THE EFFECT OF RELATIVE WAGES AND EXTERNAL SHOCKS ON QUITS AND SEPARATIONS FROM THE PUBLIC SECTOR[1]

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ABSTRACT

We use administrative records covering the workforce of a major Australian state government to investigate the determinants of quits and separations amongst permanent and temporary workers. It is shown that nurses and teachers on permanent contracts are more likely to quit, whereas other occupational groups separate. We investigate whether a matching model can explain public sector turnover, and find some support for this approach. It is also shown that relative wages are an important determinant of turnover behaviour, and that the public sector is responsive to external shocks, with a counter-cyclical separations effect and a pro-cyclical quitting effect.

Key words: Public sector, turnover, competing risks

JEL classification: I10, J22, J44

1 Introduction

The operation of the public sector labour market plays a major part in determining the efficiency and scope of government activity. Interest in this issue has been heightened by a renewed commitment by governments to the effective organization and delivery of public services, particularly in the health and education sectors.[2] Furthermore, the OECD (1999) has recently identified a number of challenges in making the public sector an effective 'employer of choice' in the contemporary labour market. Amongst the most important of these challenges are recruitment and retention problems, giving rise to critical skill shortages in occupations such as nursing and teaching.

Dunlop (1994) has argued that the public sector can be regarded as a good example of an internal labour market, where the effect of the external labour market is restricted and indirect. Baker, Gibbs and Holmstrom (1994) also show that it is only the wages of workers in (less skilled) jobs at the port of entry to the internal labour market that respond to external market forces. Internal labour markets are therefore characterized by long-term employment relationships, so that workers enjoy long employment tenure once they have passed a probationary period and the quality of the match has been established. However, one way in which the personnel challenges facing the public sector have been tackled in recent years is through the introduction of temporary contracts (Mangan, 2000). The use of temporary contracts enables government to create a more flexible public sector workforce, offering the opportunity to terminate poor matches at the worker level and at the aggregate level to adjust the size of the workforce as policy or the external environment demands. Consequently, it is to be expected that the turnover decisions of temporary workers will differ from the turnover decisions of permanent workers, the former being more responsive to the external labour market.

This paper therefore seeks to answer the following questions. First, do relative wages and local unemployment rates, our measure of external shocks, affect turnover behaviour, and do these effects vary between permanent and temporary workers?

[2] For example, the UK Cabinet Office's 1999 White Paper on *Modernising Government* set out an ambitious agenda to "reinvent" and improve many aspects of public service delivery.

Second, how does turnover vary between occupational groups? Specifically, are workers in less skilled 'entry level' occupations more responsive to relative wages and labour market shocks than say, workers in teaching and nursing? Thirdly, in view of the move to a more flexible workforce in the public sector, is worker turnover in the public sector consistent with a job matching story?

In addressing these questions we disaggregate worker turnover into quits (i.e. a voluntary exit) and separations (i.e. an involuntary exit).[3] We use administrative records for approximately 200,000 public sector workers across a range of state government departments in Queensland, Australia, excluding workers in corporatised government utilities. Using this data we estimate semi-parametric competing risks duration models, allow for time varying labour market shocks, and control for unobserved heterogeneity.

The main contribution of our paper is that we are able to paint a more complete picture of the employment problems, or challenges, facing the public sector than has hitherto been possible because we have data for an entire public sector workforce. Occupation-specific studies of turnover in the public sector (see Section 2) are clearly important, however at best they provide only a partial picture, and what is more there is a lack of consensus on the effect of relative wages and almost no evidence on the effect of local unemployment rates. A more consistent story can only be told by investigating how turnover decisions vary between occupational groups in a single public sector service. Our paper also makes a more general contribution to the descriptive personnel economics literature, which focuses on the operation of internal labour market forces in specific firms.

The remainder of the paper is organised as follows. In section 2 we discuss the literature on the determinants of worker turnover in the public sector, and in section 3 we describe the data and institutional background. Here we draw out the main features of the Australian public sector labour market in order to establish their comparability with conditions in the public sectors of other developed OECD economies. Insofar as the Queensland public sector is found to be similar to the public sectors of other states

[3] Quits refer to resignations whereas separations arise due to retrenchment, dismissal and the termination of fixed term contracts.

and countries, then our results can be generalized. In section 4 we outline the theoretical and econometric framework within which our results can be interpreted. Section 5 presents a discussion of our findings in relation to the three questions raised above.

2. A review of the literature

Inspite of the policy demands referred to in the previous section, there is relatively little known about the operation of public sector labour markets. Of those studies that do exist, the majority analyze the public-private sector wage differential (Borland and Gregory, 1999), or turnover amongst specific occupational groups, such as nurses and teachers. Relatively few studies investigate turnover rates for the whole sector. An exception is Borjas (2003), but his focus is on the effect of relative wage compression in the US public sector on the recruitment and retention of high-skill workers. Similar work has been conducted by Nickell and Quintini (2002) for the UK and Kim (1999) for the US, who find that the relative pay of public sector workers has fallen, especially amongst civil servants, teachers and nurses, which partly explains the decline in the average quality of these groups of workers.

Studies of nurses and teachers offer conflicting results on the impact of relative wages on turnover. Dolton and van der Klaauw (1995, 1999) show that relative wages are an important explanation of teacher turnover. Chevalier, Dolton and McIntosh (2001) demonstrate that UK graduates have become progressively less likely to choose to enter the teaching profession because of their sensitivity to relative wages. Similarly, Mont and Rees (1996) show for the US that higher salaries reduce turnover, whereas higher average student quality reduces the hazard of exit and a larger class size increases this hazard. Relative wages and conditions of work would therefore appear to be important determinants of teacher turnover.

However, contrasting evidence exists on the role of the relative wage. Stinebricker (2002) finds that teachers in the US are not 'lured' away from teaching by better paid jobs. He finds that the majority of exits from teaching are to 'inactivity' to raise newborn children. Similarly, Shields and Ward (2001) argue that relative pay has been over emphasized in discussions of turnover amongst nurses in the British public

sector. They find that dissatisfaction with promotion and training opportunities have a stronger impact on intentions to quit than workload and pay. Ahlburg and Mahoney's (1996) study of US nurses and Frijters, Shields and Wheatley Price (2004) study of UK teachers also found that relative pay had a limited impact on retention.

3 Data and institutional background

The size, structure and operation of Australia's public sector labour market is most closely comparable to that of Canada, the UK and the US. Employment in the extended public sector accounted for 18.7% of total employment, slightly lower than the mean level of 20.5% (see OECD, 1997). Compensation costs as a proportion of general government consumption expenditure in Australia are closest to the levels exhibited by the US, UK, Canada and the Netherlands. The public-private sector wage differential of 1.25 for the period 1994-97 for Australia is in the upper range of OECD estimates (OECD, 1997) and compares to an OECD average of 1.18. In view of these facts, we argue that the performance of Australia's public sector is comparable to that of other OECD countries.

Furthermore, the structure of Australia's public sector is similar to the US and Canadian systems, distributed across federal, state and local levels of government. State governments account for 65.8% of all public sector employees and have responsibility for core services, such as education, health, emergency services and law enforcement. The remaining public sector employees work in the federal government (23%) and local government (11.2%). Time series data for Australia indicate that federal public sector employment as a proportion of total employment has been falling steadily since the 1980s, largely as a result of the privatisation of public enterprises, from 30.9% of the total employed workforce in mid-1983 to 19.7% at the end of 2001 (Borland and Gregory, 1999), which is also consistent with the experience of other OECD countries. Employment in the state and local levels of government remained constant, whereas employment in the private sector grew at approximately 3.8% per annum. The Queensland State Government is the third largest in Australia, servicing a population of approximately 3.6 million people and making up approximately 12.5% of the total employed labour force in the State. This implies that the Queensland public sector is 'representative' of the Australian public sector.

The data used in this study are based on the administrative personnel records of the Queensland State Government. This data was collected in order to facilitate human resource management and is known as the Minimum Obligatory Human Resources Information (MOHRI) database. It represents the minimum level of human resource information that the Queensland Government's 25 agencies are required to collect and report to the central government agency for industrial relations purposes. The database holds information on approximately 200,000 public sector workers and in this study refers to the calendar year for 2001.[4] This is a stock sample, which means that it has the drawback of over-representing workers with long tenures, that is, some pre-sorting of workers has occurred.[5] The virtue of our data, however, is that we are able to analyze the turnover behaviour of 'experienced' workers, who can be regarded as a greater loss to the sector than inexperienced workers because of their greater job specific human capital.[6] Moreover, as we will show, temporary workers have higher entry and exit rates to the public sector with consequently shorter average tenure, which implies that for this sub-sample less pre-sorting has occurred.

The composition and characteristics of the workforce, sub-divided by contract type, are reported in Table 1. Females are in the majority, representing 63% of the total workforce and there are clear differences in the occupational distribution of employment for men and women.[7] Female employment is concentrated in advanced/intermediate clerical, teaching and nursing, whereas males are more likely to be employed in managerial, other professional and associate professional jobs.[8] Approximately 86% of men and 83% of women are employed in permanent jobs with a substantial proportion of the workforce therefore employed on fixed-term/temporary contracts. The occupational distribution of employment is similar for permanent and

[4] Our analysis is actually based on 177,519 workers which excludes casual workers because of their very short employment tenure.
[5] Note that we have no information on workers who do not enter the public sector, therefore we cannot control for selection into the public sector.
[6] Studies of nurses and teachers have tended to use flow samples of workers relatively early in their careers, which means that they exclude the turnover behaviour of experienced workers.
[7] Occupation groups are derived from 1 digit ASCO codes, equivalent to the US DOT codes. The exception is for the professional group, which is disaggregated into Nurses, Teachers and Other Professionals (see ABS (1997) Australian Standard Classification of Occupations, 2nd edition, catalogue number 1220, AGPS, Canberra for more details).
[8] Unfortunately, there is no education variable in the MOHRI, however, the occupation data is detailed and is likely to be highly correlated with the level of education of the worker.

temporary workers. The exceptions are female nurses where only 6% are on temporary contracts, compared to 14% on permanent contracts, and males in associate professional jobs where the equivalent figures are 13% and 24%, respectively. Note also the large proportions of males and females employed on temporary contracts in elementary clerical jobs.

Turnover is higher for temporary workers, which is perhaps unsurprising, although the extent of the difference between them and permanent workers is striking. The permanent public sector labour force experienced a 1-4% overall turnover rate in 2001, depending on whether exit from the sector was via a quit or a separation, versus 7-16% for the temporary workforce. The temporary workforce is also characterised by a high entry rate – approximately 37% were new appointees in 2001.

These findings imply that temporary contracts are used as a screening device, to enable the employer to determine the quality of the match, and as a means of adjusting the size of the workforce. This is further corroborated when we disaggregate turnover by quits and separations. Temporary workers dominate among both groups, accounting for approximately 26-32% of all quits and a massive 72-99% of separations. Table 2 shows that it is workers at the upper end of the occupational hierarchy have higher than average rates of quitting. For example, female nurses account for 13% of the workforce (see Table 1) with a high quit rate (14%) and a low separation rate (1%). In contrast, the share of female teachers in the sector is 25%, with a lower proportion of quitters (9%) and a much higher proportion of separations (30%). These outcomes are partly explained by the different shares of temporary workers recruited to these occupations. However, turnover rates are also high for other professionals, associate professionals, such as technicians, and advanced/intermediate clerical workers. Thus, contrary to the predictions of internal labour market theory, it would appear that it is the relatively skilled workers who exit the sector, either by quitting in the case of permanent workers or via a separation for temporary workers. This in turn implies that a matching model may capture the essential features of worker turnover in this Australian public sector.

4 A theoretical and econometric background

A variety of theoretical models have been developed to explain worker mobility, including human capital and search/matching models. There is substantial evidence, albeit for the private sector, in support of the Jovanovic (1979) model as an accurate depiction of the job matching process (Flinn 1986, Meitzen 1986, Farber 1994, Jovanovic and Moffit 1990). In view of the substantial changes that have occurred to public sector labour markets in recent years, such as the introduction of temporary contracts, and the magnitude of turnover described in the previous section, we argue that this framework can also be used to understand the turnover decisions of public sector workers.

The Jovanovic model is based on imperfect information and the idea that job matches are experience goods. It is assumed that both jobs and workers have heterogeneous productivities, and the problem for the employer is to optimally assign workers to jobs. It is also assumed that employers can contract with workers on an individual basis. Workers are paid their marginal products and employers offer higher rewards for workers who are regarded as 'better' matches, perhaps through promotion in the internal labour market. In practice, because firms find it expensive to negotiate wages annually with each worker, they are likely to use probationary periods, and more recently temporary contracts, so that relatively unproductive workers can be released (Bishop, 1990). The third assumption is that the quantity and quality of information about the worker and the employer increases over time, giving rise to either optimal matches, perhaps through job reassignment, or turnover.

Thus worker turnover in the public sector is a function of the expected quality of the match between a worker/job pairing, μ, which varies by each pairing and through time, t; information about a worker's previous performance or output, q; and the precision of the match, $p(t)$. In the Jovanovic model all turnover is due to workers quitting, Q, whereas in reality workers also separate, S.[9] Workers quit if the expected

[9] To ensure that all turnover is due to quitting it is assumed that, if the quality of a match falls below some reservation level, then the firm will reduce the wage sufficiently to induce a quit. This is unrealistic in practice, especially in the public sector, however, one can envisage a situation where a worker regarded as a poor match is persuaded to leave simply by virtue of disciplinary proceedings. In this case the worker simply leaves before they are pushed.

discounted benefits of alternative offers (e.g. in terms of the wage or contract status) exceed the expected discounted direct and indirect costs of job changing. Since separations do occur, one could imagine that a firm would fire a worker at time *t* if $\mu_t < r_t^e$, the employer's reservation utility or productivity.

The predictions that arise from the Jovanovic model are, firstly, that workers '…select themselves out of jobs in which their productivity is revealed to be low' (p974), implying a higher rate of quitting than separating if workers learn more quickly than employers about the quality of the match.[10] Second, the quit and separation probabilities decrease with job tenure because 'mismatches' are detected early. However, because of the need to learn about the quality of the match, the associated hazards are likely to be non-monotonic. Specifically, it is expected that the baseline hazard will initially increase and then flatten once information about the quality of the match has been observed by the worker and the firm. It is worth noting that workers in the Queensland public service can be employed on contracts of length 3, 6 or 12 months, which are renewable over an indefinite period, and permanent workers have a probationary period of 13 months. One may therefore expect to observe spikes in the hazard as employers (and workers) are required to renew the contract in the light of information revealed about the quality of the match. Third, because temporary contracts are used by firms where there is greater uncertainty regarding a workers' productivity, and hence the quality of the match, we would expect a higher baseline hazard for temporary workers.

From this we can formulate the following hazard models:

$$h^Q = \mathrm{f}(\mu_t, q, p(t)) \qquad (1a)$$

$$h^S = \mathrm{f}(\mu_t, q, p(t)) \qquad (2a)$$

Information about *q* is a function of worker tenure, which we observe in our data and is reflected in the shape of the baseline hazard. We cannot observe μ_t, thus we proxy this by worker characteristics (e.g. ethnic background, disability), the working conditions, (e.g. establishment size and establishment sickness record) and the

[10] We do not investigate the prediction from the model that job tenure and experience are correlated and wages grow over the life cycle because of a lack of suitable data.

occupation to which workers are assigned. It is difficult to observe the precision of the match, *p(t)*. However, due to the difficulty in dismissing permanent workers, temporary contracts are more likely to be used where there is less certainty about the quality of the match.

So far we have assumed that worker turnover is a function of events internal to the firm, when in practice there may be negative external shocks arising in the labour market, which also stimulate worker turnover. This kind of shock may have greater applicability to the private sector insofar as the public sector is often perceived to be insulated from the external environment. However, public sector workers may be exposed to events in the external labour market, insofar as a high local unemployment rate, for instance, will encourage immobility because the external job offer arrival rate falls. Higher relative wages may also act as a pull factor, as suggested by some of the previous literature. Equations (1) and (2) therefore need to be modified to include the unemployment rate (u_t), our proxy for shocks, and the relative wage (w_r):

$$h^Q = \mathrm{f}(\mu_t, q, p(t), u_t, w_r) \qquad (1b)$$

$$h^S = \mathrm{f}(\mu_t, q, p(t), u_t, w_r) \qquad (2b)$$

Our observed covariates are collected in a vector, $\boldsymbol{x}$, however it is possible that unobservable differences between workers, such as motivation and attitudes to work, also affect their turnover decision. This is allowed for in the econometric modelling.

Following Bradley, Crouchley and Oskrochi (2003) we view the behaviour of workers in the public sector as a semi-Markov process with individuals entering the sector either via a temporary contract ($j = 1$) or a permanent contract ($j = 2$) and exiting either by quitting ($k = 1$) or separating ($k = 2$). Thus we have two origin states and two reasons for exit, or destination states, and all spells in the public sector are assumed independent of each other for simplicity. For spell i, tenure is grouped into D_i intervals $(d_{l-1},d_l]$, $l=1,...,D_i$ with $d_0=0$.[11]

[11] In our data we observe the date started in the public sector and the date they exit. This is divided into two monthly intervals, except for workers with very long tenures where it is grouped in year bands.

Following Prentice and Gloeckler (1978), we adopt a random effect discrete time representation of the continuous time competing risk model so that the likelihood for spell *i* of type *jk* is given by

$$L_{ijk} = \int \prod_{l=1}^{D_i} h_{ijkl}(v_{ijk})^{y_{ijkl}} \left(1 - h_{ijkl}(v_{ijk})\right)^{(1-\sum_k y_{ijkl})} DG(v_{jk}; \boldsymbol{\sigma}_{jk}) \tag{3}$$

where $y_{ijkl} = 1$ for a *j* to *k* transition in interval *l*, and 0 otherwise. The probability of a *jk* transition in interval *l* (the discrete time hazard) is given by

$$\Pr(y_{ijkl} = 1 | v_{ijk}) = h_{ijkl}(v_{ijk}) = 1 - \exp[-\exp(\eta_{ijk}(l) + v_{ijk})], \tag{4}$$

where $\eta_{ijk}(l) = \log\{\Lambda_{ijk}(d_l) - \Lambda_{ijk}(d_l - 1)\}$, $\Lambda_{ijk}(d_l) = \int_0^{d_l} \theta_{ijk}(t)dt$, and $\theta_{ijk}(t)$ is the continuous time hazard for leaving origin state *j* for destination *k* at duration *t*. $G(v_{jk}; \sigma_{jk})$ is the distribution function for the unobserved heterogeneity, or random effects (v_{ijk}), and has dispersion parameter σ_{jk}. In this paper, we model the unobserved heterogeneity using Normal mixing with mean zero and variance σ_{jk}.

Under the proportional hazard assumption

$$\eta_{ijk}(l) = \beta_{0jk} + \boldsymbol{\beta}_{1jk} x_{ijkl} + \psi_{jkl}, \tag{5}$$

where x_{ijkl} is a vector of covariates, some of which vary over time (*l*), $\boldsymbol{\beta}_{1jk}$ is a vector of regression parameters and the ψ_{jkl} are constants, such that

$$\psi_{jkl} = \log\{\Lambda_{0jk}(d_l) - \Lambda_{0jk}(d_l)\}, \tag{6}$$

$\Lambda_{0ik}(d_l)$ is the integrated baseline hazard. The start and end points used to determine ψ_{jkl} often take different values to those of the time intervals $(d_{l-1},d_l]$. When this happens we can write $\psi_{jkl} = \gamma_{jkl} I(l)$; $I(l)$ is an indicator of the form $I(r < l \leq m)$, where *r* and *m* are the start and end points of an interval for duration.

This equation is estimated separately for each origin-destination pair, *jk*, which means that we assume that the hazards for each competing risk are mutually independent. This implies that the spell specific random effects (v_{ijk}) are uncorrelated across the origin-destination pairs.

The difficulty in interpreting the coefficients from a competing risks model is well documented (Lancaster, 1990; Thomas, 1996), therefore to aid interpretation we compute marginal effects following the approach suggested by Thomas (1996), which is discussed in some length in Andrews, Bradley and Stott (2002). Thus, in our empirical analysis, we report the estimated marginal effects and the probability value associated with the estimated coefficient obtained from the competing risk model. Marginal effects must sum to zero. Note that, although the hazard of exit varies over person-time, implying variation in the marginal effects, we estimate mean expected waiting times and then compute the marginal effects of the covariates at this point, that is, at *j*=16 for males and *j*=18 for females.

5 Results[12]

5.1 Job matching in the public sector?

Recall that the theory suggests that because it takes time to learn about the quality of the match, the baseline hazards should be non-monotonic, initially rising and then flattening. Figures 1a to 1c show the baseline hazards ignoring destination states for

[12] We do not discuss the effect of worker characteristics or working conditions on worker turnover, however, given the lack of evidence on turnover for the public sector they are reported for the interested reader.

males and females, with (heterogeneous) and without (homogenous) random effects.[13] Several observations can be drawn from these Figures. First, focusing on the homogenous hazards, they are clearly non-monotonic as the theory suggests but with one spike at 12 months, which is particularly large for those workers on temporary contracts (note the differences in scale on Figures 1b and 1c), and a further spike at 24 months for males on permanent contracts. The twelve month spike is consistent with the normal length of a temporary contract for 'high skill' workers, and is also consistent with economy-wide evidence on the probationary period for temporary workers in Australia (Green and Leeves, 2004). Second, when we control for unobserved heterogeneity, the shape of the hazards change, shifting down and becoming much flatter, suggesting that when unobservable differences between workers are taken into account, there is less variation in the hazard of exit from the public sector. The exceptions are the baseline hazards for male workers on permanent contracts, where no unobserved heterogeneity is detected (i.e. the spikes remain at 12 and 24 months), and the baseline hazards for temporary workers where unobserved heterogeneity is detected but a small spike at 12 months remains.

Figures 2 and 3 extend the analysis disaggregating by type of turnover. In the case of quits (see Figures 2a to 2c), there is very little difference between the shape of the baseline hazard for permanent workers (Figure 2b) and all quits (Figure 2a), probably because there are relatively few permanent workers who quit. Furthermore, once allowance is made for unobserved heterogeneity amongst workers, the quitting hazard for permanent workers is flat. The main difference occurs between temporary workers who quit (Figure 2c) and all quits (Figure 2a). However, once again controlling for unobserved heterogeneity, results in the hazard of exit for temporary workers who quit becoming flat.

A different picture emerges for workers who separate (see Figures 3a-3c). Combining workers on permanent and temporary contracts (Figure 3a), we observe that for males and females the hazards of exit from the homogenous models are initially high, fall and then exhibit a spike at 12 months. This picture is essentially replicated for males

[13] Where no unobserved heterogeneity was detected we report the baseline hazards for the homogenous models only. Note that we also truncate the baseline hazards at 10 years because they are virtually flat thereafter.

once unobserved heterogeneity is taken into account, although the hazard does shift downwards, whereas the equivalent hazard for females is flat. Disaggregating by contract status we see that it is temporary workers who drive the pattern of behaviour observed in Figure 3a.

The theoretical model suggests that the hazard to quitting will be higher than the hazard to separation. Furthermore, the baseline hazards for workers on temporary contracts should be greater than that for workers on permanent contracts if temporary workers are more imprecisely matched. Since it is difficult to compare the baseline hazards on Figures 1 to 3, due to the fact that they have different scales, Figure 4 reports transition intensities by gender.[14] For males and females, workers on temporary contracts are more likely to exit the public sector, overwhelmingly because of a separation. In the case of males on temporary contracts who separate, there is some evidence that employers take time to learn about the quality of the match reflected by the non-monotonic but rising transition intensity up to 20 months. It is difficult to see any difference between the other transition intensities, therefore Figure 4a omits the schedule for temporary workers who separate. Of the three remaining groups, males exiting from the public sector are more likely to occur amongst workers on temporary contracts who quit, followed by those on permanent contracts who separate. For females, the reverse holds in the first few months, but from 12 months temporary quits are greater than permanent separations. In the case of both males and females, permanent workers are less likely to quit.

In summary, the evidence with respect to the Jovanovic model is mixed. We do find evidence of non-monotonic hazards for males on permanent contracts and for temporary workers, even after allowance is made for unobserved heterogeneity. However, rather than observing a rising hazard, which then falls and becomes constant, in the public sector we find evidence of spikes at 12 and 24 months, followed by a flat hazard. These spikes correspond to institutional rules at which point the employer screens employees. As predicted, temporary workers are more likely to

[14] Transition intensities are computed by re-scaling the hazards so that they sum to 1 in each time interval. Since all of our models are estimated with the same number of time periods, are specified identically, and are estimated independently, we are able to combine models in this way.

exit the sector than permanent worker's, however, separations dominate quits, which is contrary to the predictions of the model.

5.2 The effect of relative wages and external shocks

If the size of the public sector workforce does now respond to the business cycle, then separations should be pro-cyclical. Alternatively, if governments use the public sector as a vehicle for achieving their objectives with respect to affirmative action then separations may be counter-cyclical. With respect to quits, as better (and more highly paid) external job opportunities dry up we would expect quits to fall and hence be counter-cyclical.

We test these hypotheses by incorporating into our models the time varying local unemployment rate.[15] Tables 3 and 4 show that, except for females on temporary contracts, a higher local unemployment rate is associated with an increase in separations, which is a counter-cyclical effect, and a decrease in quitting, a pro-cyclical effect. The finding that quits are pro-cyclical is in line with existing evidence (see Contini and Ravelli, 1997 for an overview), whereas the counter-cyclical separation effect is new.

To capture the attractiveness of alternative job matches outside of the public sector, and following the existing literature with respect to teachers and nurses, we include a non-time varying measure of the relative wage. We do observe the wage paid to workers in the public sector, and compute a measure of the relative wage by first estimating an occupation-age earnings profile for all workers using the Queensland 1996 Population Census. The coefficients from this model are then used to generate a predicted private sector weekly wage for all workers in the public sector. Deflating by the Queensland CPI series 5 we then derive the private\public sector weekly wage. Our results for the relative wage variable are broadly consistent with our findings on the unemployment shock variable. Workers on permanent contracts facing higher relative wages are more likely to quit, the exception being males on temporary contracts.

[15] Specifically, we map to each worker's tenure in the sector the quarterly unemployment rate at the Statistical Local Area level, which encompasses several local government areas.

5.3 Occupational differences in turnover, relative wages and external shocks

Our results in Tables 3 and 4 show that the probability of quitting the public service is high for nurses, especially in the case of males where the marginal effect of 0.66 is substantially larger than that for females (0.39), but note that the proportion of males employed in nursing is small. When we disaggregate the models by contract type, we find that those female nurses who quit the public sector are more likely to do so if they are employed on permanent contracts. To see this compare the marginal effect for nurses on temporary contracts (0.09) with that for permanent contract holders (0.35), a substantial differential. Male nurses have a lower quit rate from permanent contracts compared to females, 0.21 versus 0.35, a differential of 14 percentage points, but they are more likely to quit than male nurses on temporary contracts – 0.21 and 0.06, respectively.

The fact that quits are more likely amongst nurses on permanent contracts, especially for females, suggests that the retention problem is very real, which in theoretical terms may reflect their low expected valuation of the quality of the match. This could be driven by a number of factors. First, nurses are in high demand in both the private and overseas sectors, and although wages are generally lower in the former, conditions of service are better, and so they may be lured out of the public sector. Second, in recent years nurses have suffered from serious morale problems, associated with gender discrimination with respect to promotion prospects, and would therefore be expected to have an increased hazard of quitting (Pudney and Shields, 2000; Shields and Ward, 2001; Shields and Wheatley Price, 2002). The first and second arguments could explain the high quit rates for males and females. A third argument, which might explain the differential in quitting between male and female nurses is the argument put forward by Stinebrickner (2002), albeit with respect to US teachers, that female nurses leave to start a family. To investigate this hypothesis further, we calculated the proportion of exits disaggregated by age and gender. We found almost no difference in the proportion of exits between males and females for the 25-35 age group, the period in which child-bearing for females is most likely, implying that leaving nursing for child-rearing cannot explain the gender differential in the turnover rate.

In contrast to nurses, teachers who leave the public service do so because of a separation, especially in the case of females (see the combined models in Tables 3 and 4). The estimated marginal effect for females is almost twice as large as that for males (0.57 versus 0.30).[16] When we disaggregate by contract type a richer story emerges, insofar as we find that it is female teachers on temporary contracts who are more likely to separate, suggesting that the *employer* perceives the quality of the match to be lower than their reservation level. In contrast, male teachers on permanent contracts are more likely to quit, which implies that the *worker* expects the quality of the match to be low. The magnitude of the differential in quit behaviour between male and female teachers on permanent contracts is also substantial – 0.28 based on the marginal effects of 0.36 and 0.08 for males and females, respectively. In contrast to temporary nurses, temporary teachers are more likely to separate.

There are therefore differences in the turnover behaviour for nurses and teachers, and there are differences between the genders. For instance, for workers on permanent contracts, female nurses are more likely to quit than female teachers, whereas male teachers are less likely to quit than male nurses. The findings with respect to teachers are surprising since, according to the 1996 Australian Census, state school teachers in Queensland earned approximately $90 more than their private school counterparts and state school teachers have had significant pay increases since then.[17] However, the private schools typically offer better working conditions, which could attract public sector teachers. There may also be the lure of work in other sectors of the economy. Nevertheless, what is clear from the results is that the pay increases for public sector teachers has not yet had the desired effect on retention since teachers on permanent contracts are more likely to quit. Furthermore, the fact that quits from teaching are more likely amongst males suggests that, in contrast to the findings for the US, family reasons are unlikely to be the main contributor to quit decisions.

A striking finding is that all other occupational groups on permanent contracts are less likely to quit and more likely to separate from the public sector compared to nurses

[16] Note that male teachers are more likely to be employed in the secondary school sector whereas females are employed in both the primary and secondary school sectors. The results for male teachers may therefore conflate gender and school sector.
[17] Specifically, Queensland teachers received a 14% pay rise between 2000-2002, 5% in 2000 and the remainder in 2001 and 2002.

and teachers, especially in associate professional, advanced clerical and elementary clerical jobs in the case of females and low skilled manual and clerical jobs for males. This suggests that many groups of workers view the public sector as a 'safe haven'. For workers on temporary contracts there is a difference between the behaviour of males and females. Males are more likely to separate from their jobs, regardless of occupation, whereas for females all groups except teachers and elementary clerical workers quit more often.

We turn now to a discussion of whether occupational differences in turnover arise because of their different responses to relative wages and external shocks. To do this we estimate separate models for each occupational group, which also allows the effect of the other control variables in the model to vary. The limitation of this approach is that for some occupational groups the number of exits is low, hence we are forced to combine males and females and temporary and permanent workers. However, we are still able to offer some tentative evidence on the effect of relative wages and external shocks on quits and separations for each occupational group (see Table 5).

Higher relative wages tends to increase the risk of quitting in most occupational groups, with particularly large effects in occupations that have skills that are more transferable to the private sector i.e. managers, teachers and associate professionals. Intermediate production and elementary clerical workers, who are relatively unskilled, are more likely to separate, an effect that is probably due to their being a larger proportion of workers in these occupational groups on temporary contracts. Indeed, the coefficient on the 'permanent' variable in the models underpinning the results for separations in Table 5 are always large, negative and highly statistically significant, implying that temporary workers are used as a buffer to possible wage shocks that may increase the public sector wage bill.

A higher local unemployment rate reduces the risk of quitting, however, there are some noticeable differences in the responses of occupational groups. For instance, clerical workers (advanced through to elementary) are more likely to be shaken out when unemployment rises, whereas more highly skilled managerial and professional workers do face a higher risk of separation but the effects are generally small. To see this compare the marginal effect for managers of 0.04 with that of

advanced/intermediate clerical workers of 0.38, a differential of 34 percentage points. What this evidence suggests is that when unemployment rises 'less skilled' workers in entry level jobs, who are also more likely to be on temporary contracts, are released whereas 'highly skilled' workers are hoarded. This makes sense insofar as less skilled workers are in greater supply in the labour market and can always be recruited as and when they are required. Conversely, highly skilled workers have specific skills that are valuable to the public sector and they are in relatively scarce supply in the labour market.

6 Conclusion

In this paper we have departed from the previous literature on turnover in the public sector by analyzing the turnover behaviour of *all* public sector workers. A distinction is also made between the turnover behaviour of workers on permanent contracts and temporary contracts, and between quits and separations. We have used a newly constructed dataset, based on the administrative records of the Queensland State Government, and employed competing risks duration models to examine several issues raised in the Introduction. The main results of this research are as follows:

There is evidence that the public sector labour market is affected by external shocks, which runs counter to the conventional view that it is an insulated internal labour market. Thus, a higher local unemployment rate is associated with an increase in separations, a counter-cyclical effect, and a decrease in voluntary quitting, a pro-cyclical effect. Workers on permanent contracts facing higher relative wages are more likely to quit, the exception being males on temporary contracts.

The major finding is that nurses and teachers on permanent contracts are more likely to quit the public sector, compared to other occupational groups, but there are gender differences in the propensity to quit. Teachers on temporary contracts are more likely to separate, whereas nurses on temporary contracts are more likely to quit. Most other occupational groups of workers separate, and, in contrast to the existing literature, we show that for those who do exit the public sector, they have substantial work experience.

We do find evidence of non-monotonic hazards for males on permanent contracts and for temporary workers, even after allowance is made for unobserved heterogeneity. However, rather than observing a rising hazard, which then falls and becomes constant, in the public sector we find evidence of spikes at 12 and 24 months, followed by flat hazard. This reflects institutional arrangements in the Australian public sector. As predicted, temporary workers are more likely to exit the sector than permanent workers, however, separations dominate quits, which is contrary to the predictions of the model.

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Table 1 Workforce characteristics by contract type, 2001

	Permanent		*Temporary*	
	Males	*Females*	*Males*	*Females*
Personal Characteristics				
ATSI[1]	0.07	0.04	0.08	0.06
NESB [2]	0.08	0.07	0.06	0.05
Disabled	0.08	0.06	0.05	0.05
Age (years)	42.40	40.74	36.19	36.34
Wages and Tenure				
Wage Rate ($ / hour)	26.68	25.60	22.63	22.27
Tenure (years)	13.77	10.08	3.03	2.87
Occupational Group				
Managers	0.10	0.04	0.02	0.02
Professionals:				
(a) Nurses	0.03	0.14	0.01	0.06
(b) Teachers	0.13	0.25	0.17	0.24
(c) Other Professionals	0.20	0.12	0.29	0.18
Associate Professionals	0.24	0.11	0.13	0.09
Intermediate Craft	0.06	0.00	0.11	0.00
Advanced / Intermediate Clerical	0.13	0.28	0.16	0.32
Intermediate Production	0.02	0.00	0.01	0.00
Elementary Clerical	0.01	0.01	0.06	0.07
Labourer	0.07	0.05	0.05	0.02
Turnover rates				
Quits	0.03	0.04	0.09	0.07
Separations	0.01	0.01	0.16	0.16
Other[3]	0.02	0.01	0.02	0.02
Entry rates	**0.04**	**0.05**	**0.38**	**0.36**
Working conditions				
Agency Size[4]	28,855	48,153	30,723	40,733
Establishment Size[5]	1009	1147	917	863
Observations	56,697	93,207	9,006	18,609

1. Includes those who self-identify as originating from an Aboriginal or Torres Strait Islanders (ATSI) background.
2. Includes those who self-identify as originating from a Non-English Speaking Background (NESB).
3. Includes separations due to: Ill Health Retirement, Age Retirement, Voluntary Early Retirement, Death, and Pension (paid by agency).
4. Calculated as average number of employees per agency.
5. Calculated as average number of workers per postcode area by agency.

Table 2 Quits and separations by workforce characteristics, 2001

	Quits		*Separations*		*Other*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Personal Characteristics						
ATSI	0.13	0.09	0.05	0.04	0.06	0.04
NESB	0.06	0.05	0.04	0.04	0.06	0.05
Disabled	0.12	0.15	0.07	0.07	0.13	0.12
Age (years)	38.70	36.24	39.09	36.70	47.25	47.34
Wages and Tenure						
Wage Rate ($ / hour)	23.53	21.07	24.70	23.44	25.72	22.78
Tenure (years)	6.93	5.38	5.77	3.33	15.52	11.97
Occupational Group						
Managers	0.07	0.05	0.06	0.02	0.11	0.03
Professionals:						
(a) Nurses	0.04	0.14	0.00	0.01	0.00	0.05
(b) Teachers	0.06	0.09	0.23	0.30	0.11	0.19
(c) Other Professionals	0.28	0.20	0.22	0.14	0.18	0.11
Associate Professionals	0.17	0.11	0.13	0.10	0.22	0.10
Intermediate Craft	0.13	0.01	0.05	0.00	0.03	0.00
Advanced / Intermediate Clerical	0.13	0.32	0.15	0.32	0.15	0.32
Intermediate Production	0.02	0.00	0.03	0.00	0.05	0.01
Elementary Clerical	0.03	0.04	0.07	0.08	0.02	0.06
Labourer	0.07	0.05	0.07	0.02	0.12	0.13
Working Conditions						
Agency Size	23,581	34,299	26,488	34,851	22,609	36,821
Establishment Size	783	919	592	589	647	593
Establishment sick rate	1.78	1.90	1.75	1.77	1.97	2.01
Observations	3,024	5,291	2,305	4,096	1,018	1,147

Table 3 Estimated marginal effects for competing risk models, females (with heterogeneity)

	Contract Type / Turnover											
	Combined				Permanent				Temporary			
	Quits		Separations		Quits		Separations		Quits		Separations	
	Marg effect	P-value	Marg effect	P-value	Marg effect	P-value	Marg effect	P-value	Marg effect	P-value	Marg effect	P-value
Permanent	0.657	0.000	-0.657	0.000								
ATSI	0.294	0.000	-0.294	0.000	0.171	0.000	-0.171	0.875	0.090	0.000	-0.090	0.001
NESB	-0.004	0.000	0.004	0.000	-0.006	0.100	0.006	0.396	-0.038	0.000	0.038	0.000
Disability	0.224	0.000	-0.224	0.000	0.300	0.000	-0.300	0.888	0.090	0.000	-0.090	0.000
Managers	-0.189	0.467	0.189	0.000	-0.084	0.000	0.084	0.064	0.119	0.000	-0.119	0.316
Nurses	0.385	0.000	-0.385	0.000	0.354	0.000	-0.354	0.293	0.094	0.277	-0.094	0.000
Teachers	-0.569	0.000	0.569	0.000	0.081	0.000	-0.081	0.011	-0.378	0.000	0.378	0.000
Other Professional	-0.051	0.000	0.051	0.000	-0.116	0.000	0.116	0.000	0.017	0.031	-0.017	0.134
Associate Professional	-0.266	0.336	0.266	0.000	-0.485	0.862	0.485	0.000	0.034	0.188	-0.034	0.681
Intermediate Craft	-0.068	0.926	0.068	0.624	-0.393	0.396	0.393	0.234	0.199	0.005	-0.199	0.100
Advanced Clerical	-0.230	0.024	0.230	0.000	-0.404	0.877	0.404	0.000	0.004	0.008	-0.004	0.004
Intermediate Production	-0.313	0.116	0.313	0.000	-0.326	0.014	0.326	0.015	-0.099	0.774	0.099	0.116
Elementary Clerical	-0.310	0.000	0.310	0.000	-0.351	0.296	0.351	0.005	-0.033	0.001	0.033	0.000
Estalishment size	0.000	0.000	-0.000	0.000	0.000	0.000	-0.000	0.095	0.000	0.000	-0.000	0.000
Establishment sick	0.106	0.308	-0.106	0.000	0.165	0.044	-0.165	0.000	-0.002	0.000	0.002	0.000
Relative wage	0.184	0.000	-0.184	0.000	1.178	0.000	-1.178	0.018	-0.027	0.513	0.027	0.000
Ln(unemployment)	-0.426	0.001	0.426	0.000	-0.072	0.000	0.072	0.015	-0.042	0.000	0.042	0.000
Individuals	111816		111816		93207		93207		18609		18609	
Observations	2069876		2069876		1864650		1864650		205226		205226	
Log (Variance)	8.958		6.167		9.829		0.000		7.180		8.399	
Log Likelihood	-32043.1		-21325.5		-23999.2		-5576.6		-7362.4		-15118.6	

Table 4 Estimated marginal effects for competing risks models, males (with heterogeneity)

	Contract Type / Turnover											
	Combined				Permanent				Temporary			
	Quits		Separations		Quits		Separations		Quits		Separations	
	Marg Effect	P-value	Marg Effect	P-value	Marg Effect	P-value	Marg effect	P-value	Marg Effect	P-value	Marg Effect	P-value
Permanent	0.386	0.000	-0.386	0.000								
ATSI	0.272	0.000	-0.272	0.002	0.217	0.000	-0.217	0.926	0.038	0.000	-0.038	0.002
NESB	0.054	0.263	-0.054	0.003	0.045	0.749	-0.045	0.388	-0.012	0.025	0.012	0.017
Disability	0.128	0.000	-0.128	0.645	0.067	0.017	-0.067	0.744	0.075	0.000	-0.075	0.767
Managers	-0.015	0.001	0.015	0.017	-0.042	0.197	0.042	0.861	0.003	0.143	-0.003	0.000
Nurses	0.659	0.000	-0.659	0.000	0.206	0.000	-0.206	1.000	0.061	0.615	-0.061	0.000
Teachers	-0.295	0.000	0.295	0.121	0.361	0.019	-0.361	0.000	-0.221	0.000	0.221	0.119
Other Professional	0.116	0.033	-0.116	0.013	-0.010	0.000	0.010	0.000	-0.008	0.001	0.008	0.000
Associate Professional	-0.009	0.000	0.009	0.000	-0.131	0.000	0.131	0.590	-0.015	0.000	0.015	0.000
Intermediate Craft	0.159	0.021	-0.159	0.000	0.315	0.001	-0.315	0.000	0.007	0.054	-0.007	0.000
Advanced Clerical	-0.077	0.002	0.077	0.899	-0.171	0.006	0.171	0.120	-0.014	0.017	0.014	0.012
Intermediate Production	-0.178	0.005	0.178	0.162	-0.291	0.085	0.291	0.001	-0.040	0.022	0.040	0.189
Elementary Clerical	-0.151	0.588	0.151	0.000	-0.201	0.794	0.201	0.040	-0.020	0.429	0.020	0.002
Establishment size	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Establishment sick	0.061	0.300	-0.061	0.000	0.139	0.001	-0.139	0.000	-0.011	0.000	0.011	0.042
Relative wage	0.202	0.000	-0.202	0.000	0.541	0.000	-0.541	0.038	0.000	0.004	-0.000	0.000
Ln(unemployment)	-0.168	0.000	0.168	0.000	-0.052	0.044	0.052	0.012	0.062	0.000	-0.062	0.000
Individuals	65701		65701		56697		56697		9004		9004	
Observations	1287613		1287613		1192140		1192140		95473		95473	
Log (Variance)	2.772		0.725		5.196		0.000		9.427		0.000	
Log Likelihood	-17436.0		-11780.0		-13008.5		-4696.9		-4171.4		-6787.6	

Table 5 Occupational differences in the response to relative wages and external shocks

Separations	Relative wages			Unemployment		
	Marginal effect	s.e.	p-value	Marginal effect	s.e.	p-value
Managers	-0.167	0.050	0.055	0.041	0.491	0.035
Nurses	na			na		
Teachers	-0.295	0.257	0.000	0.077	0.295	0.000
Other Professionals	-0.024	0.237	0.000	0.038	0.257	0.028
Ass Professionals	-1.449	0.343	0.000	0.065	0.259	0.812
Intermediate craft	na			na		
Adv/Int clerical	-0.084	0.090	0.385	0.382	0.340	0.000
Interm production	0.206	1.167	0.030	-0.117	0.906	0.163
Elementary clerical	0.105	0.237	0.000	0.281	0.708	0.000
Quits						
Managers	0.167	0.092	0.000	-0.041	0.332	0.010
Nurses	na		0.000	na		
Teachers	0.295	0.779	0.000	-0.077	0.257	0.771
Other Professionals	0.024	0.239	0.000	-0.038	0.176	0.043
Ass Professionals	1.449	0.277	0.000	-0.065	0.230	0.161
Intermediate craft	na			na		
Adv/Int clerical	0.084	0.124	0.000	-0.382	0.195	0.101
Interm production	-0.206	1.667	0.337	0.117	0.974	0.065
Elementary clerical	-0.105	0.401	0.002	-0.281	0.654	0.009

Notes: Standard errors and p-values refer to the underlying coefficients.

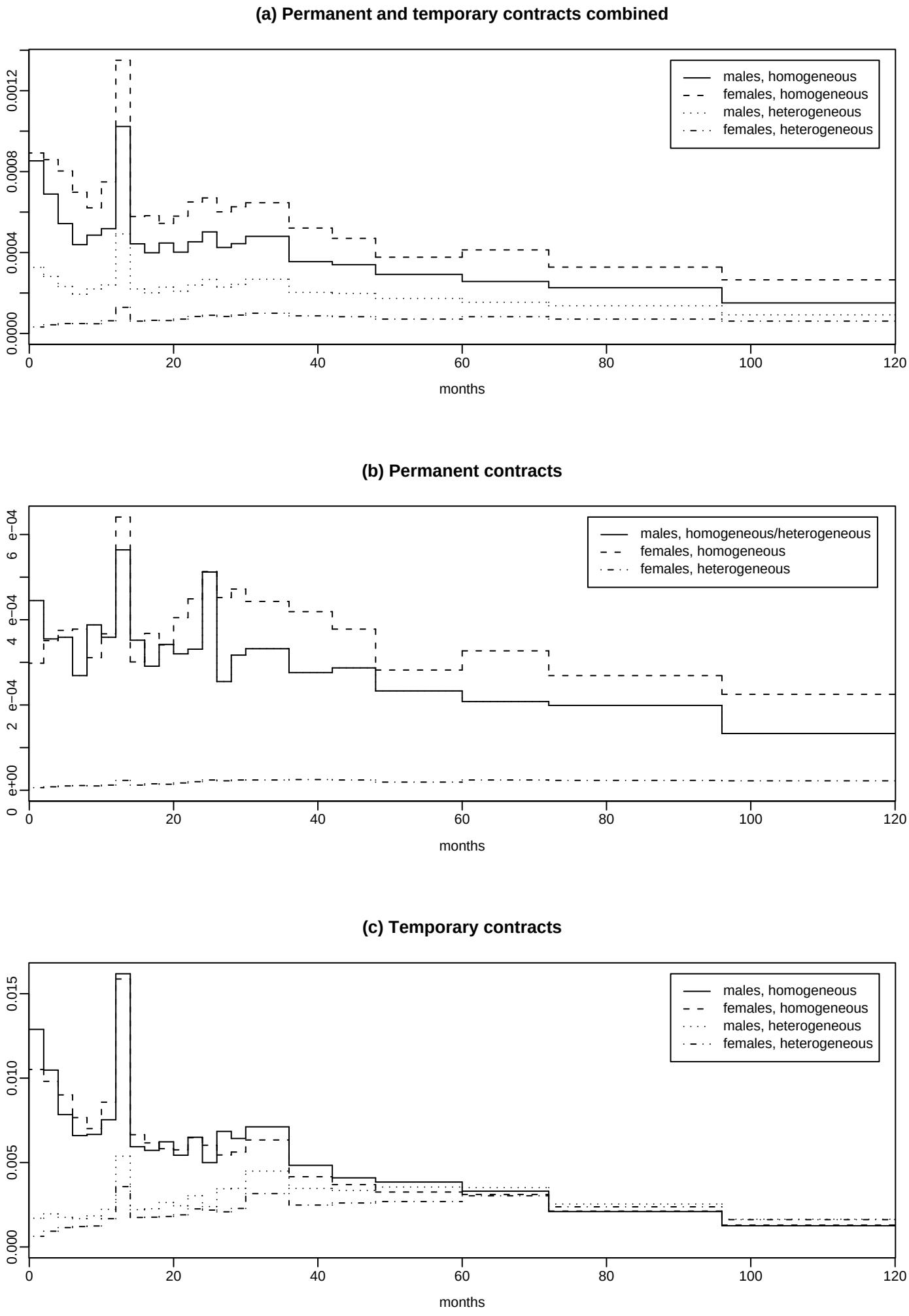
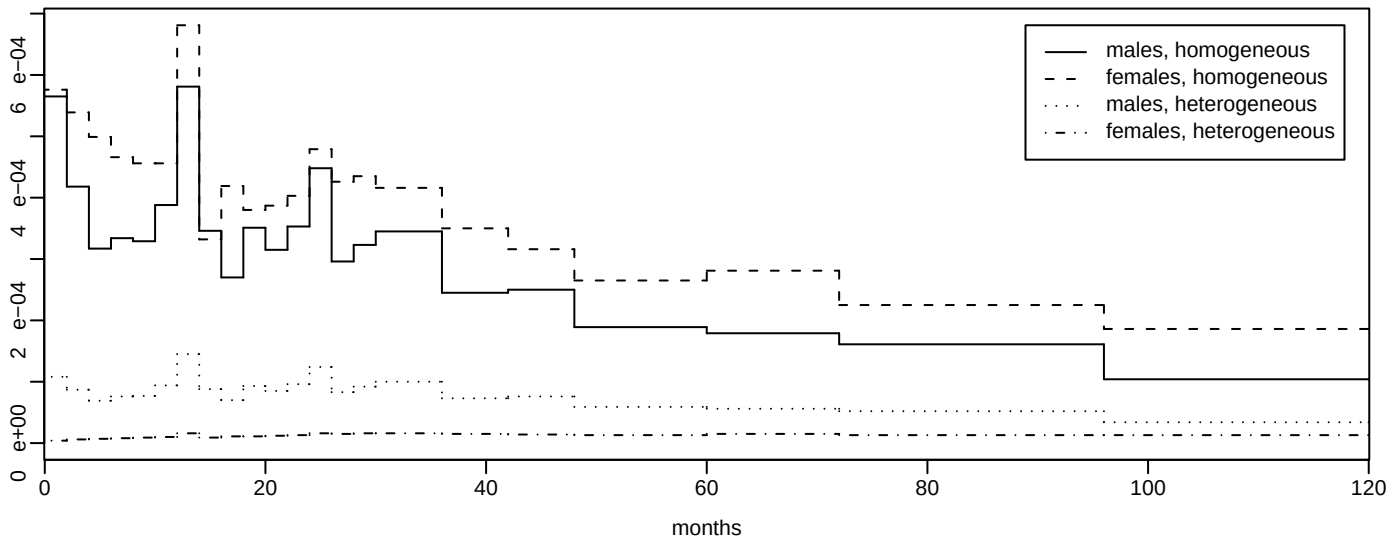
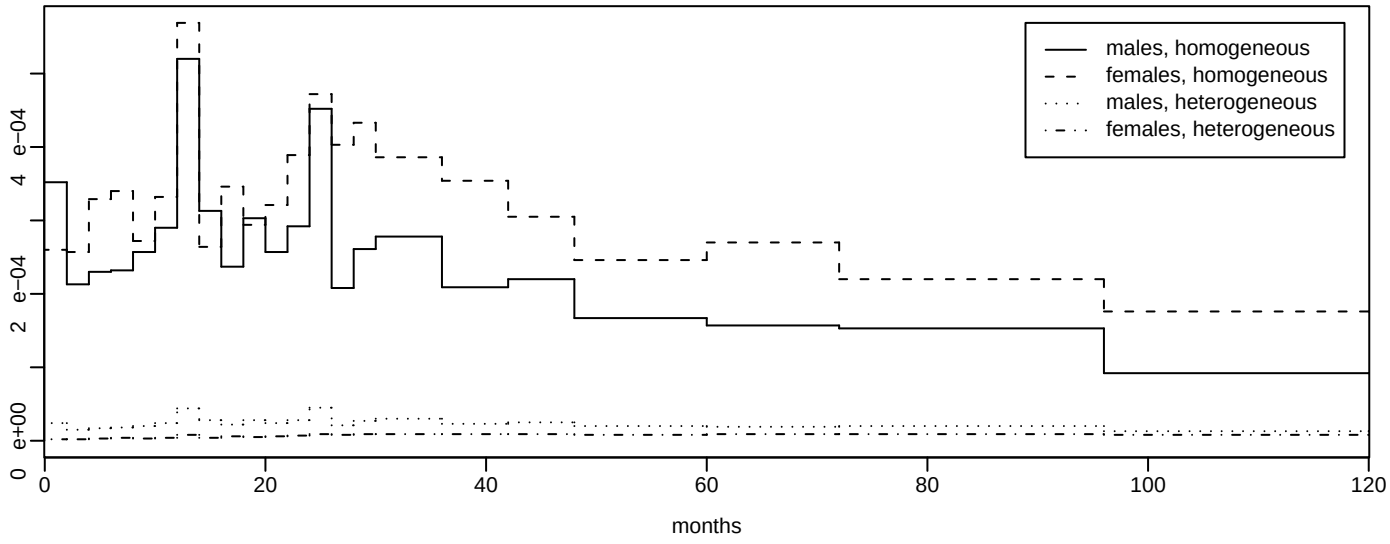


Fig. 1: Baseline hazards for combined destinations

(a) Permanent and temporary contracts combined



(b) Permanent contracts



(c) Temporary contracts

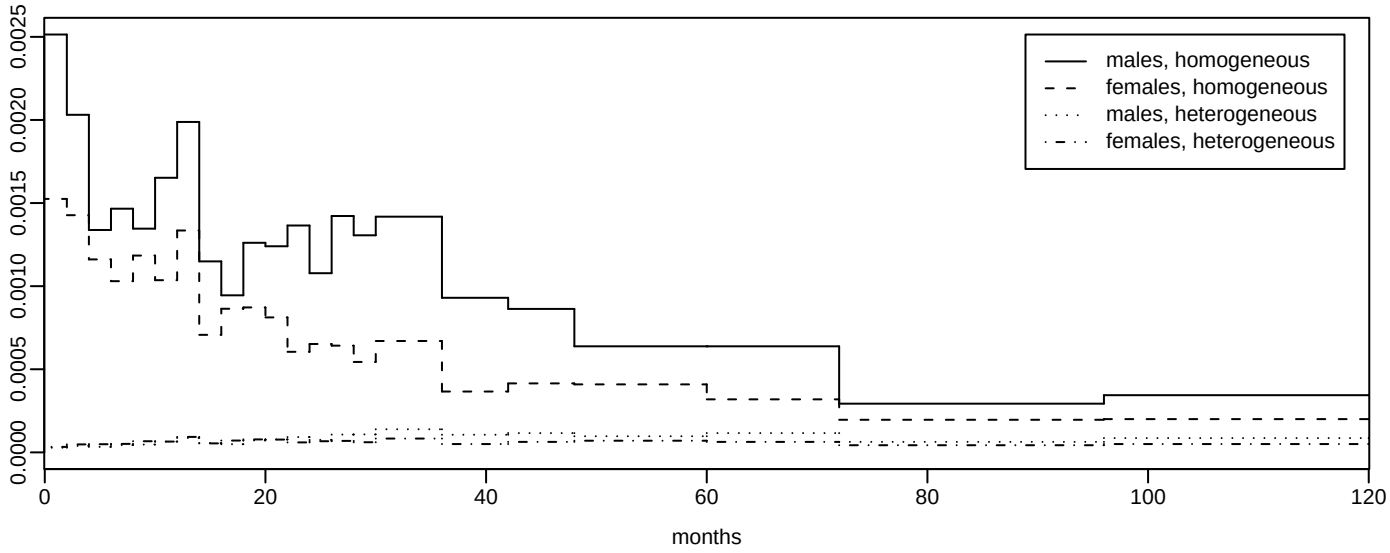
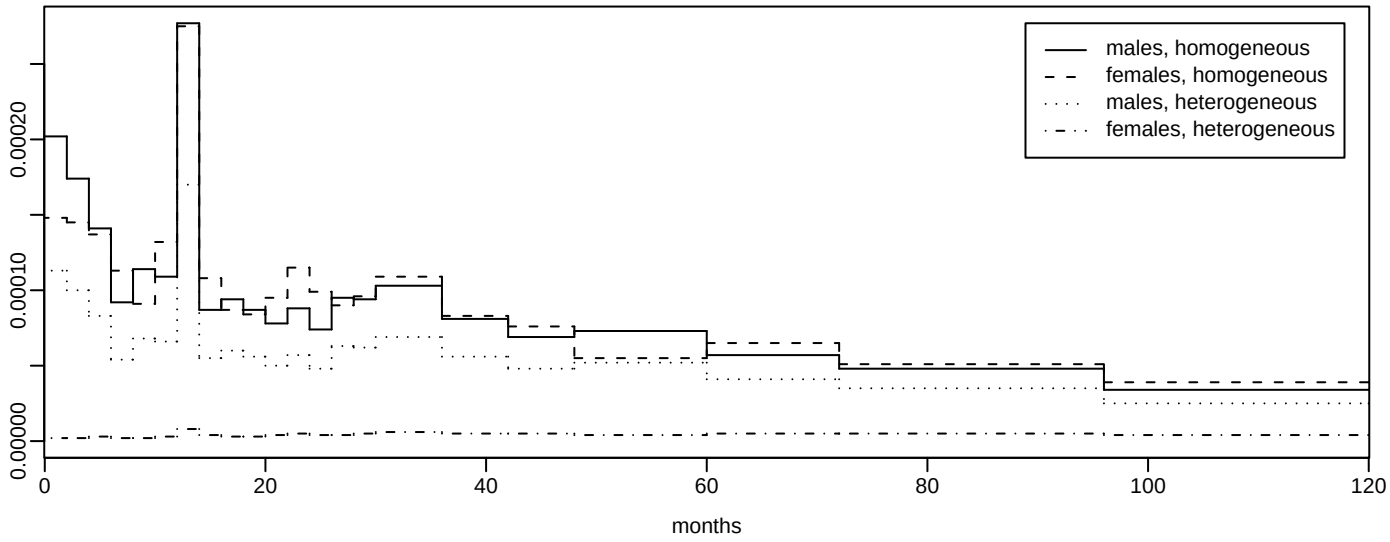
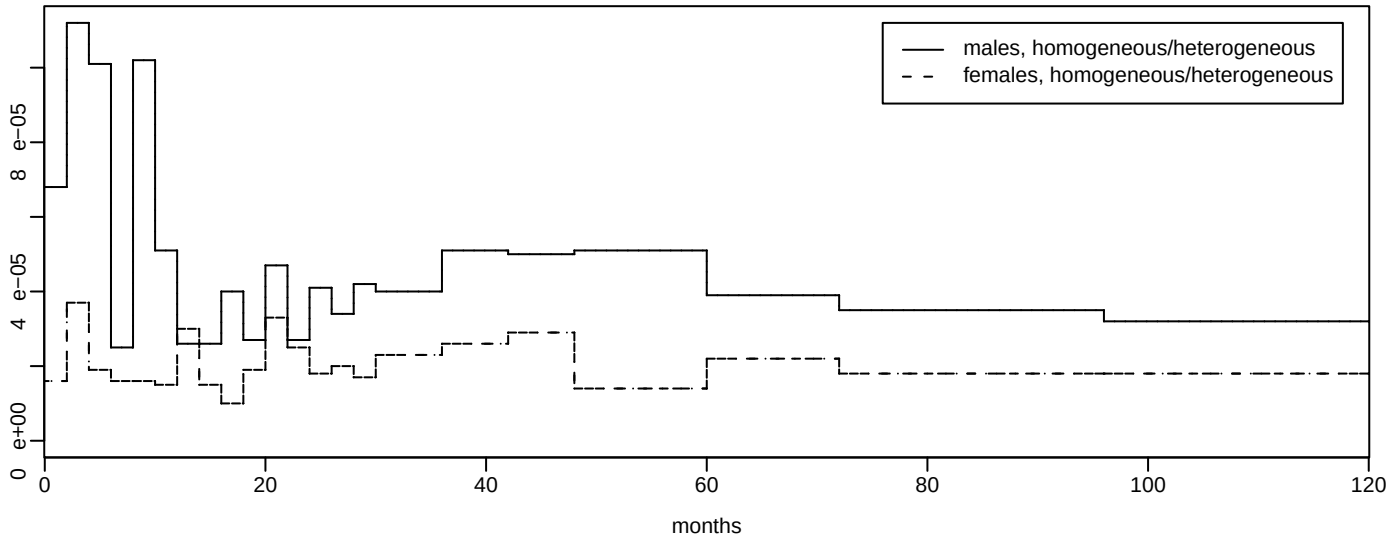


Fig. 2: Baseline hazards for quits

(a) Permanent and temporary contracts combined



(b) Permanent contracts



(c) Temporary contracts

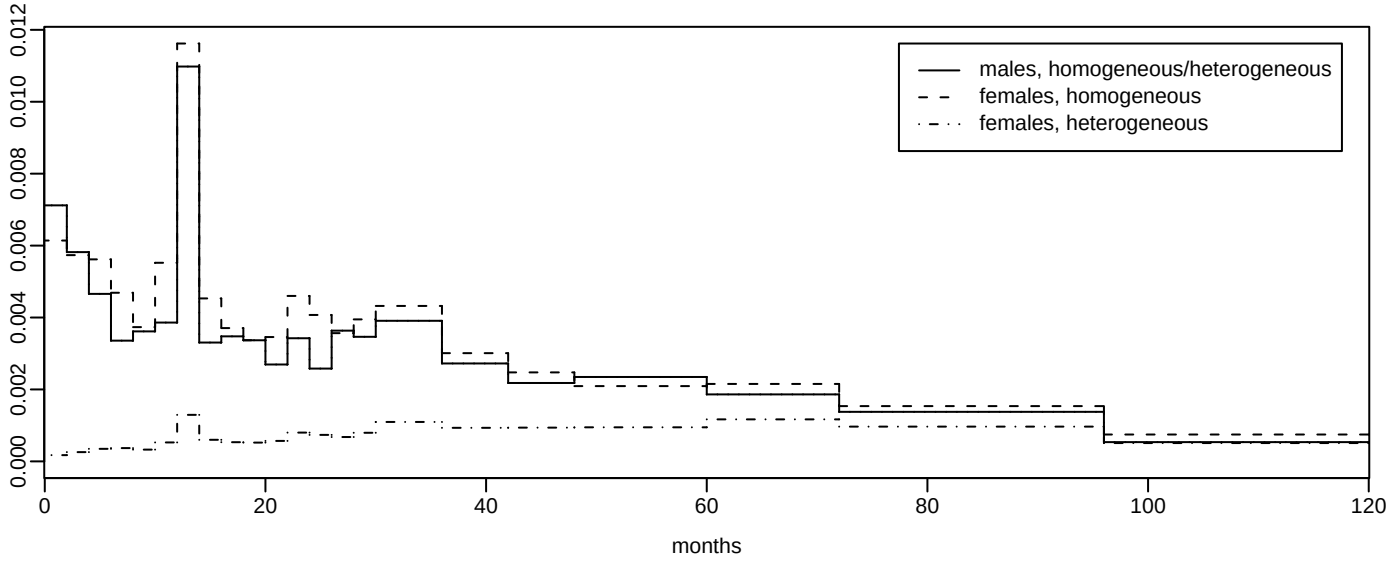
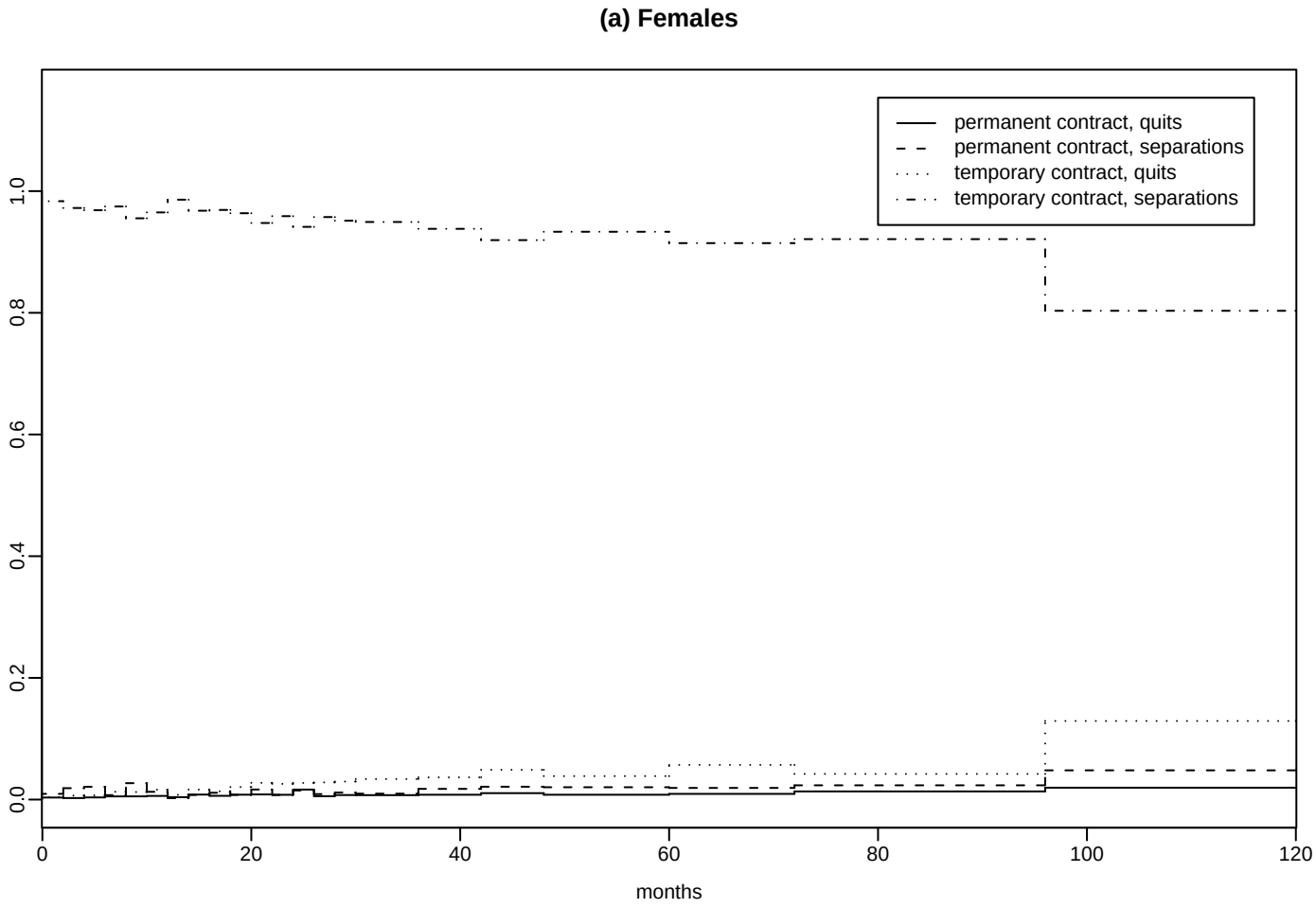


Fig. 3: Baseline hazards for separations



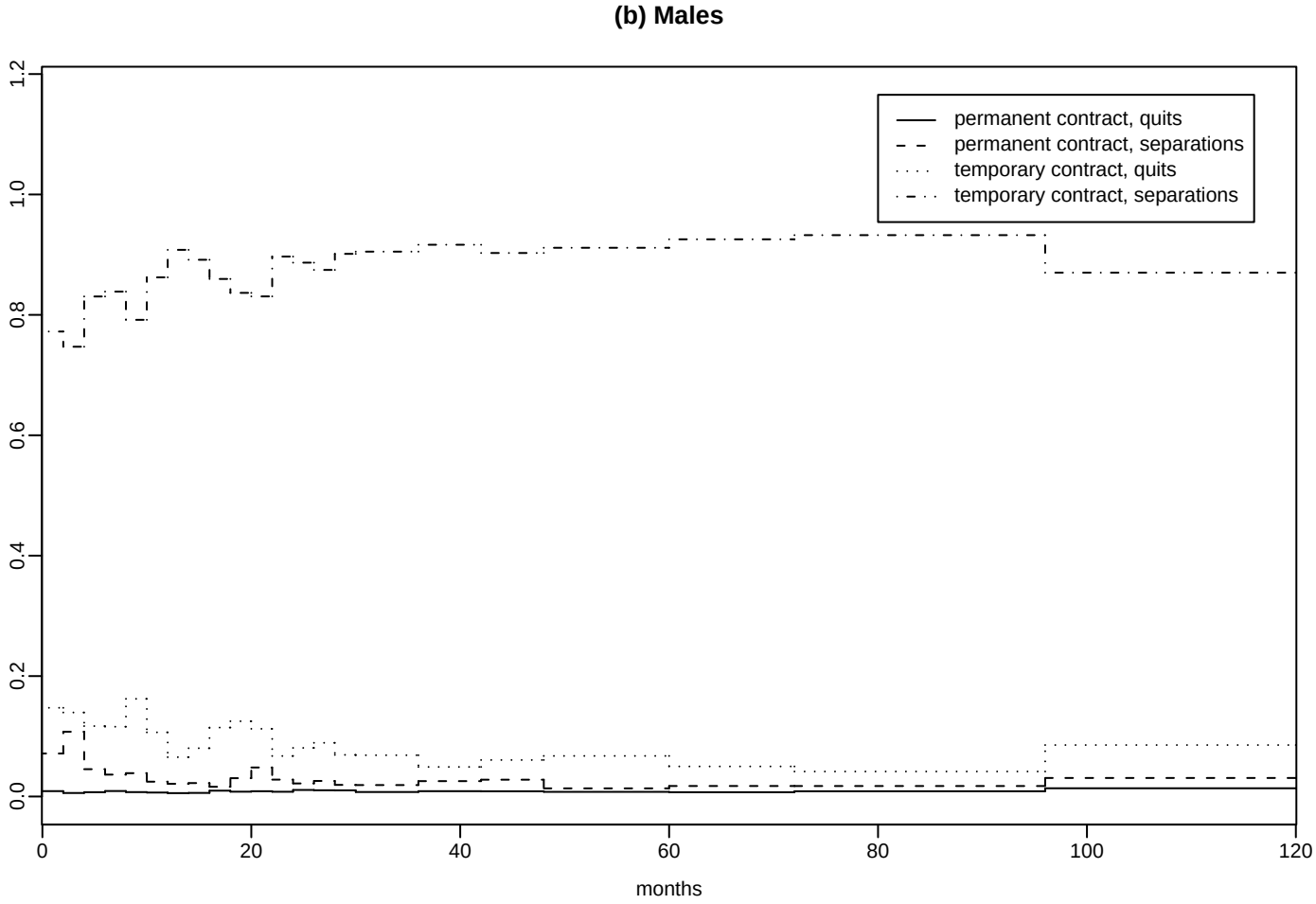
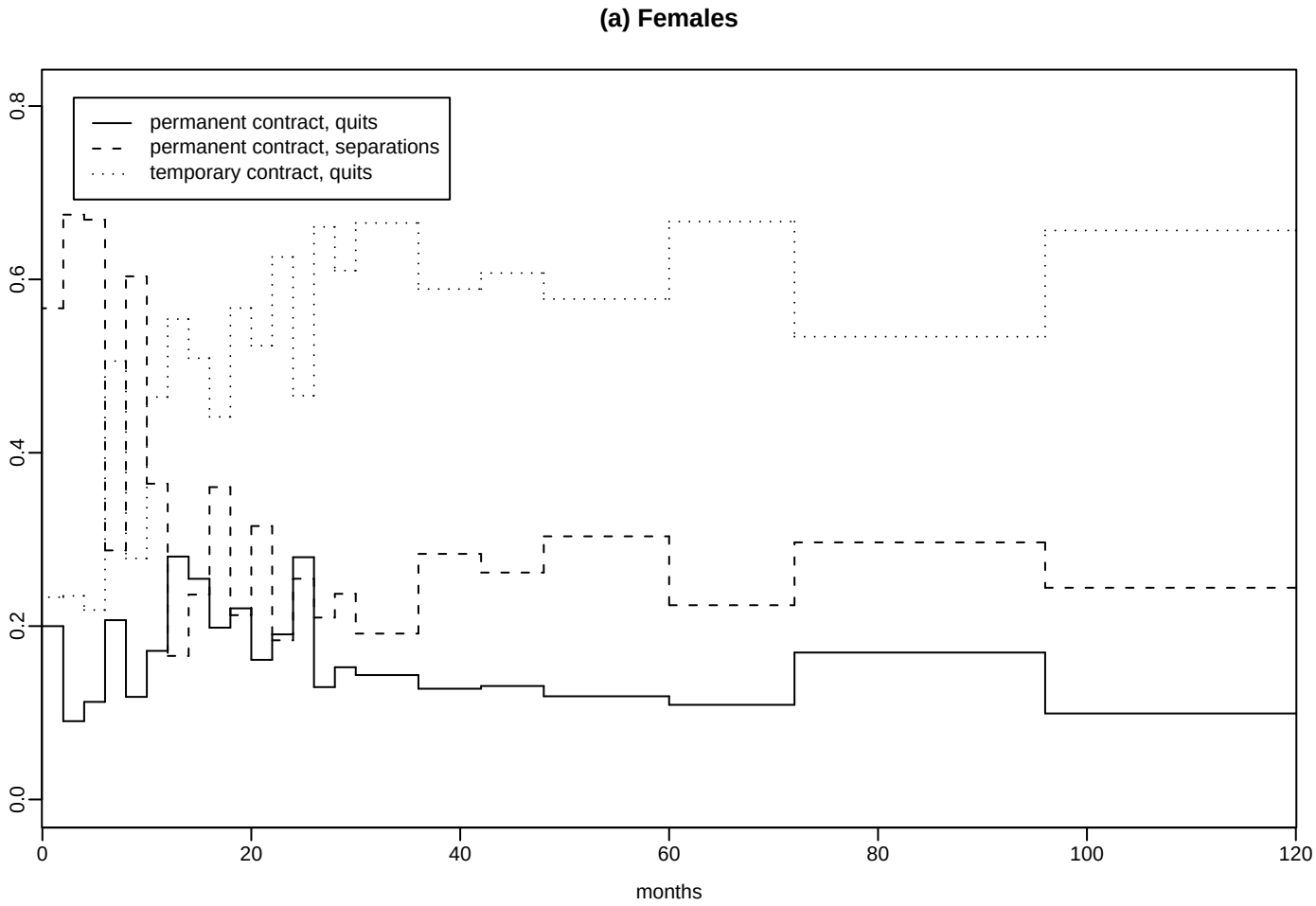


Fig. 4: Transition intensities by contract type and type of turnover



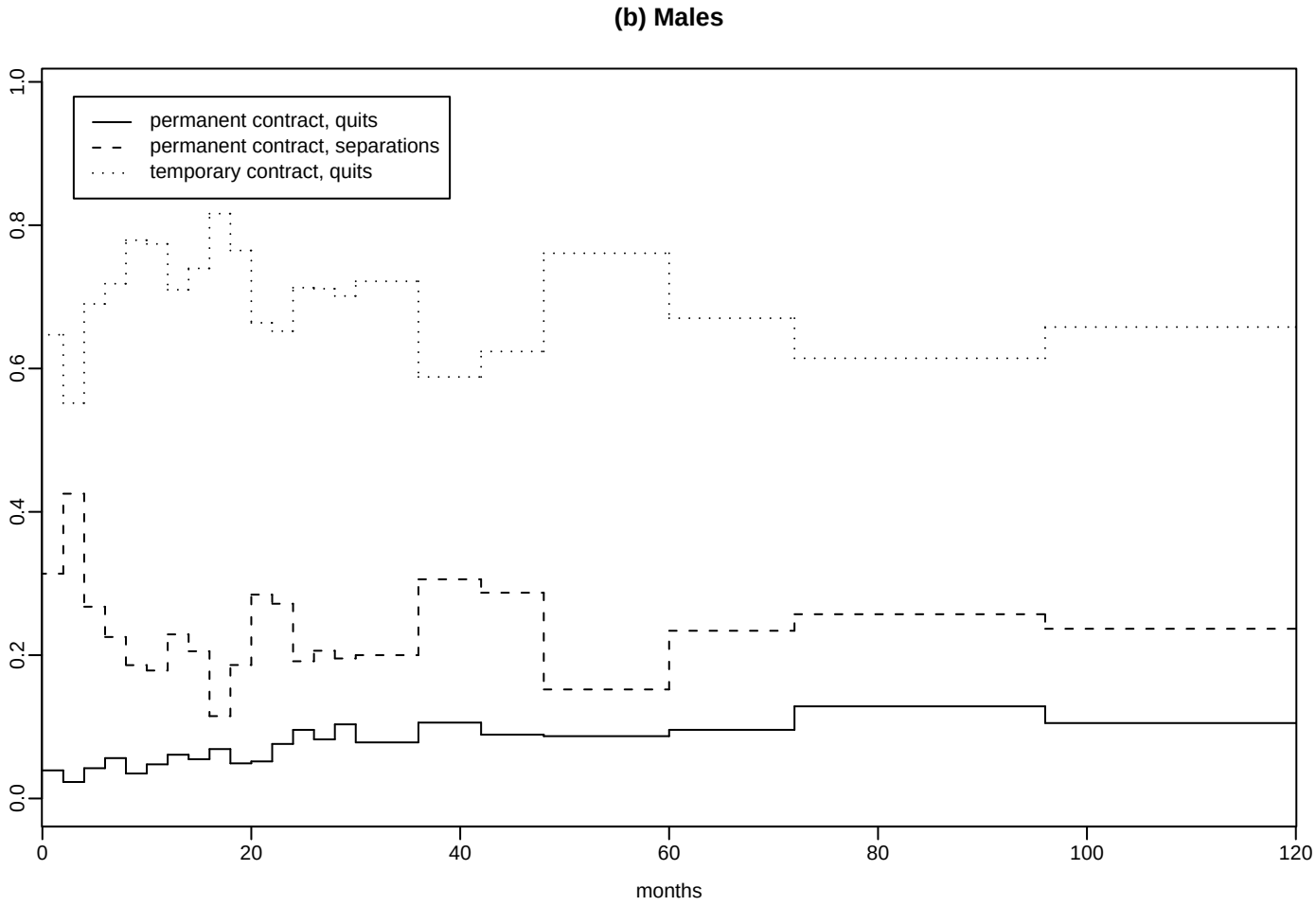


Fig. 4a: Transition intensities by contract type and type of turnover