly small, even with a substantial increase in the minimum wage for casual jobs. This sheds light on the first offsetting mechanism at work: in the casual regime, on-the-job search means that both employed and unemployed workers are attempting to match with vacancies in a labour market with search frictions. As  $w_c$  increases, firms offer more regular contracts. Since workers in a regular job cannot search on-the-job, there are fewer workers searching. In a market with search frictions, this makes it easier for unemployed workers to match with a firm.

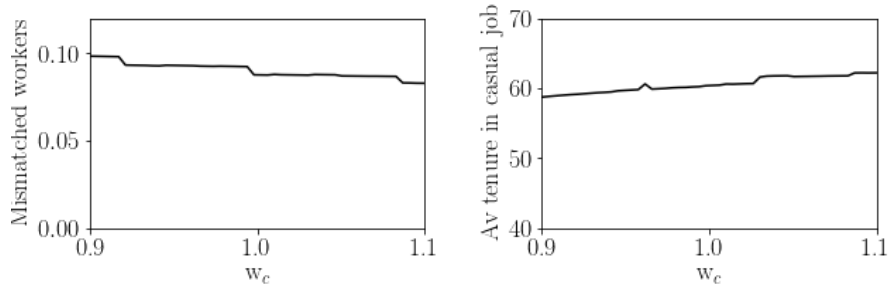
<sup>26</sup> Note that Proposition 1 may not hold if the minimum casual wage is too high. With this calibration, the proposition holds when the minimum casual wage is less than 1.1 times the minimum regular wage.

Figure 5: Effects of varying  $w_c$  on production and the measure working



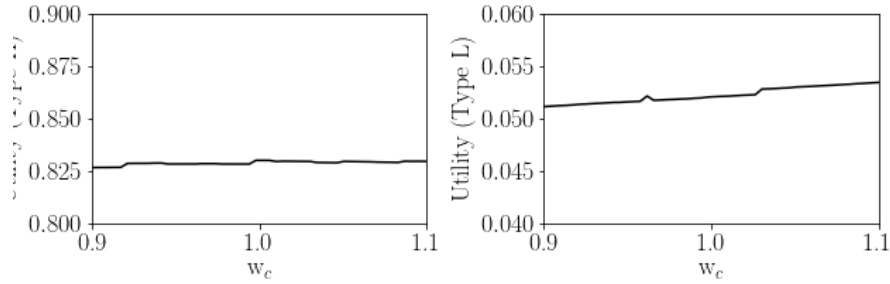
As Figure 5 shows, there is a small decrease in production as the minimum wage for casual jobs increases. As the minimum wage increases, firms offer fewer jobs and workers in casual jobs are called-up less frequently. However, there is also a small increase in the measure working. There is a second offsetting mechanism here: as  $w_c$  increases, firms offer more regular jobs, and more employed workers are called-up to work in each period, and fewer type L workers are able to turn down work. This offsets the slow increase in unemployment that occurs as the casual wage rises, as seen in Figure 4. The net effect is very little change in production or the measure working as  $w_c$  rises.

Figure 6: Effects of varying  $w_c$  on mismatched workers



As the casual wage rises, more type H workers are able to find regular jobs and so the extent of mismatch (type H workers in casual jobs) falls. At the same time however, unemployment increases, and the job-finding rate decreases. It becomes harder for workers to match with a new firm, and the tenure in casual jobs increases.

Figure 7: Effects of varying  $w_c$  on worker utility



As  $w_c$  increases, unemployment increases, which decreases utility for both types. However, there is a third offsetting mechanism: firms offer more regular jobs (increasing utility for type H workers) and casual jobs are more highly paid (increasing utility for both types). The net effect is a very small increase in utility for type H and a slightly larger increase for type L.<sup>27</sup>

### 6.3 Discussion

These results suggest that, under certain conditions, a ban on casual jobs can improve worker utility slightly. There are two main reasons for this conclusion. Firstly, the existence of a group of workers with lower labour supply preferences. In the casual regime type L workers only accept offers of work 63% of the time, leading to lost production. This does not happen in the standard regime. Secondly, in the casual regime workers search on the job for higher productivity jobs which offer work more frequently and pay higher wages. In a model with search frictions this makes it harder for unemployed workers to match with a firm, and for a firm to match with an unemployed worker. A ban on casual work in the standard regime shuts down this on the job search, offsetting the negative effects of lower labour demand by firms.

Surprisingly, I find that an increase in the casual wage has little effect on aggregate outcomes. This is due to three key offsetting mechanisms that occur as  $w_c$  increases and firms offer more regular jobs:

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<sup>27</sup> A higher fraction of type L than type H workers have casual jobs, as they are more likely to accept a casual than a regular job.

1. Fewer workers search on-the-job.
2. Workers in a regular job supply labour for production in every period, regardless of  $x$  or  $\epsilon$ , offsetting decreases in production resulting from higher unemployment.
3. Workers in a regular job are called-up in every period, regardless of  $x$  or  $\epsilon$ , offsetting decreases in utility resulting from higher unemployment.

If firms and workers were able to bargain more flexibly over wages and renegotiate contracts, then workers would be able to search on-the-job, and use job offers from another firm to capture some of the increased surplus that the firm receives with a casual contract, arising from the flexibility over whether to offer work. Equally, a firm meeting an unemployed worker would be able to capture some of the surplus to a type L worker with a casual contract that arises from the flexibility to turn down work. It is not clear which effect would be stronger, and what the resulting effect on aggregate outcomes would be. Finally, it is important to note that both workers or firms in this model are risk neutral. As a result they make choices based only on the discounted income they expect from a match. If workers were risk averse then the uncertainty of income in a casual job would decrease their utility further relative to a regular job, and might further lower worker utility in the casual regime.

## 7 Conclusion

In this paper I first describe the characteristics of workers and firms with casual jobs. I show that casual workers are generally younger and less well-educated than regular workers. They are more likely to work for small firms, in industries where demand changes frequently. Low-skilled or service jobs are more likely to be casual, and on average wages for casual jobs are lower. There is evidence that a significant number of casual workers do not want full-time jobs and that their average preferred working hours are lower.

I develop a search and matching model of the labour market in which firms can offer casual or regular jobs, that reflects the facts described above. Firms face a trade-off between the certainty of a regular job and the flexibility of a casual job. The model shows that there exists a reservation productivity for the creation of a regular job. Thus firms drawing a low match-specific productivity offer a casual job and firms



drawing a high productivity offer a regular job. In the steady state both types of jobs coexist.

My model allows me to compare aggregate outcomes in this casual regime with a standard regime, in which casual jobs are banned. I find surprising effects of such a ban: in the standard regime workers' utility and production are slightly higher. There are two reasons for this result. Firstly, in the standard regime firms must offer work and workers must accept in every period. As a result, the average measure of workers actually working in any period is higher in the standard regime, and production is higher. Secondly, in the casual regime, casual workers search for jobs that will offer work more frequently and with a higher wage. This increases the pool of workers searching for a job and, combined with matching frictions, offsets some of the benefits of lower unemployment. I also present the results of another policy experiment, varying the minimum wage of casual relative to regular jobs. Due to the mechanisms described above, there is little change in outcomes when the casual wage increases.

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## Online Appendices

### A Proofs

#### Proof of Proposition 1(i)

In order that an unemployed type H worker will always accept a regular job if offered one, the minimum wage must be high enough to compensate the worker for the value of on-the-job search. The lowest value of a regular job to the worker occurs when the minimum wage  $\underline{w}$  binds, so that

$$\begin{aligned} W_H(r, z) &= \underline{w} + \beta \left( W_H(r, z) + \delta U_H \right) \\ &= \frac{\underline{w} - \beta \delta U_H}{1 - \beta(1 - \delta)} \end{aligned} \quad (33)$$

An upper bound for the value of unemployment is given when the worker finds a job after one period with probability one. In this case,

$$\bar{U}_H = b + \beta \int_z^{\bar{z}} \int_x^{\bar{x}} \frac{w(z') - \beta \delta \bar{U}_H}{1 - \beta(1 - \delta)} dG(x') dF(z') \quad (34)$$

A minimum wage  $\tilde{w}$  which solves  $W_H(r, z) = \bar{U}_H$  gives a lower bound for the minimum wage at which workers will always accept a regular job. If the minimum wage is at least as high as  $\tilde{w}$  then the worker will always prefer to work rather than search. Figures 8 and 9 below show the values of a job to workers.

## Proof of Proposition 1(ii)

The expected value of a casual job to a type H worker before learning the temporary productivity shock can be written as a linear combination of the value if the worker is offered and accepts work, denoted  $W_H^o(c, z, x)$ , and the value if they do not, denoted  $W_H^n(c, z, x)$ , so that

$$\int_x^{\bar{x}} W_H(c, z, x) dG(x) = (1 - G(\hat{x}(z)))W_H^o(c, z, x) + G(\hat{x}(z))W_H^n(c, z, x) \quad (35)$$

where  $(1 - G(\hat{x}(z)))$  is the probability that the worker is called-up by the firm to work,  $\hat{x}(z)$  is the lowest realisation of  $x$  where the firm calls-up the worker, and

$$\begin{aligned} W_H^o(c, z, x) &= w(z) + \beta((1 - \delta) \int_x^{\bar{x}} W_H(c, z, x) dG(x) + \delta U_H) \\ W_H^n(c, z, x) &= b + \beta \left( f(\theta) \int_z^{\bar{z}} \int_x^{\bar{x}} (\mathbb{1}_{j=r}(z') \max\{W_H(r), W_H(c, z, x')\}) \right. \\ &\quad \left. + \mathbb{1}_{j=c}(z') \max\{W_H(c, z', x'), W_H(c, z, x')\}) dG(x') dF(z') \right. \\ &\quad \left. + (1 - \delta) \int_x^{\bar{x}} W_H(c, z, x) dG(x) + \delta U_H \right). \end{aligned} \quad (37)$$

Note that  $W_H^o(c, z, x) \geq W_H^n(c, z, x)$  for all  $z$ . To see this, suppose that the converse were true. In this case the worker would always turn down an offer of work in favour of searching on-the-job. Hence the value of a casual job would be equal to the value of unemployment. However, the minimum wage  $w$  is set at a value that compensates the worker for the lost value of searching on-the-job. Therefore it must be the case that, at a wage  $w$ , the worker will always accept if called-up to work, and therefore  $W_H^o(c, z, x) \geq W_H^n(c, z, x)$  for all  $z$ .

Since the worker always prefers to work, the highest value of a casual job to the worker occurs when they are always called-up to work. Thus an upper bound for the value of a casual job is

$$W_H(c, z, x) = \frac{w(z) - \beta\delta U_H}{1 - \beta(1 - \delta)} \quad (38)$$

This is equal to the value of a regular job with match quality  $z$ . Thus the value of a casual job is always lower than the value of a regular job for a given  $z$ . If the parameters are such that all casual jobs are paid the minimum wage, then this is equal to the lowest value regular job. In this case, a type H worker will always quit a casual job for a regular job, regardless of the match quality of their current match.

## Proof of Proposition 2

The expected value of a casual job to the worker is given by Equation (35). From Proposition 3, the probability that the worker is called up to work is increasing in  $z$ . The weight on the larger term in Equation (35) is increasing and thus the expected value of a casual job is increasing in  $z$ .

## Proof of Proposition 3

As  $x$  is i.i.d, the expected value of a casual job filled with a type H worker before learning  $x$  to the firm is a linear combination of the value if the firm decides to call-up the worker, denoted  $J_H^o(c, z, x)$ , and the value if they do not, denoted  $J_H^n(c, z, x)$ , so that

$$\int_x^{\bar{x}} J_H(c, z, x) dG(x) = (1 - G(\hat{x}(z))) J_H^o(c, z, x) + G(\hat{x}(z)) J_H^n(c, z, x) \quad (39)$$

where

$$J_H^o(c, z, x) = xz - w(z) + \beta(1 - \delta) \int_x^{\bar{x}} J_H(c, z, x) dG(x) \quad (40)$$

$$J_H^n(c, z, x) = \beta(1 - \delta - f(\theta)(1 - F(\hat{z}_r))) \int_x^{\bar{x}} W_H(c, z, x) dG(x). \quad (41)$$

$(1 - F(\hat{z}_r))$  is the probability that an employed worker that matches with a firm will receive a better job offer and will quit their current firm. The firm calls-up the worker when  $J_H^o(c, z, x) > J_H^n(c, z, x)$ , i.e. when

$$xz - w > -f(\theta)(1 - F(\hat{z}_r)) \int_x^{\bar{x}} J_H(c, z, x') dG(x'). \quad (42)$$

If  $J_H(c, z, x')$  is decreasing in  $z$ , then the condition to call-up the worker becomes less strict as  $z$  increases, and the firm will call-up the worker less often. However, the flow profit from calling-up the worker  $xz - w(z)$  is increasing as  $z$  increases, and so the firm will wish to call-up the worker more often. This is a contradiction, and hence the expected value of a filled casual job must be increasing in  $z$ . Let  $\hat{x}(z)$  be the lowest value of  $x$  at which the firm will call-up the worker. If  $J_H(c, z, x')$  is increasing then  $\hat{x}(z)$  must be decreasing in  $z$ .

## Existence of the reservation productivity

The reservation productivity for type H workers must satisfy

$$\frac{1}{1 - \beta(1 - \delta)} \left( \int_{\underline{x}}^{\bar{x}} (zx - w(z)) dG(x) \right) = \frac{1}{1 - \beta(1 - \delta - f(\theta)G(\hat{x}(z))(1 - F(\hat{z}_r)))} \left( \int_{\hat{x}(z)}^{\bar{x}} (zx - w) dG(x) - k_c \right). \quad (43)$$

To show existence of  $z_H^*$ , it is sufficient to show that there exists at least one region in the domain of  $z$  where the expected value of a casual job, conditional on  $z$  (the left-hand side) is greater than or equal to the value of a regular job (the right-hand side), and vice versa. Firstly, note that if  $z < w/\bar{x}$  then for any realisation of  $x$ ,  $xz < w$  and a firm with a casual job will never call-up the worker. The value of such a casual job is zero, and so the value of a filled casual job is bounded below by zero. However, a firm with a regular worker must still call-up and pay the worker in every period, and hence the value of a regular job is negative for  $z < w/\bar{x}$ . Therefore, for  $z < w/\bar{x}$  the expected value of a casual job is greater than a regular job.

Secondly, for  $z > w/\underline{x}$  a firm with a casual job will always want to offer work, regardless of the realisation of  $x$ . The expected value of a casual job is

$$\frac{1}{1 - \beta(1 - \delta)} \left( \int_{\underline{x}}^{\bar{x}} (zx - w(z)) dG(x) - k_c \right). \quad (44)$$

The inclusion of the (small) administrative cost  $k_c$  ensures that this is always less than the expected value of a regular job, and hence there exists at least one reservation productivity  $z_H^*$ . Similar arguments ensure that there exists a reservation productivity  $z_L^*$ .

To prove uniqueness of  $z_H^*$  it is necessary to show that the left- and right-hand sides of Equation (43) are only equal for one value of  $z$ . It is therefore necessary to know the functional form of the distribution  $F(z)$ . It is possible to show that  $z_H^*$  is unique for certain distributions, including the uniform distribution.

Figure 8: Job values (type H worker)

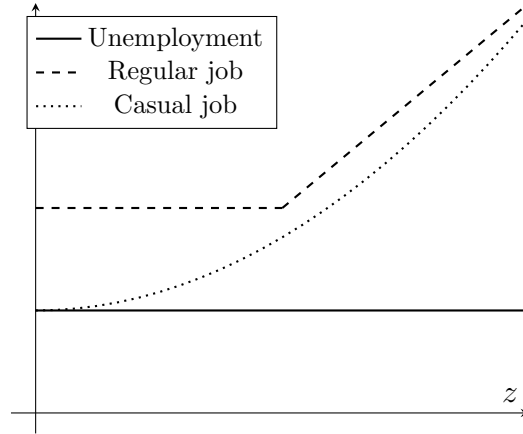
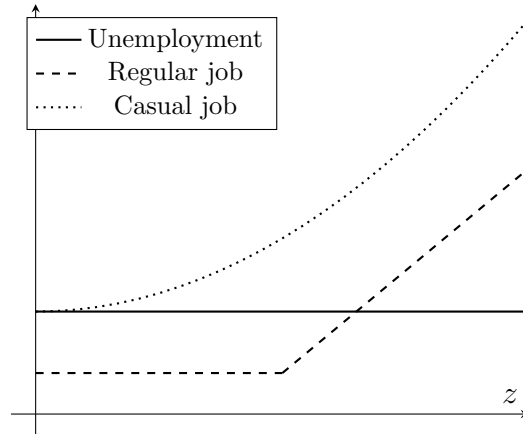


Figure 9: Job values (type L worker)



## B Algorithm for equilibrium solution

I use the following algorithm to find the equilibrium values of  $\theta^*$ ,  $z_i^*$ , the steady state stocks  $u_i^*$  and distributions  $N_{ij}(z)$ :

1. Set an initial value for  $\theta^* = \theta_0$
2. Using a guess  $\theta_0$ , find the firm's expected values of a filled job after learning  $z$   $J_{H0}(r, z, x)$ ,  $J_{L0}(r, z, x)$ ,  $J_{H0}(c, z, x)$ ,  $J_{L0}(c, z, x, \epsilon)$  using Equations (14) to (16).

From these values, find the reservation productivities  $z_{i0}^*$

3. Using the firm values, find the steady state stocks  $u_{i0}^*$  and distributions  $N_{ij0}^*(z)$  using Equations (20) to (22)
4. Given the firm's values of a filled job, and the stocks  $u_{i0}^*, S_{ij0}^*(z)$ , find the updated value  $\theta_1$  that satisfies the free entry condition Equation (19)
5. Update the initial guess to the new guess  $\theta_0 = \theta_1$  and continue from Step 2
6. After each iteration calculate the difference between the current and previous guess for  $\theta^*$  (i.e. after  $n$  iterations, calculate  $|\theta_{n+1} - \theta_n|$ ). Continue until the difference is lower than some  $\epsilon$ . Stop when  $|\theta_{n+1} - \theta_n| < \epsilon$
7. If  $w_c > w_r$ , confirm that all type H workers in casual jobs would prefer regular jobs. It is sufficient to check that  $z_H^*$  occurs when the minimum wage is binding i.e. that  $z_H^* < (w - (1 - \eta)b)/\eta$ . In this case, all casual workers will be paid the minimum wage, and will prefer regular jobs (with a wage at least as high and the guarantee of work).
8. Confirm uniqueness of reservation productivities  $z_H^*, z_L^*$

## C Worker types

The HILDA survey contains the following questions about preferred working patterns for employed and unemployed workers:

**(A) Please pick a number between 0 and 10 to indicate how satisfied or dissatisfied you are with [the hours you work/ the flexibility to balance work and non-work commitments].**

**(B) You have said that (currently) you usually work fewer than 35 hours per week. What is the main reason for your working part-time hours?**

- (i) Own illness or disability
- (i) Caring for children/ disabled or elderly relatives
- (iii) Other personal or family responsibilities
- (iv) Could not find full-time work



- (v) Prefer part-time work
- (vi) Involved in voluntary work
- (vii) Attracted to pay premium attached to part-time or casual work/Welfare payments or pension may be affected by working full-time
- (viii) Getting business established
- (ix) Prefer job and part-time hours are a requirement of the job
- (x) Other

**(C) At any time during the last 4 weeks have you looked for paid work?**

- (i) No, have not looked for work in last 4 weeks
- (ii) Yes, looked for full-time work only
- (iii) Yes, looked for part-time work only
- (iv) Yes, looked for any work, FT or PT

**(D) What is the main difficulty you have had in getting a job?**

- (i) Hours were unsuitable
- (ii) Difficulties in finding child care
- (iii) Other family responsibilities (not child care difficulties)
- (iv) [Variety of other reasons]

Source: HILDA survey (edited for clarity).

As Figure 10 shows, there are noticeable differences in reported satisfaction with hours and flexibility between regular and casual workers. I am therefore able to use these questions to identify workers who have a strong preference for flexibility as follows:

**Casual workers**

Type L: satisfaction with hours and flexibility of at least 5; would prefer to work fewer than 30 hours (4 days) per week; and any answer to question B, other than (iv), (vii), (ix)

Type H: satisfaction with hours and flexibility of below 5; answered (iv), (vii), or (ix) to question B; or would prefer to work more than 28 hours a week

**Regular workers**

Type L: satisfaction with hours and flexibility of below 5; and would prefer to work fewer than 28 hours a week

Type H: all other regular workers

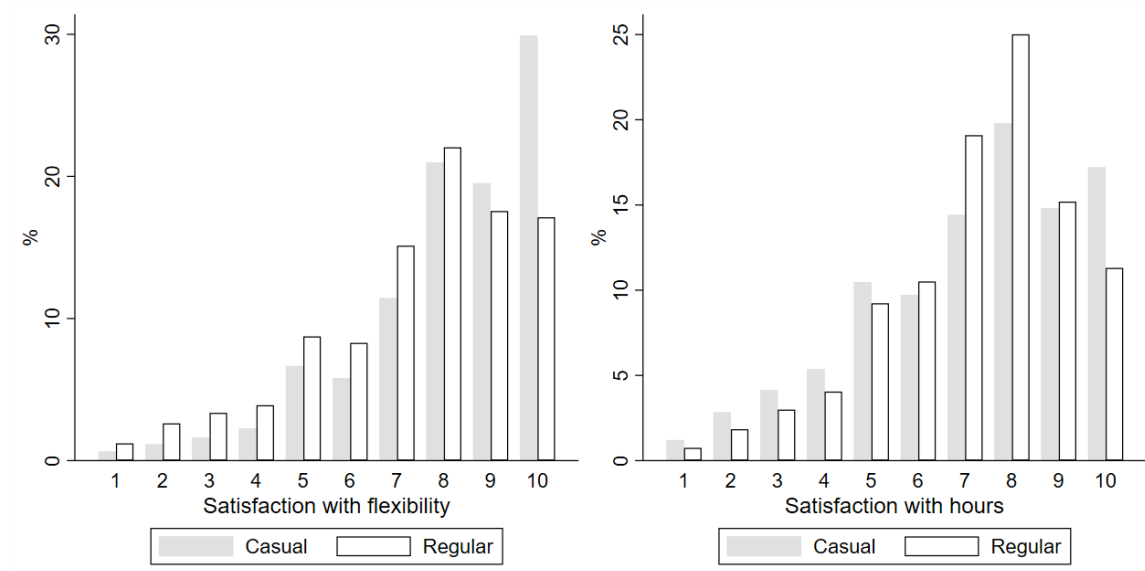
**Unemployed workers**

Type L: answered (i), (ii) or (iii) to question D; or answered (iii) to question C

Type H: all other unemployed workers

In total 89% of the sample are classified as type H.

Figure 10: Level of satisfaction (as % of workers)



Source: HILDA survey.