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Female Human Capital Mismatch: An extension for the British public sector*

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Abstract

This paper looks at the extent of labour market mismatch of public-sector female employees. It contributes to earlier findings for the British labour market by taking into account the endogenous self-selection into jobs. Estimates are based on data from the British Household Panel Study and the 'Understanding Society' covering the years 1991-2016. The analysis verifies that the public sector offers a few low-skilled jobs and employs, mostly, high-educated (female) workers. Regarding the market flows, findings show the greater mobility of the female workforce, which moves proportionately between sectors. Greater in-/out-flows to/from private sector are observed regardless the gender of the employee. Once comparing women to the median employee, a sizeable incidence of mismatch arises due to negative selection. Specifications using the selection model for the public sector illustrate a systematically higher magnitude of mismatch. Pooled results seem to dominate when women seen in the male labour market or in a restricted subsample. Finally, the map of occupations in mismatch supports that the public sector is more attractive as a waiting room for highly-qualified graduates. They queue less time until they find a good job. Hence, policy implications regarding the allocation of jobs for women may arise.

Key words: Human Capital Mismatch; women; British public-sector

JEL Classification: I24, I26, J21, J24

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1 Introduction

Does the public sector allocate efficiently its workforce? If so, no mismatch should arise (Gomes and Kuehn, 2020; Mocetti and Orlando, 2019; McGowan and Andrews, 2017; Gomes, 2015). The answer has important implications for gender inequality in the labour market; especially for women, for whom public sector is the major (if not the sole, in some cases) employer. Implications may extend in the provision of public services and the productivity of government sector (Caponi, 2017). Garibaldi et al. (2020) offer a model to compute the cost of mismatch. They find that elimination of education (or skills) mismatch, on average, raises output by 2.5 (or 3.2%); significant variation across countries, though, exists.

Human Capital Mismatch (HCM) in the labour market may occur when individuals occupied in lower-skilled occupations have similar observable characteristics with those employed in a more skill-demanding job (Galanakis, 2019a). For instance, Galanakis (2019b) discusses the women's greater risk to be in mismatch relative to their male counterparts albeit their constantly changing role in the market. It is not only that women are genuinely more exposed to the mismatch, but also the person's gender may influence their career even before entering into the market. However, no discussion revolved around the particular affiliated sector or the duration of contract women accept.

This paper aims to evaluate the extent of female HCM in the British public sector employing a rich dataset of individual characteristics. In neoclassical terms, if no (significant) mismatch arises, the allocation of public servants is efficient (Pissarides, 2000). Otherwise, the public-sector operates inefficiently despite its better skilled workforce.[1] Therefore, we need to consider each sector as a separate labour market. One may accept their difference, because if the public sector operated as the private one, little would it matter *where* provision comes from. Hence, there are intrinsic factors that make public-sector act differently than the private one.

Firstly, even though private sector is profit maximiser, public sector faces a political constraint. In other words, the public-sector workforce not only produces goods and services, but it engages to activities which aim to vote maximising. Hence, its role may contribute to higher pay (Cai and Liu, 2011; Fuller, 2005; Gunderson, 1979). To this end, each sector forms a *different labour demand* and wage determinants. The public-sector demand will disproportionately benefit those workers whose skills are more useful in the production of public versus private goods (Blank, 1994). The public-sector is the major employer for specific-training jobs (e.g. nurses, teachers).[2] These specialised workers have no expectations for a better job. Their initial mismatch - if any - might result from occupational choices of younger individuals with little or no hiring by public-sector

[1] Generally, the public sector attracts highly educated workers. In the recent years, public servants have become more skilled, whereas their private sector counterparts have maintained a broadly unchanged profile of jobs (ONS, 2017).

[2] Therefore, a fair expectation regards the public-sector insulation from national and international business cycle shocks because both the demand for health and education are local services, and quite independent of demand shocks (Liu et al., 2016) and labour demand is rather inelastic.

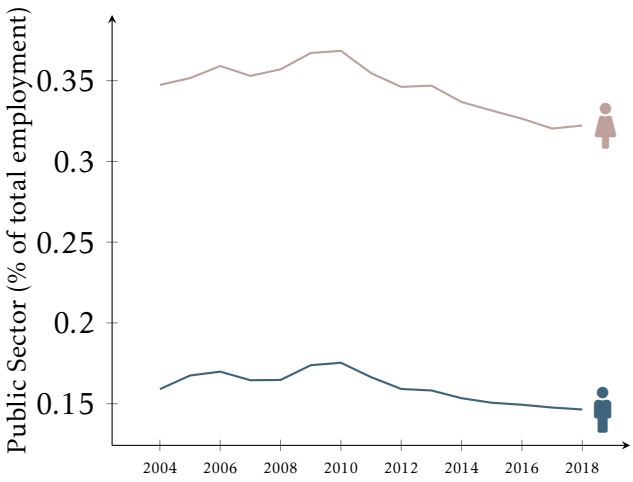


Figure 1: Public Sector employment, by gender; 2004-2018
Note: Public Sector employment rate as percentage of total employment, by gender. A persistent over time unadjusted gender bias in favour of women participation is observed.
Source: Annual Population Survey, ONS

recruiters. In December 2019, 79,000 (or 1.5%) more people work in the British public sector compared to the same month a year ago. According to ONS estimates, it employs 5.44 million individuals; 0.3% more than September of the same year (Caldwell, 2020). However, the interest does not lie on the size of public sector *per se*, but on its gender composition (figure 1).

Secondly, public-sector offers only a few low-skilled jobs (figure 2), but many high-skilled[3] and well-paid ones attracting more female candidates (figure 1; Gomes and Kuehn (2020); Anghel et al. (2011); Gornick and Jacobs (1998)). Due to relatively lower competition and flexibility[4] of the public sector, sizeable mismatch may arise. For instance, let us consider the marginal individual who decides whether to join the public service.[5] If she is highly-qualified but her competition too high,[6] she may *initially* be allocated in a position demanding less skills. Otherwise, she would be immediately

[3]In the UK, public servants are mostly high-educated (43.3% and 42.28% of men and women of total workforce, respectively.). Among those highly-educated women dominate (68%).

[4]For example, in 2011 the public-sector pay freezes for all but those on annual salaries less than £21,000. Since 2013, most of those earnings rise on average by 1%. The stronger unions' bargaining, though, bring about the policy relaxation on 2017, when the private sector recovers (Cribb, 2017). ONS (2017) claims that, in real terms, public servants have been poorer because inflation was greater than the pay growth since 2011. As a result, the public sector is restricted to remunerate its workforce. This restrictive potential is, additionally, indicative in terms of the full use of labour force's abilities.

[5]One enters into the public sector if her utility exceeds the one coming from private-sector employment or unemployment. Hence, a fair argument may claim that the public-sector reservation wage should exceed the competitive-sector one and the unemployment benefits. Further assuming that one dislikes inactivity is convenient for this analysis.

[6]In other words, high competition implies an inflation of graduates with similar characteristics, whose supply cannont meet the demand (number of jobs available).

matched; e.g. nurses or teachers who queue less for a matched job. If jobseekers disproportionately search for jobs in sectors where productivity is relatively low, hires are concentrated in the wrong sectors (Patterson et al., 2016). In other words, if public-sector wages are not high, a few unemployed would be willing to look for a job and public-sector may face recruitment difficulties. Transitions from public to private sector, though, may lead to a better-educated and more productive private labour force (Cribb et al., 2014a). Though, these transitions are not very frequent (see unconditional transitions; figure 10).

Finally, the public sector aims to alleviate widespread disparities met in its competitive counterpart. In fact, in most of the countries, as in the UK, female public servants outweigh their male counterparts. For instance, intrinsic preferences make women choose the public sector; hence, occupational segregation is a forthcoming outcome. Greater job security and satisfaction and better conciliation of work-family life push to the same direction. An initial expected interpretation does not blame the public sector for any mismatch. In other words, horizontal match is more successful in the public rather than private sector (Wolbers, 2003).[7] Instead, we may expect a better matching process achieving the efficient allocation (Gomes, 2015). However, if allocation is not random, the public-sector labour market is segmented and probability of mismatch increases.

This paper has a twofold contribution in terms of evidence and methodology. First, I document the extent of HCM in the public sector given its participation gender bias. Yet, I provide insights on why women are willing to join and wait in the public sector until they find their matched job. Gomes (2015), assuming labour market segmentation and unemployment search according to governmental hirings, shows that public-sector wages play an essential role in efficient allocation. Any premium arisen there reflects the differences in frictions across sectors with two inefficiencies[8] occurring simultaneously. Later, he extends his model in a more realistic set of assumptions and shows the essential role of the endogeneity on the number and type of candidate employees in the public sector (Gomes, 2018). Though, what Gomes does not discuss regards the flows of those employees in mismatch and different sectors dynamically - why would they accept a less skills-demanding job initially? If hires in the government sector are from a private-sector pool, the cost of mismatch should be lower.[9] Santos and Cavalcanti (2015) show that a premium generates (mis)allocation effects and significant productivity losses using a model calibrated for Brazil. Literature connecting the public-sector employment with the mismatch is not rich and has not reached to any consensus. Empirically, Dolton and Vignoles (2000)[10] reject the HC interpretation that wage losses of overeducated are due

[7] Somers et al. (2019) attribute this assumption to healthcare and education; two sectors which mostly employ graduates in the public sector.

[8] (a) Persistent queues and significant unemployment for low-skilled and (b) recruitment problems for high-skilled.

[9] The idea of the cost here stands only for motivating purposes. No discussion on the penalty of mismatch is evolved in this paper.

[10] Scholars usually employ a dummy variable in their analysis aiming to explore the effect of overeducation in the public sector. This is not necessarily correct as the (strong) working assumption considers that the

to the public-sector rigidities.

Second, I account for the endogenous decision of sectoral affiliation. Pooling earlier estimates may be a potential way to examine the magnitude of mismatch in the public-sector, but it neglects the unobserved worker heterogeneity (Nickell and Quintini, 2002) resulting from the self-selection into jobs. As discussed later, OLS estimates which do not account for selection into the public sector, might be biased.[11] If allocation into sectors is not random, then estimates might overstate the existent gap. Some studies addressing this issue, either employ a selectivity correction or instrumental variables (e.g. Afonso and Gomes (2014); Maczulskij (2013)).[12] Some scholars have taken advantage of the privatisations and use them as a 'natural experiments' (e.g. Danzer (2019); Disney and Gosling (2003)).[13] Clark and Senik (2006) use individual fixed effects. The less sensitive to errors estimates may come from double selection models, like in Heitmueller (2006). However, this implies that we can identify what affects the labour-supply decision and not the public-sector choice. This exercise might be puzzling given the timing of individual decisions and the data availability. To this end, I restrict the sample to those in paid employment and control for the endogenous decision to contribute as public servants.

Using data coming from the UK for 25 years (1991-2016), I find a negative selection for the public sector employees, which contributes to the incidence of mismatch for women. Changing the control group creates differences in the incidence. When comparing women with the median employee, one may notice a sizeable magnitude of the mismatch reaching, on average, 37.8%. This may be explained if we see which occupations suffer the most. They usually include entry-level jobs which may act as a waiting room. Highly-qualified individuals seem to prefer waiting in a public-sector position being in mismatch rather than a private-sector matched one. In the former case, the likelihood finding better jobs is greater. What this measure likely picking up is the individual lower relative labour market experience. Since they end up in a matched position later than their well-allocated colleagues, they have accumulated less relevant experience. To this end, the policy perspective of this paper regards the allocation of talent in the public sector and its impact on the sectoral competitiveness and quality of goods and services offered. In other words, in this paper I stress the relative scarcity of the high-skilled jobs in the public sector. The negative selection implies the lower return to skills in the public sector coming from the unobserved individual productivity.

The rest of the paper is structured as follows. Section 2 describes the British public sector. Section 3 reports the methodology followed in this paper. Section 4 discusses

rest of covariates are equally distributed across sectors. Instead, analysis should be separate for each sector trying to control for the endogenous sectoral decision.

[11] In fact, these estimates suffer from a double selection, especially important for women. Initially, individuals decide if they will work (labour supply decision). Upon participation, they choose the sector of employment.

[12] Inconclusive findings of empirical studies signal the difficulty of identifying instruments for the public-sector.

[13] This method may neglect dynamic effects of those enjoying the public-sector pay premium.

the results, while section 5 concludes.

2 The British Public Sector

In the mid 2019, ONS estimated that 5.4 million employees (or 16% of labour force)[14] work in the public sector in the UK (Bodey and Haughton, 2019). This may include cleaners and drivers to technicians and nurses. Prior to any attempt of analysis regarding public-sector workforce mismatch, it is essential to describe its composition. Whether jobs belong to public sector depends on the organisation's degree of governmental regulation. In other words, who funds, controls and owns a company indicate the sector of a certain job.

To this end, some individuals are clearly public servants, like workers in civil service or the central government. To the opposite extreme, others are, undoubtedly, private-sector employees, e.g. developers in a tech start-up company. Considering the above jobs allocation as a continuum (figure 3), where on the one side we have strictly public-sector jobs and on the other side solely private-sector ones. The in-between area constitutes a grey area without clear boundaries. For example, Higher Education Lecturers are employed by non-profit (at least in principle) institutions. They are independent to the government despite their subsidy or control on EU-students' fees. Finally, School Academies or Foundation Hospitals may belong to charitable institutions and enjoy a certain degree of freedom in terms of hiring staff. Their funding and regulation, though, lie on the central government (Fontaine et al., 2020; Cribb et al., 2014a).

The distinctive feature of the public sector regards the provision of a good (or service) to the population financed by the taxation. If an organisation does not belong in this sector, *by definition*, is part of the private one.[15] As in the official statistics, in my data, the distinction between the sectors comes from a self-reported variable[16,17] For this paper, I adopt the definition from Fontaine et al. (2020), excluding (i) every private organisation; (ii) public companies; (iii) Nationalised industry or state corporation; (iv) Charity, voluntary organisation or trust; (iv) other organisation.[18]

[14] In their analysis, demographics depend on the Annual Population Survey estimates. This estimate is based on the public sector employment (PSE) which lacks in the individual characteristics of British workers.

[15] Therefore, private sector consists of both for-profit firms and non-profit organisation uncontrolled by central government.

[16] The question asked "What kind of non-private organisation do you work for?".

[17] Self-reporting raises concerns about misclassification of the sector or the kind of organisation one is employed for. To a certain extent, the measurement error might overstate the (unconditional) transitions between the sectors. Though, less problem is generated once looking the overall sector and its human capital composition. Greater issue might lie on the bottom of the occupation distribution, where only a few jobs in the public-sector exist.

[18] For robustness check of the mismatch magnitude, I have generated a variable equal to 1 if individuals are employed by NHS or work in Education industries, and 0 otherwise. The mismatch does not seem to come from these industries, since the incidence has minor changes. This may further motivate the analysis operated on the last section.

Figure 4 illustrates the distribution of more than 300 various occupations demanded by the British public sector in 1-digit classification. Following this classification and sorting occupations by the median level of education and hourly earnings, 3 occupational groups (high-, middle- and low-skilled) are generated, as in Galanakis (2019a).

Regarding the size of public sector, one can observe slight changes annually in aggregate terms. The proportion of each industry within the public sector illustrate these changes. Official statistics verify that NHS and Education dominate other industries (figure 5). At the same time, it is interesting to see how the public-sector participation dropped since 1992 and its size shrank significantly by 2018. Structurally, austerity's result contributed to a significant flow of workforce from the public to private sector. The recession's aftermath brought about a cap on nominal wages increases on 2010 by the UK government aiming to cut the budget deficit. Seven years later, when participation was less than 17% of the total employment and a noticeable private sector recovery occurred,[19] this policy was relaxed (Cribb, 2017).

2.1 Wage differentials

The literature very often visits the wage differentials between the public and private sectors. It acknowledges a public-sector double-premium, mostly evident for (low-skilled) women, but not for men. This twofold premium relates to the higher quality jobs and better pay, which contribute to greater job satisfaction[20] (for a relevant discussion see Blackaby et al. (2015)). Traditional arguments include the better long-standing formation of the public sector (Davies, 2012), its highly unionised institutional environment (Hoque and Bacon, 2014). Cribb (2017) and Disney and Gosling (1998) support that an important (fringe) benefit attached to the public sector, particularly among women, regards the occupational (or workplace) pensions; their value remains higher than in private sector.

Figure 6 illustrates the wage distribution by sector highlighting their unadjusted gap. Each curve represents the average of 25-years data for the total population and for women. In both cases, the earnings distribution of the public servants stands on the right of private-sector workers. In raw terms, hourly pay is higher in the public sector, partly reflecting that workforce is high-skilled or more educated (Cribb et al., 2014b). A simple exercise, here, tests for Lorenz dominance, for the female subsample, to elaborate on inequalities and preferences in favour of the public sector. The lorenz curve of $\ln(wage)$ of female public workers lies above the Lorenz curve of private sector women (figure 7b). This suggests that the private-sector wage distribution is more unequal, revealing public-sector as a fair employer. Whether the latter is preferable, from a welfare point of view, Generalised Lorenz (GL) dominance is essential. Again, a dominance of the

[19] During the period of Great Recession, private sector shrank by 0.8 million from its before-crisis peak. Since 2010, private sector jobs increase by around 2 million (Coulter, 2016).

[20] As a result, the public sector, seen as an employer, enhances the work-life balance (WLB). Lewis et al. (2017) question senior professionals employed by the British public sector in Human Resources positions. They find that WLB is not only a personal concern for employees, but it also has a structural role during the times of financial pressure. However, austerity shrinks WLB concerns.

public-sector distribution is verified signalling a slight preference in favour the public sector, in average terms (figure 7c). Figure 7d shows that not only less equality arises for women in the private sector, but also they strongly prefer the public one from a welfare perspective (Jann, 2016).

A large part of the literature does not neglect the adjusted public/private wage gap employing several controls, such as job tenure, size of enterprise, managerial responsibilities etc. Attempts for cross-country comparisons are not always successful, even among EU countries. The main reason of failure of such comparisons regards the different public-sector structure in different countries. The country-specific studies decomposing the pay hiatus are more frequent aiming to relate differentials to regional frictions.[21]

In the UK context, recent evidence declares a larger differential for women. In fact, Blackaby et al. (2018) find that additional controls make the differential for men negative and significant. However, their results are sensitive to the measurement of hourly earnings. To this end, earlier evidence has shown that the gap narrows the higher one stands on the income distribution (e.g. Blackaby et al. (2015); Cribb et al. (2014b); Lucifora and Meurs (2006); Disney and Gosling (1998)). The same stream of literature points out that public premium favours mostly those low-paid, low-skilled women and younger employees (Giordano et al., 2015; Depalo et al., 2015). This evidence arisen by the individual heterogeneity, additionally, points out that more educated workers enjoy a lower premium (Postel-Vinay and Turon, 2007). Hence, the public sector aims to alleviate inequalities. However, whether it allocates its employees efficiently remains a concern. This paper aims to highlight whether efficiency arises, controlling for the individual self-selection into jobs.

3 Data and Methodology

3.1 Data

This study utilises an unbalanced panel covering the period 1991-2016. It comes from the British Household Panel Survey (BHPS; waves 1-18), and its successor, United Kingdom Household Longitudinal Survey (UKHLS; also known as "Understanding Society"; waves 2-7).[22] I employ survey data for their informative power in terms of household dimensions and individual status.

The sample is restricted to women aged 23 to 59, employed in either sectors. The analysis does not look at self-employed, those working in the army or farmers. Hence, these categories have been excluded. The main analysis of this paper does require information regarding the individual wages. Income outliers, though, may affect the estimates. Therefore, the top and bottom 1% of the distribution have been dropped

[21] Elliott et al. (2007) make a comparison of 5 European countries, including the UK. They find that the British differential is not the same as in Mediterranean public sectors, while high-earnings areas - like London - deal with issues of common public services provision.

[22] For a more thorough description of the dataset and the cleaning process, see Galanakis (2019a,b).

ending up with a sample size of 64,690 observations.

3.2 Methodology

Earlier work supports that female employees face a greater probability to be in mismatch in the labour market (Galanakis, 2019b). Here, I offer new and better informed estimates for the British public sector controlling for the endogenous decision related to the sector of work. To do so, as in Galanakis (2019a), an individual i is in mismatch if her predicted HC in the public-sector occupation j is greater than the median returns in a more skills-demanding public-sector occupation, namely in occupation $j-1$.[23] Alternatively speaking, the magnitude of mismatch replies the question: "How many women employed in the public sector in $j-1$ occupation hold similar HC to their colleagues in j one?". Or,

$$\text{mismatched}_{i,t} = \widehat{HC}^{\text{pub}}_{i,t} | occ_{j,t} > \left(\widetilde{\widehat{HC}}^{\text{pub}}_{t} | occ_{j-1,t} \right) \tag{1}$$

where $\widetilde{\widehat{HC}}$ is the median of the estimated HC.

To calculate the $\widehat{HC}$, a Mincerian wage equation is necessary. As before, due to data restrictions HC is formed through the level of education.[24] Here, I estimate the following:

$$\ln[\text{wage}]_{i,t} = \alpha + \boldsymbol{\beta}_1 \boldsymbol{x}_i + \sum_{k=2}^{7} \beta_k S_{k,i,t} + \vartheta_t + u_{i,t} \tag{2}$$

where $\boldsymbol{x}_i$ includes controls of age (and its square) and marital status. $S_{k,i,t}$ regards the k level of education. Estimates will have year fixed-effects (ϑ_t) and standard errors are clustered in household level.

The Ordinary Least Squares (OLS) estimates of equation 2 may be inconsistent. In fact, they are exposed to two types of selection bias: the first one comes from the endogenous labour supply decision, whereas the second one from the choice to work in the public sector. If individuals systematically decide to be in paid employment, the assumption of random sample selection is violated (Heckman, 1979). This is usually addressed in the literature; the application of 2-step Heckman approach is usually adopted. Given their participation in the market, individuals choose the sector of their employment. If the sectoral allocation is not random, OLS estimates would be downward biased (Maddala, 1983). The underlying idea comes from the fact that each sector faces different wage equations due to their different demand of skills or unequal skills distribution. Hence, we need to control our estimates for a dual-selection bias, which arises from the simultaneous or sequential decision a woman makes (Tunali, 1986).

[23] In this identification strategy, I keep ranking occupations according to their median level of education and hourly earnings. Occupation here takes three values; 1 for high-skilled, 2 for middle-skilled and 3 for low-skilled.

[24] A richer definition of HC is offered when using cohort studies where tests of (non-)cognitive skills are offered. See details in Galanakis (2019a).

The self-selection problem into jobs and sectors of employment is not thoroughly visited in the literature and no consensus on how to treat this enodgeneity exists. Considering decomposition exercises for pay differentials, one can find several examples where the endogeneity is not treated at all (e.g. Jones et al. (2018); Mahuteau et al. (2017); Ramos et al. (2014); Cai and Liu (2011)), or a dummy variable for the public sector aims to capture the effect (e.g. Dolton and Vignoles (2000)). Heitmueller (2006) attempts a double-selection model, but his findings are not on a dynamic framework. Long et al. (2017); Christopoulou and Monastiriotis (2016, 2014); Luechinger et al. (2010); Dustmann and Van Soest (1998) proceed with a endogenous switching regressions aiming to alleviate the dual selection bias. Their identification power, though, rests on very strong functional assumptions; a collapse of the exclusion restriction generates inconsistent estimates (Danzer, 2019).

To proceed with this dual-selection model, data need to provide enough information so that we can identify sufficient instruments. This approach would require a variable to affect only the decision of employment and not the wages or public-sector affiliation. Similarly, another variable should only affect the decision of employment sector and be independent to the labour supply decision and the wages. However, as literature acknowledges, it is very hard to identify this variable that respects the exclusion restrictions credibly and correct for the selection bias (Araujo, 2020; Van Ophem, 1993). To overcome this identification problem, I restrict the sample to employees and correct for the potential sector selection. The final step of the exercise revisits three indices for mismatch, as in Galanakis (2019b). Changing the control group is crucial,[25] since it generates different estimates on the magnitude of mismatch. Hence, I look the (a) position of a female worker relative to the median employee; (b) counterfactual case - where I consider estimates of the male labour market; and, (c) the position of a female worker relative to their colleagues (in the female labour market).

To control for the endogenous self-selection into sectors, a two-step Heckman model will be applied. The decision to work in the public sector will be instrumented using the hours of paid overtime, a public-sector time lag .[26] Furthermore, a set of dummies will be employed to signal an older worker or a highly educated employee[27],.[28] Hence, the public-sector participation could have this structural form:

$$\text{public}_i = \delta \boldsymbol{z}_i + v_i \tag{3}$$

where public_i is the dependent variable. $\boldsymbol{z}_i$ is a vector of the independent variables as described above. For each wave, linear predictions are sorted by occupation to calculate

[25] For example, recall the assumption that women are more likely in mismatch. It signals that when women seen in the male labour market, alleviating any *a priori* discrimination, their probability of mismatch may change.

[26] These factors are related to the public-private sector pay gap (Depalo et al., 2015; Giordano et al., 2015).

[27] It receives the value of 1 if a worker is older than 35 years old or has a level of education greater than A-levels, respectively.

[28] The choice of these instruments is based on the public servants' features. A battery of robustness checks controls for the number of children and the single parenthood. None change the incidence of mismatch.

the median of high- and middle-skilled ones. The final step of the exercise applies eq. 1 to identify those in mismatch.

4 Results - Discussion

4.1 Public-sector participation gender bias

Descriptive results may motivate further the mismatch estimates in the British labour market. Table 1 employs several measures to validate the female dominance in the public sector. In fact, it seems that 46.21% and 23.95% female and male, respectively, are employed in the public sector as percentage of the total employment. A closer look on the female workforce indicates that the monopolistic sector is the main employer for them (41.69% against 39.84% in the competitive sector). Panel B presents two accounting definition exercises, as in Gomes and Kuehn (2020). The first one shows the ratio of public employment shares. It is defined as share of women relative to share of men's employment. Over the examined period, both ratios increase (figure 8). This may be related to the augmenting female labour supply decision. Around the Great Recession, a drop is noticed most likely driven by the significant changes in the private sector and/or the shrinkage of the public one.

Table 1: Different measures for the gender bias in public employment; employment shares

Panel A.i (as % of total employment)		
	Men	Women
Public-sector	23.95	46.21
Panel A.ii (as % of female workforce)		
	Public	Private
Women's empl share	41.69	39.84
Panel B: Accounting Definition Exercises		
Ratio of public empl shares	1.9897	
	(0.1438)	
Ratio of women's empl shares	0.8627	
	(0.1392)	

Note: Panel A presents a descriptive analysis regarding the public sector. *A.i* shows the employment shares in the public sector by gender. *A.ii* shows the female employment share by sector over the female workforce. Panel B reports the accounting definition exercise (as in Gomes and Kuehn (2020)). s.d. in parenthesis. Figures reported for individuals aged between 23 and 59.
Source: Own elaboration, based on BHPS/UKHLS

One may wonder about the public servants' age. Indeed, this data verifies that older worker prefer to be occupied in the public sector. Figure C.1 illustrates the normalised

age-public-sector-employment profiles pooled for men and women. At the beginning until early 30s, individuals share same prospects of employment. Noticeable differences arise after the age of 32 when women seem to dominate.[29] This dominance may be related to their intrinsic preferences or the family-related decisions which occur around that age. Childbearing and household production may urge women towards the public sector.

4.2 Transitions

Table 2: Stocks, flows and transitions of the British Labour Market, by gender

	Men	Women	
Panel A: Stocks			
Public Empl	0.0689	0.1419	
	(0.0098)	(0.0234)	
Private Empl	0.2413	0.198	
	(0.0351)	(0.0267)	
Out-of-work	0.2170	0.3446	
	(0.0122)	(0.0087)	
Panel B: Flows			
Out-of-work	0.1517	0.2938	***
	(0.3587)	0.4555	
Panel C: Transitions (in %)			
Pri2OoW	3.97	5.47	***
Pub2OoW	1.14	2.95	***

Note: *Panel A* figures are as fraction of the total working-age population, regardless whether they are (in)active. All panels are expressed for this study's sample (aged 23-59). Out-of-Work (OoW) includes states of unemployment and inactivity. The unconditional transition probabilities report the probability of an employed worker to exit from employment. Figures are averages over the total period of 1991-2016. The rightmost column (***) declares that differences are significant at 1% level.
Source: Own elaboration based on BHPS/UKHLS

Since this analysis lies on a dynamic framework, labour mobility across the sectors or out of employment is essential. Here, out-of-work status is broadly defined including both unemployment and inactivity. To elaborate on the different decisions between men and women, descriptive statistics on the labour market stocks and flows (table 2) are crucial. Stocks are calculated as a fraction of the entire working-age population.[30] This

[29] Consistent result arise the ratios of public and women's employment shares by age (figures 9 and C.2). The slope becomes significantly steeper the older a worker is. Greater jump noticed after the 40 years of age.

[30] The definition of the working-age populition adopted by the BHPS. It includes individuals aged 16-65 and 16-59 for men and women, respectively.

is why figures in tables 1 and 2 differ. Flows are expressed for the sample applying any age restriction. Gender differences in flows and transitions are statistically significant at 1% level.

Still, on average 7.3% more women are employed in the public sector, but 4.3% more men are occupied in the private one. Public servants face a lower probability to exit from employment.[31] A probable explanation for this pattern might arise by the different demand of skills for the public sector and the preferences of women. Regardless the sector of prior affiliation, women are more prone to exit from work mirroring their lower participation rate in the market. Figure 10 adds some further quantitative results. Women are more mobile than men in general. The female state-sector inflow dominates the male equivalent one. Once in the public sector, women are less willing to leave within a year. Potentially due to greater job security, the outflow from work is greater in the private sector. Additionally, this works vice versa, because of the quicker job creation (Lavery, 2015). Finally, flows between sectors are similar for women, but not for men; the majority of the latter are willing to join the private sector probably due to lower risk aversion (Borghans et al., 2009). These unconditional worker flows are consistent with recent evidence on the UK; interstate flows are significant, but smaller than to/from out-of-employment (Chassamboulli et al., 2020).

One may fairly accuse the sectoral gender difference of composition effects or sampling variation. To account for this, I estimate the conditional transition probabilities to observable characteristics (see B). Marginal effects are illustrated on figure B.1. Conditional probabilities to OoW coming from public employment is equal to zero for men and close to zero women. Transitions from the private sector differ. Men are less vulnarable to loose their employment affiliation, while women are more prone to exit verifying the lower employment attachment the latter have.

4.3 Incidence of Mismatch

The main purpose of this paper is to highlight the extent of HC mismatch female employees face in the public sector. To do so, the endogenous decision related to the sector of employment is considered. To see whether the selection model is of any need, I compare the estimates with earlier findings (see Galanakis (2019b)) pooled for public sector. If the estimates using selection model differ, it is essential to control for this source of endogeneity.

Relative to median employee Firstly, the position of a female employee relative to the median employee is observed. I estimate the returns to HC for the entire population. Then, I assign them to women and see their position compared to the median employee. Figure 11a outlines the main result of this index. Specifications, restricted to the employees, with the selection for the public sector model denote a sizeable incidence of HCM. It is not only the magnitude reaching (or exceeding) 40%, but it is the difference

[31] The trend is not persistent, though, when looking at the unemployment or retirement separately. Though, this is not a case of analysis in this paper.

with the pooled results. The pooled estimates declare a more moderate picture. Before the crisis, the selectivity model looks to be systematically above the pooled one. Right after the Great Recession, a v-shape increase of the selectivity model occurs; the incidence later meets the results from the pooled estimates. Hence, this questions *why* the selection model shows an important level of mismatch? Technically speaking, each specification of the two-step Heckman selection model is statistically significant. The average gap is 12.64% (s.e. 0.0035; significant at 1% level) against the pooled results denoting an underestimation if one neglects selection for the sector of employment.

Restricted female subsample Secondly, I test the position of a female employee relative to her colleague in a more skills-intensive job. For example, the comparison takes place between a Teaching Associate and a Teacher, both women. Here, we still observe a difference between the selection specification and the pooled estimates. Though, the average gap is smaller than before (figure 11b); 3.62% (s.e. 0.0035; significant at 1% level). The trend is similar at the most of the time with great consistency in terms of the Great Recession effect.

Counterfactual female subsample Finally, to alleviate any discrimination women may face even before they enter the labour market, I see their position in the male market. To do so, I assign the estimates of the male subsample to women and see their relative position. By this way, I consider that they have the same observables as men questioning how this changes their position. The average gap is -0.91% (s.e. 0.0059; significant at 10% level). Figure 11c depicts that the trend is not always the same; opposite direction revolves after the period of the financial crisis. The selection model specification matches the pooled estimates in 2009/10. Right after the crisis, the former shows a quicker adjustment to the pre-crisis levels.

A persistent common pattern across the three measures - despite the control group change - regards the point of the big rise in the mismatch magnitude. When the British economy suffers from the financial crisis and the Great Recession, the incidence seems quite high both in the selection model and in the pooled results. Lazear et al. (2016) claim that hires during recessions are better matched in the public sector than those in booms. However, this does not seem to be the case here. Instant response of the market, is an initial misallocation which aims to be restored several years after.

Selection Inference One may reasonably question why the estimates coming from the selection model specifications are greater. The necessity of correcting for the endogenous self-selection into jobs regards the non-random allocation of workers. If they were randomly assigned between sectors, estimates of HCM would be accurate; not controlling generates a smaller magnitude of this inefficiency. Table 3 reports the average difference on the incidence of HCM between the selection model and the pooled estimates for public sector affiliation. Panels I and III show, on average terms, that the selection model dominates the pooled estimates. The opposite holds for panel II. In fact, in most of the cases,[32] the correlation of error terms (between the wage equation [eq. 2]

[32]There is a small variation regarding the sing of the Inverse Mills Ratio (IMR) over the specifications. On 2009 and 2016, lambda becomes not significant. Losing the significance, though, may not necessarily

Table 3: Average difference of the HCM incidence between selection models and pooled estimates; 1991-2016

Model	Mean (s.e.)	
Panel I: Relative to overall		
Selection	0.3782	
	(0.0023)	
Pooled	0.2519	
	(0.0023)	
Difference	-0.1264	***
	(0.0035)	
Panel II: Restricted Female subsample		
Selection model	0.1133	
	(0.0025)	
Pooled Estimates	0.1496	
	(0.0023)	
Difference	0.0362	***
	(0.0035)	
Panel III: Counterfactual female		
Selection model	0.5969	
	(0.0035)	
Pooled Estimates	0.5878	
	(0.0047)	
Difference	-0.0091	*
	(0.0059)	

Note: The first number of each model declares the mean. Standard errors are reported in parenthesis. Each panel contains one measure with the 2 different models, the specification with selection of the employment sector and the pooled estimates, as in figure 11. The ultimate row reports their average difference and s.e.. The ultimate column declares the statistical significance.
Significance level: * 10%; ** 5%; *** 1%
Source: Own elaboration based on BHPS/UKHLS

and the public sector one [eq. 3]; ρ_{uv}) is negative. This signals a negative selection for the public servants; the allocation into jobs between the two sectors depends on additional determinants than the individual observed skills (selection on unobservable productivity). The matching of workers across sectors decreases, since the gap between pooled estimates and Heckman specifications increases. This sorting tool drives women with great demands of work-life balance or specific intrinsic preferences[33] into the public sector. This means that, before they enter into the market, women are already endowed with unobservable characteristics[34] in favour of the state-employer and its accompanying work-life balance which increase their wage. For example, if a high-skilled woman is likely to join the public sector given her preferences, she is not well-suited for the private sector (e.g. she might be more risk averse; Guiso and Paiella (2008); Bonin et al. (2007)). This could mean that her counterfactual private-sector wage is lower than her counterpart who actually works in private sector (due to negative selection). At the same time, this implies a lower return to skill in the public sector, as in Hanushek et al. (2017, 2015).

Alternatively, not selecting for the sector of employment underestimates the extent of HCM (figure 12). Since the incidence increases after correcting for the self-selection problem into jobs, pooled estimates are downward biased understating the real HCM. Greater mismatch is caused by a correlation between individual inherent skills and public-sector affiliation (Danzer, 2019). In other words, the returns of the high- and middle-skilled workers are closer in the selectivity model, while in the pooled one they are further apart. Or, people who do not enter immediately in a public-sector job, but hold features and preferences in favour of good job there, accept a "pay cut". They wait at the back of the waiting queue for this good state-sector job, while being underpaid. This elaborates empirically why the incidence increases when controlling for the sector affiliation.

4.3.1 Waiting Room for university graduates

A reasonable argument may revolve around the primary results. According to an alternative interpretation, the public sector does not cause the mismatch and it has a better matching process; so, *why* do we observe this great magnitude of mismatch? A twofold reasoning declares the importance of the measure which accounts the position of women relative to the median employee. First, it presents the greatest gap between

imply an absence of the sample selection bias. A small sample (as in these cases), Heckman model are not likely to produce significant lambdas (Certo et al., 2016). Non-significance may, additionally, occur if exclusion restrictions are weak.

[33] Gomes and Kuehn (2020) find that female preferences for state-sector activities explain 95% of the gender bias participation in the UK. According to them, women count more work-life balance, while men job security. They relate this evidence to the higher female opportunity cost of labour supply by accepting lower wages.

[34] These features may include intrinsic preferences to work in the public sector; preferences for particular state-provided jobs (recall the different demand) or they are more risk averse.

the selection model and the pooled estimates. Second, its magnitude is around (and sometimes exceeds) 40%.

Aiming to explore the mechanism driving this result, we need to see which occupations bear the greatest impact of mismatch. Recall figure 2, according to which only a few low-skilled jobs exist in the public sector. Hence, the incidence noticed (figure 11a) should mostly come from those employed in middle-skilled jobs holding enough HC to be in a high-skilled one. Table 4 reports the average percentage of those in mismatch in each 3-digit-classified occupation. Consistently as before, the incidence changes when the control group is different. One occupation may be in mismatch when women seen relative to overall population, but not in the restricted subsample, and *vice versa*.

Table 4: Map of occupations in Mismatch; 1991-2016 (in %)

Occupation		Restricted Female Subsample		Relative to overall	
Code	Title	Matched	Mismatched	Matched	Mismatched
311	Physical and Engineering Science Technicians	33.33	66.67	35.56	64.44
312	Computer Associate Professionals	100	0	100	0
313	Optical and electronic equipment operators	91.67	8.33	91.49	8.51
321	Life science technicians and related associate professional	33.33	66.67	37.5	62.5
322	Health associate professionals (except nursing)	54.19	45.81	63.92	36.08
323	Nursing and midwifery associate professionals	51.22	48.78	53.67	46.33
334	Other Teaching Associate Professionals	50	50	44.44	55.56
341	Finance and sales associate professionals	46.77	53.23	62.96	37.04
342	Business services agents and trade brokers	60	40	70	30
343	Artistic, Cultural and Culinary Associate Professionals	70.53	29.47	67.02	32.98
344	Customs, tax and related government associate professionals	68.42	31.58	68.52	31.48
345	Police inspectors and detectives	100	0	100	0
346	Social work associate professionals	64.91	35.09	71.03	28.97
347	Artistic, entertainment and sports associate professionals	56.25	43.75	54.55	45.45
411	Secretaries and keyboard-operating clerks	86.55	13.45	88.83	11.17
412	Numerical Clerks	70	30	76.19	23.81
414	Library, mail and related clerks	86	14	90.12	9.88
419	Other Office clerks	82.57	17.43	85.25	14.75
421	Cashiers, tellers and related clerks	90.48	9.52	92.86	7.14
422	Client information clerks	92.17	7.83	93.24	6.76
512	Housekeeping and restaurant services workers	98.41	1.59	99.15	0.85
513	Personal care and related workers	86.39	13.61	89.8	10.2
516	Protective services workers	79.72	20.28	82.48	17.52
522	Shop, stall and market salespersons and demonstrators	84.21	15.79	87.5	12.5
612	Animal producers and related workers	20	80	30	70
731	Precision workers in metal and related materials	66.67	33.33	66.67	33.33
832	Car, Van and Motorcycle Drivers	33.33	66.67	80	20
913	Domestic and related helpers, cleaners and launderers	77.96	22.04	95.54	4.46
915	Messengers, porters, doorkeepers and related workers	58.14	41.86	70.27	29.73

Note: In this paper, mismatch is initially defined on 1-digit level. ISCO88 codes including only matched employees have been omitted. Codes with less than 10 observations have been eliminated.
Source: Own elaboration based on BHPS/UKHLS

These occupations concentrating workers in mismatch are mostly those entry-level jobs which individuals may choose until they find a better opportunity. In other words, these occupations may act as a waiting area for a matched position. This would be the case mostly for high-educated workers who have more options than their low-educated peers. The former type of workers can either find a matched position immediately after

graduation or be unemployed. Alternatives include to be employed in the public or private sectors. In any sector, they may find a job and be in match or mismatch. Hence, university graduates have six options after graduation. Assuming a similar arrival rate would not be irrational. Hence, the question is where do they prefer to wait for the "perfect" job?

For instance, a nurse, a teacher or a psychologist can go quicker or directly to a matched job.[35] On the other hand, a Ph.D. in Philosophy graduate[36] may need to further wait for a lectureship outside of the traditional academic sector due to job scarcity (Canal Domínguez and Muñiz Pérez, 2012). In the meantime, a low-skilled job in a retail store or as a waiter[37] would not look appealing (due to frustrations, e.g. a lower job satisfaction). Instead, accepting a public-sector job in mismatch may look significantly more attractive given her preferences. Yet, this type of workers benefits the public sector since they are more productive, under the HCT. Figure 13 illustrates these choices and their unconditional transition rates reaching the perfect job within two periods. The least likely waiting area occurs in unemployment. It concerns highly-educated workers whose skills are important for any market; they rather be employed than unused. On the other hand, workers previously in the public sector seem to find their matched position sooner. Estimates imply that almost 1 in 6 female public servants (18%) are more likely to end in a matched job sooner, while almost 1 to 8 (or 12%) for those in the private sector (difference statistically significant at 1% level). The aforementioned matched position is highly likely to be in the public sector (table 5). This evidence argues, further, in favour of accounting for the endogenous decision of the affiliated sector. Individuals may choose the public one due to its attractiveness, fringe benefits and opportunities.

4.3.2 Job satisfaction and sector of employment

To validate the argument above, I further test whether these choices are consistent with the self-declared job satisfaction of employees. If highly-educated workers prefer to be in mismatch and work in the public sector, they should report greater job satisfaction than their colleagues who are in the private sector (and in match), *ceteris paribus*.

To this end, I run an ordered probit regression of job-satisfaction on the offers one may have controlling for the level of education, the age (and its square, as a proxy for experience), marital status, number of children and the danger of retirement for any female employee and for high-educated type one. Regional fixed effects included. Figure 14 reports the marginal outcomes of offers on the jobs satisfaction. Results suggest that

[35] The focus centres around those educated workers, because they are qualified to be employed in either sector. They are probably not going to get a graduate public-sector job, because they do not hold the job-specific skills or they face a great competition (excess labour supply). Otherwise, if they did, as for example nurses, they would already have the graduate public-sector job.

[36] De Paola and Gioia (2012) find that higher risk aversion should induce students to enrol in humanities. If Human Capital Theory holds, these students make an investment in education, which will pay off in the long-term.

[37] There is a direct relationship between the mismatch and firm productivity across different working environments (Mahy et al., 2015).

Table 5: Where is the perfect job?

	Period t			
	Private		Public	
Period $t-1$	N	%	N	%
Public	7	7.29	89	92.71
Private	61	93.85	4	6.15
Unemployment	2	40	3	60

Note: In period $t-1$ a high skilled individual is in mismatch and the consecutive period, i.e. in period t, she finds the perfect (matched) job. The measure of mismatch employed here regards the restricted female subsample.
Source: Own elaboration based on BHPS/UKHLS

more satisfied with their job women accept a less skills-intensive job in the public sector. Alternatively, female employees prefer to wait in the public sector in mismatch rather than the private one in match. This is robust with the earlier result and consistent for both highly-educated and any type of female employee. To make it more clear, for the highly-educated women, I group the 7 self-reported answers into 3; dissatisfied, neither satisfied not dissatisfied and satisfied. This step is more interpretable and strengthens the same argument. The greater job satisfaction in the public sector is not unprecedented in the literature (Blackaby et al., 2015), even in non-UK context (e.g. Danzer (2019)).

5 Conclusions

This paper looks at the extent of female public-sector employees in mismatch. It contributes to earlier evidence accounting for the endogenous self-selection into jobs. To this end, I examine the position of a woman relative to the median employee, her peers or in the male labour market. Working assumption treats each sector as a separate, potentially segregated, labour market which has a different demand for skills. This is why each sector offers different wages.

Initially, I verify the existent gender bias in favour of women regarding public-sector participation. The government sector employs more women and older workers (whose age exceeds the 33 years). Concerning their educational profile, public servants are mostly highly educated; besides, this sector does not offer many low-skilled jobs.

The incidence of mismatch differs when the control group changes. Once women seen relative to overall population, the magnitude may reach, or in some cases exceed, 40%. The mechanism aiming to explain this sizeable magnitude of mismatch is not frequently visited by the empirical literature. Occupations, which mostly suffer from this inefficiency, include more entry-level jobs. Individuals may not find their matched job immediately due to job scarcity and great competition. These junior positions endow the employees with job-specific skills for their future career. Workers may find later

their 'perfect' job most likely in the same sector they wait. Otherwise, if employees enter into the labour market highly-educated holding specialised skills, they will probably end up in the matched position without waiting or queuing for any better job. Therefore, what this mismatch measure counts is the lower relevant labour market experience these individuals have relative to their initially matched counterparts.

This analysis is consistent with the self-reported overall job satisfaction of employees. If the aforementioned mechanism holds, i.e. individuals prefer to wait in the public sector in mismatch, they should gain greater job satisfaction from their job. Indeed, other things being equal, public servants in mismatch report greater satisfaction than their counterparts in high-skilled private-sector jobs.

Limitations First limitation of this paper regards the dataset used. BHPS and 'Understanding Society' are survey data with small number of observations; their informative power, though, is strong. Second limitation concerns no control for the participation decision, since the working sample is only comprised of those in paid employment. This choice was driven by the data limitation to respect the exclusion restriction. To the best of my knowledge, there was no variable to contribute exclusively in favour of the labour supply. A potential claim of not directly comparable estimates between the selection model and the pooled one is recognised. An additional source of data may help to identify a double-selection model, as in Tunali (1986).

Policy Implications The importance of this evidence sets the framework on efficient allocation in the public sector. This paper does not aim to answer *how* the public sector should allocate its workforce. It stands a step behind and highlights the extent of mismatch. Men and women are not symmetrically affected by employment and wage policies. This discussion should welcome great attention, since women, who are prone to be in mismatch, are overrepresented in the public sector. Clear implications, standing in line with earlier research (Mocetti and Orlando, 2019), may regard the effectiveness of governmental investments and the quality of services provided. Misallocated human capital endowments may result in lower competitiveness. Finally, evidence on the negative selection in the public sector imply that what increases the probability of becoming a public servant acts as a 'pay cut' for those selected. In other words, the return to skill is lower in the public sector. Given that the analysis provided concerns women, this has direct implications on their working life and can address motherhood policies.

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A Sample Characteristics

Table A.1: Descriptive Statistics

	All	Private	Public	p-value
Highest Qualification				0.000
Higher Degree	3.76	2.26	6.59	
1st Degree or equiv	12.95	9.53	19.38	
other higher degree	11.42	8.84	16.25	
A-level etc	23.96	25.46	21.13	
GCSE etc	27.18	29.62	22.61	
other qualification	10.21	11.97	6.92	
No qf	10.51	12.32	7.12	
No of hrs overtime	3.79	4.01	3.41	0.000
	(6.20)	(6.32)	(5.95)	
No of hrs worked	34.07	35.25	31.94	0.000
	(10.99)	(11.08)	(10.49)	
Has dependent child(ren)	42.29	41.81	43.14	0.000
Real hourly wage	13.33	12.77	14.3	0.000
	(7.11)	(7.26)	(6.72)	
Number of children				0.000
0	57.71	58.19	56.86	
1	18.69	18.41	19.2	
2	17.72	17.43	18.26	
3	4.97	5.01	4.89	
4	0.77	0.81	0.71	
5+	0.13	0.16	0.08	
Older employee (35+ yrs.old)	62.66	59.04	69.24	0.000
Closer to retirement (55+ yrs. old)	8.75	8.14	9.84	0.000
Single parent	3.7	3.11	4.77	0.000
Married	61.29	60.22	63.22	0.000
Ln(hwage)	2.47	2.42	2.56	0.000
	(0.55)	(0.57)	(0.51)	
Age	39.84	39.05	41.26	0.000
	(9.99)	(10.06)	(9.69)	
Entered LM in t-1	6.01	6.42	5.25	0.000

Note: For the continuous outcomes, means are reported in the first cell and standard deviations are reported in parentheses. The rightmost column reports p-values from tests of equality of distributions between public- and private-sector employees, based on a Wilcoxon rank-sum tests for ordinal variables and χ^2 tests for categorical variables.
Source: Own elaboration based on BHPS/UKHLS

B Conditional Transition Probabilities

If individuals are employed in period $t-1$, they can (i) maintain their job (or move from private to public sector, and *vice versa*). Alternatively, (ii) they can exit from work (OoW).[38]

$$\Pr(OoW_t|\text{empl}_{t-1}) = \frac{\exp(x_i\beta_u)}{1+\exp(x_i\beta_u)+\exp(x_i\beta_{in})} \tag{4}$$

where x_i includes the control variables of age (and its square); level of education, region, year, occupation, a dummy to capture the increasing influx into retirement (=1 if individual is older than 55 years old.). Control for the gender and public sector, and their interaction has been included.

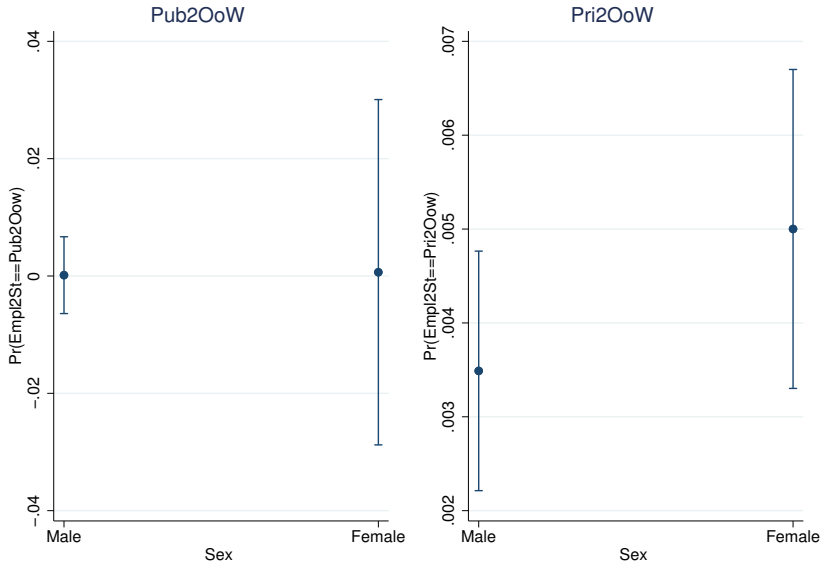


Figure B.1: Conditional transition probabilities to unemployment and retirement

Note: Estimates from a multinomial logit regression of the change after employment on age (and its square), education level, occupation. To account for the increasing influx to retirement, a dummy =1 when age is in the range of 55 to 65 is also used. Estimation includes a public sector dummy, the gender dummy and their interaction. Region and year fixed effects included. The first row illustrates the transition into unemployment and the second into inactivity. The first and second columns represent the estimates for private and public sectors, respectively.

Source: Own elaboration, based on BHPS/UKHLS

[38] Here, I poorly define out-of-work state. It includes unemployment and inactivity, as in the unconditional setting.

C Robustness Checks

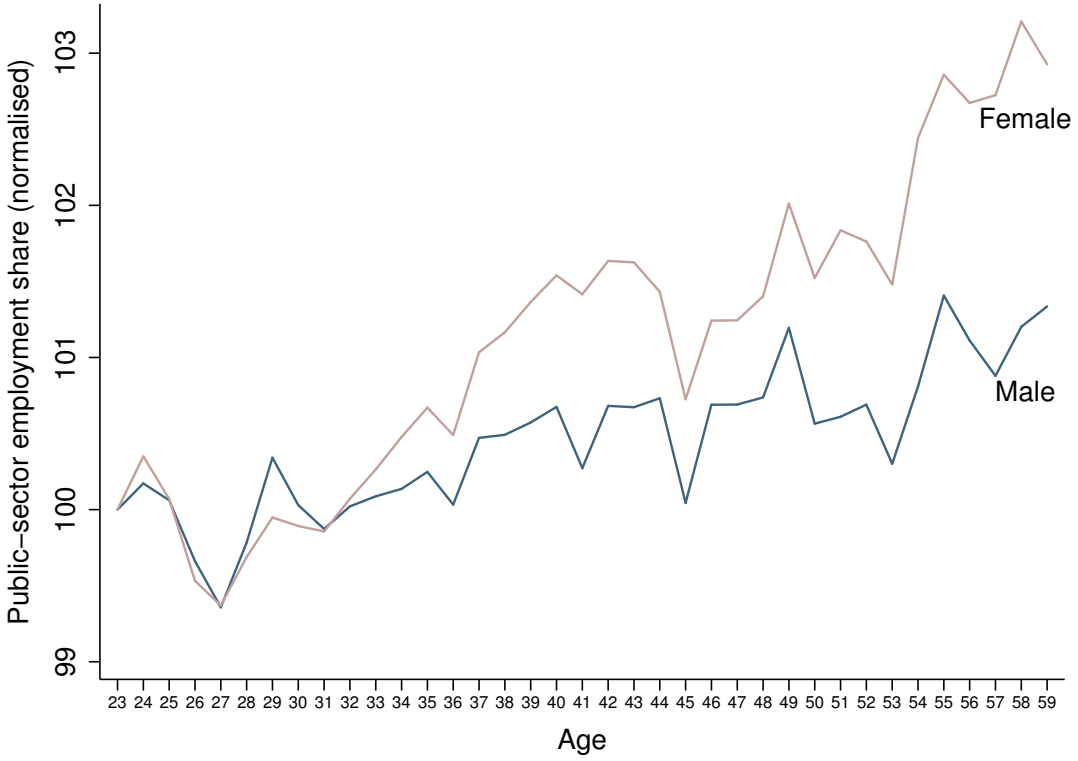


Figure C.1: Public employment shares by gender, variation over age groups
Note: Profiles have been normalised around 26yo and the share of public-sector employment of women. Significant changes appear after 33yo.
Source: Own elaboration based on BHPS/UKHLS

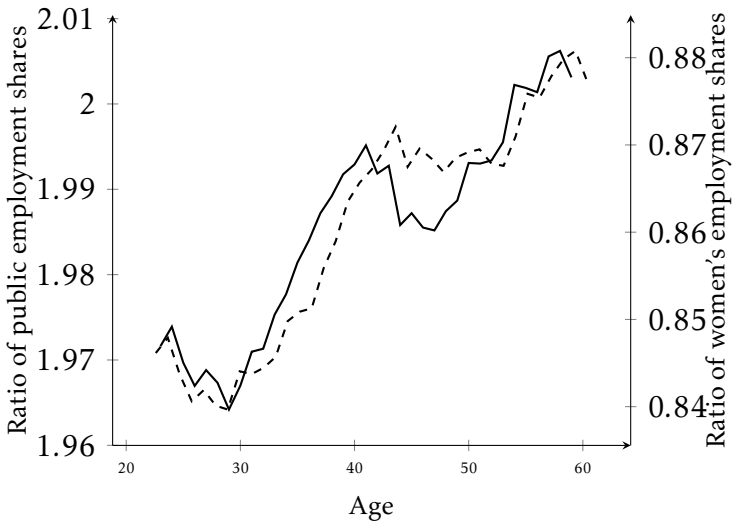


Figure C.2: Ratios of public and women's employment shares, by age
Note: *Ratio of public employment share* (solid line) equals the share of women relative to men's employment. *Ratio of women's employment share* (dashed line) equals the sare in public relative the one in private sectors for female workers. Both figures declare that older workers are employed in the public sector; the slope becomes steeper over the age.
Source: Own elaboration based on BHPS/UKHLS

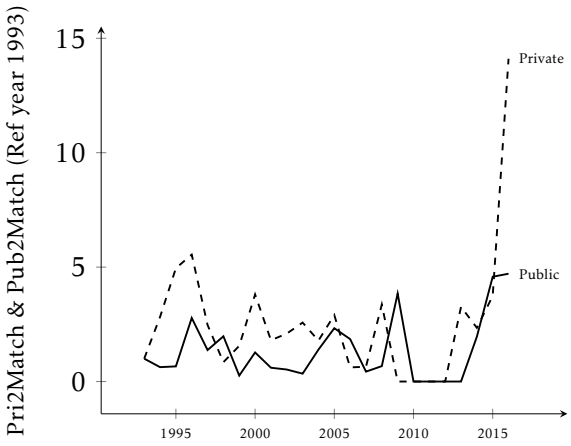


Figure C.3: Transitions: Pri2Match and Pub2Match; Restricted female subsample
Note: Reference year 1993. The solid (dashed) line reports the annual transition rates from a job in the public (private) sector in mismatch to one in any sector but in match. Around the Great Recession, it is evident that the private sector reacted quicker than the public one. This is consistent with the changes on employment rates (overall and by gender) and the participation rates.
Source: Own elaboration based on BHPS/UKHLS

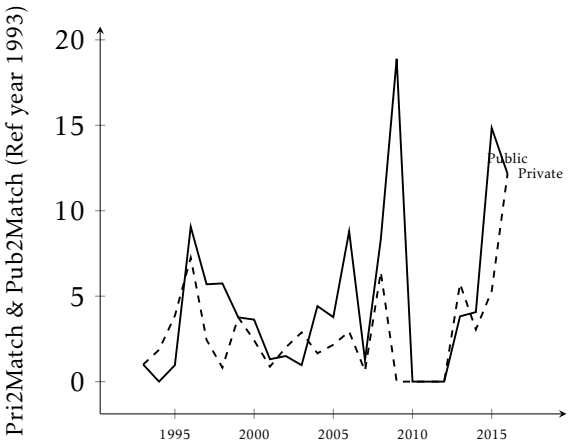


Figure C.4: Transitions: Pri2Match and Pub2Match; Relative to overall population
Note: Reference year 1993. The solid (dashed) line reports the annual transition rates from a job in the public (private) sector in mismatch to one in any sector but in match. Around the Great Recession, it is evident that the private sector reacted quicker than the public one. This is consistent with the changes on employment rates (overall and by gender) and the participation rates. Around this period, spikes are consistent with literature evidence (see Fontaine et al. (2020))
Source: Own elaboration based on BHPS/UKHLS

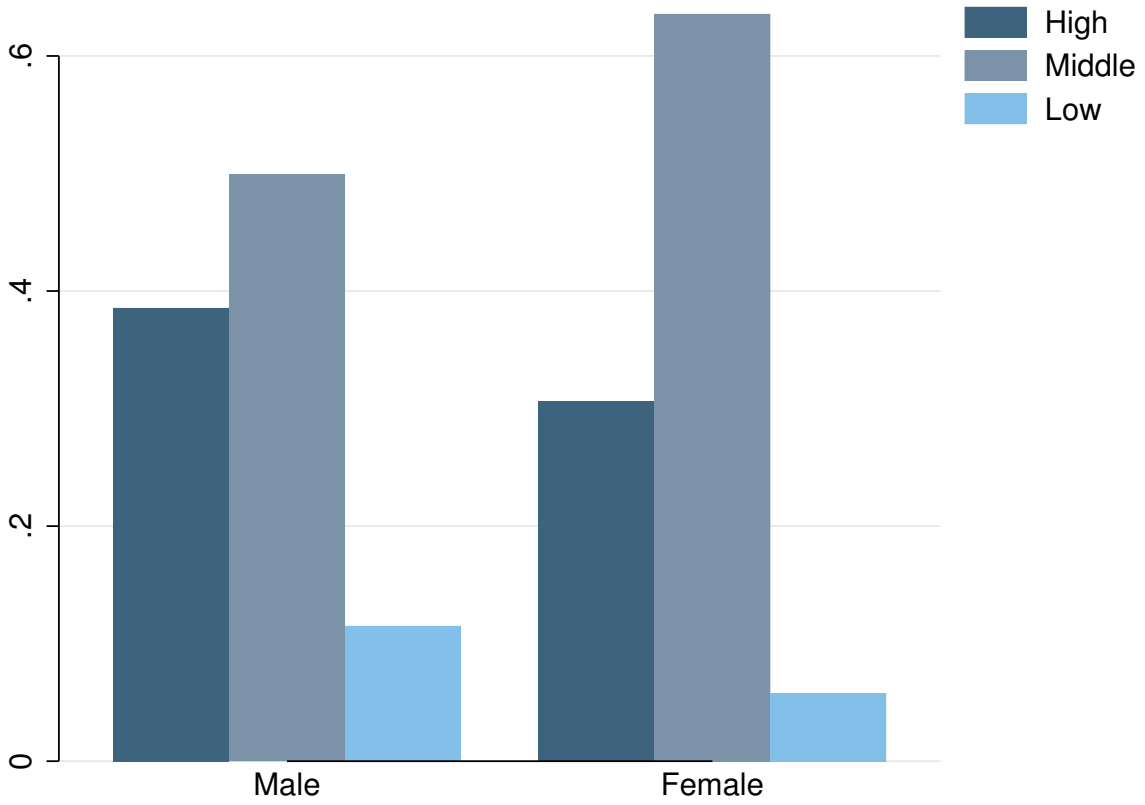


Figure 2: Size of the public sector, by type of occupation; 1991-2016
Note: 1-digit occupations defined using the International Standard Classification of Occupations: ISCO 88. They have been sorted by the median level of education and hourly earnings; classified as high-, middle- and low-skilled. The former category includes "Legislators, Senior officials and managers" and "Professionals", while the latter includes "Skilled agricultural and fishery workers", "Plant and machine operators and assemblers" and "Elementary Occupations". The middle-skilled jobs include the remaining occupations. For details, see Galanakis (2019a).
Source: Own elaboration, based on BHPS/UKHLS

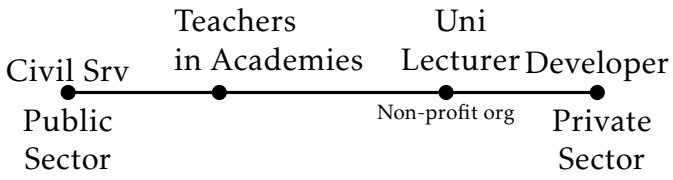


Figure 3: Allocation of jobs in sectors: Examples
Note: This figure illustrates a continuum of the jobs allocation between the two sectors. Above the continuum, one finds examples of jobs in each sector.
Source: Own elaboration

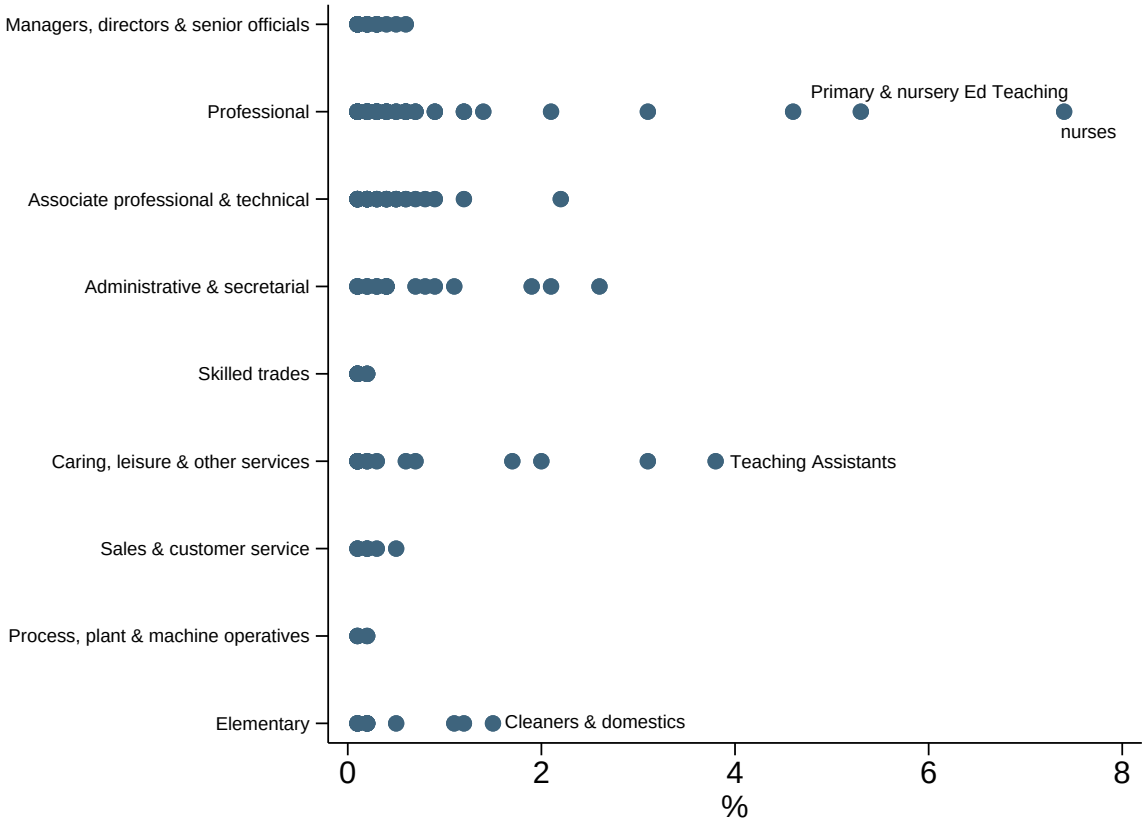


Figure 4: Distribution of occupations in the British public sector

Note: Percentage of UK public-sector employees in individual occupations, Jan-Dec 2018. Public sector demands more than 300 various occupations. *Nurses, Primary & Nursery education teaching professionals* and *Teaching Assistants* constitute the 7.4%, 5.3% and 3.8% of the public servants, respectively.
Source: APS; Data retrieved from ONS on 14.01.2020

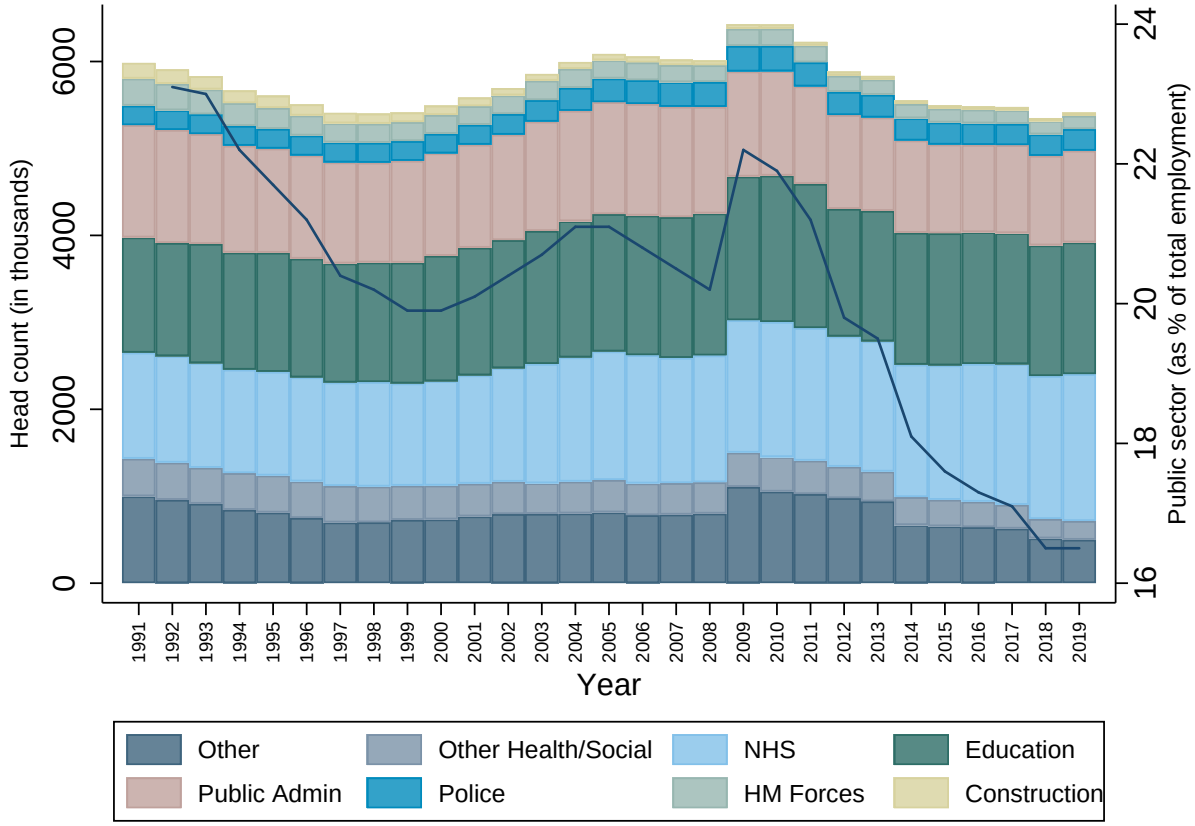
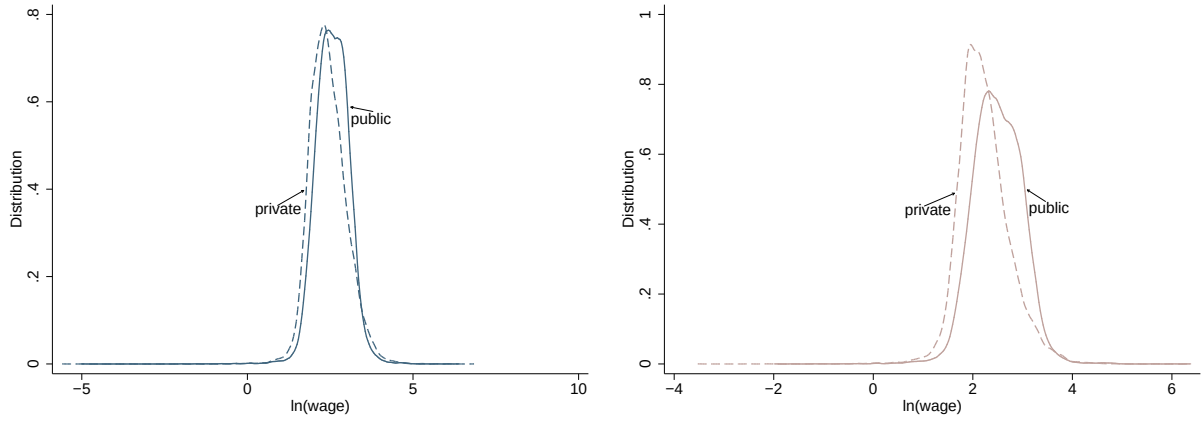


Figure 5: Size of Public Sector, by industry; 1991-2019
Source: ONS; Dataset ID: PSE; Released 11 June 2019

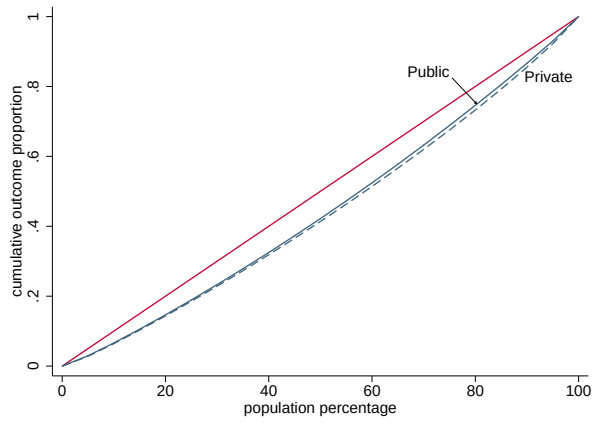


(a) Total population; age 23-59 **(b)** Women; age 23-59

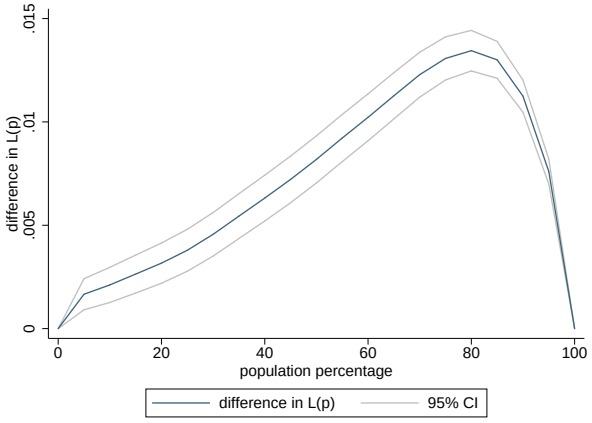
Figure 6: Average unadjusted wage gap, by sector; 1991-2016

Note: Panel (a) illustrates the distribution for the total employees in the labour market. The difference of the average ln(wage) between the sectors is -0.1337 (se 0.0035), significant at 1%. Panel (b) focuses on women whose difference is -0.2777 (se 0.0043), significant at 1%.

Source: Own elaboration, based on BHPS/UKHLS

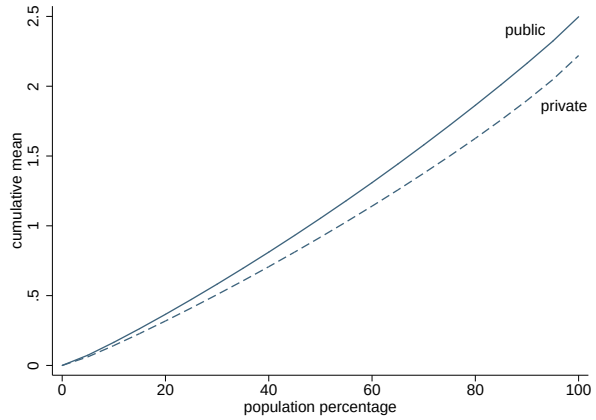


(a) Overlayed Lorenz curves, by sector

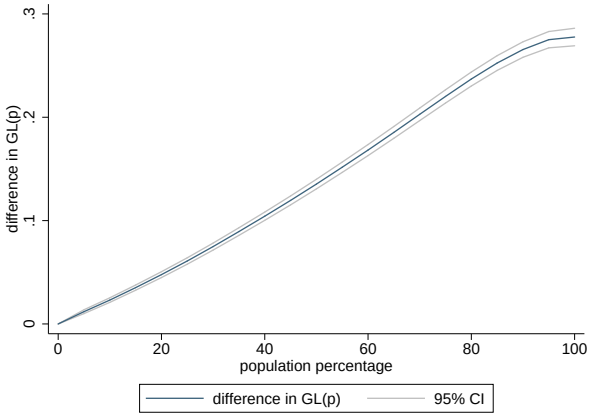


(b) Difference in Lorenz curves, by sector

Note: Blue solid and dash lines represent the public and private sectors, respectively



(c) Generalised Lorenz curves, by sector



(d) Difference in Generalised Lorenz curves, by sector

Figure 7: Lorenz curves for female employees, by sector

Note: For this set of graphs Stata command lorenz has been employed. Clustered on HH level s.e.

Source: Own elaboration, based on BHPS/UKHLS

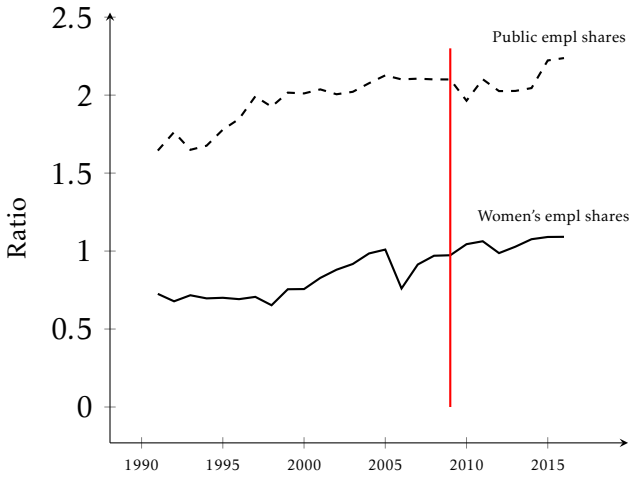


Figure 8: Ratio of public employment shares and ratio of women's employment shares
Note: Dashed line illustrates the ratio of public employment shares by year. This measure is defined by the share of women over the share of men employed in the public sector. The solid line illustrates the ratio of women's employment shares. It is defined as the share of women in the public relative to the private sectors. A vertical red line for 2009 is added to signal potential differences after the Great Recession.
Source: Own elaboration, based on BHPS/UKHLS

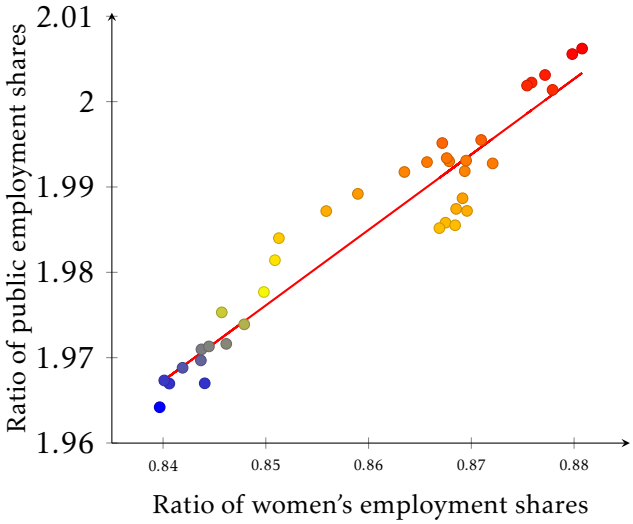


Figure 9: Correlation of ratios of employment shares, by age
Source: Own elaboration based on BHPS/UKHLS

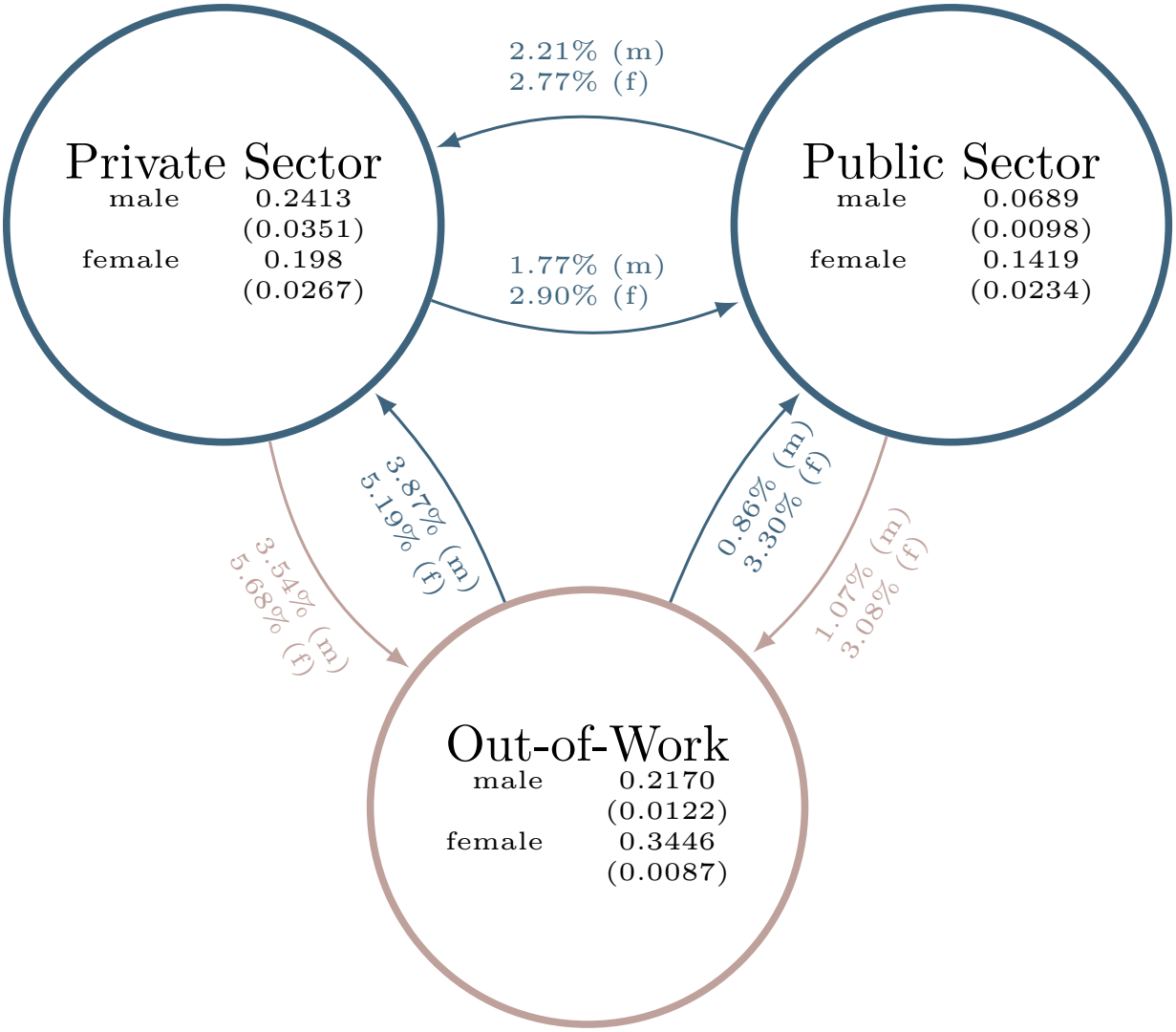
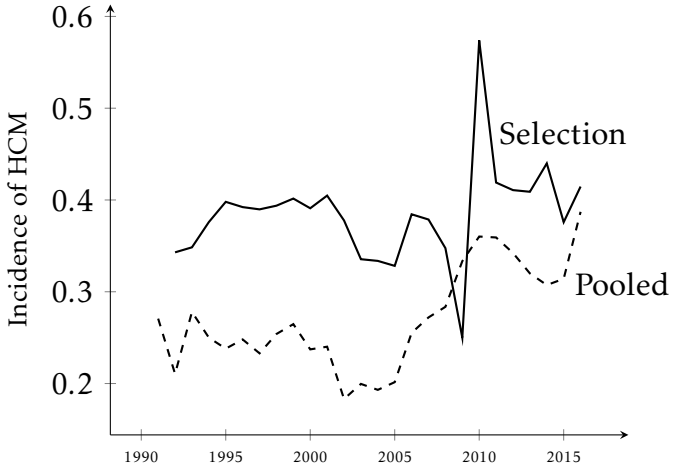


Figure 10: Average unconditional worker transitions, 1991-2016

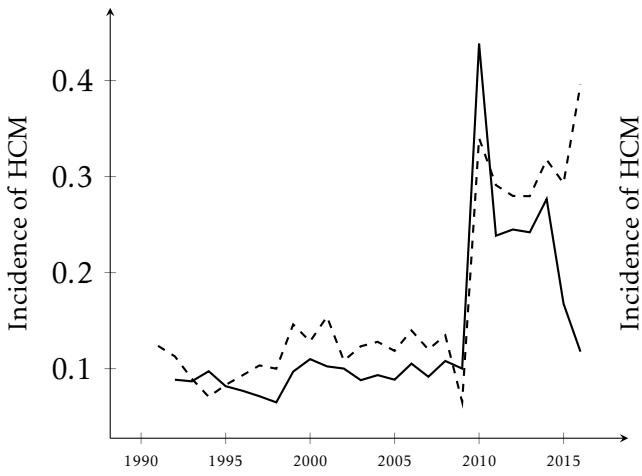
Note: The *circles* illustrate the average employment (blue) and Out-of-Work (pink) stock rates over the period of 1991-2016. The blue circles show that a worker can be either employed in the private or public sector. Within a circle, the first value shows the average stock rate; the s.d. is in parenthesis. Worker stocks are expressed as a fraction of the total working-age population (definition followed by BHPS including individuals aged 16-65 and 16-59 for men and women, respectively). The *arrows* illustrate the unconditional transition from the one status to the other within two periods, e.g. between $t-1$ and t. The values above each arrow show average probability to move from the one status to the other. *(m)* and *(f)* represent the values for men and women, respectively.

Source: Own elaboration, based on BHPS/UKHLS



(a) Women relative to median employee

Note: I assign the overall population estimates to women and I compare their relative position to the overall distribution of the more skill-demanding occupation.



(b) Restricted female subsample



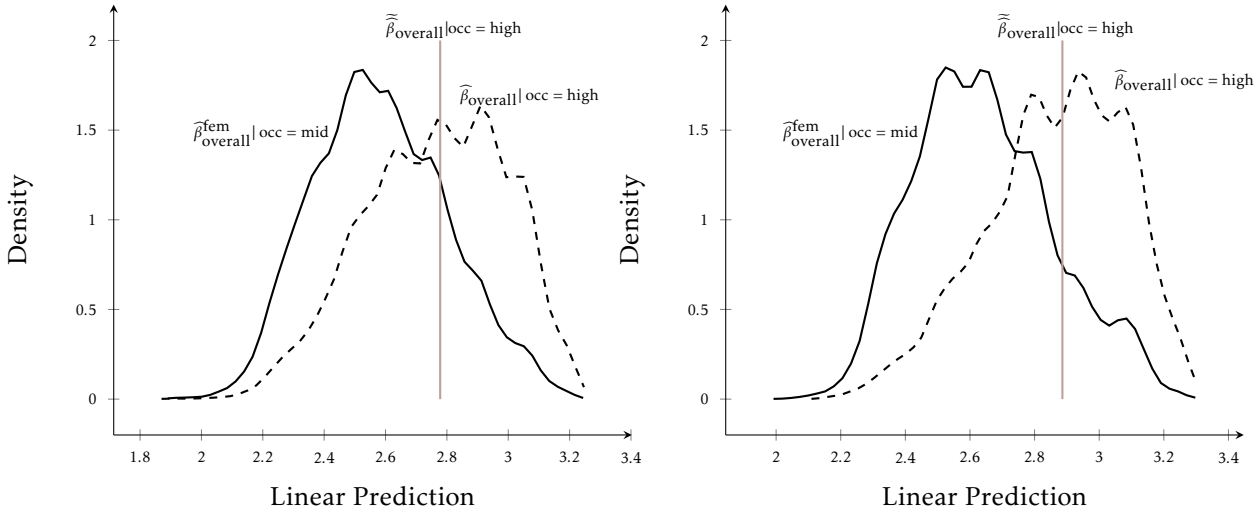
(c) Counterfactual Female

Note: I assign the estimates of men to women. I repeat the previous exercise. By this way, I alleviate any *a priori* discrimination against women. Alternatively, this method treats women as being in the male labour market.

Figure 11: Incidence of Human Capital Mismatch: three indices

Note: Solid lines show the estimates from specifications using the selection model for the public-sector employment. Dashed lines show the estimates from pooled results for those in the public sector. In terms of the economic context the period when peaks observed: In 2010, the government in the UK implements a nominal wage cap across the public sector but for salaries below £21,000. Since 2013, most annual pay rises have not exceeded an average of 1% annually. This policy has been relaxed in 2017 given the recovery of private-sector real wage growth (Cribb, 2017; ONS, 2017).

Source: Own elaboration based on BHPS/UKHLS



(a) Selection Model **(b)** Pooled Estimates

Figure 12: Importance of the selection model: negative selection; relative to median employee

Note: Solid line regards female employees in middle-skilled occupations with the overall population estimates in the public sector. Dashed line regards the overall population estimates employed in high-skilled occupations in public sector. The vertical solid line shows the median of the dashed line. Whoever stands on the right-hand side of the median and on the solid line is in mismatch.
Source: Own elaboration based on BHPS/UKHLS

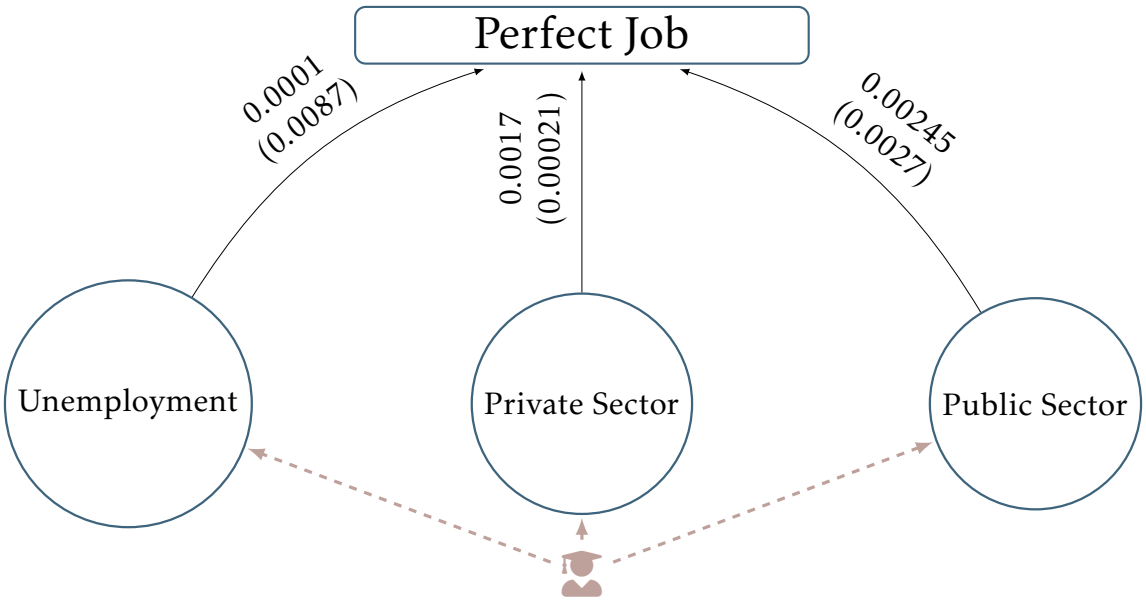
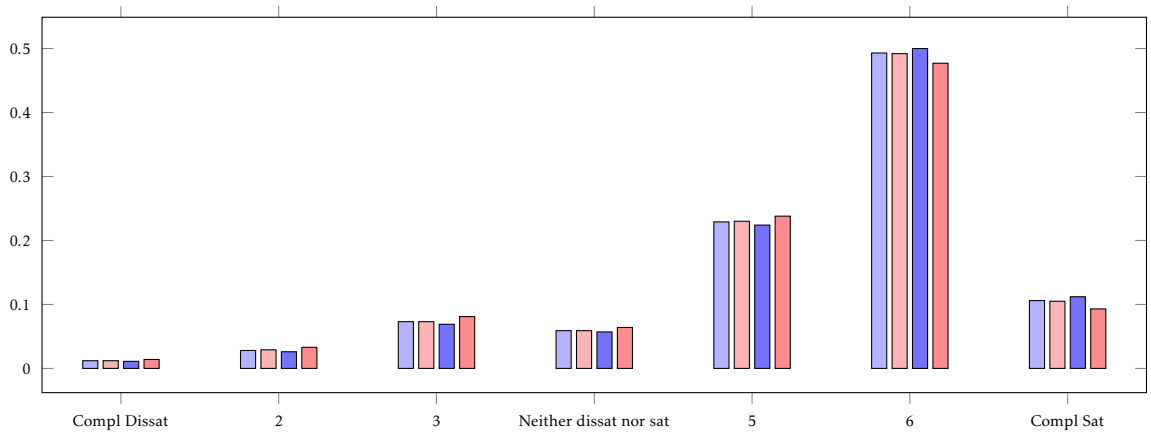


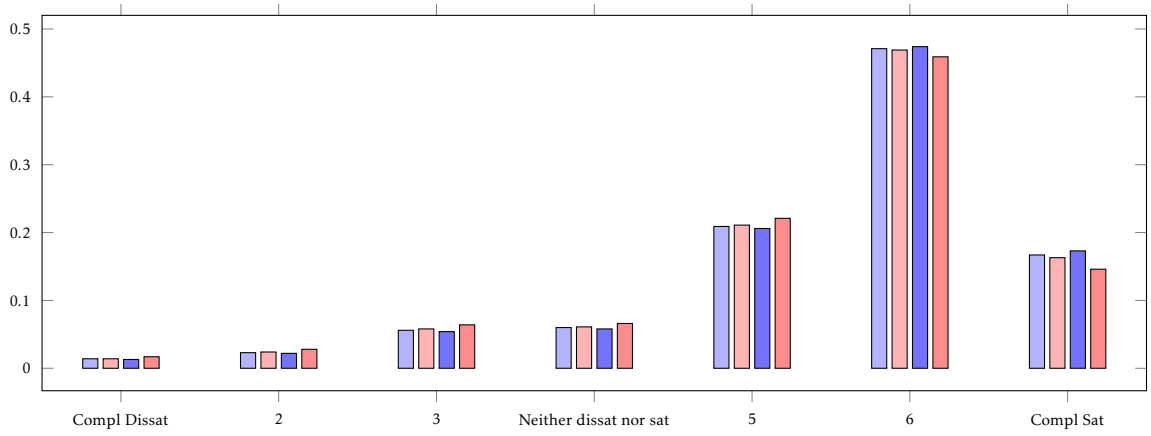
Figure 13: Waiting room for a *university graduate* within periods $t-1$ and t; Restricted Subsample

Note: Averages over the panel. s.e. in parenthesis. Each circle represents the state a university graduate is in period $t-1$. Probabilities to end up in a matched (or perfect) job is placed over each arrow. Difference between public and private sectors is significant at 5%.

Source: Own elaboration based on BHPS/UKHLS



(a) High-skilled female employee



HS Public HS Private non-HS Public non-HS Private

(b) Any female employee

Figure 14: Marginal outcomes of offers on job satisfaction

Note: HS stands for High-skilled. Outcomes of offers include: (1) Unemployment; (2) High-skilled public-sector job; (3) High-skilled private-sector job; (4) non-High-skilled public-sector job; (5) non-High-skilled private-sector job. Probability of unemployment was equal to zero and omitted. Interestingly, the more satisfied a woman is with her job, the greater the gap of accepting a non-high-skilled job in the public sector. In other words, more satisfied female employees prefer to wait in mismatch in the public-sector. Difference between the outcomes is significant in 1%.
Source: Own elaboration, based on BHPS/UKHLS

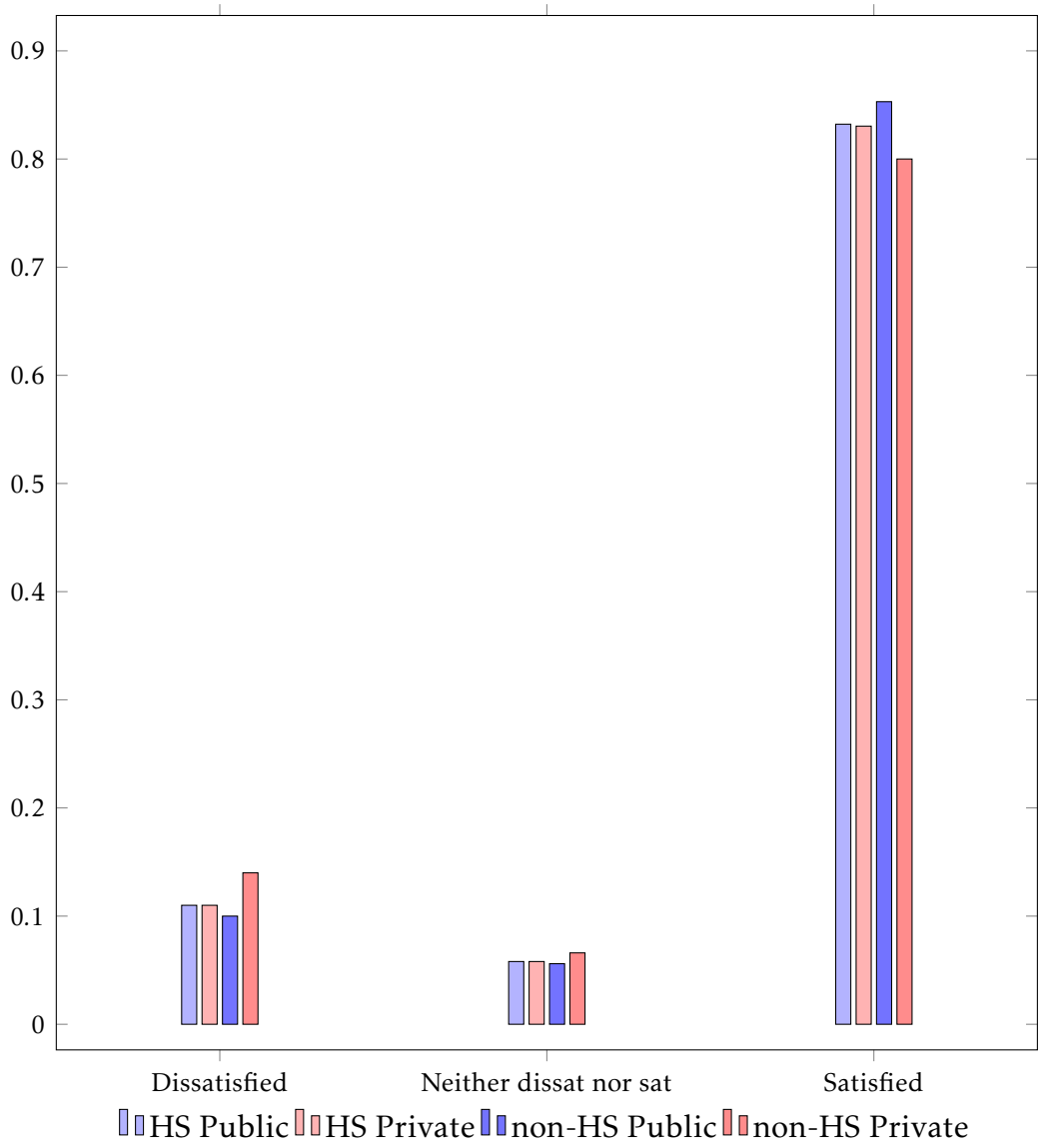


Figure 15: Marginal outcomes of offers on job satisfaction, recoded

Note: HS stands for High-skilled. Outcomes of offers include: (1) Unemployment; (2) High-skilled public-sector job; (3) High-skilled private-sector job; (4) non-High-skilled public-sector job; (5) non-High-skilled private-sector job. Probability of unemployment was equal to zero and omitted. Interestingly, the more satisfied a woman is with her job, the greater the gap of accepting a non-high-skilled job in the public sector. In other words, more satisfied female employees prefer to wait in mismatch in the public-sector. Difference between the outcomes is significant in 1%. This graph differs from the previous one in terms of coding the level of satisfaction from 7 categories to 3.
Source: Own elaboration, based on BHPS/UKHLS