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# ICT employment, over-education and gender in Spain. Do information and communication technologies improve the female labour situation?[1]

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***This paper investigates the extent to which ICT-related employment is improving the labour situation of women in Spain by reducing female over-education. Outcomes indicate no reduction in female over-education, nor does a woman's marital status produce any significant differences. However, the best result is observed for ICT occupations linked to higher job quality characteristics.***

## 1. Introduction and objectives

Women are the leading protagonists of recent developments in the labour market in the most industrialised countries. As their presence in the labour market increases, guidelines for family and social organisation change, and they progressively assimilate the patterns and labour choices of men. This socio-demographical behaviour can be clearly observed in Spain (Garrido, 1993; González and Requena, 2006) and are demonstrated by the main labour rates. While the female activity rate in 1987 was 31.8 per cent, by the second quarter of 2007, it had increased to 49 per cent. In other words, the number of Spanish women taking part in the labour market has increased by almost 54 per cent in the last twenty years. Similarly, the Spanish female employment rate has almost doubled, increasing from 23 per cent in 1987 to 43.8 per cent in 2007.

However, women cannot be considered as a homogeneous group, especially in a country like Spain, where economic and social changes related to gender have been changing at an increasing rate. Within the domestic context, there are deep differences in female labour behaviour. Using data from 2007, married women show remarkably different labour rates to those with other marital status: less frequent participation in the labour market (2.2 points), lower unemployment rates (2.6 points) and lower occupation rates (0.8 points). Furthermore, Spanish married women are slightly less educated than other women. While 44.9 per cent of unmarried[2] women have an educational level that is equal to or higher than compulsory education, only 38.2 per cent

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of married women show this outcome. Fixed-term employment is more frequent for unmarried women (39.6 per cent) than for married women (27.6 per cent). Conversely, part-time work is more common among married women (25.9 per cent) than for unmarried women (19.6 per cent).

Nevertheless, gender-related labour differences are one of the most persistent features of the Spanish labour market. As such, female activity and employment rates were only 70.4 and 67.1 per cent, respectively, of the corresponding male rates in 2007.[3] The levels of gender-related occupational segregation are high and increasing slightly (Iglesias and Llorente, 2009) to such an extent that the existence of female wage discrimination is a situation that can be clearly demonstrated (see, for example, De la Rica, 2007).

A particularly significant feature of the adverse situation of women in the labour market is that over-education is more prevalent for women, which is an indication of the increased difficulty the female population faces with regard to the educational mismatch. This is a significant point, as one of the main strategies developed by women in their attempts to incorporate into the labour market is founded on their investments in the acquisition of education. The problems of occupational segregation and over-education are relevant because of the under-utilisation of a woman's skills potential and the undervaluation of women's work through a lack of recognition or low valuation of the skills used in women's jobs (Horrel *et al.*, 1990).

In addition, an idea widely dealt with in economic and sociological literature is that the new Information and Communication Technologies (ICT) may offer new opportunities that will reduce gender-related labour disparities and so improve the social and occupational position of women. New technologies reduce the need for manual skills and physical strength in favour of knowledge, team work and communicative abilities (WWW-ICT, 2004), thus changing the sectoral distribution of employment, the educational requirements of jobs and the demand for manual occupations (Colecchia and Papaconstantinou, 1996; Ducatel and Burgelman, 1999; Carnoy, 2002), and provide an important source of employment, directly within ICT and indirectly in other fields (World Bank, 2006).

The relevance of the connection between female employment and employment in ICT explains why it has been widely studied, especially from a gender perspective. Contrary to initial expectations, outcomes indicate that, in general, women working in ICT: (1) earn less than their male counterparts; (2) face deep disparities between educational and training attainment and progression to senior positions; (3) their desires for motherhood may be frustrated and penalised; (4) must confront both direct and indirect discrimination; (5) and the incompatibility of having a full-time ICT career and raising a family (Moore *et al.*, 2005; Keogh *et al.*, 2007). However, the gender pay gap in ICT employment appears to be narrower than in the economy as a whole.[4]

Within this complex context, the objective of this work is to establish the extent to which new technologies are improving, or not, the labour situation of women in Spain, with special reference to the educational requirements of their jobs. In order to do this, we analyse the effects employment closely linked to ICT has on over-education by gender. In contrast to the more habitual approach, which uses a sociological perspective based on data from personal interviews and descriptive analysis, our work is based on an economic study, using highly rich microdata from the Spanish Labour Force Survey (EPA), de-aggregated to three digits for the second quarter of 2007. Conclusions are supported by the application of econometric methodologies.

The rest of the article is organised as follows. The second section examines the existing literature on the economic analysis of over-education, particularly that concerning the differential over-education of women. In the third section, we debate the assessment of ICT-related employment and over-education. Various significant characteristics of ICT-employment are established in the fourth section. The fifth section assesses over-education and analyses its determining factors. The article ends with a summary of the main results (sixth section).

## 2. Analysis of over-education

The concept of over-education, which was introduced by Richard Freeman in 1976, describes the extent to which an individual possesses a level of education in excess of that required for her/his particular job. Therefore, in analysing it, we study the difficulties concerning the mismatch between qualifications supplied and those required by the labour market. Where over-education exists, the decisions made by the labour supply on investment in education are not accompanied by the relevant qualification requirements of the jobs that make up the demand for labour. Therefore, a mismatch exists between the decisions made by both sides of the labour market.

The analysis of over-education is justified by the significance of its economic effects. From a macroeconomic perspective, over-education implies the under-utilisation of labour, which translates to a lower output level (McGuinness, 2004). From a microeconomic point of view, over-education is linked to lower productivity levels for companies (Tsang, 1987) and losses related to their investment in training (Sloane *et al*., 1999), while for individuals, part of their investment in human capital is unproductive (Tsang *et al*., 1991).

There are several theoretical arguments that attempt to explain the existence of over-education. On the assumption that, in the long term, salaries must always be equal to productivity, the Human Capital Theory states that over-education can only be a temporary situation, insofar as that companies complete their production adjustment processes, and workers complete their employment-seeking processes (Becker, 1964). Within this theoretical approach, the lack of information (Jovanovic, 1979), problems regarding training acquired in the workplace (Sicherman and Galor, 1990) and the under-education problems that could be associated with technological changes (Rumberger, 1999) are also established as reasons for studying over-education, and thus obtain more realistic content for original human capital postulations.

For the purposes of the present work, the differential over-education hypothesis by gender, which was initially formulated by Frank (1978), is especially significant. According to this theory, married women earn less than their husbands on the basis of the different methods they use when searching for a job. Married men search unlimitedly and, depending on the results of their search, their wives take certain parameters (mainly spatial), which are established by the husband's job, into consideration. In this context, over-education is more frequent among women than among men.

Beyond the spatial aspects attached to its original formulation, the interesting point about the differential over-education hypothesis is that the differences observed between women and men in terms of over-education are explanatorily related to the fact that women have to deal with restrictions on their labour decisions. These restrictions can also be linked to the number of jobs women are able to access. For women, over-education is more frequent because their employment-seeking processes are conditioned by a lower number and type of job.

Similarly (some decisions made by women are conditioned by their husband's decisions), it is also possible that over-education differences by gender reveal that women and men are different with regard to their need to reconcile work and family life (Hertz, 1997; Folbre and Nelson, 2002; Gregory and Connolly, 2008). This demonstrates that women are more likely than men to accept jobs which are below their qualification level if the labour conditions allow them to maintain a balance between work and family life.

The previous idea that a woman's labour behaviour is conditioned by her husband's decisions finds its origin in Becker's New Economics of the Family Theory (Becker, 1981). The main implication is that differences in labour participation and wage rates between women and men are explained by differences in productivity-related endowments (basically a consequence of investment in education) and exogenous discriminations. However, the drawbacks to this approach were outlined early, especially by feminist thought (Bergmann, 1995). The division of household labour that we observe is the consequence of a gendered labour market where women invest less than men in human capital because they foresee the continuation of existing segregation and dis-

 

crimination against them which pushes down returns related to their investments. As a result, female labour decisions are constrained by the existence of a gender-segregated labour market (Rubery *et al*., 1996).

In spite of some methodological difficulties (Robeyns, 2000), there is no doubt that feminist economics supports a very relevant and alternative explicative hypothesis. From a feminist economic perspective, labour market performance is a political, cultural and economic process that is embedded in an institutional and social context (Karamessini and Ioakimoglou, 2007). Gender relations must be at the core of the analysis, introducing effects on wages and the relative bargaining power of men and women (Figart *et al*., 2002). Occupational segregation is regarded as the outcome of gendered socialisation processes, constraints on women's employment related to the domestic division of labour and social policies based on the male breadwinner model, and discrimination.

In accordance with the two aforementioned points, our work takes into consideration two different and alternative hypotheses:

1. First, it is possible to assume that the diffusion of ICT and the increase in employment linked to this kind of technology expand the employment possibilities of women, as ICT-related employment favours female employment (more possibilities within their restricted search area) and comprises labour conditions that improve the balance between work and family life. In addition, ICT-related employment is expected to be associated with higher-skilled jobs, which might favour the approximation of labour demand and supply in terms of qualifications. Therefore, it would be reasonable to expect ICT-related employment to reduce levels of over-education, particularly in the case of women.
2. However, the socio-cultural contextualisation must be taken in account, as ICT work has also been constructed as a masculinised domain. The existence of gendered structures and segregation within the ICT sector shows that labour differences by gender, in particular over-education in the ICT workplace, are very similar to the situation observed in more traditional activities.

## 3. Measurement and definitions: ICT-related employment and over-education

The first task to be tackled in order to analyse the effects of ICT on over-education is to state how we define and measure ICT employment and over-education situations.

ICT employment is defined as that part of total employment specifically related to Information and Communication Technologies (OECD, 2004). To measure it, the Organisation for Economic Co-operation and Development (OECD) establishes two different approaches. According to the first of these, ICT employment is understood to be that which is included in the ICT-goods-and-services-producing sector (ICT sector). From the second perspective, ICT employment refers to that in which the qualifications required share a special relationship with ICT. This is also known as ICT-skilled employment.

In accordance with the first definition, ICT-related employment covers all jobs in the ICT producer sectors, regardless of the job content, and excludes those jobs which, although related to ICT, are part of the group of sectors which are not directly producers of these kinds of products. Pursuing our analytical goals, the second definition is more appropriate, as it considers that ICT affects the whole productive structure. Therefore, this is the one used in the present research.

Table 1 shows the OECD definition and composition of ICT-skilled employment. ICT-related occupations are classified in accordance with what the OECD calls *narrow* and *broad definitions*. The first concept refers to the so-called specialists, while the second includes advanced and basic users, based on the intensity with which the different groups of labour occupations are related to ICT. However, it is necessary to take into account that, using the previous approach to ICT employment, we are dealing

Table 1: *Definition of ICT-Skilled Employment. ISCO-88 and CNO-94*

| ISCO-88 | CNO-94 | Occupation |
|---|---|---|
| 121 | 111 | Directors and chief executives |
| 122 | 112 | Production and operations department managers |
| 123 | 113 | Managers of specialised areas and departments |
| 211 | 201 and 261 | Physicists, chemists and related professionals |
| 212 | 202 and 262 | Mathematicians, statisticians and related professionals |
| **213** | **203 and 263** | **Computing professionals** |
| 214 | 204 and 264 | Architects, town and traffic planners |
| | 205 and 265 | Engineers and engineering technicians |
| 241 | 241 and 291 | Business professionals |
| 242 | 231 | Lawyers and prosecutors |
| | 232 | Judges and magistrates |
| | 239 | Legal professionals not elsewhere classified |
| 243 | 252 and 292 | Archivists, librarians and related information professionals |
| **312** | **303** | **Computer associate professionals** |
| **313** | **304** | **Optical and electronic equipment operators** |
| 341 | 331 | Finance and sales associate professionals |
| | 332 | Technical and commercial sales representatives |
| 342 | 351 | Employment agents and labour contractors |
| 343 | 341 | Administrative associate professionals (performing general administrative tasks) |
| 411 | 421 | Stenographers and typists |
| | 422 | Word-processor operators |
| | 430 | Back-office clerks, n.e.c. |
| | 440 | Front-office clerks, n.e.c. |
| 412 | 401 | Statistical and finance clerks |
| **724** | **762** | **Electrical and electronic equipment mechanics and fitters** |

*Note*: The codes in **bold** indicate specialised occupations (narrow definition). The other occupations are added to these in order to obtain the broad definition.

with a wide range of labour occupations, associated with highly diverse labour characteristics and work organisations. Consequently, it will be worth considering some kind of break down of next analyses.

In turn, there are two different methodologies for measuring over-education in labour: by using either subjective measures or objective indicators. At the same time, within the latter option, two other possibilities exist: the method based on the offer of the education system and the differential method.

According to the first methodology, over-education is approached by using the answers given by the workers in this respect. The main problem with this approach is the subjective nature of the responses, as it is the worker him/herself who assesses the existing relationship between his/her education credentials and the qualification requirements of the jobs held.

The advantage of the second approach is that it attempts to measure over-education using objective indicators. The method based on the supply of the education system (Rumberger, 1987) determines over-education by comparing the educational level supplied by the education system and links it to a certain type of job and the educational level possessed by the individuals occupying that type of job. The main disadvantage of this method lies in the impossibility of linking a specific study type to each of the existing labour occupations.

For this reason, the most frequently used method is the differential one (Clogg and Shockey, 1984), which involves calculating the average and standard deviation in the years of education possessed by the workers of a certain labour occupation. Over-

 

education exists when the educational level of an individual is higher than the average for his/her labour occupation plus one time the standard deviation. When this is lower than the average for his/her occupation minus the standard deviation, the worker is seen to be under-educated (the individual possesses a lower educational level than that required by his/her occupation). When the worker's level of education is within the interval between the results obtained from adding and subtracting the standard deviation from the average, the employee can be said to be adequately educated.

Thus, we will use the latter aforementioned method for the present analysis. The problem is that, to apply such a method, we need to know the number of years of education possessed by the individuals that make up the working population, while EPA only provides information on the level of studies completed. In other words, we need to construct a numerical variable in relation to the years of study in order to calculate the average and standard deviation.

On the basis of the data provided by the EPA regarding the highest level of studies reached by the person interviewed, we have constructed a numerical variable by assigning the number of courses usually required to obtain the level of study for each of these.

## 4. Characteristics of ICT employment in Spain

Once we have defined ICT employment and established how we are going to measure over-education, a key question is what we understand to be the basic characteristics of most ICT related employment and what differences exist between them. To do this, we have carried out two different analyses. First, we created a quality employment index in order to obtain greater knowledge of ICT employment. Second, we estimated a pair of *logit* models designed to identify the principal labour traits associated with Spanish ICT employment.

In order to create a Quality Employment Index, we calculated a synthetic index using a variable pool: fixed-term employment rate, current labour contract tenure, current job tenure, potential labour experience, involuntary part-time rate, the difference between usual working time and the legal level, the difference between actual and usual working time as a percentage of usual working time, percentage of employees with high studies and gender segregation level.[5]

We have to use aggregate data due to the heterogeneity of the units used for different variables. So, in accordance with standard methodology (European Commission, 2009), we first obtain data for each of the variables mentioned for every ICT-related occupation. Then, we calculate the average and standard deviation of each variable. Next, the variables are typified into normalised values ($z$ variables). If an ICT occupation[6] shows a positive value for any variable we know that this labour aspect in this occupation has been evaluated as higher than average and it makes a positive contribution to job quality. The opposite conclusion is reached if a negative value is shown. Thus, each occupational value must always be interpreted in relative terms in relation to the other kinds of jobs. Finally, the ultimate value of the synthetic index is the result of a weighted average of all the variables.

Table 2 shows significant differences between ICT related occupations in terms of their job quality standing. On the basis of these results, we have classified ICT occupations into four main groups. Both, variables related to job tenure and the presence of employees with a high level of education, demonstrate the differences between ICT related occupations. Opposing values are especially obtained for both, working time variables and labour experience. Differences between ICT occupations are based on these job quality components, which show good values for the first group (higher job quality) and worse for the latter (lower job quality). While less intensely, experience and involuntary part-time working also contribute some distance to ICT occupations.

In order to determine the principal features of ICT employment, we have estimated a series of binomial *logit* models on the probability of obtaining ICT-skilled employment, against other types of employment. The estimates have been specified for men, women and married women,[7] they are aimed at detecting, as far as possible, the

*Table 2: Quality Employment Index (QEI) for ICT related occupations*

| ICT related occupations | QEI | Group |
|---|---|---|
| Production and operations department managers | 0.691 | ICT-1 |
| Lawyers, prosecutors, judges, magistrates and legal professionals not elsewhere classified | 0.528 | |
| Archivists, librarians and related information professionals | 0.431 | |
| Directors and chief executives | 0.384 | |
| Statistical and finance clerks | 0.221 | |
| **Managers of specialised areas and departments** | **0.063** | **ICT-2** |
| **Architects, town and traffic planners, engineers and engineering technicians** | **0.011** | |
| **Employment agents and labour contractors** | **0.007** | |
| Administrative associate professionals (performing general administrative tasks) | –0.007 | ICT-3 |
| Computing professionals | –0.143 | |
| Physicists, chemists and related professionals | –0.147 | |
| Computer associate professionals | –0.148 | |
| Optical and electronic equipment operators | –0.150 | |
| **Business professionals** | **–0.209** | **ICT-4** |
| **Finance and sales associate professionals and technical and commercial sales representatives** | **–0.219** | |
| **Electrical and electronic equipment mechanics and fitters** | **–0.256** | |
| **Mathematicians, statisticians and related professionals** | **–0.453** | |
| **Stenographers, typists, word-processor operators, back-office clerks, front-office clerks (n.e.c.)** | **–0.605** | |

Z variables.
*Source*: Own elaboration from EPA data for the second quarter of 2007.

differences that exist according to gender and household situation.[8] We have taken into consideration the explanatory variables of age, marital status, educational level, autonomous region of residence (defined according to how intense the presence of ICT employment is in the region), being a parent, depending on the gender of the relevant individual, the length of the working day (full-time or part-time), a variable that encapsulates the labour situation that exists within the labour market together with the length of the contract for wage-earners, the work experience in the company and the activity sector.

Table 3 display the results obtained for the three estimations. For all of them, the most significant characteristics of ICT employment are: holding university studies, working under a permanent, full-time contract, working in a region with high presence of ICT occupations, and, evidently, working in any non-agricultural sector, and being working in the service sector. Moreover, white-collar labour occupations also positively affect the probability of being included in ICT employment.[9]

If we compare the patterns obtained for men and women, some facts must be mentioned. First, being a young woman increases ones probability of working in ICT occupations (this is not significant for men and married women). Second, undergoing higher education increases the probability of working in ICT occupations. However, this affects men more than it does women. Third, the different patterns that activity sector has on gender must be underlined. In the case of industry, the probabilities are similar. In construction, the probability of working in ICT for all women and for married women is much bigger than the probability for men, so we can conclude that women's labour in this sector is linked to ICT-employment. In services, on the contrary, the probability for men is bigger than the probability for women and married women. In this sense, we can conclude that women have less probability than men of working

 

*Table 3: The probability of being employed in an ICT-skilled labour occupation against that of being employed in other occupations*

| | Men | | Women | | Married women | |
|---|---|---|---|---|---|---|
| | B | Sig | B | Sig | B | Sig |
| Age | | 0.020 | | 0.031 | | 0.182** |
| Young (16–35 years) | –0.013 | 0.843** | 0.167 | 0.020 | 0.106 | 0.241** |
| Mature (over 55) | 0.247 | 0.006 | –0.134 | 0.272** | –0.199 | 0.173** |
| Marital status | | 0.799** | | 0.064* | | |
| Single | –0.045 | 0.503** | –0.073 | 0.300** | | |
| Others | –0.007 | 0.956** | –0.243 | 0.025 | | |
| Education | | 0.000 | | 0.000 | | 0.000 |
| Primary education | –1.321 | 0.000 | –1.729 | 0.000 | –1.620 | 0.000 |
| Higher education | 1.285 | 0.000 | 0.824 | 0.000 | 0.735 | 0.000 |
| Type of region | | 0.000 | | 0.000 | | 0.000 |
| Scarce presence of ICT occupations | 0.066 | 0.373** | 0.069 | 0.401** | 0.056 | 0.612** |
| High presence of ICT occupations | 0.388 | 0.000 | 0.362 | 0.000 | 0.434 | 0.000 |
| Children | | | | | | |
| Fathers/Mothers | –0.039 | 0.571** | 0.041 | 0.535** | 0.031 | 0.686** |
| Duration of working day | | | | | | |
| Part-time | –0.420 | 0.002 | –0.423 | 0.000 | –0.309 | 0.001 |
| Professional situation | | 0.000 | | 0.000 | | 0.000 |
| Wage-earner with a temporary contract | –0.604 | 0.000 | –0.440 | 0.000 | –0.637 | 0.000 |
| Non-wage-earner | 0.074 | 0.257** | 0.273 | 0.002 | 0.172 | 0.111** |
| Work experience in the company | | | | | | |
| High, more than 58 months | 0.000 | 0.490** | 0.001 | 0.003 | 0.001 | 0.021 |
| Activity sector | | 0.000 | | 0.000 | | 0.000 |
| Industry | 1.718 | 0.000 | 1.527 | 0.000 | 1.676 | 0.000 |
| Construction | 1.000 | 0.000 | 3.471 | 0.000 | 3.604 | 0.000 |
| Services | 1.961 | 0.000 | 0.845 | 0.004 | 0.974 | 0.010 |
| Constant | –3.618 | 0.000 | –2.735 | 0.000 | –2.738 | 0.000 |
| Cases | 40,616 | | | 29,269 | | 16,161 |
| –2 log of likelihood | 9,937.990 | | | 7,927.214 | | 4,384.303 |
| Cox and Snell R-squared | 0.149 | | | 0.128 | | 0.129 |
| Nagelkerke R-squared | 0.237 | | | 0.192 | | 0.194 |

*Source*: Own elaboration from EPA data for the second quarter of 2007.
Reference person of an intermediate age (36–54 years), married, with secondary education, living in an autonomous region with an average presence of ICT occupations, wage-earner with an open-ended contract and scarce work experience who develops his/her activity in the agricultural sector.
**No significant values under a probability of 95%. *No significant values under a probability of 90%.

in ICT occupations in service sector. Generally speaking, taken as a whole there are no relevant differences between married women and all women.

## 5. Over-education and gender in ICT employment

Now, we will measure over-education levels in ICT employment, comparing them to those observed for employment as a whole. The objective is to determine the extent to which ICT employment reduces over-education levels, paying special attention to the gender perspective. We introduce details for married women and the four ICT occupation groups we have previously set on the basis of the job quality index (see Table 2). Table 4 shows the results for the estimation of over-education, under-education and adequate education indicators, which have been obtained by using the differential method previously described. According to the results, there are differences between women and men and also within ICT employment.

For total employment (both genders), 18.08 per cent of Spanish workers are over-educated, 20.04 per cent are under-educated and almost 62 per cent are adequately educated. These results are intermediately positioned compared with those demonstrated in previous works on the Spanish situation (see Sanromá and Ramos, 2004: 17, for a review of this respect). Over-education is slightly more frequent among women (18.13 per cent) than among men (18.04 per cent).

If we compare these results with those obtained for employment defined by the development of ICT-related labour occupations, we can see that over-education is notably reduced (from 18.08 per cent to 15.86 per cent, i.e., almost 4.3 points less). This pattern is clearly reproduced for men (nearly 5 points less for over-education in ICT employment). The most significant feature is that, for women, there is a slight increase in over-education in ICT (almost 0.5 points higher). Therefore, ICT employment does not have the same effect on women as it does on men. This accentuates, although only slightly, the female educational mismatch. The result for married women is very similar. ICT employment does not reduce their level of over-education. But we must pay attention to the fact that the level of over-education for married women is much lower than it is for women as a whole.

*Table 4: ICT occupations, gender and qualification mismatch*

| | Total employment | ICT employment | ICT E1 | ICT E2 | ICT E3 | ICT E4 |
|---|---|---|---|---|---|---|
| Women | | | | | | |
| Over-educated | 18.13 | 18.61 | 16.74 | 18.33 | 15.22 | 19.68 |
| Under-educated | 17.68 | 14.62 | 8.84 | 16.07 | 6.52 | 15.59 |
| Adequately educated | 64.19 | 66.77 | 74.42 | 65.60 | 78.26 | 64.73 |
| Men | | | | | | |
| Over-educated | 18.04 | 13.59 | 18.88 | 12.17 | 12.90 | 13.19 |
| Under-educated | 21.69 | 16.68 | 15.43 | 19.79 | 9.68 | 14.76 |
| Adequately educated | 60.27 | 69.73 | 65.69 | 68.04 | 77.42 | 72.05 |
| Both | | | | | | |
| Over-educated | 18.08 | 15.86 | 18.10 | 14.75 | 13.43 | 17.17 |
| Under-educated | 20.04 | 15.75 | 13.03 | 18.24 | 8.96 | 15.27 |
| Adequately educated | 61.88 | 68.39 | 68.87 | 67.02 | 77.61 | 67.55 |
| Married women | | | | | | |
| Over-educated | 16.24 | 16.54 | 14.52 | 15.40 | 17.95 | 18.26 |
| Under-educated | 19.82 | 16.36 | 10.48 | 17.04 | 2.56 | 18.49 |
| Adequately educated | 63.94 | 67.10 | 75.00 | 67.56 | 79.49 | 63.24 |

*Source*: Own elaboration from EPA data for the second quarter of 2007.

 

Taking into consideration the quality employment desegregation that we have brought in, it is true that ICT employment reduces over-education for all the groups we have created except ICT-1, the group with a higher quality level, which has an over-education level that is very close to that existing for employment as a whole. The previously mentioned best outcomes that ICT involves for men are based on ICT-2, ICT-3 and ICT-4, where over-education levels present very important reductions. This pattern does not hold true for women, because over-education increases in ICT-2 and ICT-4, nor is it true for married women, who obtain worse over-education results in ICT-3 and ICT-4.

In general terms, over-education reaches its highest values at both extremes, ICT-1 (men) and ICT-4 (women). It must be pointed out that, for married women, over-education levels decrease with quality of employment.

If we focus on the over-education differential by gender, the levels for women are only less than they are for men in ICT-1 (2.1 points less). This fact is especially important for married women, whose over-education levels are 4.3 points lower than they are for men in these kinds of ICT occupations. Conversely, worse results are again observed for women in ICT-4, where over-education levels for women and married women are 6.5 and 5 points higher than they are for men. Thus, in order to achieve a reduction in the over-education gender gap in ICT employment, a good job quality context is also required.

Therefore, ICT employment does not appear to be a good ally for women in their efforts to improve their over-education levels. On the contrary, their problems of educational mismatch are considerably higher in this employment sector. However, we must point out that ICT occupations connected with the highest quality employment reduces the over-education gender gap considerably.

In order to establish more thoroughly what the factors determining over-education are and to find out what effects ICT employment has on this situation, we have estimated several multinomial *logit* models. The estimation is carried out, for men, women and married women. The dependent variable classifies employed persons into three categories: adequately educated, under-educated and over-educated. The independent variables used are the following: age, years of study, work experience, marital status, being a father or mother, professional situation/type of contract (wage-earners with an open-ended contract, wage-earners with a temporary contract and non-wage-earners), and ICT occupations ordered by job quality used previously.[10]

The results are shown in Table 5. When we take into account personal and professional factors, we observe that the following:

1. Age has no significance on the probability of over-education for men and women. Over-education increases with age in the case of married women, but only slightly.
2. Over-education becomes more probable when the educational level of the individual is higher. We observe this result for both men and women. However, the effect is greater in the case of men.
3. Fatherhood and motherhood have no significant influence on over-education, for men, women and married women.
4. Marital status has no significant effect on the probability of over-education.
5. All ICT groups reduce the probability of over-education compared with non-ICT-related labour occupations. This outcome is common for men, women and married women. However, ICT-related occupations reduce over-education more intensively for men than for women. There are no significant differences between coefficients for women and married women.

## 6. Conclusions

The aim of the present article has been to establish the extent to which Information and Communication Technologies reduce labour disparities by gender in Spain. In order to do so, we have analysed the effects induced by ICT-related employment on female and male over-education levels.

*Table 5: Probability that an individual is under-, over- or adequately educated depending on his/her characteristics*

| | Men | | Women | | Married women | |
|---|---|---|---|---|---|---|
| | B | Sig. | B | Sig. | B | Sig. |
| Under-educated | | | | | | |
| Constant | 13.293 | 0.000 | 12.671 | 0.000 | 12.024 | 0.000 |
| Age | 0.020 | 0.001 | 0.001 | 0.888** | –0.012 | 0.217** |
| Years of study | –1.641 | 0.000 | –1.502 | 0.000 | –1.381 | 0.000 |
| Work experience in the company | 0.001 | 0.059* | 0.001 | 0.270** | 0.002 | 0.144** |
| Marital status | | | | | | |
| Single | –0.023 | 0.926** | 0.174 | 0.449** | | |
| Married | –0.349 | 0.125** | –0.148 | 0.444** | | |
| Others | 0.000 | . | 0.000 | . | | |
| Father/mother | | | | | | |
| Yes | –0.066 | 0.604** | –0.099 | 0.437** | 0.035 | 0.869** |
| No | 0.000 | . | 0.000 | . | 0.000 | . |
| Professional situation | | | | | | |
| Non-wage-earner | 0.111 | 0.376** | 0.358 | 0.027 | 0.296 | 0.301** |
| Wage-earner with temporary contract | –0.349 | 0.011 | –0.371 | 0.012 | –0.096 | 0.614** |
| Wage-earner open-ended contract | 0.000 | . | 0.000 | . | 0.000 | . |
| Aggregate labour activity | | | | | | |
| Agriculture | –3.312 | 0.000 | –2.818 | 0.000 | –3.765 | 0.000 |
| Industry | –0.646 | 0.000 | –0.247 | 0.155** | –0.242 | 0.344** |
| Construction | –1.233 | 0.000 | 0.173 | 0.591** | –0.142 | 0.774** |
| Services | 0.000 | . | 0.000 | . | 0.000 | . |
| Occupations/ICT | | | | | | |
| ICT employment 1 | 3.979 | 0.000 | 3.893 | 0.000 | 3.496 | 0.000 |
| ICT employment 2 | 4.327 | 0.000 | 3.834 | 0.000 | 3.440 | 0.000 |
| ICT employment 3 | 4.351 | 0.000 | 3.996 | 0.000 | 3.590 | 0.000 |
| ICT employment 4 | 2.449 | 0.000 | 2.811 | 0.000 | 2.319 | 0.000 |
| Non-ICT-related labour occupations | 0.000 | . | 0.000 | . | 0.000 | . |
| Over-educated | | | | | | |
| Constant | –7.455 | 0.000 | –6.266 | 0.000 | –6.774 | 0.000 |
| Age | –0.005 | 0.240** | 0.008 | 0.094* | 0.021 | 0.001 |
| Years of study | 0.529 | 0.000 | 0.407 | 0.000 | 0.402 | 0.000 |
| Work experience in the company | –0.004 | 0.000 | –0.007 | 0.000 | –0.007 | 0.000 |
| Marital status | | | | | | |
| Single | –0.310 | 0.047 | –0.215 | 0.126** | | |
| Married | –0.130 | 0.378** | –0.144 | 0.253** | | |
| Others | 0.000 | . | 0.000 | . | | |
| Father/mother | | | | | | |
| Yes | –0.124 | 0.129** | 0.047 | 0.553** | 0.116 | 0.413** |
| No | 0.000 | . | 0.000 | . | 0.000 | . |

*Table 5: Continued*

| | Men | | Women | | Married women | |
|---|---|---|---|---|---|---|
| | B | Sig. | B | Sig. | B | Sig. |
| Professional situation | | | | | | |
| Non-wage-earner | 0.272 | 0.000 | 0.095 | 0.374** | –0.095 | 0.586** |
| Wage-earner with a temporary contract | 0.172 | 0.020 | –0.065 | 0.402** | –0.139 | 0.185** |
| Wage-earner open-ended contract | 0.000 | . | 0.000 | . | 0.000 | . |
| Aggregate labour activity | | | | | | |
| Agriculture | 2.022 | 0.000 | 2.220 | 0.000 | 2.268 | 0.000 |
| Industry | 0.790 | 0.000 | 0.201 | 0.077* | 0.302 | 0.051* |
| Construction | 1.102 | 0.000 | –0.565 | 0.050 | –0.566 | 0.177** |
| Services | 0.000 | . | 0.000 | . | 0.000 | . |
| Occupations/ICT | | | | | | |
| ICT employment 1 | –1.493 | 0.000 | –1.221 | 0.000 | –1.200 | 0.000 |
| ICT employment 2 | –2.043 | 0.000 | –0.573 | 0.000 | –0.540 | 0.001 |
| ICT employment 3 | –1.926 | 0.000 | –1.567 | 0.000 | –1.822 | 0.000 |
| ICT employment 4 | –1.256 | 0.000 | –0.161 | 0.142** | –0.282 | 0.069* |
| Non-ICT-related labour occupations | 0.000 | . | 0.000 | . | 0.000 | . |
| Pseudo R-squared | | | | | | |
| Cox y Snell | 0.617 | | 0.554 | | 0.506 | |
| Nagelkerke | 0.727 | | 0.663 | | 0.608 | |
| McFadden | 0.507 | | 0.447 | | 0.394 | |
| Cases | 11,956.650 | | 8,314.160 | | 3,728.630 | |

*Note*: Reference category: adequacy, woman, non-wage-earner, non-ICT-related labour occupations. The variables referring to age, years of study and work experience in the company are defined continuously.
*Source*: EPA, second quarter of 2007.
**No significant values under a probability of 95%. *No significant values under a probability of 90%.

ICT-related employment has been estimated using the OECD concept of ICT-skilled employment, that is to say, that employment for which ICT-oriented qualifications are required. Over-education has been measured using objective indicators, which have been calculated according to the differential method. For this purpose, we have used data from the Spanish Labour Force Survey de-aggregated at a higher level than usual (three digits).

Because female employment and ICT-related occupations are highly heterogeneous, analyses have been broken down on the basis of the marital status of women and the job quality levels shown for each ICT labour occupations.

In this paper, two alternative explanatory hypotheses have been considered. First, on the basis of the differential over-education hypothesis, which states that the higher over-education of the female population is due to the fact that women face several restrictions when searching for a job, we tentatively assume that ICT employment could reduce the extent of these restrictions because the characteristics of ICT employment are especially oriented towards female employment. The educational require-

ments of ICT employment are higher, and are able to facilitate the reconciliation of work and family life and thus improve family decisions. Second, following Feminist Thought, the existence of gendered structures and segregation within the ICT sector explain why over-education in the ICT workplace are similar, from a gender perspective, to those observed in the economy as a whole.

Generally speaking, ICT employment reduces the over-education levels observed. This result is clearly observed in the case of men, but not in that of women, for which ICT employment introduces a slight increase in over-education. The estimates confirm that holding an ICT-related occupation is a statistically significant variable when explaining over-education. However, this reduction is much more intense in the case of men. This demonstrates that, in Spain, the over-education differential by gender is higher in ICT employment than it is for employment as a whole.

Throughout the Spanish labour market, women are expected to be more highly qualified than men in order to do the same job. This restriction is equally significant in the case of ICT employment. And as such, Information and Communication Technologies are not reducing the labour limitations that explain the traditionally higher over-education levels faced by women.

The outcomes obtained do not support the implications derived from the first hypothesis. The estimation for married women does not introduce significant differences to the results. What is more, married women generally show less over-education levels than women as a whole. From a statistical point of view, motherhood is not a significant variable for explaining over-education.

However, job quality in ICT employment is an important variable in the relationship between female over-education and ICT employment. Over-education among women is less prevalent in ICT occupations with higher job quality levels, and a negative relationship is observed between over-education and ICT job quality for married women. A reduction in the over-education gender gap in ICT employment also requires a good job quality context.

It is worth noting that in order to achieve a reduction in female over-education, especially for married women, not only is it necessary for them to work in an occupation related to ICT but it must also be a good quality job in terms of its labour position. A reduction in the over-education gender gap in Spain will only be possible for ICT employment with high job quality. Working in an ICT-related occupation is not enough to guarantee a more egalitarian situation.

Therefore, outcomes have only partially supported the first hypothesis. ICT employment only reduces over-education for women (and married women) if job quality is associated. Perhaps job quality is linked to present possibilities of conciliation, especially in so far as working hours are concerned. However, the second hypothesis must also be taken into consideration. Probably, lower job quality, even in ICT employment, means that gendered structures, segregation and discrimination against women increase, thus explaining the poor results we have found in terms of over-education.

On the basis of these conclusions, a policy implication is clear. If we want to use ICT employment as a tool for pursuing targets related to the reduction of gender differences in labour markets, we must insure that ICT employment and job quality are 'two sides of the same coin'. The possibilities of ICT employment improving the working position of women is potentially high, but this will only come about if the jobs created are good quality ones, associated with labour conditions that unmistakably reduce the labour restrictions faced by women. Maybe in the future, the main problem in ICT could be the segregation of women, despite their education, to lower quality occupations due to their qualifications being poorly valued or the difficulty of establishing a balance between work and family life.

However, further research must be done in order to obtain a deeper insight into the relationship between ICT and the labour market from a gender perspective. For instance, measurements of job quality must be refined and, furthermore, the domestic circumstances of women must be included in order to create a more in-depth analysis.

 

## Notes

1. The content of this article is based on some of the results obtained from the research entitled '*Desajuste entre participación y posición de las mujeres en la investigación y el empleo TIC*' (mismatch between the participation and position of women in ICT-related research and employment), financed by the Spanish Ministry of Industry. Plan Avanza, Program on Gender Equality 2007–2008, and carried out by the Universitat Oberta de Catalunya, the Universidad Complutense of Madrid and the Economic and Social Analysis Institute (IAES).
2. Unmarried women include single, widowed and divorced women.
3. Although the latest available data correspond to 2008, we have decided to use data for the year 2007 in order to avoid the exceptional effects of the current economic crisis.
4. In 2006, according to data from EPA, the average wage of men is a 5.62 per cent higher than that of women in ICT-occupations.
5. These variables are used in an attempt to include the main labour features of the jobs that make up ICT employment. We are aware that other variables must be included. However, these are the main aspects included in Spanish Labour Force Survey.
6. For reasons of statistical significance, some aggregation has been done.
7. In order to include women's domestic circumstances, two possible approximations have been considered: being a mother and being married. The first would be of enormous interest but the Spanish Labour Force Survey data barely touch on this situation. However, we estimated models for both alternatives and marital status always obtained better econometric outcomes than motherhood. So, we finally chose women's marital status in order to organise the analysis.
8. The estimates respond to the following equations:

$$Y_i = \frac{1}{1+e^{-\alpha-\beta_k X_{ki}}} + u_i \quad \text{Prob}\,(Y_i = 1) = \frac{1}{1+e^{-(\alpha+\beta_k X_{ki})}}$$

   where $Y_i$ represents the event to be evaluated: being employed in an ICT-skilled occupation as opposed to other occupations; and *Prob* $(Y_i = 1)$ is the probability of such events occurring. The $X_{ki}$ variables refer to the personal and labour characteristics determining the event to be verified.
9. This conclusion is obtained from the estimate of a logit model similar to the one herein presented, but where the dependent variable (ICT employment) is defined from the viewpoint of activity sectors producing ICT goods and services, and where the independent variable 'activity sector' has been substituted by that of 'labour occupation held'. The complete results of this estimation are available on request.
10. The variables related to the type of working day (part-time or full-time) and age-squared were also taken into consideration, but these were finally eliminated due to their lack of significance and low contribution to the model adjustment.

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