

Wages and jobs in the Portuguese air transport industry

[Salários e empregos na indústria do transporte aéreo portuguesa]

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Abstract

Using a large matched employer-employee data set with information at both the worker and the company level we characterise the Portuguese airlines' employment structure and, by comparing it with the general structure of the Portuguese labour force, we stress the particularities of the sector. Based on the Heckman selection model, we develop an analysis of the variables that influence wages in this sector and which contribute to its differentiation from the general labour market. Particular attention is paid to the disparity among different types of jobs in the air transportation sector, namely amongst flight crews and land personnel. We also analyse the differences between regular and non-regular sub-sectors. Our main findings indicate that the aviation sector labour force is clearly specific regarding gender distribution and human capital accumulated by its workers. Moreover, some professions, pilots in particular, have important specificities compared to other jobs even within the sector. We also find that wages are strongly influenced by levels of education, tenure and experience as well as professional categories, which appears as an important specificity of this sector.

Key words: labour, airlines, wages, human capital.

Resumo

Usando uma grande base de dados com correspondência empregador-empregado com informações tanto ao nível do trabalhador quanto da empresa, caracterizamos a estrutura de emprego das companhias aéreas portuguesas e, por meio de comparação com a estrutura geral da força de trabalho portuguesa, destacamos as particularidades do setor. Com base no modelo de seleção de Heckman, desenvolvemos uma análise das variáveis que influenciam os salários neste setor e que contribuem para a sua diferenciação do mercado de trabalho em geral. É dada atenção especial para a disparidade entre os diferentes tipos de empregos no setor de transporte aéreo, ou seja, entre os tripulantes e o pessoal de terra. Analisamos também as diferenças entre os subsetores de aviação regular e não-regular. Nossos principais resultados indicam que a força de trabalho no setor de aviação é claramente específica quanto à distribuição de gênero e de capital humano acumulado por seus trabalhadores. Além disso, algumas profissões, pilotos em particular, têm especificidades importantes em comparação com outros tipos de trabalhos, mesmo dentro do setor. Também apontamos para evidências de que os salários são fortemente influenciados pelos níveis de escolaridade, senioridade e experiência bem como pelas categorias profissionais, que aparecem como uma especificidade importante deste setor.

Palavras-Chave: trabalho, companhias aéreas, salários, capital humano.

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Introduction

Although research on the Air Transportation industry is developed up to the point that it has become an autonomous research field, studies on its labour force are relatively scarce. The recent process of de-regulation of this industry and its higher or lower capacity to adjust to changes, namely the recent crisis that affected the sector following the demand contraction after 11.09 and SARS¹, have prompted a few studies on airlines' labour costs and conditions. The effects of those exogenous shocks appear to have been overcome since demand started growing again after 2002 and it continues growing at high rates. ICAO (2007) reports an average annual growth rate of 5.1 per cent between 1985 and 2005 and an expected growth rate of 4.6 per cent for the period 2005 - 2025 (expressed in RPKs: revenue passenger kilometres).

Nonetheless, exogenous shocks were not the main factor leading to labour force adjustments within this industry. Important economic and organisational changes have taken place in the last two decades, resulting in fundamental rearrangements in the structure of the industry. In Europe as elsewhere, airlines recently faced the effects of a de-regulation process. Consequently, the entry of new companies in air travel markets has increased competition within the industry, forcing a decrease in fares and an urgent need for reducing costs. This process was enhanced by the entry of low cost carriers, reinforcing the need for full service airlines to adapt in order to meet decreasing fares and, consequently, to decrease costs.

The purpose of this paper is twofold: (i) to understand the characteristics which distinguish workers in the air transport industry from other labour market workers, both in regular and non-regular air transport; and (ii) to find the main variables influencing wages in the Portuguese airline sector which contribute to its differentiation from the general labour market. Regarding our first aim, we start with a statistical analysis of the main features of Portuguese aviation labour force compared to workers of all other sectors. To handle the

¹ Ito and Lee (2005) provide an assessment of the impact of 11th September on US airline demand. Impacts of the same events in Europe were investigated, among others, by Hättý and Hollmeier (2003) and Inglada and Rey (2004).

second aim we used Mincerian wage equations to perform a regression analysis, both for the whole sector and for its regular and non-regular segments. Our main findings indicate that the aviation sector labour force is clearly specific regarding male share and human capital accumulated by its workers. Moreover, some professions, particularly pilots, have important specificities compared to other jobs, even within the sector. We also find that wages are strongly influenced by levels of education, tenure and experience. Also, professional categories are an important determinant of wages, which is an interesting specificity of this sector.

This paper is innovative in that, as far as we know, no other studies have been done on this theme in Portugal and even on a worldwide basis they are sparse. Its main importance for knowledge on the industry lies in the fact that airlines' efforts to improve efficiency are highly dependent on labour efficiency improvements. A better understanding of the variables that influence wages may inform management choices on labour organization. Although confined to the Portuguese case, the paper has the advantage of relying on a data set that covers all the employees of the airline sector in the country, allowing the comparison of their profile with the average profile of Portuguese labour market workers for a relevant number of variables.

The paper is organised as follows: in Section 1 we make a brief literature survey on the topic; in Section 2 we analyse the general characteristics of employment and wages in the air transportation industry as compared to the other sectors of Portuguese labour market; in Section 3, the Heckman selection model is used to estimate wage equations on this sector. Final conclusions will be presented at the end of the paper.

1. Brief literature survey

The contribution of previous papers dealing with this topic is an important departure point for the present analysis. We will synthetically present some conclusions that have been shown to be particularly appropriate for our purposes.

Turnbull *et al* (2004) identified the main characteristics of employment in civil aviation as follows: (i) high regulation of the supply of skilled work, (ii) high union membership levels indicating a strong bargaining position for employees and (iii) high sensibility to economic or other fluctuations (for instance, 11.09, SARS), leading to capacity cuts and job losses in situations of demand contraction.

Neven and Roller's (1996) results suggest that European airline workers acceded to monopoly rents, trade unions having played an important role in the process of rent appropriation. However, this conclusion was drawn in a time of monopolies and protectionism and must be re-considered after all the changes the civil aviation industry has undergone in recent times, mainly concerning its vulnerability to crisis and the ongoing changes in competition policies. In fact, as labour costs are one of the largest parts of firms' operating costs², adjustments, either to demand fluctuations or to changes in structural conditions of the industry, rely much on firms' capacity to adjust labour costs (Turnbull *et al*, 2004).

A few studies have focused on labour adjustments implemented to answer the challenges of new competitive conditions. Turnbull *et al* (2004) analysed partnerships between employers and employees in order to establish agreements towards adjustments in the labour force as a means of reacting to the 11.09 crisis in three European airlines. Lucio *et al* (2001) developed a comparative study of the national flag-carriers British Airways and Iberia Airlines regarding labour adjustments following de-regulation processes. In particular, they analysed the relations between the state, firm managers and unions. They found that in Iberia Airlines the involvement of trade unions in the process was much more intense than in British Airways, who delayed or postponed wage reductions. In British Airways the cost-cutting process

² According to Turnbull *et al*. (2004: 291), the share of labour cost in total operating costs reaches around 33 per cent in Europe and 20 per cent in Asia (where labour is much cheaper).

focused on quality and productivity targets and was developed with less involvement of unions. According to Blyton *et al* (2001) trade unions have shown to be able to delay European airlines' efforts to cut costs, and so wage differentials relative to other sectors persist even after the implementation of the de-regulation process and in a context of a more competitive environment.

As for the Portuguese airlines, TAP, the biggest Portuguese company, also faced a restructuring process aiming at adjusting employment to changes in the air travel markets. Major changes in the company's operating network (Button *et al*, 2005) with an increased focus on long haul flights imposed labour adjustments, mainly in the pilot and cabin crew groups. By 2001 the company managers proposed a cost reduction based on a gradual decrease of total employees that led to a 6.7 per cent fall in employment from 2001 to 2002 (with an initial reduction of 11.8 per cent in 2001, and smoother decreases from 1.8 per cent to 2.6 per cent in the following years). This restructuring programme had, in general terms, the agreement of the unions and of the employees they represent (Pinto, 2002).

In general, the literature on the adjustment of labour costs to new competitive conditions in the airline industry suggests that the process of cost reduction is not yet complete, and that unions have often played an important role in sustaining a high level of wages. It is then to be expected that wage premiums over other industries will persist.

Other papers add more elements to explaining the persistent high wages that characterise the air transportation industry, namely by studying in more detail some of the most influential professions of the airline industry. As passenger demand grew and new airlines entered the market³, demand for workers with the skills required by this industry also increased. In particular, some specific categories of workers experienced a high demand that went together with a rather inelastic supply, leading to pressures towards a rise in wages. Such was the case of pilots, a profession that requires a long period of education and training.

Some studies have explicitly focused on the effects of deregulation in wages in the airline industry. Card (1986) stresses the importance of analysing such effects on different categories

³ To give an example, in 1986 Ryanair started operating as the first European scheduled low cost air line and by 2005 there were around 60 LCCs in Europe (AEA, 2006).

of skilled workers. Three categories are considered as central to the understanding of the effects of de-regulation on employment and pay: pilots, flight attendants and mechanics. The author argues that within the airline industry, mechanics have a particular situation since “of the three categories of skilled employees, airline mechanics are the most similar to unionised workers elsewhere in the economy” (Card 1986: 528). The author concludes that the effect of the de-regulation process⁴ is stronger on the earnings of pilots than on those of mechanics, precisely because of the higher importance of general training capabilities that this last group has: redundant mechanics can find a new job in other economic sectors more easily after being dismissed from the air transportation industry than pilots can, given the highly specific capabilities of their job.

Crémieux (1996) highlights the ambiguity of the results of prior studies made to evaluate the effects of deregulation in airlines in the US, pointing out that while some studies found relevant negative effects on wages, others conclude that no visible long-run effects have been proven to exist. He stresses that the scarcity of reliable data is one of the problems that research on this issue has to deal with and, using a more extended data set than previous studies did, he analyses the evolution of wages in the three categories of workers previously considered by Card (1986), pilots, mechanics and flight attendants over a period of 34 years (from 1959 to 1992). The author concludes that deregulation had no effect on the wages of mechanics but had clear negative effects on pilots, and especially on flight attendants’ wages.

Following a similar research line, Hirsch and McPherson (2000) conclude that different professional groups within the airline sector did show a diverse capability of achieving and keeping their wage advantage after the de-regulation process: i) pilots, when compared to similar workers, had high wage premiums and kept them throughout the de-regulation process, ii) flight attendants and ticket and reservation workers had high premiums that declined sharply from 1993 to 1997, while iii) aircraft mechanics’ wages were only slightly above other mechanics before and after the de-regulation process. They show that wage differentials, even if controlled by worker and job characteristics, depend on the particular professional group to which the workers belong within the airline sector. Moreover, Hirsch and McPherson (2000) show that unions had a decisive role in keeping wages high in the air

⁴ Card (1986) analyses the US economy in the period 1978-1984.

travel industry. Conditions like the low elasticity of supply due to long education and training, high unionisation of workers and pressures on the demand side seem to account for the high wage premiums of civil aviation workers over similar professionals in other industries.

Another important specificity of airline employment quoted in the literature is the high gender segregation of jobs. In some professional groups women are dominant, while other jobs are mainly performed by men. Referring to the United States in 2000, Turnbull and Harvey (2001) showed that only 3.7 percent of pilots and 6 percent of mechanics were women, yet women represented 80 per cent of cabin crews. The same authors state that there is no data on gender related job segmentation for European airlines, but that the impact of employment reduction that followed 11.09 was more strongly felt by female than by male workers in this industry, namely in France. Turney *et al* (2002) performed a survey covering 390 students in air pilot schools and found that in 1997 women accounted for less than 6 per cent of students on the grade of qualified pilots, and less than 5 per cent of students in the course of maintenance technicians in air transportation.

2. Main characteristics of employment in the Air Transportation sector in Portugal

In this work we use matched employer-employee data from the Personnel Records database (*Quadros de Pessoal*), an administrative dataset collected annually by the Portuguese Ministry of Employment. This dataset provides information on workers' attributes (such as gender, age, education, occupation, qualification level, years with the firm, hours worked and earnings) and job related attributes (such as type of industry, geographic location and plant size). Response to the questionnaire is mandatory for all private-sector firms with at least one employee. Information about employees in the public administration, self-employed and military personnel is not included in the data set, but those categories are not important to the air transportation sector. Therefore, the data set we use reports data on all the employees and companies working in civil airlines in the country.

We used the 2006 spell, which is the most recent available. Observations with incomplete or inconsistent data were excluded, as well as individuals in very specific situations such as owner-managers, farmers and unpaid family workers.

The analysis of these data allows us to integrate the air transportation sector within the overall situation of the Portuguese labour market. It is worth noting that the air transport sector is clearly dominated by the national flag company, TAP, which employed about 65 per cent of the whole labour force of the sector in 2006.

2.1 General characteristics of employment in the Air Transportation sector

Table 1 presents some general labour market indicators for the air transportation sector and the other sectors of the Portuguese labour market covered by the dataset used.

Employment in the air transportation sector represents only 0.3 per cent of total employment in the Portuguese private sector. Still, the airline industry is quite relevant in economic terms, showing important specificities compared to the average situation in other sectors of the Portuguese labour market. Those specificities refer both to the characteristics of the workers (namely regarding the education level, the age and the concentration of male and female workers) and to the characteristics of jobs (namely those related to working hours and to the prevailing types of contract), as well as to wages.

As to the characteristics of workers, the data clearly show that employees in the air transportation sector have a much higher education level than do the workers of the other sectors (the employees of the air transportation sector have 12.1 years of education on average, quite above the 8.5 years of average education of workers in other sectors). In particular, 67.6 per cent of Portuguese workers in all sectors other than air transportation have 9 years of schooling or less, while the corresponding percentage for air transportation workers is only 17.7 per cent.

In average terms, air transportation workers also have a longer tenure than workers in other sectors have (workers in the air transportation industry had been working in the company for 12 years, which is 72 per cent higher than the average tenure observed in other sectors). In contrast, experience is much lower than it is in the other sectors. Also, air transportation has a higher incidence of male workers compared to other sectors of the economy.

Jobs in airline companies also show relevant particular characteristics compared with other sectors, namely i) the incidence of permanent contracts is higher in this sector but ii) workers

in the air transportation industry work more hours in average terms than workers in other sectors.

Table 1 - Labour market indicators

2006	Air transportation	Other sectors
number of employees	8,075	2,579,592
average monthly earnings, in Euros	2,361.4	949.3
average monthly working hours	168.4	159.7
average hourly earnings, in Euros	14.0	6.1
male (%)	60.8%	55.5%
age, in years	39.1	37.7
tenure, in years	11.9	6.9
experience in other sectors, in years	9.0	16.3
school, in years	12.1	8.5
<= 9 years	17.7%	67.6%
>9 and <= 12 years	58.0%	19.9%
> 12 years	24.3%	12.5%
permanent contracts (%)	85.8%	71.8%

Earnings are much higher in air transportation than they are in the other sectors of the economy, both on a monthly and an hourly basis. On average, the monthly wage of a worker in the air transportation sector is about 2.5 times the monthly wage of a worker in other sectors.

Thus, in average terms airline workers have better wages, more stable types of contracts and stronger links with the firms than the average worker has in other industries of the Portuguese labour market.

Conditions of admission in the sector are also more stringent than the average in other sectors, namely in educational terms: access to a job in this sector implies the availability of a high education level and turnover in this sector is less than in others. In fact, considering the higher average age of workers and their longer tenure, the entry of younger workers in the sector is probably more difficult. This idea is reinforced by the comparatively high number of hours worked in the sector, indicating that specific arrangements in the working schedules (continuous provision of service without daily, weekly or yearly interruptions but with important seasonal diversity) are mainly accomplished by arrangements in the work

schedules. Compared with other sectors of the Portuguese labour market, airlines seem to manage their human resources much more in accordance to internal labour market strategies than other sectors do. Due to the quite stringent conditions and given the particularity of jobs within the airline industry, once a worker is hired the firms have to finance a lot of additional specific training which is largely developed through on-the-job-training and experience acquired in that specific job. As a result, firms have high costs with the recruiting processes and developing the skills of their workers. Accordingly, they have a greater interest in keeping their workers even if they have to pay higher wages and provide expectations of a career as an incentive for them to stay in the firm, thereby avoiding the high turnover costs associated with frequent employee changes⁵. Workers in this situation normally have strong bargaining power and are usually represented by powerful unions.

Industrial relations in the airline sector in Portugal are indicative of the relevance of the largest firm in the sector, TAP, which periodically negotiates a firm agreement with its employees. Pilots have their own union (with a high density rate) and celebrate a pilot-specific agreement with the company. Other workers are spread among different unions. The cabin crew union has its own agreement. Three additional agreements are signed with different unions representing land-based personnel.

2.2 Is there relevant job disparity within the Portuguese airline sector?

It is also important, as the literature survey indicates, to analyse the disparity among different types of jobs, and namely amongst flight crews and land personnel. General data on the main professional groups is reported in table 2.

Wages, both on a monthly and hourly basis, differ widely among the diverse professional groups. The hierarchy of wages defines a clear diversity within the industry and can be ranked

⁵ There is an important field of research on the topic of “internal labour markets” as a model of managing human resources. For further developments of the concept see, among others, the seminal work of Doeringer and Piore (1971).

according to the hourly average earnings as follows: pilots, directors, technicians, cabin crews, administrative staff⁶.

Table 2 - Characteristics of employees and jobs in the Portuguese airline industry

Air transport	Pilots	Cabin crews	Directors	Technicians	Administr.	Others	Total
Number of employees	1030	2156	101	3228	1077	483	8075
Average monthly earnings, in Euros	5186.9	1786.1	4558.8	2179.8	1520.6	1533.7	2361.4
Average monthly working hours	173.9	171.0	167.7	167.0	164.9	162.6	168.4
Average hourly earnings, in Euros	29.7	10.6	27.2	13.1	9.2	9.6	14.0
Male (%)	98.2%	36.2%	76.2%	67.2%	38.4%	93.8%	60.8%
Age, in years	39.7	37.7	46.3	40.5	36.0	39.9	39.1
Tenure, in years	7.8	12.4	9.8	13.9	9.3	11.6	11.9
Experience, in years	13.0	6.8	16.2	8.3	8.6	14.4	9.0
Schooling, in years	12.9	12.5	14.3	12.2	12.1	7.9	12.1
<= 9 years	2.1%	9.8%	4.0%	21.1%	15.7%	69.6%	17.6%
>9 and <= 12 years	72.8%	65.6%	32.7%	51.1%	64.3%	30.4%	58.0%
> 12 years	25.0%	24.6%	63.4%	27.7%	20.1%	0.0%	24.3%
Permanent contract (%)	87.4%	79.5%	97.0%	91.5%	78.4%	85.9%	85.8%

Pilots and directors are at the top of the earnings ranking but it is worth stressing that the average wage of pilots is higher than that of directors (on an hourly basis the wage of pilots is 9 per cent higher than the average wage of directors). This is particularly striking if we consider that directors are more educated than pilots, and that pilots have the lowest average tenure of the considered groups.

In the middle of the earnings ladder are the technicians (on an hourly basis the wage of pilots is 127 per cent higher than the average wage of technicians). Cabin crews come next in the earnings ranking (on an hourly basis the wage of pilots is 180 per cent higher than the average wage of cabin crews). It is worth noting that cabin crews are, in average terms, one of the youngest groups and that this goes together with one of the highest observed average tenures.

In the bottom of the ranking are the administrators: on an hourly basis the wage of pilots is 223 per cent higher than the average wage of administrative staff and the wage of cabin crews is 16 per cent higher.

By the simple exercise of ranking the professional groups (from the highest to the lowest values) according to the average level of hourly wages and the main human capital variables

⁶ For the purposes of the ranking we ignored the residual group “Others”.

(schooling, experience outside the firm and tenure) we have an interesting picture of the airline sector (Table 3).

Table 3 - Ranking of the professional groups in airline

Hourly earnings	Schooling	Experience	Tenure
Pilots	Directors	Directors	Technicians
Directors	Pilots	Pilots	Cabin Crews
Technicians	Cabin Crews	Administrative staff	Directors
Cabin Crews	Technicians	Technicians	Administrative staff
Administrative staff	Administrative staff	Cabin Crews	Pilots

In the context of a sector having high standards of schooling and tenure in national terms, in each of the five considered professional groups⁷ relevant differences appear. Pilots and directors bring to the company high levels of human capital, a relevant part of which has been acquired outside the airline company (both in the school system and in previous jobs they had)⁸. Technicians and cabin crews have a professional profile where human capital acquired within the firm (and so specific to the airline) has the highest importance.

Besides earnings and human capital characteristics, huge differences also exist regarding gender segregation. Pilots are almost exclusively male and the large majority of directors and technicians are also male. In contrast, cabin crews and administrative positions are predominantly filled by female staff.

Monthly working hours also differ among professional groups and a division is clear amongst flight and land occupations: Pilots and cabin crews have higher working hours than the other professions.

⁷ Average schooling and tenure is higher in each one of these groups as compared to other sectors of the Portuguese labour market.

⁸ Recently this topic has been discussed in the press when, after a meeting of the President of Portugal and the Chief of Portuguese Military Air Force, they officially declared that “regarding the hiring of pilots, TAP and SATA are, in fact, the second and third branch of the Military Air Force”. They expressed concern over the fact that pilots are trained by the Military Air Force but often leave it as soon as they have a job opportunity in the airline industry. (LUSA – Agência de Notícias de Portugal, S.A., 2009, 19th May).

Permanent contracts are the norm in the air transportation industry. Some diversity remains amongst the professional groups, cabin crews and administrative staff being relatively more exposed to fixed-term contracts than the other groups.

2.3 Regular versus non-regular Air Transportation

It is also important to analyse whether homogeneity within the airline industry is the rule or if diversity is visible, namely amongst the sub-sectors of regular (hereafter REG) and non-regular transportation⁹ (hereafter NREG).

As Tables 4 and 5 clearly show, REG airlines are the dominant employer of the sector (89 per cent of the employees), with NREG transportation having a rather marginal importance. Also, the two sub-sectors differ in some characteristics of workers and jobs that should be mentioned.

NREG transportation workers are younger and have a much lower tenure than REG transportation workers do, which is not surprising since firms operating in NREG airlines are, in general, more recently begun than those operating in REG airlines.

NREG transportation workers have a higher average level of education (each NREG worker has, on average, one more year of education than REG workers do). But, despite this, wages (both monthly and hourly) are higher in REG air transportation jobs (in particular, wages are 75 per cent higher for pilots and 37 per cent higher for cabin crews). Therefore, important diversities exist in the two sub-sectors, especially in remuneration levels. Whether this is determined (or not) by different economic contexts prevailing in the period of creation of the new firms, implying that workers recruited by the new companies operating in a more competitive environment have a weaker link to the company, remains an open question.

⁹ NREG air transportation refers to activities of transportation of passengers and goods that are not regularly, continuously and frequently organized.

Table 4 - Total employment and main average characteristics of employees and earnings in the regular air transportation sector in Portugal

Regular air transport - 2006	Pilots	Cabin crews	Directors	Technicians	Administr.	Others	Total
Number of employees	847	2057	52	2840	908	470	7174
average monthly earnings, in Euros	5644.1	1813.4	4986.4	2168.6	1515.3	1546.7	2374.1
average monthly working hours	175.0	171.6	164.5	166.3	164.4	162.8	168.4
average hourly earnings, in Euros	32.2	10.7	30.3	13.1	9.2	9.7	14.1
male (%)	98.0%	36.1%	69.2%	67.0%	37.3%	95.1%	59.9%
age, in years	39.1	38.0	48.7	41.2	36.3	39.7	39.4
tenure, in years	9.0	12.9	15.0	15.5	10.4	11.7	13.1
exp, in years	11.2	6.6	13.1	7.7	7.9	14.1	8.3
school, in years	12.9	12.5	14.6	12.1	12.0	7.9	12.0
<= 9 years	2.4%	10.2%	3.8%	22.6%	15.1%	69.1%	18.6%
>9 and <= 12 years	72.7%	64.9%	25.0%	52.3%	67.6%	30.9%	58.7%
> 12 years	24.9%	24.9%	71.2%	25.0%	17.3%	0.0%	22.7%
permanent contract (%)	96.5%	81.3%	100.0%	93.8%	82.5%	86.6%	88.7%

Table 5 - Total employment and main average characteristics of employees and earnings in the non-regular air transportation sector in Portugal

Non Regular air transport - 2006	Pilots	Cabin crews	Directors	Technicians	Administr.	Others	Total
Number of employees	183	99	49	388	169	13	901
average monthly earnings, in Euros	3070.5	1219.8	4105.1	2261.6	1548.7	1062.5	2260.7
average monthly working hours	168.9	158.6	171.2	172.6	167.8	154.3	169.1
average hourly earnings, in Euros	18.4	7.8	24.0	13.0	9.2	6.9	13.3
male (%)	98.9%	38.4%	83.7%	68.8%	44.4%	46.2%	67.5%
age, in years	42.3	30.1	43.8	34.8	34.3	45.7	36.3
tenure, in years	2.3	2.2	4.4	2.6	3.6	6.5	2.8
exp, in years	21.1	9.3	19.5	12.8	12.1	25.9	14.5
school, in years	12.9	12.6	14.0	13.4	12.6	7.3	13.0
<= 9 years	1.1%	1.0%	4.1%	10.1%	18.9%	84.6%	9.7%
>9 and <= 12 years	73.2%	79.8%	40.8%	42.5%	46.2%	15.4%	53.1%
> 12 years	25.7%	19.2%	55.1%	47.4%	34.9%	0.0%	37.3%
permanent contract (%)	45.4%	41.4%	93.9%	75.3%	56.2%	61.5%	62.7%

It is also very clear that the incidence of permanent contracts is much lower in NREG than it is in REG transportation jobs. In REG, 88.7 per cent of the employees have a permanent contract (these percentages ranking from 96.5 for pilots to 81.3 for cabin crews) while that percentage stands at 62.7 for NREG (45.4 for pilots, and 41.4 for cabin crews). This is an important element to support the hypothesis that different models of managing human resources exist in the two sub-sectors. NREG activities imply a higher flexibility in firms. Thus the establishment of strong links between the employees and the companies is not as important as the need for flexibility in order to adapt to changes in the demand. Lower wages remunerate less stable jobs and shorter contract periods with the firm.

The hierarchy of wages reveals a wage structure with huge diversities amongst professional groups in the two sub-sectors. Yet, besides the already mentioned differences in wage levels, important differences exist in the ranking of professions amongst them (Table 6).

Diversity is visible both at the top and bottom of the wage ladder: in average terms, the highest wages are paid to pilots in REG and to directors in NREG; administrative staff have the lowest wages in REG while in NREG the lowest wages are paid to cabin crews.

Table 6 - Ranking of the professional groups in REG and NREG airlines

REG			
Hourly earnings	Schooling	Experience	Tenure
Pilots	Directors	Directors	Technicians
Directors	Pilots	Pilots	Directors
Technicians	Cabin Crews	Administrative staff	Cabin Crews
Cabin Crews	Technicians	Technicians	Administrative staff
Administrative staff	Administrative staff	Cabin Crews	Pilots
NREG			
Hourly earnings	Schooling	Experience	Tenure
Directors	Directors	Pilots	Directors
Pilots	Technicians	Directors	Administrative staff
Technicians	Pilots	Technicians	Technicians
Administrative staff	Cabin Crews	Administrative staff	Pilots
Cabin Crews	Administrative staff	Cabin Crews	Cabin Crews

General training (education and experience outside the firm) is a main requirement to enter an NREG job. The schooling level is higher on average in NREG, but this is mainly the outcome of higher schooling of technicians and is not generalised to all professional groups. The main difference in regard to general training lies in the average experience of the workers in the two sub-sectors, which is much higher in NREG in all professional groups and particularly in the pilot group (Tables 4 and 5).

Specific training (here measured through variable tenure) is very important in REG and is low in NREG. Specific training provided in the firm and associated with workers' seniority is a major mark of REG in the air transportation industry. This suggests that work mobility is probably much higher in NREG.

The previous statements indicate that “internal labour markets” as a model of managing the human resources of the airline industry is a characteristic of its REG sub-sector and differs from the much more flexible management model that applies to NREG.

Gender segregation (male biased) characterises both sub-sectors, being stronger in NREG: male dominated professions are identical in the two sub-sectors but the overall percentage of males is higher in the NREG. Also the professional groups mainly occupied by women (cabin crews and administrative) are identical in both sub-sectors, but have a higher percentage of males in NREG.

Average working hours show an interesting diversity: flight personnel have the highest working schedules of the occupations considered in REG but have the lowest in NREG. This may be due to irregular working schedules for NREG following the nature of operations in this sector, which may have seasonal or occasional peak and off-peak periods.

3. Estimation of wage equations for air transportation industry

In the estimation of wage equations for the air transportation industry we have to deal with the so-called problem of self-selection bias as we are using observations referring to workers that have already chosen to work in that industry, meaning that we are using a non-randomly selected sample. The Heckman (1979) selection model allows a simple two-stage estimator to correct for that bias, by simultaneously estimating a wage equation and a probit equation modelling the probability of working in the selected industry.

We assume that in the air transportation industry labour is paid according to the wage equation

$$\ln W_i = X'_i \beta + u_i \quad u_i \sim N(0, \sigma^2)$$

where $\ln W_i$ is the hourly wage (in natural log form) received by worker i , X'_i is a vector of variables determining earnings, β a vector of unknown parameters and u_i a disturbance term.

We also consider the following selection equation, to deal with the referred sample selection:

$$y_i^* = Z'_i \alpha + v_i \quad v_i \sim N(0, 1)$$

where y^* is the (unobserved) variable responsible for the choice of individuals to work (or not to work) in the air transportation industry (for instance, differences between the expected wage in air transportation and the expected wage in any other sector), and y its observed counterpart defined as

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 & \text{(worker chooses to work in air transportation)} \\ 0 & \text{if } y_i^* \leq 0 & \text{(worker chooses to work in non - air transportation)} \end{cases}$$

Z_i is a vector of relevant variables to explain why an individual chooses to work in air transportation/non-air transportation, α is a vector of unknown parameters and v_i a disturbance term.

If $\text{Corr}[u_i, v_i] = \rho \neq 0$, OLS produces biased estimators. Alternatively, the Heckman (1979) selection model provides consistent, asymptotically efficient estimators for all parameters in the model.

The two equations have been simultaneously estimated by maximum likelihood for 2,587,667 observations, 8,075 of them corresponding to workers in the air transportation industry. The likelihood ratio test rejects the independence of the two equations (rejects $\rho = 0$ for a level of significance below 1 per cent) showing that, effectively, correction for selectivity was necessary.

In the probit equation, variables assumed to affect the individuals' decision of working in the air transportation sector are schooling (number of years of education of the worker), gender, experience (and its square) and the region where the plant is located.

Results of the probit model are shown in Table 7.

The coefficient associated with schooling is positive, indicating that more years of school increases the probability of working in the air transportation industry. Gender also has a significant impact on that probability, which is higher for male workers. Therefore, more educated male workers have a higher probability of choosing to work in these firms.

The coefficients of experience and of its square are negative, which is related to the fact that experience is, on average, much lower in the air transportation sector than in other sectors, as mentioned in Section 2.

Table 7 - Probit model for the probability of working in the air transportation industry

Variable	Coefficient
school	0.05283 (39.4)*
male	0.16102 (18.5)*
exp	-0.00378 (-2.3)**
exp^2	-0.00042 (-8.5)*
North	0.25131 (7.9)*
Lisbon	1.23838 (44.9)*
Algarve	0.21479 (3.8)*
Açores	1.58913 (51.0)*
constant	-4.14363 (-120.5)*

* Denotes significance at the 1% level.

** Denotes significance at the 5% level.

The last variable assumed to affect the probability of working in the air transportation industry is the region where the plant is located. We used four dummies corresponding to four major tourism regions in Portugal¹⁰ and, given the positive sign of all the coefficients, those regions have a positive impact on the decision of working in the air transportation industry.

As explanatory variables in the wage equations we used: (i) schooling (four dummies concerning the number of years of school enrolment - 12 years of schooling being the omitted category), (ii) tenure and its square, (iii) experience and its square, (iv) occupation (cabin crews, directors, technicians, and others – pilots is the omitted category) and (v) a dummy variable referring to fixed term contracts. Table 8 summarises the results obtained.

All the coefficients of this equation are statistically significant at the 1% level and have the expected signs. Schooling appears clearly as one of the main determinants of wages. Our results show relevant differences between the reference group (workers having less than 12 years of schooling) and the other groups. As expected, workers with less schooling earn lower wages. Looking at the extreme classes we can see that, on average, workers with 16 years of schooling earn 14.8 per cent more than those with 12 years¹¹, while those with less than 9 years of schooling earn 22.5 per cent less than those of the reference group.

Tenure and experience are both significant at the 1 per cent level and have positive coefficients. But, as expected, the coefficient of their squares is negative, denoting that wage functions have the usual concave form.

¹⁰ These are the regions where Portuguese airports are located and, except for Madeira, the regions where airline headquarters are located.

¹¹ According to the log-linear form of the wage equation, the interpretation of the estimated coefficient associated with a dummy variable (say $\hat{\beta}_2$) is made through $(e^{\hat{\beta}_2} - 1) \times 100\%$. Thus, the coefficient of 0.13795 associated with the class of workers with 16 years of schooling means that those workers earn 14.8 per cent more than those with 12 years of schooling (the omitted class), all other things remaining constant.

Table 8 – Wage equation for air transportation industry

Variable	Coefficient
educ<9years	-0.25452 (-11.4)*
educ=9years	-0.07910 (-5.7)*
educ=14years	0.06635 (4.1)*
educ=16years	0.13795 (12.9)*
tenure	0.04272 (30.2)*
tenure^2	-0.00056 (-14.5)*
exp	0.02500 (15.4)*
exp^2	-0.00039 (-8.7)*
cabin crews	-1.03393 (-76.3)*
directors	-0.23031 (-6.6)*
technicians	-0.86263 (-68.3)*
Administrative staff	-1.06562 (-70.7)*
other	-1.02903 (-48.1)*
fixed term contract	-0.27418 (-20.4)*
constant	2.94114 (70.5)*

* Denotes significance at the 1% level.

The coefficients of occupation dummy variables show striking differences between pilots and all other professional groups. In average terms and considering the other characteristics remaining constant, all the other occupations earn less than pilots do, these differentials ranking between -20.6 per cent and -65.6 per cent. Pilots' union power, the long training time required for flying and the shortage of pilot supply may be responsible for it. The current shortage of pilots has recently been documented by several sources, including a statement by the TAP CEO, where he states that constraints to activity expansion derive mainly from a lack of pilots (LUSA – Agência de Notícias de Portugal, S.A., 2007, 12th December).

The dummy that gathers the influence of fixed term contracts is also significant, showing that these workers earn, on average and other things remaining constant, 24.0 per cent less than those having permanent contracts.

As we stated above (Section 2.3) there are relevant differences between regular (REG) and non-regular air transport (NREG). Accordingly, we estimated different wage equations for both sub-sectors using an identical methodology. Table 9 displays the results obtained for the wage equations¹².

As expected, the results show some clear differences between the two sectors. Such diversity relies more on the magnitude of the coefficients (expressing the influence of the variables) than on the signs and the significance levels, which follow the results of the general wage equation.

¹² The estimated probit equations are similar to those obtained for the whole industry and can be sent upon request.

Table 9 – Wage equations for regular and non-regular air transportation

Variable	Regular AT	Non-Regular AT
	Coefficient	Coefficient
educ<9years	-0.22760 (-11.0)*	-0.35202 (-2.8)*
educ=9years	-0.05593 (-4.3)*	-0.07748 (-1.2)
educ=14years	0.03843 (2.5)**	0.10898 (1.8)
educ=16years	0.09291 (8.9)*	0.13535 (3.2)*
tenure	0.04937 (35.6)*	0.02027 (2.2)**
tenure^2	-0.00071 (-19.3)*	-0.00050 (-1.1)
exp	0.01072 (6.2)*	0.04660 (8.0)*
exp^2	0.00005 (0.9)	-0.00092 (-7.4)*
cabin crews	-1.12595 (-86.3)*	-0.58916 (-10.1)*
directors	-0.29319 (-6.9)*	0.18065 (2.5)**
technicians	-0.99315 (-80.0)*	-0.19762 (-4.5)*
administrative staff	-1.18283 (-80.1)*	-0.44833 (-8.6)*
other	-1.12698 (-56.3)*	-0.76287 (-5.6)*
fixed term contract	-0.26867 (-18.8)*	-0.13192 (-3.7)*
constant	3.04722 (75.8)*	3.30282 (12.7)*

* Denotes significance at the 1% level.

** Denotes significance at the 5% level.

The effect of schooling on wages is, for REG, quite similar to the results of the general wage equations. But schooling has diverse and wider effects in NREG: in the two intermediate classes (9 and 14 years) coefficients are non-significant, even at a 10 per cent level, and differences between the two extreme classes are larger than those in the general wage equation. So in REG a worker with 9 years of schooling earns, on average and other characteristics remaining constant, 22.8 per cent less compared to a worker with 12 years of schooling, this being 35.2 percent less in NREG. In the upper extreme of educational levels when we analyse the case of a worker with more than 16 years of schooling the wage premium is lower in REG compared to NREG (respectively, 9.3 per cent and 13.5 per cent more than a worker with 12 schooling years).

In both sectors pilots earn more than other professional groups, the sole exception being directors in NREG. However, differences are significantly smaller for NREG: pilots earn, on average and other characteristics remaining constant, 29.3 per cent more than directors in REG and 18.0 per cent less in NREG; technicians earn 99.0 per cent less (than pilots) in REG and 19.8 per cent less in NREG; cabin crews earn 112.6 per cent less (than pilots) in REG and 58.9 per cent less in NREG; administrative staff earn 118.3 per cent and 44.8 per cent less than pilots in REG and NREG respectively.

The influence of fixed term contracts is also stronger in REG. Workers holding this type of contract have a wage that, on average, is 26.9 per cent lower than those with permanent contracts in REG, but only 13.2 per cent lower in NREG.

To understand these results it is important to bear in mind that REG in Portugal is dominated by one large and long-established airline, while NREG has 23 smaller and younger airlines. Entry in this industry is easier for NREG due to their small scale of operations, with smaller and usually leased aircrafts. It is also easier for them to leave the industry as their investments, and so sunk costs, are of a smaller magnitude. Therefore it is natural the workers prefer REG, and that only those who cannot find a job in this sector engage in NREG.

Conclusions

This paper is intended to identify the main distinguishing factors of employment in the air transport industry as compared to the other sectors of the Portuguese labour market, and to investigate the main variables that influence wages in this industry.

The fact that our study relies on a data set that reports data on all the employees working in civil airlines in the country, allowing a comparison of their profile with the profile of the average worker in the whole private sector of the Portuguese labour market, makes our conclusions very robust. Previous available studies rely on more or less extended samples of workers and jobs and, even if they referred to much larger labour markets than Portugal has, the number of observations used was considerably more reduced.

We found evidence of remarkable differences between the working conditions in the airline sector compared to the other sectors of the Portuguese labour market: airline jobs are better paid and more stable (as there is a high incidence of permanent contracts and higher average tenure) than jobs in the other sectors are. They also capture, at least by Portuguese standards, highly qualified workers, both in terms of schooling and of general training acquired in the labour market. Jobs in the air transportation hire male workers more intensely than other sectors do.

Important diversities persist in different sub-sectors of the industry, clearly showing that the regular airlines subsector generates jobs of better quality than those generated in the non-regular one. Also, in both sub-sectors diversities of working conditions and pay are visible among different professional groups, with pilots emerging at the top of the wage ranking of the regular airlines industry.

Empirical evidence suggests that firms within the sector implement different strategies of managing their human resources. Regular airlines dominated by one domestic firm manage their workforce mainly following an “internal labour market” model: workers enter the firm with adequate general training (provided by the school system and experience gained in previous jobs) and the firm provides the specific abilities needed by creating incentives for workers to stay in the company, namely by means of well-established systems to progress in different careers, formally agreed by collective bargaining at the firm level and by giving

wage incentives. Nonetheless, this management model seems to fit pilots better than the other groups. Despite not being the group with the highest accumulated human capital, they are clearly the professional group that benefits most from monetary rent compared to any other profession. The strong bargaining position of pilots' union is also linked to this capacity of generating rents.

Econometric analysis confirms these arguments. Wages are significantly influenced by the educational level, tenure, experience, the type of contract the worker has and by the professional group to which he belongs. Pilots have a higher wage than any worker in the other professional groups with the same type of contract and identical human capital background.

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References

- Association of European Airlines – AEA (2006). *AEA Yearbook*.
- Blyton, P., Lucio, M., McGurk, J. and Turnbull, P. (2001) Globalization and trade union strategy: industrial restructuring and human resource management in the international civil aviation industry, *International Journal of Human Resource Management*, vol. 12, n. 3, pp. 445-463.
- Button, K., Costa, A and Reis, V. (2005) How to control airline routes from the supply side: the case of TAP, *Journal of Air Transportation*, vol. 10, n. 3, pp. 50-72.
- Card, D. (1986) The impact of deregulation on the employment and wages of airline mechanics, *Industrial and Labor Relations Review*, vol. 39, n. 4, pp. 527-37.
- Crémieux, P. Y. (1996) The effect of deregulation on employee earnings: pilots, flight attendants, and mechanics, 1959-1992. *Industrial and Labor Relations Review*, vol. 49, n. 2, pp. 223-42.
- Doeringer, P. B. and Piore, M. J. (1971) *Internal Labor Markets and Manpower Analysis*. Lexington, Mass.: D. C., Heath and Company.
- Hätty, H. and Hollmeier, S. (2003). Airline strategy in the 2001/2002 crisis - the Lufthansa example, *Journal of Air Transport Management*, vol. 9, n. 1, pp. 51-55.
- Heckman, J. (1979) Sample selection bias as a specification error, *Econometrica*, vol. 47, n. 1, pp. 153-161.
- Hirsch, B. and McPherson, D. (2000) Earnings, rents and competition in the airline labor market, *Journal of Labor Economics*, vol. 18, pp. 126-155.
- Inglada, V. and Rey, B. (2004) Spanish air travel and the September 11 terrorist attacks: a note, *Journal of Air Transport Management*, vol. 10, n. 6, pp. 441-443.

- International Civil Aviation Organization - ICAO (2007) *News release 08/07*. Available at www.icao.int.
- Ito, H. and Lee, D. (2005) Assessing the impact of the September 11 terrorist attacks on U.S. airline demand, *Journal of Economics and Business*, vol. 57, pp. 75-95.
- Lucio, M., Turnbull, P., Blyton, P. and McGurk, J. (2001) Using regulation: an international comparative study of the civil aviation industry in Britain and Spain, *European Journal of Industrial Relations*, vol. 7, pp. 49-68.
- Pinto, F. (2002) *TAP Annual Report 2002*. Available at www.tap.pt.
- Neven, D. and Roller, L. (1996) Rent sharing in the European airline industry, *European Economic Review*, vol. 40, pp. 933-940.
- Turnbull, P. and Harvey, G. (2001) *The impact of 11 September 2001 on the civil aviation industry: social and labour effects*. Sectoral activities programme working paper. International Labour Office Geneva.
- Turnbull, P., Blyton, P. and Harvey, G. (2004) Cleared for take-off? Management-labour partnership in the civil aviation industry, *European Journal of Industrial Relations*, vol. 10, n. 3, pp. 287-307.
- Turney, M., Bishop, J., Karp, M., Sitker, R. and Green, M. (2002) National survey results: retention of women in collegiate aviation, *Journal of Air Transportation*, vol. 7, n. 1, pp. 69-92.