Knowledge and Job Opportunities in a Gender Perspective:

Insights from Italy✤

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Abstract

The paper proposes an enlargement of the traditional notion of human capital, by conceptualising knowledge in a comprehensive and multidimensional way. In our empirical operationalisation, knowledge encompasses several formal and informal skills, to complement the mainstream view narrowly concerned with education and on-the-job training.

We consider the the case of Italy under a gender perspective. As it turns out, the impact of knowledge on men's and women's employment statuses and wages is very different. Our results point out that despite much rhetoric about the reduction (or even the reversal) of gender gaps in education, women often lack the main skills and competencies that can profitably be deployed in the labour market. Unsurprisingly, in Italy women's accumulation of labour market experience is mostly hindered by unpaid housework burdens. However, when adopting an extensive definition of knowledge these activities may be regarded as a source of relevant knowledge. Yet, problematically they do not seem to be positively valued by the market, either in terms of employability or in terms of wages, thus calling for a serious rethinking of the role of knowledge in shaping men's and women's economic opportunities.

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1. Introduction

It is widely recognized that knowledge is central to the process of economic growth and job creation, and not only in Western countries. Human capital has been at center stage of economic theory both in mainstream microeconomics, in the wake of the works by Becker (see for example Becker, 1964), and mainstream macroeconomics (especially after the work by Romer, 1990). Even in its proponents' aims, the concept of human capital was conceived as a multidimensional concept, referring to the stock of competences, knowledge and personality attributes embodied in the ability to perform labor so as to produce economic value (Mincer, 1974). However, it is nowadays current practice to look at best at only two dimensions: (i) formal education, and (ii) work-related skills. By contrast, the increasing diffusion of information networks has progressively accrued the importance of tacit knowledge, in the form of general skills, abilities and comprehensive competencies, on labor market outcomes making it easier and less expensive to access and to efficiently use general information. Thus, in this paper we try to extend the traditional focus on education and labor market training to encompass a wider set of constituent variables of human capital.

Sex differences have widely been considered in the stream of literature on human capital. Ever since Becker posited different returns on different forms of human capital as the founding block of the sexual division of labor in the household (Becker, 1985), the New Household Economics literature has sought to use the differences in the monetary benefits of education as a means of explaining practically the entire social construction of gender roles. Besides the issue that such a position may lack realism, in so far as millennial social structures such as patriarchy and gender-based discrimination are here reduced to a "simple" matter of financial expediency (and possibly limited to contemporary capitalist societies only), this strand of human capital theory is especially problematic from a feminist perspective since it assumes that (a-gendered) individuals decide on their education and training by rationally weighing the associated prospective benefits and costs (David Colander and Joanna Wayland Woos, 1997).

Indeed, the feminist literature has frequently tout-court dismissed neoclassical explanations of gender roles as unrealistic and irrelevant (see for example the works collected in Barker and Kuiper, 2003; or Ferber and Nelson, 2003). However, in this paper we argue that feminist scholars and activists should not throw out the baby with the bath water, as an opportunely

extended notion of knowledge may convey relevant information on gender and gender roles. Indeed, a high level of education is more relevant for the career dynamics of women than of men (for the case of Italy see Cipollone and D'Ippoliti, 2011): women enjoy higher returns to education and training than do men, while men exhibit higher returns from their occupational status. However, recent studies show that women receive less training than men in terms of training hours; such a gender training gap may intensify the relative difficulties of women to enter and to remain in the labor market with better job conditions and better career prospects. Especially in the light of the ongoing process of population ageing, which itself is a gendered phenomenon, increasing and updating adults' skills and competencies will become increasingly crucial (Corsi et al., 2010). Moreover, the ability to efficiently use Information and Communication Technologies (ICT) could improve the likelihood of women to find a job after a career interruption, while knowledge in terms of financial literacy may raise their intra-household empowerment, which in turn positively affects the willingness to take up a job and to continuously participate in the labor market along the entire life-cycle.

These facts strongly motivate the use of a more comprehensive indicator of knowledge rather than education only in order to discuss career dynamics under a gender perspective. We propose a modification and enlargement of the traditional concept of human capital, which we will refer to as "knowledge" in order to avoid unwarranted assumptions on the rational process of its accumulation. We specifically consider some formal and informal skills to complement the more traditional analyses of education and on-the-job training.

By considering the case of Italy, we estimate the interrelation and joint impact of education, skills and labor market experience on men's and women's employment status and wages. Italy is an especially interesting case study because knowledge has been put at the center of the European Union's strategy for growth and social cohesion through the "Lisbon Agenda" first, and most recently with the new "Europe 2020" strategy framed by the European Commission "to become a smart, sustainable and inclusive economy" (needless to say, "smart" is meant here as a reference to the role of knowledge in the economy and its identification as the main policy tool to boost economic growth in Europe).[1] Yet, Europe's labor markets exhibit relevant gender differentials in terms of employment, unemployment,

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[1] Economic and social policy (apart from monetary policy for countries who adopt the euro) are not directly set by the European Union. However, EU Member States used to coordinate their policies through periodic benchmarking and exchange of information (the so called Open Coordination Method). Up to 2010 common objectives and policy tools, together with indicators to measure advancement towards such goals, were defined by the Lisbon Agenda that, among other things, envisaged the target of 60% for women's employment rate in 2010. This year the European Commission proposed a new long-run strategy and a new set of policy objectives named "Europe 2020". More information can be found at the Commission's website: http://ec.europa.eu/europe2020/

activity rates, and labor incomes, and among these, Italy's labor market exhibits even greater gender imbalances than the EU-27 average. For instance, the current women's employment rate is the second lowest after Malta, and after Italy failed to reach many of the objectives set forth by the Lisbon Agenda (especially in terms of women's employment) there are grounds to expect that it will fail to reach some of the objectives set by the Europe 2020 roadmap as well.

2. Gender and knowledge

We propose a multidimensional view of knowledge, including the following dimensions: education (i.e. schooling and continuing (or adult) education); job and labor market related skills (i.e. on-the-job and off-job training, experience, etc.); economic and financial literacy; ICT skills; general informal skills, such as basic household management skills. Most of these dimensions exhibit relevant gendered features.

With respect to education, during the second half of the twentieth century (and in the twenty-first so far) the educational attainment of women has progressively increased in nearly all industrialized and in many developing countries. However, while women are now more often involved in university education, in most countries they constitute only a minority of the students involved in the highest educational (i.e. graduate) programs (see for example Stalker and Prentice, 1998; Leonard, 2001). What may be even more relevant, is that aggregate figures hide a very high gender segregation in education, which paves the way for subsequent segregation in the labour market.[2] According to an elaboration by the European Commission (2006), while 60% of PhD students in education and pedagogy are women (72% in Italy), only 15% of PhD students in engineering are women (13% in Italy) and only 19% in computing (25% in Italy).

The other dimensions of knowledge listed above have progressively shown to exhibit a relevant influence on gender inequality and power structures in contemporary societies. Financial literacy is key to a balanced smoothing of consumption over time, especially in the context of a general move of European pension systems towards pre-funded schemes based on individual decisions to save. In such an institutional environment, the unwillingness or

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[2] As noted by Anne M. Hill and Elizabeth M. King (1995), "education enhances labor market productivity and income growth for all, yet educating women has beneficial effects on social well-being not always measured by the market." Yet, due to the nature of our data in the rest of the paper we do not consider such well-being effects.

inability to properly plan one's future resources may aggravate the already substantial gender gap in elderly persons' at-risk-of-poverty rates (Corsi et al., 2010). It is thus worrying to note that, for example, in the USA women exhibit substantially lower financial literacy than men, and that this is related to a lower propensity to plan (Lusardi and Mitchell, 2008). The issue is partly related to intra-household dynamics, for example Clark et al. (2009) show that women are more likely to rely upon others (i.e. their breadwinner spouses) for their expected welfare in old age. In the case of Italy, Addis (2008) shows that not only many women are unconcerned with financial planning in the family, but a considerable number does not even possess precise information on their family's resources (and on their husbands' income in particular). Financial illiteracy is especially diffused among women at a higher risk of poverty and thus the increasing presence of microcredit institutions has frequently served to provide a useful and widespread range of services – such as the joint supply of financial products and training-related facilities – to overcome this women-specific vulnerability. For example, a research focusing on Mediterranean countries showed that the impact of microcredit on women's empowerment is associated to a greater participation in intra-household savings and investment decisions and enlarged capacity to undertake purchases in autonomy (Corsi et al., 2006).

Information and Communication Technologies are at the core of the European strategy for an economic growth founded on knowledge.[3] The Digital Agenda is one of the main initiatives for Europe's economic policy in the coming decade and among its main goals it includes the objective of promoting a higher participation of young women and women returners (i.e. adult and relatively older women who enter the labour market after a long period of inactivity) in the ICT workforce. Such a focus on women is due to two concurrent causes: on the one hand, women's employment rates across European countries are still significantly lower than men's, and there is thus a greater potential for job growth for the female workforce; on the other hand, on top of the previously mentioned underrepresentation of women among graduate students in scientific and technological fields, there is also a more general gender gap in basic ICT skills. Accordingly, a report by the European Commission notices that among persons of working age there is a 6% difference in the diffusion of internet users between European men and women (61% as opposed to 55%) but the gap among "frequent" users (at least once a

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[3] Setting the agenda for the coming decade, the European Commission writes: "The crisis has wiped out years of economic and social progress and exposed structural weaknesses in Europe's economy. [...] Faced with demographic ageing and global competition we have three options: work harder, work longer or work smarter. We will probably have to do all three, but the third option is the only way to guarantee increasing standards of life for Europeans. To achieve this, the Digital Agenda makes proposals for actions that need to be taken urgently [...]" (European Commission, 2010a, p. 3).

day) increases to almost 40% (European Commission, 2010b). The poor endowment of basic ICT skills also explains the low participation of women in ICT-related tertiary education, which frequently reinforces the gender horizontal segregation and the exclusion of women from one of the few industries that was least affected by the economic crisis (for a recent review see Anderson et al., 2008). Moreover, the efficient and immediate use of ICT facilities may increase participatory relations in organizations and workplaces and allow for a greater flexibility of working places and times (Soete, 2001), thus possibly facilitating the conciliation of work and family life. However, it has also been shown (Corsi, 2004) that, though women are more involved than men in the use of e-mail in top-down communication (that is within command-and-control hierarchies), their introduction does not seem to have brought about a greater participation of women in decision-making. As the works collected by Walby et al. (2007) report, the introduction of ICTs stimulated a growth of non-standard employment forms beneficial to women's employment and, at the same time, led to a "re-gendering" of the ICT workforce by segregating women to the lower tail of the occupational hierarchy in ICT-using and ICT-producing industries.

With respect to the set of job and labor market related skills more in general, a gender approach to adult training and lifelong learning has become increasingly relevant as it has been shown that, while women constitute the majority of workers and jobseekers enrolled in adult education programs, numerous gendered disadvantages still exist for women learners. On the one hand, research showed that women may struggle to continue or even quit formal education due to unpaid work burdens (Blundell, 1992; Stalker, 2001; Shipley, 1997). On the other hand, due to these gender-specific responsibilities women exhibit more irregular and fragmented careers and thus they are less likely to accumulate a profitable labor market experience and benefit from it. Conversely, women returners to the labor market may capitalize on training and lifelong learning opportunities in the transition from unpaid to paid work to a greater extent than men (see for example Campbell, 1993; Stalker, 2001; Heenan, 2002).[4]

Mainstream theory interprets the distinction between job and labor market related skills by focusing on the differences between specific and general knowledge, whereby firm-specific knowledge produces an extra-productivity of workers that result in quasi-rents (Becker, 1964). Given the limited availability of such data, in this paper we try to distinguish the two

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[4] An issue on which further research is needed is the question raised by feminist scholars and pedagogues, on the extent to which gender segregation in education and training and the very content of learning act to reinforce gender roles and stereotypes (Sayman, 2007; Jackson, 2003).

notions by referring to tenure, the time spent by workers working for their current employer, as job-specific skills, and to workers' effective age, that is the time passed since workers' entrance in the labor force, as labor market related skills. As it turns out, the two variables are highly correlated for men (88% for working age men in 2008),[5] possibly due to Italy's low workers' mobility and very low turnover, but they are considerably less correlated for women (78% for working age women in 2008), mainly due to their more frequent career interruptions. However, as suggested by the feminist literature we do not consider housework and care as unproductive activities (irrespective of their being carried out within the family or in the market). Thus in the set of knowledge components we finally include general informal skills, such as basic household management skills, in order to investigate the relevance of the home as a place of learning (Gouthro, 2005). To do so, we separately consider what we called workers' effective age and the number of years spent in paid employment. As shown in the next section, while the two quantities tend to coincide for men (preventing their joint use in regression analyses, among other things), their difference is informative of women's work trajectories in a life-cycle perspective.

3. Expanding the notion of knowledge

To estimate the relevance of knowledge in determining men and women's work trajectories we use multivariate techniques to summarize the several dimensions described above into a few variables. We use the 2006 wave of the Bank of Italy's Survey of Households' Income and Wealth (SHIW) because on that occasion a special module on financial literacy and other dimensions of knowledge was included.[6] The sample (representative of Italy's population) is composed of 9,730 persons of "working age", by which we denote, with some modification upon the common practice in EU, all individuals between 25 and 60 years old (included). Of these, 4,973 are women and 4,757 are men. We also defined a more restrictive sample of people of prime age, which we define as persons between 25 and 50 years old in order to prevent interference with widespread practices of early retirement. The restricted sample is composed of 3,468 women and 3,309 men.

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[5] This figure is estimated employing the latest wave of the Bank of Italy's Survey of Households' Income and Wealth.
[6] Results for the 2008 wave, the latest available at the time of writing, are not qualitatively different when allowance for missing variables biases is made. Detailed results are available from the authors upon request.

We mainly focus on the impact of knowledge on employment status[7] and labor income. In the sample 82% of working-age men and 87% of prime aged men are employed, as opposed to 56% of working-age women and 61% of prime aged women. Mean hourly wages in the sample are 8.95€ for working age men (8.59€ for prime aged men) and 8.52€ for working age women (8.33€ for prime aged women).

As described in the previous section, the first set of variables employed in explaining these gender gaps concerns formal education and schooling. We consider six levels of educational attainment, ranging from no education to postgraduate training, distinguishing between the two levels of secondary education in accordance with Italy's institutional setting.[8] However, in order to better highlight the role of education in shaping individuals' job opportunities we also distinguish six broad fields of study: vocational, humanistic and social studies for secondary education degrees and scientific, humanistic and social studies for tertiary and upper educational levels.[9] The distributions of educational attainments, average number of years spent in education, and field of study are summarized in Table 1. As it is shown, the younger prime age individuals are better educated than the working age persons, and prime aged women are characterized by the highest average number of years of education. Women exhibit a significantly lower participation in vocational training at all ages, while they are overrepresented in the social sciences field (no significant differences emerge in the humanistic and scientific fields).

Table 1. Educational attainment and field of study, by sex and age

	Working age		Prime age	
	M	W	M	W
Educational attainment				
No education (0 years)	0.5%	0.7%	0.3%	0.4%
Primary ed. (5 yrs)	7.5%	11.6%	3.3%	5.2%
Lower Secondary (8 yrs)	38.5%	32.9%	39.5%	33.2%

[7] Thus, we take a binary approach to employment: individuals are considered to be employed or not employed. However, we recognise that important issues are also the engagement in part-time work or the distinction between unemployed and inactive population. Moreover, we specifically focus on women's employment rather than women's participation for several reasons. On the one hand, we maintain that among the key labor market indicators the employment rate constitutes the best index of labor market dynamics and functioning. On the other hand, in terms of the reciprocal influence of the key labor market indicators, the employment rate can play the major role. Finally, Italy lags well behind the Lisbon target in terms of women's employment rate and this index constitutes thus a major priority for economic policy.

[8] Up to 1996 it was possible to quit school at age 14, that is (usually) after a minimum of 8 years of education. In 1997 compulsory education was extended up to 16 years old, although in the form of an "individual right to state-financed education". Being enrolled in formal education at least up to 16 years old became a binding obligation only in 2007.

[9] In Italy's educational system scientific studies in tertiary education are jointly classified with humanistic studies under the heading "liceo".

Upper secondary (13 yrs)	42.1%	40.3%	44.8%	44.7%
Tertiary ed. (17 yrs)	11.0%	14.3%	11.6%	16.1%
Post-graduate ed. (19/20 yrs)	0.4%	0.3%	0.5%	0.3%
Mean edu. Years	10.9	10.8	11.3	11.5
Field of education				
Sec. vocational	28%	18%	30%	20%
Sec. humanities	6%	4%	6%	5%
Sec. social	2%	6%	2%	6%
Tert. scientific	5%	7%	5%	8%
Tert. humanities	3%	4%	4%	6%
Tert. social	1%	8%	1%	7%
Population	4,757	4,973	3,309	3,468

Source: SHIW (2007). Note: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. In case of discordance, field of education refers to the highest educational attainment.

Concerning job and labor market related skills, our sample does not allow us to account for workers' participation to formal training. However, we are able to capture three different measures of acquired general and specific skills and competencies. As already mentioned, we consider the difference between workers' age and their age at the time of first entry in the labor force as a measure of effective workers' age and interpret it as an indicator of general work-related knowledge. As shown in Table 2, it is significantly higher for men than for women both of working and of prime age. In the case of men, this measure of labor market experience is highly correlated to our second dimension of work-related knowledge, i.e. job experience, the number of years (and months) spent in actual employment. The correlation between the two variables, as mentioned, is significantly lower for women, who exhibit much more frequent career interruptions (in 2006, the correlation was 78% for women as opposed to 87% for men). We also computed a final measure of work-related knowledge, arguably closer to the neoclassical notion of firm-specific knowledge, that is tenure, the number of years spent working for the current employer. As for the other two variables, women's mean value is significantly lower than men's, as a consequence of both women's lower participation in the labor market and women's overrepresentation among the workers employed on flexible and fixed-term work arrangements (Cipollone and D'Ippoliti, 2010).

Finally, work-related knowledge may be acquired by means of unpaid work activities, such as productive activities carried out within the family, housework and care work. A relevant question is how tacit skills and competencies acquired at home are valued in the market, and if they may become useful (possibly in certain industries such as services to household).

Information on unpaid work may partly be ascertained by investigating the differences between our effective workers' ages and their labor-market experiences. However, such differences may also imply either involuntary job loss or a (temporary or permanent) withdrawal from the labor force to enjoy leisure activities. In order to account for these eventualities, we add upon the differences between our effective workers' ages and their labor-market experiences with a measure of the demand for unpaid work within the household, proxied by (i) being in a long-term affective relationship implying cohabitation (that for reasons of simplicity we denote as "married" status); and (ii) co-living with an elderly person (above 75 years old) or having young children (below 3 years old).[10]

Table 2. ICT skills, financial literacy and labor market related knowledge, by sex and age

	Working age		Prime age	
	M	W	M	W
Labor market				
Eff. worker's age	22.93	16.54	17.03	12.92
Std. dev.	(12.61)	(14.13)	(9.77)	(10.81)
Job experience	18.21	11.46	13.04	9.08
Std. dev.	(12.22)	(11.69)	(9.49)	(9.25)
Tenure	7.26	5.02	6.00	4.53
Std. dev.	(9.45)	(8.36)	(7.8)	(7.35)
ICT skills				
Computer use	60.7%	60.1%	60.2%	62.7%
Computer at home	56.3%	55.7%	55.4%	57.8%
Internet use	50.7%	50.1%	50.0%	52.2%
e-buy	14.0%	13.3%	14.6%	14.0%
Financial literacy	(% correct answers)			
Quiz 1	31.2%	30.7%	30.4%	31.4%
Quiz 2	55.3%	56.5%	52.8%	56.9%
Quiz 3	26.5%	25.6%	25.1%	25.9%
Quiz 4	32.3%	32.3%	31.2%	31.3%
Quiz 5	47.9%	50.7%	45.0%	49.7%
Quiz 6	50.9%	53.5%	48.8%	52.7%

Source: SHIW (2007). Note: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Under the heading ICT skills, percentages denote the proportion of individuals satisfying the requirement. Under the heading Financial literacy, percentages denote the share of individuals selecting the correct answer; questions are listed in Annex.

As suggested by Cipollone and D'Ippoliti (2011), the impact of being married on employment may be considered as a measure of traditional gender roles, while co-living with elderly people or children is a proxy of care work burdens. In our sample women appear to

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[10] Alternative specifications, considering 70 or 80 years old for the elderly dependent and 6 years old for children do not qualitatively change the results. Detailed results are available from the authors upon request.

face a slightly higher demand for unpaid work in the household, since men more frequently live alone.[11] Due to the prevalence of heterosexual cohabitation in the working age population, however, such difference is very small (though statistically significant) and living arrangements on average tend to be equal for men and women: by attributing an equal weight (equal to 1) to all the mentioned sources of demand for unpaid labor and summing them up, on average men face a demand equal to 0.94 (that is on average each working age man lives with almost one person in need for care) and women 0.97.

Next, exploiting a specific set of questions available in our dataset, we integrate information on education and work-related knowledge with two further dimensions of knowledge: economic and financial literacy and ability to use information and communication technologies. With respect to the former, six questions were asked[12] to measure the respondents' ability to understand the working of inflation, the meaning of basic financial terms such as "bonds" and "shares", and their ability to solve basic financial arithmetic problems (all questions and answers are listed in the Annex). For each question we created synthetic dummy variables assuming a value of 1 if the individual responded correctly and 0 if otherwise (descriptive statistics are shown in Table 2). As it emerges from Table 2, women in Italy do not exhibit pronouncedly lower levels of financial literacy, differing from what was found for the United States.[13] Concerning ICT skills we selected four potential proxies by considering the following questions in the survey: (1) if the person uses a computer at home or at work; (2) if his/her family has a computer at home; (3) if the person uses the internet for emails or surfing the web; (4) if the person bought goods or services online. Similarly we created a dummy variable for each of these questions.

In order to summarize the information contained in the former proxy variables for financial literacy and ICT ability, and to try to retain the relevant information on the person's skills into a few meaningful indicators abstracting from other sources of variance (such as the person's financial means), we carried on a factor analysis on the matrix obtained by computing tetrachoric correlation of all the mentioned dichotomous dummy variables (on the

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[11] By contrast women tend to leave alone in old age due to divorce or widowhood (Corsi and Samek, 2010).

[12] These special questions were only asked to a random half of the sample, composed of persons whose year of birth ends by an odd number. We imputed predicted answers to the other half by using multiple iterative techniques based on probit analysis (since all variables are dichotomous) employing the ICE module on the software STATA 9. More information is available from the authors upon request.

[13] As suggested by some participants to the IAFFE session on "Frontiers of Feminist Economics" at the 2011 ASSA Meeting in Denver, such difference may be due to the different kind of questions included in the surveys. Accordingly, the questions asked in Italy's SHIW are relatively easier and more straightforwardly related to the actual knowledge of basic financial concepts, requiring a more limited use of mathematic or logic skills (see Annex).

9,187 observations of persons of working age). We followed the standard practice in selecting the (two) factors that exhibit an eigenvector greater than one and that contribute to the explanation of a reasonable share of variance, and then rotated the factors according to the varimax method. Results are shown in Table 3. As it emerges, the two factors clearly imply a cluster of financial skills (Factor 1) separated by a second factor summarizing ICT skills (Factor 2). Thus, the two factors are liable for straightforward economic interpretation and allow us to keep more than half the variance of the original variables with the exception of the financial problem-set questions which are more likely to also enclose other skills (mostly in the field of mathematics, such as the ability to read a graph or to make basic computations).

Table 3. Factor analysis on ICT skills and Financial literacy, rotated factor loadings

	Factor 1	Factor 2	Uniqueness
Quiz 1	0.6942		48.8%
Quiz 2	0.6976		48.8%
Quiz 3	0.469		73.0%
Quiz 4	0.632		56.3%
Quiz 5	0.6631		54.1%
Quiz 6	0.5817		65.6%
Computer at home		0.8364	28.1%
e-commerce		0.8366	29.4%
Internet use		0.7957	34.4%

Source: SHIW (2007). Note: Year 2006; sample restricted to working age, defined as the [25-60] age bracket. Blanks represent absolute loadings smaller than 0.3; factor analysis performed on the matrix of tetrachoric correlations.

In conclusion, we were able to gather variables measuring the number of years and the field of education, three dimensions of work-related experience, proxies of the unpaid work burden, and two indexes measuring ICT skills and financial literacy. We excluded the information on the field of study because it cannot be reduced to a quantitative measure and normalized all the quantitative variables by subtracting their (working age) population average and dividing by the standard deviation. These normalized variables were then collapsed by means of arithmetic average, to create a synthetic index of Knowledge. We also created a second index, Extended Knowledge, constructed as the previous one with the

addition of a further dimension related to care burdens, in order to measure the skills acquired by doing unpaid work. This last variable was created by summing the number of people in the household that assumedly imply a demand for care, as described above. This variable has been averaged jointly with the others by means of arithmetic average. In other words, both indexes of Knowledge and Extended Knowledge are constructed by attributing an equal weight to all the component variables (three for the labor market, one for education, one for ICT skills and one for financial literacy in the standard case, plus a further one for unpaid care work in the extended case).

Descriptive statistics for the two indexes are reported in Table 4, distinguishing between the variance of the knowledge indicators in the population – within-group Knowledge – and the variance between the several dimensions of knowledge for a single person (since the Table shows the average value of the variance of the Knowledge indicator across all individuals, it may be interpreted as the variance of the Knowledge of the "average individual").

Table 4. Measures of Knowledge and Extended knowledge, by sex and age

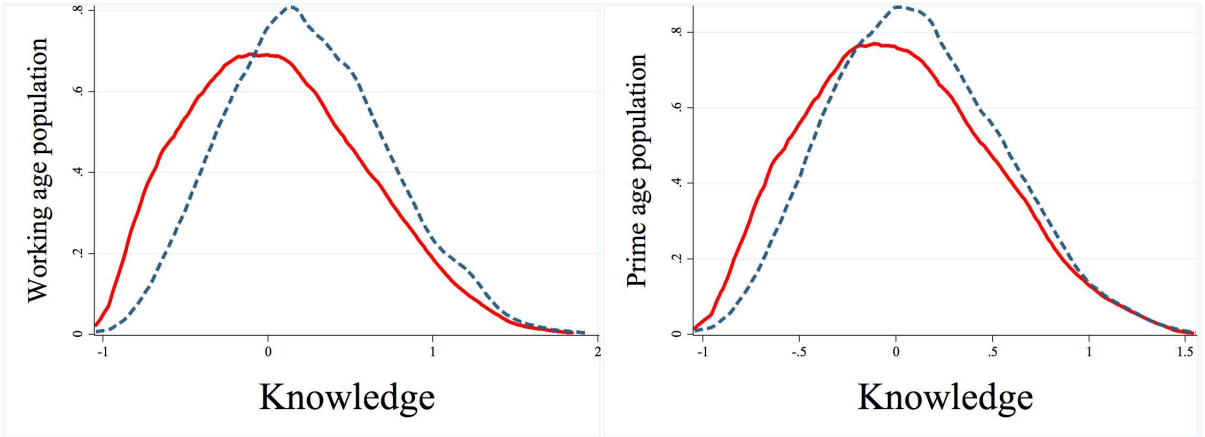|	Working age		Prime age	
	M	W	M	W
Knowledge	0.24	0.06	0.11	0.02
Std. dev.	(0.49)	(0.53)	(0.44)	(0.48)
Extended knowledge	0.20	0.05	0.09	0.03
Std. dev.	(0.46)	(0.47)	(0.44)	(0.43)
Individuals' std.dev. of Knowledge	0.80	0.74	0.74	0.73
Individuals' std.dev. of Ext. knowledge	0.82	0.78	0.78	0.78
Individuals' kurtosis of Knowledge	0.97	0.90	0.90	0.88
Individuals' kurtosis of Ext. knowledge	1.01	0.96	0.96	0.95

Source: SHIW (2007). Note: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Standard deviation in parentheses and italics represent between-persons variability of the indexes of knowledge; individuals' std.dev. and kurtosis of the variables Knowledge and Extended knowledge measure, for each person, the variability between his/her different dimensions of knowledge.

As shown in Table 4, women exhibit lower average values of both Knowledge and Extended Knowledge (the difference is again small but statistically significant). Moreover, the men's group appears to be less heterogeneous in terms of Knowledge, as they exhibit a lower variance than women both in the working age population and in the prime age population. Women's lower concentration is graphically shown in Figures 1 to 4, whereby it is evident

that a majority of women of working age exhibit values smaller than men's for both indicators of knowledge (since the distributions approximate Gaussian distributions, mode and median values coincide). Prime aged women partly filled the knowledge gap, but there is still a substantial number of women who cluster at substantially lower values than men's and women's mean values. As shown in the Annex, the knowledge gender gap is substantially lower for prime aged individuals, especially when the knowledge indicators are constructed excluding firm-specific knowledge, i.e. excluding workers' tenure.

Finally, as shown in Table 4, for each individual the indicator of Knowledge seems to be constructed by averaging more heterogeneous skill levels (across the several dimensions) for a single man than for a single woman. Indeed, at the individual level, both prime aged and working-age men exhibit higher (mean) standard deviation of the Knowledge and the Extended Knowledge indexes. In particular, women's experiences appear as more diverse through their life course, while men's high standard deviation is a consequence of single very high values, as evidenced by their higher (mean) kurtosis of the two indexes in both age brackets. In other words, men appear to specialize more (often in labor-market experience) than women.

Figures 1 to 4. Distribution of Knowledge and Extended knowledge, by sex and age
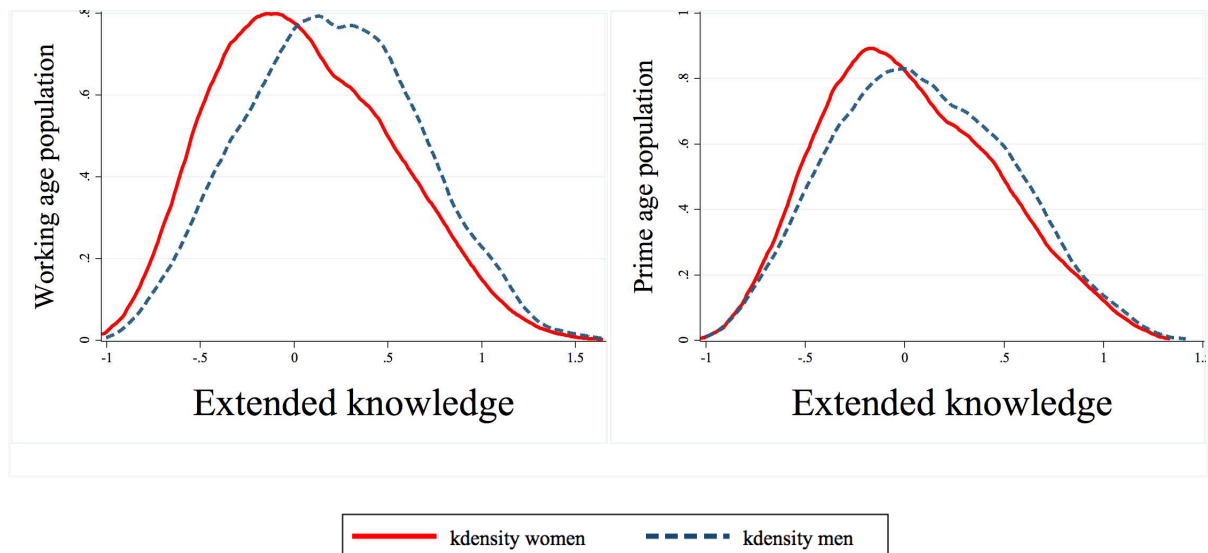
Source: SHIW (2007). Note: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Kernel estimation (Epanechnikov).

4. The economic relevance of knowledge

4.1 Employment

We investigate the economic relevance of knowledge in the specific sense of the private returns to knowledge in terms of employment and of labor income. To do so, we first estimate a probit model of the probability of being employed separately for men and women.[14] Marginal effects are reported in Table 5.

A comparison of the sex-specific estimates highlights a number of significant differences in the impact of individual and household level variables (for example concerning the impact of the "care" variable). As a consequence, we may conclude that active policy interventions aimed at boosting employment should be very different according to their target of either men's or women's employment, and sometimes their effects may even be opposite (see Cipollone and D'Ippoliti, 2011). More in general, from a simple comparison of the sex-specific estimates it emerges that a model based on an "average" a-gendered economic agent (i.e. on a representative agent) may fail to grasp relevant economic dynamics. Thus, men and

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[14] We also run a pooled regression (i.e. jointly on men and women), from which it emerges that Knowledge and Care are sufficient to explain the observed differences in employment between men and women of working age. Among prime aged individuals, instead, an unexplained residual difference lowers women's probability of being employed, given all the other variables, by roughly 50%. More results are available from the authors upon request.

women cannot simply be conceived of as heterogeneous. Moreover, sex-specific theoretical models are needed to understand their behavior and separate empirical models are necessary for empirical analysis (i.e. the notion of "diversity" introduced by D'Ippoliti, 2011).

From Table 5 it emerges that knowledge exerts a large and significant impact on individuals' probability of employment. For women, such an impact is significantly larger than for men.

Table 5. The employment impact of knowledge, marginal effects

	Working Age		Prime Age		Working Age		Prime Age	
	M	W	M	W	M	W	M	W
Care	43.7%	-26.2%	34.3%	-26.7%				
	(0.052)**	(0.039)**	0.06**	0.043**				
Knowledge	80.0%	181.1%	165.4%	205.4%				
	(0.087)**	(0.081)**	0.17**	0.104**				
Kurtosis Knowledge	-63.2%	-73.9%	-94.1%	-93.0%				
	(0.11)**	(0.097)**	0.161**	0.116**				
Ext. knowledge					123.7%	153.1%	187.8%	151.9%
					(0.096)**	(0.081)**	(0.186)**	(0.103)**
Kurt. of Ext. knowledge					-68.3%	-72.0%	-75.6%	-79.4%
					(0.107)**	(0.099)**	(0.155)**	(0.116)**
Observations	4757	4973	3309	3468	4757	4973	3309	3468
Log-likelihood	-1.90E+03	-2.50E+03	-933.916	-1.70E+03	-1.90E+03	-2.70E+03	-942.254	-1.80E+03
Chi squared	369.665	898.767	267.372	596.843	360.789	665.706	249.428	457.491
AIC	3894.283	4963.763	1917.832	3358.788	3929.194	5429.921	1932.507	3740.464
BIC	4055.967	5126.558	2070.442	3512.572	4084.411	5586.204	2079.013	3888.096
Deg.s of freedom	24	24	24	24	23	23	23	23
Pseudo R2	0.14	0.28	0.273	0.288	0.132	0.211	0.267	0.205

Source: SHIW (2007). Notes: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Standard deviation in parentheses. Marginal effects denote the mean variation in individuals' probability of being employed corresponding to an infinitesimal variation of the independent variable, estimated at the mean value of the independent variable; for dummy variables marginal effects denote the average variation in individuals' probability corresponding to the modification of the independent variable from 0 to 1. Control variables include real and financial wealth, age (squared), Regional fixed effects and a constant term.

A unitary change in the indicator of knowledge, approximately correspondent to a shift from the mean value to the top 5% of the distribution, corresponds to an almost doubled probability of being employed for men (+80%) and almost tripled for women (+180%). For men, the impact is considerably higher for the population of prime age, while for women the coefficients are approximately the same. Extending the notion of Knowledge by considering our indicator of Extended Knowledge increases the impact for men and lowers it for women. This result depends on the critical fact that care burdens are positively associated to men's

employment and negatively to women's, thus reflecting the traditional division of labor in the household.

Specialization (for example in the form of high imbalances between work-related knowledge, education, and skills), as measured by the kurtosis of the knowledge indicators, appears to be negatively associated to both men's and women's employment, with no significant difference in the value of the coefficient between men and women or between the prime age and the working age samples.

In conclusion, Knowledge seems a crucial determinant of the likelihood of employment, especially for women. More importantly, for women the amount of skills and competencies acquired by practicing unpaid work at home does not seem to be valued by the market. On the contrary, the demand for care constitutes a constraint to women's employment, even when controlling for other variables such regional factors and real or financial wealth.

When considering disaggregated variables (Table A1 in the Annex), it emerges that the largest gender differences occur with respect to the returns to the labor market components of Knowledge, namely effective worker's age and job experience. Specifically, both indicators are positively associated to the probability of being employed, though the second boosts the chances of employment more so for women. Concerning formal education, the returns to secondary education would appear as higher for men than for women. Tertiary education, with the exception of the social sciences, appears instead to benefit women more than men.

The proxy variables for the specific skills considered here appear to exert ambiguous impacts. For women, ICT skills positively increase the probability of employment for the working age population, while financial literacy is never statistically significant. On the contrary, for men of working age financial literacy lowers the probability of employment (though not for prime aged individuals). This peculiar result may be due to an income effect especially in the case of older workers, given the high correlation between financial literacy and accumulated financial wealth.[15]

Finally, concerning the set of care-related variables, gender differences are impressive. For women there are negative and significant impacts from having small children (less than 3 years old), from having a partner and from cohabiting with an old-aged person (above 80 years old). These same variables exert no significant impact on men's chances to be employed and cohabiting with a partner is even positively associated to a higher probability of men's

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[15] Although in the estimations we control for households' real and financial wealth, a study from the Bank of Italy suggests that these are among the least reliable variables in the sample, given a certain reluctance in the population to uncover such private information in a survey (Biancotti et al., 2004).

employment. This may denote that women's unpaid work facilitates men's employment in the market by complementing it and making it easier (and in some cases may even be instrumental to it).

4.2 Labor income

We next considered the returns to Knowledge in terms of labor income by estimating Heckman models of (the logarithm of) hourly wages, using the previous probit models as selection equations. As shown in Table 6, women appear to benefit from slightly higher returns to knowledge in prime age and slightly lower in working age. In particular, a unitary change in the indicator of knowledge corresponds to an increase of almost 19% of the log of hourly wage for men and between 15% and 17% of the log of hourly wage for women. Specialization is rarely statistically significant, but when it is women appear to benefit from it more than men.[16]

Table 6. The labor income impact of knowledge, log. of hourly wages

	Working Age		Prime Age		Working Age		Prime Age	
	M	W	M	W	M	W	M	W
Knowledge	0.19	0.154	0.16	0.187				
	(0.02)**	(0.03)**	(0.025)**	(0.029)**				
Kurtosis Knowledge	0.019	0.035	0.051	0.028				
	(0,023)	(0,027)	(0.028)*	(0,032)				
Ext. knowledge					0.199	0.108	0.17	0.157
					(0.021)**	(0.047)**	(0.026)**	(0.032)**
Kurt. Ext. knowledge					0.025	0.073	0.049	0.045
					(0,024)	(0.032)**	(0.028)*	(0,033)
Statistics								
lambda	-0.154	-0.03	-0.15	-0.016	-0.155	-0.092	-0.142	-0.049
	(0,027)	(0,035)	(0,028)	(0,025)	(0,032)	(0,064)	(0,029)	(0,033)
Rho ath	-0.521	-0.097	-0.538	-0.053	-0.524	-0.3	-0.509	-0.159
	(0,093)	(0,112)	(0,104)	(0,081)	(0,108)	(0,208)	(0,109)	(0,108)
ln-sigma	-1.132	-1.173	-1.186	-1.188	-1.132	-1.15	-1.192	-1.179
	(0,039)	(0,034)	(0,043)	(0,037)	(0,042)	(0,049)	(0,044)	(0,037)
sigma	0.322	0.309	0.305	0.305	0.323	0.316	0.304	0.308
p	0	0	0	0	0	0	0	0
rho	-0.478	-0.097	-0.492	-0.053	-0.48	-0.292	-0.469	-0.158

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[16] If we run the above estimations in the pooled sample (i.e. including both men and women), an unexplained residual, corresponding to a "woman" dummy variable, confirms previous estimations of the presence of a gender pay gap being not accountable for by other observable factors but gender (between 16% and 17% in all estimations).

Observations	3884	4558	2672	3149	3884	4558	2672	3149
Censored obs	945	2282	467	1365	945	2282	467	1365
Log-likelihood	-2.70E+03	-3.10E+03	-1.40E+03	-2.20E+03	-2.80E+03	-3.30E+03	-1.50E+03	-2.40E+03
Chi squared	1086	1181	699	842	1085	1179	688	841
AIC	5567	6318	2983	4417	5662	6725	2989	4855
BIC	5837	6595	3237	4678	5925	6995	3237	5109
Degrees of freedom	16	16	16	16	16	16	16	16

Source: SHIW (2007). Notes: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Standard deviation in parentheses. Marginal effects denote the mean variation in individuals' probability of being employed corresponding to an infinitesimal variation of the independent variable, estimated at the mean value of the independent variable; for dummy variables marginal effects denote the average variation in individuals' probability corresponding to the modification of the independent variable from 0 to 1. Control variables include real and financial wealth, age (squared), Regional fixed effects and a constant term.

When considering disaggregated results (Table A2 in the Annex) it appears that ICT skills benefit men's and women's hourly wages approximately in the same measure (around +1%), while financial literacy is significantly associated to higher wages only for working age men (+3.5%). The returns to education are more similar between men and women, especially for the prime age group, suggesting that the skills distribution and the skills composition of women and men in older ages (between 50 and 60 years old) are less homogeneous compared to those in prime age.

Finally, women benefit significantly more than men from firm-specific knowledge, as their return to tenure is on average 50% higher than men's.

In conclusion, women appear to exhibit higher returns to knowledge, both in terms of returns to education and of returns to work-related knowledge. Women's employment determined to a larger degree by the joint impact of care burdens and knowledge-determined opportunities, and their wages are more significantly affected by our indicators of knowledge. More than for men, while specialization improves employed women's wages, it reduces the ability to obtain a job for women currently excluded from the labor market.

5. Conclusions

After the Lisbon Agenda and the new Europe 2020 strategy, the relevance of knowledge as a driver of individuals' economic opportunities has become widely recognized in Europe. However, the gender dimension of knowledge is most frequently neglected despite the fact that women represent the larger pool of the inactive work force.

By considering the case of Italy, in this paper we showed that despite much rhetoric and expectations about the fact that women have gradually overcome men in terms of educational attainments, they still lag behind in terms of the main skills and competencies that can profitably be used in the market. Indeed, distinguishing the concept of knowledge from the solely formal education seems to be crucial, and it is thus fundamental to focus on gender gaps in all the several dimensions of knowledge, beyond education.

In particular women lack both general and specific knowledge related to the labor market, as measured by tenure and labor market attachment. Women's accumulation of labor market experience is mostly constrained by unpaid work and care work burdens. These activities should be regarded, in our opinion, as a source of relevant knowledge in terms of social and interpersonal skills, managerial and organizational capacities. While from a feminist perspective these skills may be considered to be relevant in any work environment, even from a conservative viewpoint this knowledge should be valued at least in certain industries, such as health, long-term care, and services to the households. By contrast, we find that in Italy the skills and competencies acquired by carrying out unpaid work do not seem to be positively valued by the market, either in terms of employability or in terms of wage.

Even considering just education, the picture seems to be more differentiated than is usually assumed. Despite the substantial growth of women's educational attainments, gender segregation in education is still a relevant issue. This phenomenon compresses both women's employment chances and women's wages, as evidenced by the fact that the returns to education (both in terms of employability and wage) are significantly higher in the case of scientific disciplines than in the humanities. Gender segregation in education is especially problematic because it is very likely to be highly correlated to gender occupational segregation, which in turn is a major source of the gender pay gap. Thus, educational and cultural policies aimed at overcoming traditional gender roles and images among younger students seems to be a very sensible policy option.

On the whole, a note of optimism may come from evidence that gender differentials in the accumulation of knowledge are smaller for the younger population, although prime aged individuals appear to be as affected by traditional gender roles (as measured by the patriarchal sexual division of labor) as older cohorts are.

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ANNEX

A1. Financial literacy: special module of the questionnaire in the SHIW 2006 survey

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QUIZ1
Suppose you receive this statement of account from your bank; can you tell me what sum of money is available at the end of May?
- amount in euros € |__|__|__|__| 1
- don't know 2

(the   interviewer   shows   a   separate   figure,   available   online   at   the   URL
http://www.bancaditalia.it/statistiche/indcamp/bilfait/docum/ind_06;internal&action=_setlanguage.action?LANGUAGE=en)

QUIZ2
Imagine leaving 1,000 euros in a current account that pays 1% interest and has no charges. Imagine also that inflation is running at 2%. Do you think that if you withdraw the money in a year's time you will be able to buy the same amount of goods as if you spent the 1,000 euros today?
- Yes.. 1
- No, I will be able to buy less 2
- No, I will be able to buy more 3
- Don't know 4

QUIZ3
This figure shows the value of two different investment funds over the last four years. Which fund do you think produced the largest return in that period?
- fund 1.. 1
- fund 2.. 2
- the funds earned the same 3
- don't know.. 4
(the   interviewer   shows   a   separate   figure,   available   online   at   the   URL
http://www.bancaditalia.it/statistiche/indcamp/bilfait/docum/ind_06;internal&action=_setlanguage.action?LANGUAGE=en)

QUIZ4
Imagine leaving 1,000 euros in a current account that pays 2% annual interest and has no charges. What sum do you think will be available at the end of 2 years?
- less than 1,020 euros 1
- exactly 1,020 euros.. 2
- more than 1,020 euros.. 3
- don't know.. 4

QUIZ5
Imagine you have only equity funds and stock market prices fall. Are you...? (The interviewer reads the answers aloud)
- better off... 1
- less well off 2
- as well off as before... 3
- don't know.. 4

QUIZ6
Which of the following types of mortgage do you think will allow you from the very start to fix the maximum amount and number of instalments to be paid before the debt is extinguished?
- floating-rate mortgage.. 1
- fixed-rate mortgage.. 2
- floating-rate mortgage with fixed instalments 3
- don't know.. 4

A2. Measures of Knowledge and Extended knowledge, excluding individuals' tenure

Figures A1-A4. Distribution of Knowledge and Extended knowledge without tenure, by sex and age
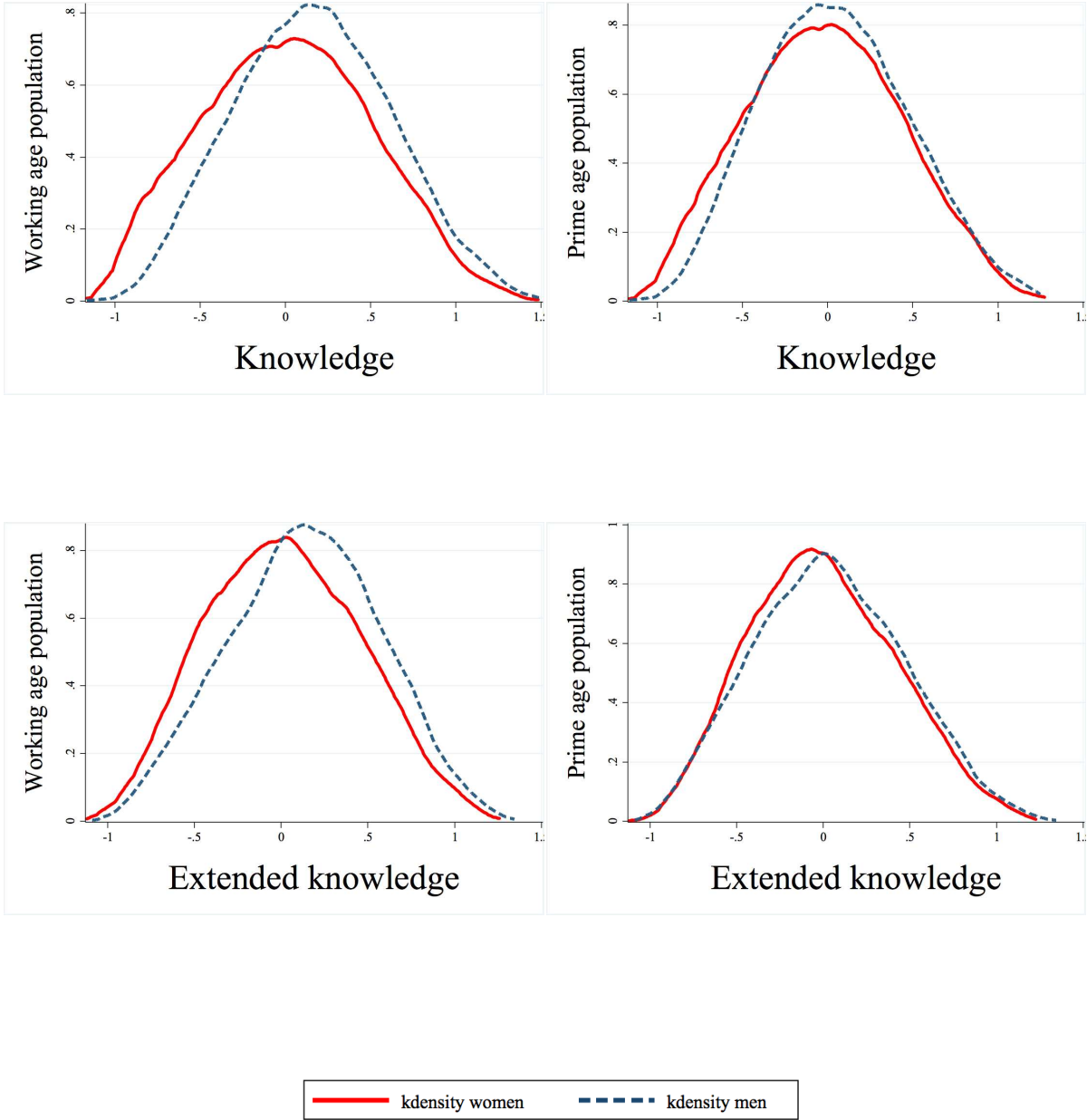
Source: SHIW (2007). Note: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Kernel estimation (Epanechnikov).

A3. The economic impact of Knowledge, disaggregated variables

Table A1. The employment impact of knowledge (disaggregated variables) on the probability of employment, marginal effects

	Working Age		Prime Age	
	M	W	M	W
	Unpaid work			
Partner	81.4%	-22.0%	60.4%	-36.1%
	(0.079)**	(0.075)**	(0.129)**	(0.094)**
Child (below 3 yo)	6.8%	-24.6%	-1.4%	-22.3%
	(0.134)	(0.097)**	(0.171)	(0.11)**
Child (below 6 yo)	19.2%	-12.3%	12.2%	-10.9%
	(0.138)	(0.098)	(0.161)	(0.112)
Elderly (above 70 yo)	6.3%	5.1%	-9.8%	13.6%
	(0.123)	(0.128)	(0.16)	(0.144)
Elderly (above 80 yo)	19.3%	-39.5%	-4.3%	-56.0%
	(0.178)	(0.143)**	(0.26)	(0.217)**
	Education			
Sec. vocational	58.1%	35.9%	60.6%	42.2%
	(0.085)**	(0.079)**	(0.127)**	(0.097)**
Sec. humanities	72.7%	29.6%	64.9%	38.3%
	(0.151)**	(0.106)**	(0.198)**	(0.12)**
Sec. social	118.2%	47.3%	57.5%	64.8%
	(0.515)**	(0.167)**	(0.595)	(0.207)**
Tert. scientific	78.9%	81.1%	89.7%	97.8%
	(0.168)**	(0.14)**	(0.188)**	(0.16)**
Tert. humanities	25.8%	61.8%	42.8%	80.7%
	(0.226)	(0.119)**	(0.238)*	(0.15)**
Tert. social	71.2%	64.7%	86.0%	85.5%
	(0.157)**	(0.141)**	(0.193)**	(0.152)**
	Labor market			
Eff. worker's age	5.2%	3.2%	4.3%	2.9%
	(0.007)**	(0.005)**	(0.008)**	(0.006)**
Job experience	2.5%	7.3%	8.8%	12.3%
	(0.004)**	(0.005)**	(0.01)**	(0.009)**
	Specific skills			
Financial literacy	-19.3%	8.0%	-19.2%	5.3%
	(0.083)**	(0.078)	(0.13)	(0.099)
ICT skills	6.3%	31.1%	12.7%	9.8%
	(0.123)	(0.103)**	(0.204)	(0.132)

Statistics				
Observations	4757	4973	3309	3468
Log-likelihood	-1.80E+03	-2.10E+03	-792.097	-1.30E+03
Chi squared	461.837	841.983	391.691	754.168
AIC	3670.888	4372.129	1658.194	2687.967
BIC	3910.18	4613.065	1884.057	2915.566
Degrees of freedom	36	36	36	36
Pseudo R2	0.196	0.37	0.383	0.437

Source: SHIW (2007). Notes: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Standard deviation in parentheses. Marginal effects denote the mean variation in individuals' probability of being employed corresponding to an infinitesimal variation of the independent variable, estimated at the mean value of the independent variable; for dummy variables marginal effects denote the average variation in individuals' probability corresponding to the modification of the independent variable from 0 to 1. Control variables include real and financial wealth, age (squared), Regional fixed effects and a constant term.

Table A2. The impact of knowledge (disaggregated variables) on log. of hourly wages

	Working Age		Prime Age	
	M	W	M	W
	Education			
Sec. vocational	0.062	0.04	0.046	0.055
	(0.018)**	(0.024)*	(0.02)**	(0.023)**
Sec. humanities	0.046	0.072	0.076	0.08
	(0,035)	(0.035)**	(0.04)*	(0.035)**
Sec. social	0.09	0.043	0.144	0.074
	(0,08)	(0,033)	(0,099)	(0.036)**
Tert. scientific	0.239	0.199	0.215	0.229
	(0.047)**	(0.058)**	(0.056)**	(0.06)**
Tert. humanities	0.114	0.13	0.114	0.15
	(0,073)	(0.037)**	(0,086)	(0.039)**
Tert. social	0.195	0.131	0.144	0.153
	(0.061)**	(0.054)**	(0.064)**	(0.055)**
	Labor Market			
Eff. worker's age	0.003	0.002	0.002	0.005
	(0.002)*	(0,002)	(0,002)	(0.002)**
Job experience	0.003	-0.001	0.003	0.001
	(0,002)	(0,002)	(0,002)	(0,002)
Tenure	0.005	0.007	0.004	0.006
	(0.001)**	(0.001)**	(0.002)**	(0.001)**
	Specific skills			
Financial literacy	0.037	-0.019	0.02	-0.023
	(0.02)*	(0,022)	(0,021)	(0,025)

ICT skills	0.099	0.06	0.1	0.081
	(0.03)**	(0.028)**	(0.034)**	(0.03)**
Statistics				
lambda	-0.167	-0.09	-0.143	-0.029
	(0,024)	(0,045)	(0,024)	(0,025)
Rho hat	-0.575	-0.299	-0.518	-0.098
	(0,087)	(0,149)	(0,091)	(0,085)
ln-sigma	-1.136	-1.17	-1.202	-1.203
	(0,038)	(0,042)	(0,043)	(0,037)
sigma	0.321	0.31	0.301	0.3
p	0	0	0	0
rho	-0.519	-0.291	-0.476	-0.098
Observations	3884	4558	2672	3149
Censored observations	945	2282	467	1365
Log-likelihood	-2.60E+03	-2.90E+03	-1.30E+03	-1.80E+03
Chi squared	1170	1209	845	899
AIC	5364	5872	2720	3709
BIC	5765	6284	3097	4096
Degrees of freedom	25	25	25	25

Source: SHIW (2007). Notes: Year 2006; working age is defined as the [25-60] age bracket, prime age is [25-50]. Standard deviation in parentheses. Heckman estimation on the natural logarithm of hourly wages. For the wage equations, control variables include occupation, industry, firm size, contractual arrangement and yearly hours worked. Selection equations are the same as the probit estimates reported in Table A1.