

Austerity's Gender Impact on Tertiary Education: the Cases of Spain and Germany

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Abstract

This paper focuses on the potential gender impact of austerity policies in tertiary education. The uneven gender distribution across fields of study is known as horizontal gender segregation, and is associated with key implications in future earnings and career prospects, gender pay gap, human capital accumulation and economic growth. We compare the patterns of horizontal gender segregation in Spain and Germany with other European Union (EU) members in the aftermath of the Great Recession and austerity rationale. These two countries are usually placed at the conservative cluster of European economies, while adopted different policies over the last decade. We corroborate an uneven and stalled trend in the consecution of gender parity in Western societies: although there is a slight trend towards de-segregation in female-dominated fields, male-dominated ones are persistently segregated. We review theoretical explanations of gender segregation and build upon the two-way interaction and relative autonomy of social reproduction approaches to provide some potential effects of austerity policies in these two familiastic welfare states.

Keywords: Austerity policies, gender impact, tertiary education, relative autonomy of social reproduction, two-way interaction, feminist economics

JEL: B54, J18, I24

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1 Introduction

The Global Economic Crisis of 2008, the Euro area sovereign debt crisis and the following austerity measures had dissimilar effects on women and men in Europe. Contraction of employment in male-dominated industries coined the term *he*-cession, while the crisis and austerity's effects have soon highlighted a *she*-austerity phenomenon where women bear the brunt of austerity choices (Périvier (2016); Karamessini and Rubery (2014)). Although the austerity rationale is widely debated in academic and policy circles regarding the economic growth and labour market outcomes, the gender dimensions of it has attracted limited attention so far (Bettio et al. 2013: 123). This gender blindness of fiscal consolidation in several European countries have been stressed by many researchers (see the case studies in Bargawi et al. (2017)). The *she*-austerity has been attributed to different features of EU societies; the majority of countries in Europe women constitute above 50% of public sector employment (OECD, 2017); women are usually the primary beneficiaries of public services and welfare provisions; women usually bear the burden of unpaid household reproductive work (Himmelweit 2017). Furthermore, EU politics in the aftermath of the global crisis have forgotten their gender mainstreaming goal. Correspondingly, the crisis and the *she*-austerity issue re-vitalized the feminist debates and feminist activism in Europe (Dean and Aune (2015)).

The analysis of the gender impact of policies, such as the neo-liberal policy agenda and austerity policies, is not only important for identifying potential worsening effects in gender inequalities, but it is crucial for improving the efficiency of policy-making, whatever the goal of the policy might be (Bargawi et al (2017). We fully agree with Bargawi et al. (2017) that to understand the gender impact of austerity, one should not only focus on well-known gender inequalities in the economy, commonly considered in the form of employment rates, earnings, hourly wages, skill levels and employment incentives. To assess the gender impact of austerity, researchers should also focus on less *obvious* economic variables, such as the gender distribution of unpaid household labour, gender roles and opportunities at large. It is precisely along this line of thought that we assess the gender impact of austerity policies in the distribution of women and men across fields of study in tertiary education, and acknowledge tertiary education as a source of different gender roles in the economy and society. Gender segregation of tertiary education and the labour market is in fact at the heart of the different impact that the recent recession and austerity policies had in women and men (Rubery and Rafferty (2013); Bargawi et al. (2017)). An interplay between these choices and the labour market is straightforward. Segregation reduces direct competition between men and women for jobs (Bettio (2002)), but exposes or protects women as a consequence of differential recessionary effects on sectors and occupations.

Over the last three decades developed countries experienced a remarkable increase of female graduates, which led to the so-called reversal of the gender gap in tertiary education in the vast majority of Western countries. The reversal of the gender gap in educational attainment came along with a persistent concentration of females and males into certain areas of study. Generally speaking, humanistic, social sciences and health fields of study are found to be female-dominated, whereas engineering and scientific fields are male-dominated (Meulders et al. (2010); Barone (2011)). In particular, some large-scale comparisons have established that the underrepresentation of women in scientific fields can be observed worldwide (Ramirez and Wotipka (2001); Smyth and Steinmetz (2008)). This phenomenon is known in the literature as horizontal gender segregation, and is associated with key implications in future earnings and career prospects (Altonji et al. (2015); Bailey and DiPrete (2016)), the gender pay gap (Brown and Corcoran (1997)), human capital accumulation and economic growth (Dollar and Gatti (1999); Klasen and Lamanna (2009)). We embrace the idea that sex segregation in fields of study, which has different prospects in the labour market, is both a clear sign of gender inequality, which is alive in contemporary industrial societies (Charles and Bradley (2006)) and is evidence of sex-labeled fields of study.

That is especially evident in Science, Technology, Engineering and Mathematics (STEM) degrees, as documented in Sassler et al. (2017).

This paper focuses on horizontal gender segregation in tertiary education rather than on vertical segregation, because the former may be unnoticed as an indicator of gender inequality. The literature of the returns to education often focuses on years of schooling (Card (1999); Altonji et al. (2015)). However, treating education as it was uni-dimensional might hide an important feature of gender inequality in tertiary education. Indeed, similar levels of educational attainment in different fields of study are associated to highly different returns to education and conducive to different future prospects (Reimer and Steinmetz (2007)). It is important to use a critical approach to the choice of the field of study by women and men because it could be seen as the materialization of individual preferences and aspirations, and thus cover a source of gender disparities derived from cultural values. However, those preferences might be influenced by social norms and gender stereotypes that are inherit throughout the socialization process. As noticed in Del Río and Alonso-Villar (2012), women in Spanish universities continue to acquire skills oriented mainly towards jobs traditionally held by women, as is true in other EU countries.

Germany and Spain are appealing case studies because both are continental welfare regimes with a strong familialist tradition, whereby the major source of the welfare provision is family. The familialist regimes are characterized as favoring the provision of domestic work, especially care work within the household, rather than via market or public services, for example compared to Nordic countries (Esping-Andersen (2002); Esping-Andersen et al. (2001)). Spain and Germany have long been studied jointly because they are often placed in the cluster of conservative state, and they both have experienced changes from male-breadwinner to a dual-earner model (Drobnič and León (2014)).

Concerning the repercussions of fiscal consolidation on gender segregation in education, we build upon the idea of two-way interaction (Rubery (2015)) -whereby gender relations are not only an outcome but also a factor of institutional change-, and combine it with the relative autonomy of social reproduction (Humphries and Rubery (1984)) to surmise the potential effects of austerity on horizontal gender segregation. The way in which social reproduction is organized has a certain degree of autonomy from the economic system and family structure: once the social reproduction mechanism in the family (female *vs* male household roles) is altered, for instance, via demand for higher female labour in the economy, reversal of this demand would not necessarily reverse the social reproduction in the family.

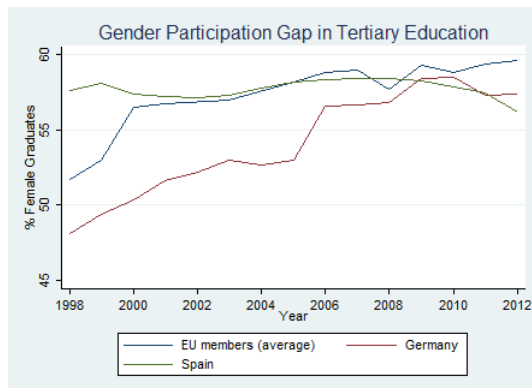
The remaining of the paper is organized as follows. Section 2 explores segregation trends in tertiary education by using the dissimilarity index (Duncan and Duncan (1955)) and the association index (Charles and Grusky (2004)). Section 3 briefly describes some of the austerity policies implemented in the countries studied. Section 4 provides potential implications of austerity in segregation. Section 5 concludes our findings.

2 Horizontal Gender Segregation in Tertiary Education: Spain and Germany

The growing participation of females in tertiary education in European Union states can be seen in Figure 1. In what follows, we provide a descriptive analysis of female and male graduates in Spain and Germany in the context of European

Union members¹. We consider female and male graduates irrespectively of the level of tertiary education². The period of time considered throughout the entire paper is 1998-2012 and the data is collected from the OECD Online Education Database. We employ data on graduates instead of enrollment data due to the fact that the latter might underestimate gender distribution across fields if students drop out in gender-atypical fields before graduation (Mastekaasa and Smeby (2008)). Spain has a more stable trend and higher percentage of graduates who are female relative to Germany and the average EU members, although there is a decreasing trend in the last years considered. Germany and the EU at large show an increasing trend at the turn of the XXI century in the percentage of female graduates.

Figure 1



We employ the International Standard Classification of Education - 1997 (ISCED 1997) at a 2 digit-level disaggregation level to compute the female-to-male ratios in the 23 fields of study that this classification entails³. Female-to-male ratios evolved similarly across EU member states over the 1998-2012 (Table 3 in appendix). Social services, health, veterinary and education are highly female-dominated, whereas Computing, engineering, environmental protection and transport services are male-dominated. As regards to humanities and arts, which are dominated by women, there is a small reduction in Spain and at the EU level. Considering the variation over 1998-2012 of the female-to-male ratio, male-dominated sectors such as computing, engineering, agriculture, personal services and environmental protection do not increase the presence of females. On the contrary, the ratios in female-dominated fields have been reduced. This can mean that men are less likely to transgress gender social norms regarding the choice of field and thus, less prone to graduate in a sex-atypical field. In the case of Germany, this trend is even more evident: women graduates have been reduced in highly male-dominated fields (physical sciences, computing, engineering, agriculture).

2.1 Dissimilarity Index

Drawing upon the literature on racial segregation, we first make use of the Duncan and Duncan (1995) index, also known as the index of dissimilarity (ID henceforth). ID index⁴ is one of the benchmark indices of segregation used in two

¹Croatia, Cyprus, Bulgaria, Malta, Lithuania and Romania are excluded from our analysis due to data unavailability. Thus, the averages are computed based on EU members with the exception of these countries.

²There are available from the authors upon request data on vertical segregation based on the division of ISCED level 5B, 5A and advanced research programs.

³Table 1 and Table 2 in the appendix display the fields of study classified in ISCED 1997 at 1 and 2 digit-levels

⁴We have also conducted a descriptive analysis using the Karmel and Maclachlan (1988) index of segregation, also known as the IP index. The outcomes are similar to those using the ID index.

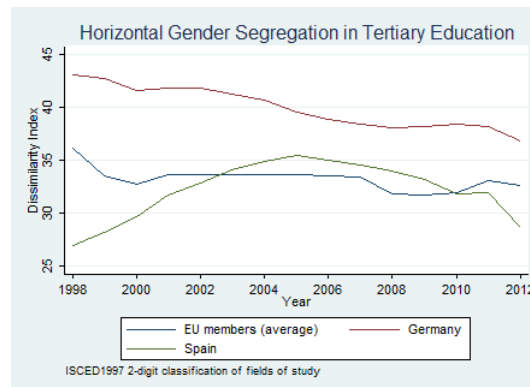
population subgroups, which allows us to compare the results provided in this paper with those in other works on gender segregation in education (Barone (2011); Gelbgiser and Albert (2017); Dolado et al. (2012)) or related to the labour market (Borrowman and Klasen (2017); Dolado et al. (2003)).

$$ID = \frac{1}{2} \sum_i \left| \frac{F_i}{F} - \frac{M_i}{M} \right| * 100 \quad (1)$$

Where F_i corresponds to the number of female graduates in field i , F is the total number of female graduates, M_i is the number of male graduates in field i , and M the total number of male graduates in tertiary education. ID values range from 0 (meaning no segregation) to 1 (which indicates a complete horizontal segregation). The dissimilarity index is also understood as a measure of distance, which indicates how far the gender distribution across fields should change in order to be in line with the overall presence of females or males in tertiary education. However, we follow the definition in Duncan and Duncan (1955) to interpret the ID index as the proportion of women who would have to move across science fields in order to achieve a similar distribution across fields as men. Although the ID measure of gender segregation is relatively easy to compute and interpret, it comes at a various costs. The index is mechanically sensitive to the relative sizes of fields of study and changing trends of that weights might disguise some patterns in segregation (Blackburn et al (1993), Bradley (2002); Borrowman and Klasen (2017). In this sense, we review the trends of the composition of educational systems based on the ISCED-1997 at 1 and 2 digit-levels classifications (included in the Appendix).

The ID has a country-year dimension, and Figure 2 provides the index computed based on ISCED 1997 at 2 digit-level for Spain, Germany and compare with the European Union members (Table 4 in appendix provide the exact ID for EU countries available in 2012).

Figure 2



The EU average of horizontal segregation index has a stable trend over 1998-2012. The German tertiary educational system is more segregated than the EU average, although there is a decreasing trend (39% in 1998 to 37% in 2012). Following the interpretation of dissimilarity index provided in Duncan and Duncan (1955), this figure means that 37% of German graduates who are women would have to change their field of study so as

to have a similar distribution across fields of study as men. Segregation in Spain decreased in the period from 35% to 29% and is below the level of Germany and the EU average; this decrease the largest among the sample countries. The pre-crisis and post-crisis ID index is on average slightly lower in EU countries⁵.

Table 5 in the appendix includes the variations in the ID index between 2006-2012 in the countries in the sample. Notwithstanding a reducing trend in segregation, Finland still has the highest level of ID index in 2012 (41%). Austria and the Netherlands score an ID of 35%, as well as Sweden. The Swedish case is particularly striking due to the family-friendly policies in the form of tax reductions and parental leave. Some of the reasons can be found in Evertsson et al. (2009) and Albrecht et al. (2003), which point to supply-side features as important drivers of gender inequality in the labour market, even more than hiring discrimination practices (Carlsson (2011)). The tertiary educational systems of Italy and Luxembourg are the least segregated among the sample countries in 2012. Focusing on Southern European countries, the level of segregation is low relative to that of Nordic countries or Central-European countries. Greece and Portugal display, respectively, a 29% and 26% ID index.

2.2 Charles and Grusky (2004) Measure of Segregation: Association Index

We recognized one of the limitations of the ID index, as stated in Nelson (2017), which regards the sensitivity of the levels of aggregation in defining categories. In the case of horizontal segregation in tertiary education, this categories correspond to the fields of study. Due to the sensitivity of the ID index to different categorizations, manipulation of the ID index is consequently straightforward and the choice of the level of disaggregation is crucial to the outcome. In this sense, narrow categories will display lower levels of segregation relative to broad categories. Historical and cross-national variations of the size of the fields of study motivated the development of alternative measures of gender segregation. Charles and Grusky (2004) provide a measure of segregation that is independent of changes in women’s overall participation in tertiary education. We compute this alternative index of segregation, namely the association index (A_i). This association index is also usually employed in educational and labour market segregation literatures (Barone (2011); Charles and Bradley (2009)).

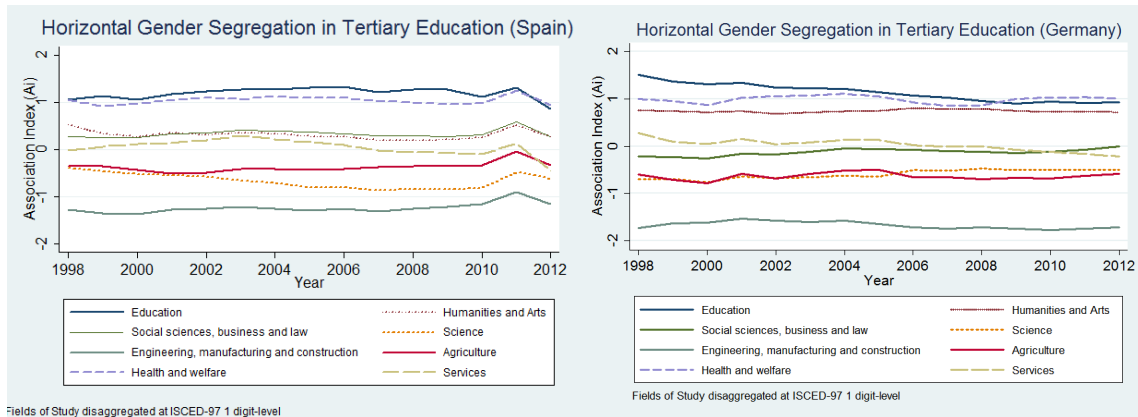
$$A_i = \ln \frac{F_i}{M_i} - \left[\frac{1}{n} * \sum \ln \left(\frac{F_i}{M_i} \right) \right] \quad (2)$$

Where \ln is the natural logarithm, n stands for number of fields, and F_i , M_i , F and M are respectively females in field i , males in field i , total graduate females and total graduate males. The association index A_i is a field-specific measure of sex segregation that contrasts the female-to-male ratio in the respective field or that in the "average" field of study. Negative values of A_i indicate a female underrepresentation, whereas positive values indicate female overrepresentation relative to the other fields of study. A_i is consequently a summary index, in other words, a combination of field-specific values, that gives for each country the multiplicative factor by which women or men are overrepresented in the average field (see Charles and Grusky 1995, 2004 for details).

⁵Information for Ireland and Luxembourg in 2006 is not available. Data for Estonia, France, Latvia and Slovenia is not available in our main data source (OECD online database on Education)

The main advantage is that they measure the association between gender and field choice of net cross-country (or cross-cohort) variations in the marginal distributions of these two variables. For instance, the assessment of similarities and differences between nations with regard to gender segregation is not affected by the share of each field of study in different countries or by the share of females among tertiary graduates when using log-linear techniques (Charles and Grusky 2004).

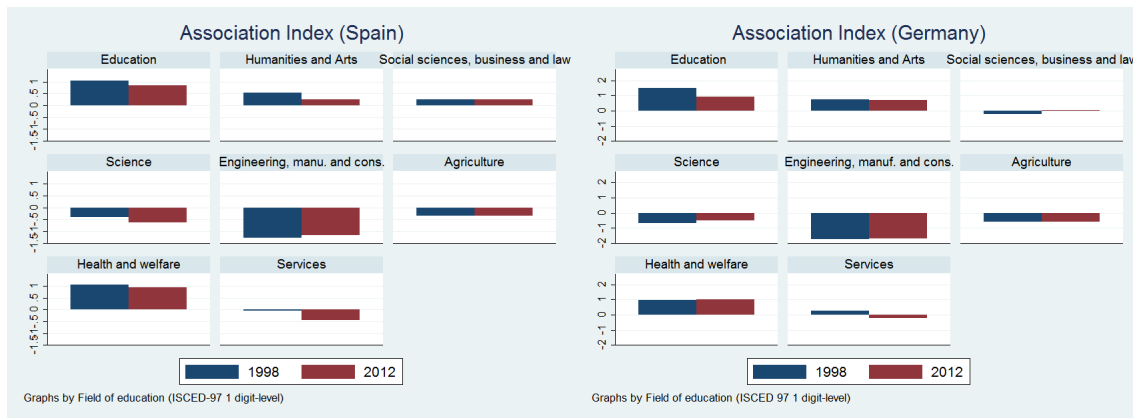
Figure 3



2.2.1 Low Disaggregation of Fields of Study (ISCED97 1 digit-level)

Fields of study which are placed above zero are female-dominated, whereas fields scoring values lower than zero are male-dominated. In both cases, the higher the value the more segregated the field is. We can pinpoint certain similarities in the cases of Spain and Germany as displayed in Figure 3: education and health-related fields are similarly feminized, services is a gender-neutral field, whereas males dominate scientific and technical fields of study. If we compare the segregation levels in 1998 with that of 2012, some additional insights can be arisen. The main goal of our descriptive analysis is to study whether there is a de-segregation - or to the contrary, a re-segregation- trend in the aftermath of austerity policies. Based on the indices of segregation up to this point, we found a stable segregation trend, which would be in line with the literature of a stalled trend in the achievement of gender-egalitarian goals in Western societies (England 2010, 2011; Barone 2011). As a secondary goal, we are interested in discerning whether the trends are motivated by the behavioral choices of women or men: are females more prone to choose a gender-atypical field?

Figure 4



Although there is scarce variability of the level of segregation in these fields, the diagrams in Figure 4 serve to draw some insights into this issue. Considering the case of Spain, the association index based on ISCED at a 1 digit-level classification, which considers the above-mentioned nine fields; we corroborate that education, health and welfare and engineering fields are highly gendered. In these three fields, there has been a relative reduction of the degree of segregation. However, science, a highly masculinized field of study, has been re-segregated in the period 1998-2012 in Spain, a phenomenon that has been also occurred in services. Other sectors, such as agriculture and social science and business have maintained the same levels over this period.

In the German tertiary educational system, the level of feminization of the field of education is reduced in a higher proportion than it was in Spain. Social science, as a female-dominated field in Spain, was male-dominated in Germany at the beginning of the period studied, and the level of segregation is very low in 2012. Although there is an assumed homogeneity in the sex-labelling of fields of study across EU countries, some disparities might be also expected insofar different countries have different levels of economic development and degrees of technological innovation. Economic and sociologic accounts explain that the geographical nature of the sex-labelling of the fields of studies has been already considering in regards manual and non-manual jobs (Charles and Grusky 2004). In this instance, Alesina et al. (2013) explore the relationship between historical agricultural techniques and contemporaneous gender disparities to show how geographical characteristics can be a source of an unequal division of labour as well as discriminatory social norms relating to gender.

2.2.2 High Disaggregation of Fields of Study (ISCED97 2 digit-level)

A note on the classification of the educational systems in fields of study is necessary. The diversification of educational systems and the classification of the curricula supply have been historically motivated by efforts to create more women-friendly enclaves within tertiary education, as discussed in Charles and Bradley (2009). These authors also acknowledge the gender-essentialism and sex-stereotyped guidelines within educational policy-making, even at the international level⁶. The expansion and reclassification of short and strongly gender-typed programs into the tertiary level of the educational system has been associated with an increasing effect in horizontal gender segregation (Charles and Bradley 2002; Rawlings 2007). Thus, we believe that the

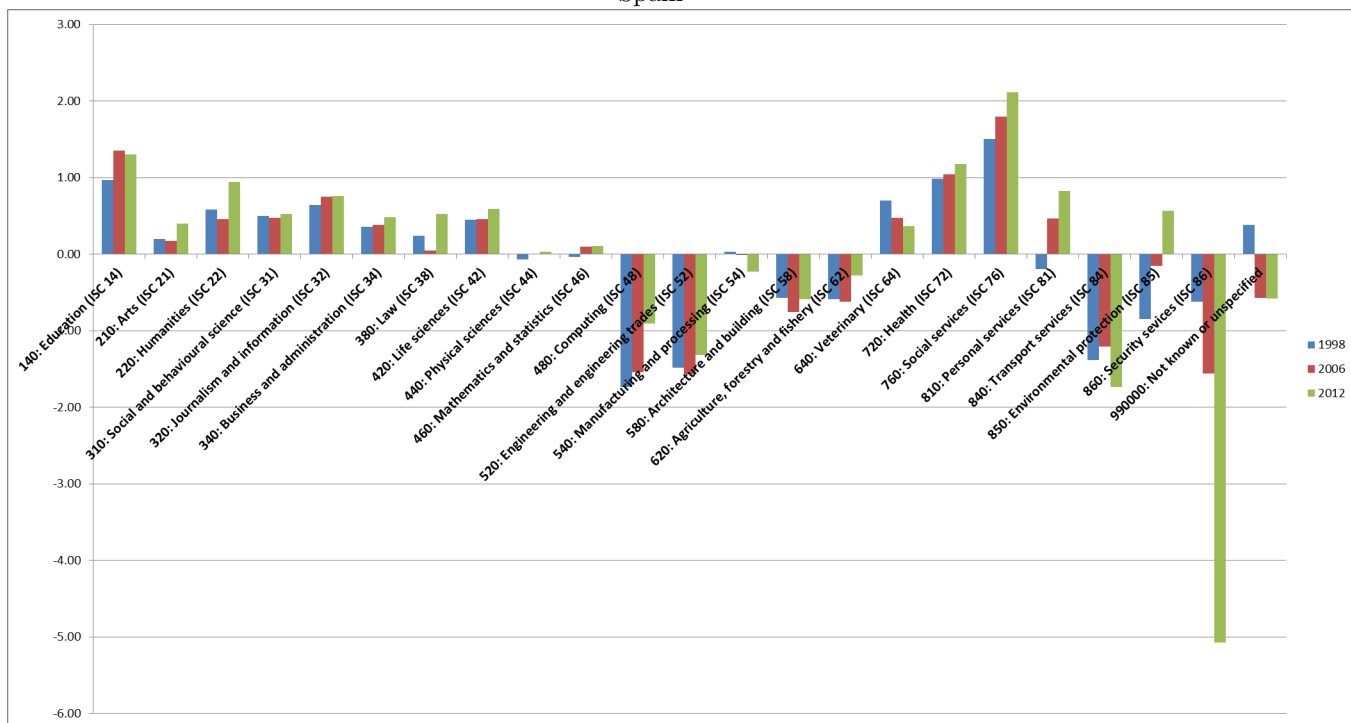
⁶See UNESCO recommendations are based on beliefs on feminine aptitudes, UNESCO 1953, p.263

classification of the educational system can be in itself a macro-societal force of segregation.

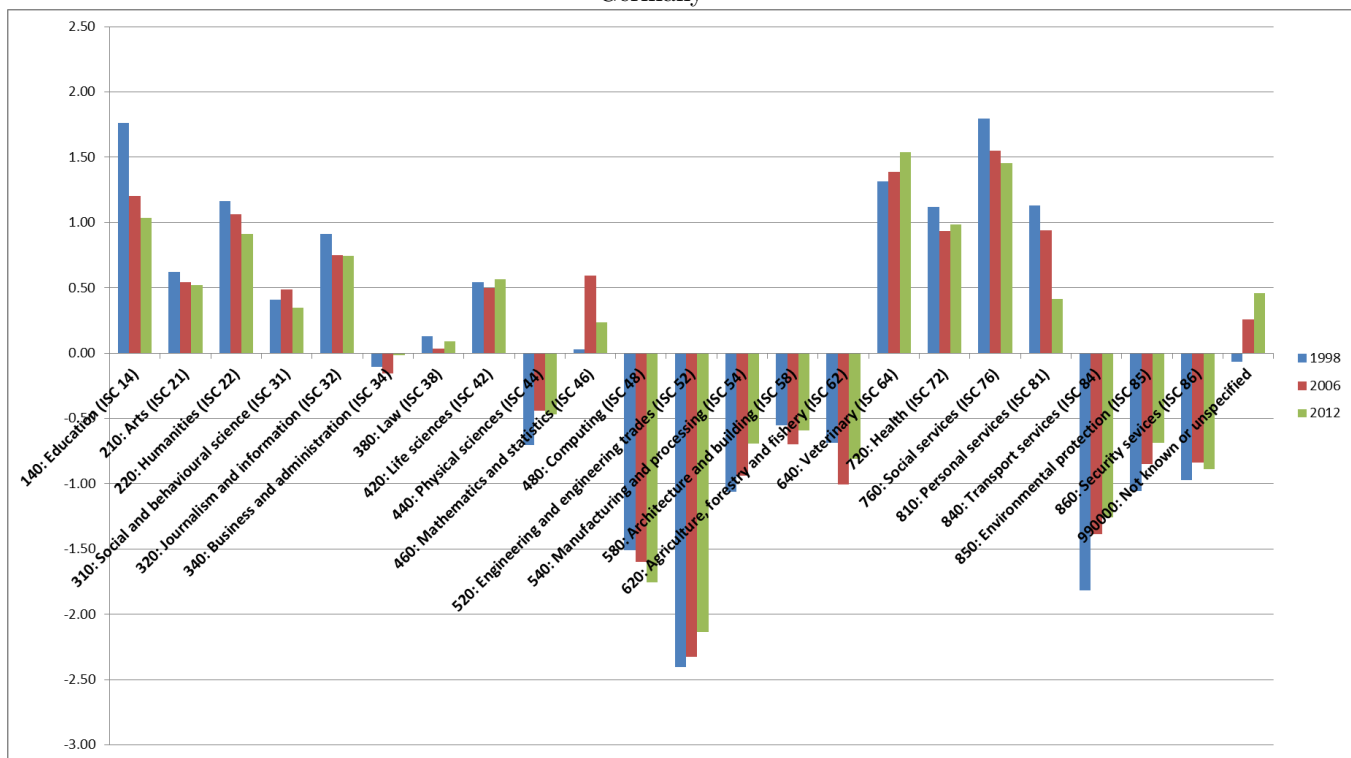
The final step of our description of segregation in tertiary education in Spain and Germany is to compute the association index for each of the fields classified in the ISCED-1997 at 2 digit-level (Figure 5). Tables 6 and 7 in the Appendix report the precise values of the association index for 23 fields of study in 1998, 2006 and 2012 in the two countries. Positive values mean that the field is dominated by women, whereas negative values are interpreted as male domination of the field. There is an increasing trend in Health and Social services towards more feminization. Education in Spain, although the level of association has been slightly reduced between 2006 and 2012, is still dominated by females. Security services remarkably increased towards masculinization in the field. Computing and Engineering are also dominated by males in the Spanish educational system, although the association index for these two fields decreased. Overall, female-dominated fields increased the level of association or display similar values over the period 1998-2012, whereas male-dominated fields reduced the level of association, with the exception of Transport and Security services. In the case of Germany, there is an overall reduction of the association index across fields of study during 1998-2012. However, both veterinary and computing increased the level of association to women and men.

Figure 5

Spain



Germany



3 Austerity Policies: Spain and Germany

The economic policy debate in European member states has been marked by the emphasis on the need of labour market structural reforms, and this consideration started even before the recent European crisis (Dosi et al. (2016)). The Italian Jobs Act and the reform of the *Code du Travail* in France, as well as the below examples of the German and Spanish governments have targeted the potential rigidities of labour market institutions such as collective bargaining, minimum wages, employment protection laws and unemployment benefits, which ultimately make job creation less attractive for employers and joblessness more attractive for workers. As suggested by Himmelweit (2017), the austerity measures introduced in European economies since the financial crisis (Bargawi and Cozzi (2017); Bettio and Verashchagina (2014); Karamessini and Rubery (2014)), can be seen as the continuation of a neo-liberal policy agenda which started much earlier in many other parts of the world (Elson (2013), Lethbridge (2012), Young (2003)). The implementation of Agenda 2010 by Germany in 2004, with policies that were in accordance with the market liberalization approach and labour market liberalization, can serve as an example.

In the context of the global crisis of 2008, Germany and Spain reacted to the contraction of demand by implementing fiscal stimulus programs which raised the public debt to GDP ratios above the Maastricht levels. The following fiscal consolidation programs in these two countries, likewise many other Euro area countries, mainly focused on expenditure cuts, particularly in public sector employment and social transfers (see Federal Government 2010; Blömer et al. (2015); Starke; Kickert et al. (2015); De Grauwe and Ji (2013); OECD 2017: 9). In Germany, the fiscal consolidation plan included expenditure cuts, for example, reduced salaries of state officials (due to cuts in Christmas bonuses), hiring freezes and staff reductions, reorganization and efficiency cuts as well as the abolishment of a heating allowance and a parental allowance for the long-term unemployed and cutbacks in parental allowances for middle-income individuals (net income above 1,240 Euro) (Federal Government, 2010). In Spain, the program included a hiring freeze, wage reductions, pay freezes, staff reductions, reorganization as well as cuts in health care, education, pensions, unemployment benefits and other social security and welfare provisions (Kickert et al. (2015); De Grauwe and Ji (2013)).

Over the period 2008-2016, unemployment benefits and housing benefits in % of total social benefits declined in Germany and Spain. In fact, in Germany, unemployment benefits as a share of total social benefits has been showing a declining trend since the early 1990s (Eurostat 2017). In Spain, family/childcare benefits in % of total social benefits decreased as well in the same period (see table 10 in appendix). While public sector employment only decreased from 2010 to 2011 in Germany, in Spain a rather continuous reduction of it can be observed in the period of 2008-2016 (ILOSTAT 2017). Furthermore, in Spain, the Equality Ministry was integrated in to the Health, Social Services and Equality Ministry and the Women's Institute, founded in 1897, was transformed into Women's Institute and Equal Opportunities, losing its autonomous status and focus on gender inequality (Gago and Marcelo (2013); Karamessini and Rubery (2014)). Tertiary education spending as a % of GDP also decreased in Germany and Spain, and financial aid to students as a share of total public expenditure in Germany decreased as well in the period of 2012-2014 (Eurostat, 2017).

Apart from the prevailing gender inequalities such as the gender employment gap and gender pay gap, some of the gender inequality measures exacerbated in Spain and Germany. Occupational segregation and sectoral segregation have remained among the highest in the EU and above the EU average in these two countries (EU 2017). In fact, Germany has been one of the countries with highest gender pay gaps, above the EU average (Eurostat 2017). The gender pay gap among tertiary education graduates in Germany is particularly striking as it is higher than the average gender pay gap and increased in the period of 2008-2016. The share of male and female labour force at risk of poverty increased in both countries in the same period but remained higher for females. The share of women neither in employment nor in education and training (NEET) stayed above men for both Germany and Spain, but this rate significantly increased in Spain in this period. Furthermore, a significantly larger share of women in the labour force work part-time than men in both countries (see table 10 in appendix). The primary reason for almost half of the part-time working women is either looking after children or incapacitated adults or other responsibilities, while for only around 10 % of part-time working men either of these is a primary reason (Eurostat 2017).

4 Implications for Horizontal Gender Segregation in Tertiary Education

We can now proceed to discuss how the austerity regulations on the labour market, on the household through welfare benefits and directly on tertiary education might be connected with horizontal gender segregation in tertiary education. Drawing on the social reproduction theory (Humphries and Rubery 1984; Rubery 2013, 2015; Himmelweit 2017) and the plausibility of the relative autonomy thereof, we review the extant explanations of horizontal gender segregation. Based on the descriptive analysis above, we surmise potential segregative or de-segregative effects in tertiary education in the aftermath of austerity policies. Our framework builds upon the acknowledgement of the role of social reproduction in the choices of educational fields. We believe that this theoretical framework advances our understanding of not only the aftermath of austerity policies but also how European countries arrived to those choices (Himmelweit (2017)).

The explanations of horizontal gender segregation in education can be divided into three broad strands: the neoclassical tradition, the institutional explanation and feminist economics theories (Meulders et al. 2010). The neoclassical tradition provides rational choice explanations implying that women and men choose fields of study based on an economic calculus that maximizes their future life-time earnings (Polachek (1987)) and anticipates work-family balance and foresee family obligations (Becker (1991), Mincer and Polachek (1974)). In these accounts, women are expected to opt for some fields (e.g. teacher education) because they give access to female-friendly jobs. However, this strand of explanation has been already contested in the literature (England et al. (1988); van de Werfhorst (2017)). Additionally, rational choice theories are based on an individualist approach which seems at odds to the societal-dependant and context-specific economic decisions of agents. As Barone (2011) suggests, it is unclear whether graduated women anticipate a traditional division of domestic work, and had this been the case, that would correspond to internalized gender norms which can be better ana-

lyzed from institutional and cultural approaches. Indeed, institutional arrangements are pinpointed as engines of gender inequality through the promotion of gender segregation of women in fields with lower career prospects and socioeconomic status (Barone, 2011).

The behavioural, institutional and feminist economics scholarship on horizontal gender segregation accounts for a complex interplay among cultural, gender norms and sex-stereotyped preferences, achievement-oriented and labour market conditions (Jacobs (1995); Anker (1998); Borrowman and Klasen (2017); van de Werfhorst (2017)). In a series of works, Charles and Bradley (2006, 2009) point to three key macro-societal forces of gender segregation in Western societies: postindustrialism and female-demanding occupational sectors, the structure of educational systems and cultural value systems.

We build on the propositions in Charles and Bradley (2009) to explore the implications of austerity precisely on the grounds of these three forces: labour market features, structural educational systems and cultural values. Additionally, we acknowledge the potential implications of austerity in horizontal gender segregation in education may have further repercussions on gender equality in the labour market and in the household. Indeed, horizontal gender segregation is critical to the maintenance of gender inequality insofar as it reinforces traditional, sex-typing of roles in the labour market and in the household. Drawn upon the relative autonomy of social reproduction (Humphries and Rubery (1984)), the two-way interaction hypothesis (Rubery (2015)) suggests a feedback between the impact of institutional changes in the societal gender balance and that this gender balance also affects institutional arrangements. If austerity policies (institutional changes) affect women much more severely than men (*she*-austerity), then the resulting gender inequality would likely have further repercussions on the institutions as well (labour market institutions such as minimum wage, working hours, parental leave). Applying this reasoning to the educational system context, the structural changes in labour market and educational arrangements implemented by the austerity packages might have further repercussions on the household bargaining power.

From the standpoint of the labour market forces towards segregation of tertiary education, we surmise that cuts in public sector employment -the main employer of educated female labour force- and the withdrawal of some public institutions in charge of gender equality may increase the precariousness of skilled women. Further long-lasting imbalances in the labour markets of Spain and Germany in the aftermath of the sovereign debt crisis, including the high share of females in part-time work, occupational and sectoral gender segregation, gender pay gap as well as higher share of employed females at risk of poverty can be considered as a discouragement for female students to target unconventional career paths. These labour market conditions might perpetuate the current segregation trends or even have re-segregative effects.

Austerity might make a dent in the achievement of gender equality in European countries through the reduction of the welfare state. Structure of the educational systems can be particularly salient to the promotion of gender segregation. Charles and Bradley (2009) use cross-country analysis to show that diversification of the tertiary education -defined as the weight of vocational or two-year college degrees over the total tertiary education- increases the level of segregation. The reduction of public spending in tertiary education between 2012-2014 in Spain might have a segregative effect in tertiary education. Higher costs of completion might induce the

shortening of educational attainment of women and men. Based on the finding of Charles and Bradley (2009), this might increase the level of diversification and thus, promote gender segregation across fields of study.

The fiscal consolidation and cuts in welfare provisions may add to the existing gender segregation insofar as the prevailing gender norms define care as a female-related duty. Along this line, we consider cultural values and gender stereotypes as crucial determinants for horizontal segregation. Gendered roles have shown to be very consistent across time even if traditional cultural values have been debunked. Charles and Bradley (2009) found that gender-essentialism as a way of self-expression is stronger in post-industrial societies than in less developed countries. We bring to the centre the role played by gender relations and social reproduction in the distribution of household work. Throughout this paper we confirm the humanistic-care and scientific-technical divides in tertiary education in Western societies (Barone 2011). This segregative pattern fulfills the expectation that females are more likely to engage in care-related fields of study whereas males are expected to opt for scientific and technical careers.

As exposed in Himmelweit (2017), care work is a fundamental aspect of social reproduction, which is constructed upon social norms. This social norms also govern institutional arrangements, such as austerity policies, and the society at large. Institutions are gendered, reflect sociocultural norms regarding gendered skills and the content of jobs (Elson (1999)). Additionally, not only gender-essentialism might be at work in the choice of certain fields of study in the supply side, but also in the demand-side of the labor market. Employers are also subject to societal gender norms, and thus are likely to implement, conciously or not, the established gendered hierarchies of work in the hiring practices (Borrowman and Klasen (2017)).

The reduction of parental allowance for middle and higher income individuals is part of the fiscal consolidation program in Germany can increase the financial burden of childcare. A higher anticipated work burden of women can add to existing horizontal segregation in tertiary education, since women would stick to the feminized fields of study to be able to balance their work-family obligations in the future. In Spain, part-time employment of women is much lower than in Germany, although the cuts in welfare benefits might increase the segregation of females into gender-typical fields.

5 Conclusion

This paper provides a descriptive analysis of the distribution of women and men across fields of study within tertiary education in Spain and Germany. The phenomenon of the uneven gender segregation across fields of study is known as horizontal gender segregation, and it is associated to key implications in gender inequality in the labour market and in society at large. The austerity policies in European countries have dissimilar effects in women and men, and bred a blossoming literature on this differential effect.

We focus on German and Spain, and conclude that the levels of segregation remain generally stable over the period considered (1998-2012). This stalled trend in segregation is in line with the explanations in England (2010), and Christensen (2015). Female-to-male ratios suggest that in both countries, there was a slight de-

segregation in female-dominated fields whereas there was a re-segregation in male-dominated fields. Based on this evidence, we hypothesize a higher cost of choosing sex-atypical fields for males. However, this evidence might be driven merely by the fact that female-dominated fields are associated with less returns to education and less socioeconomic status. We compute two different measures of horizontal segregation. The dissimilarity index shows that Spain is less segregated than Germany and the average of EU members. Employing the association index, we uncover different patterns in Spain and Germany. In Spain, Computing and Engineering fields reduced the level of segregation while Social services and Health suffered a re-segregation trend. In the case of Germany, both female-dominated and male-dominated fields reduced the level of segregation. The implications of austerity in horizontal gender segregation might fuel the conditions of the labour markets, the changes in the educational institutions and the perpetuation of gender-essentialism. In this latter source, the social norms surrounding care and the gendered divides of fields of study (humanistic/care *vs* scientific/technical) might be crucial to the choices of future cohorts of graduates. Finally, as Bargawi and Cozzi (2017) explain, the role of women in the Great Recession departs from previous crises as women are not leaving the labour market. Rather, females are participating as flexible, part-time and contingent labor force. If this role maintains over time, it would hinder the ability of future cohorts to engage in sex-atypical sectors.

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Appendix

Classification of Fields of Study (Education) and Sectors (Labour Market)

Code	Field of Study
140	Education
200	Humanities and Arts
300	Social sciences, business and law
400	Science
500	Engineering, manufacturing and construction
600	Agriculture
700	Health and welfare
800	Services
990	Not known or unspecified

Table 1: ISCED 1997 1 digit-level

	Field of Study
140	Education (ISC 14)
210	Arts (ISC 21)
220	Humanities (ISC 22)
310	Social and behavioural science (ISC 31)
320	Journalism and information (ISC 32)
340	Business and administration (ISC 34)
380	Law (ISC 38)
420	Life sciences (ISC 42)
440	Physical sciences (ISC 44)
460	Mathematics and statistics (ISC 46)
480	Computing (ISC 48)
520	Engineering and engineering trades (ISC 52)
540	Manufacturing and processing (ISC 54)
580	Architecture and building (ISC 58)
620	Agriculture, forestry and fishery (ISC 62)
640	Veterinary (ISC 64)
720	Health (ISC 72)
760	Social services (ISC 76)
810	Personal services (ISC 81)
840	Transport services (ISC 84)
850	Environmental protection (ISC 85)
860	Security services (ISC 86)
990000	Not known or unspecified

Table 2: ISCED 1997 2 digit-level

Table 3: Female to Male ratios

Field of Study	Spain		Germany		EU	
	2012	98-12	2012	98-12	2012	98-12
140: Education (ISC 14)	2.8	-0.2	3.2	0.2	3.9	0.1
210: Arts (ISC 21)	1.3	0.0	1.9	0.5	1.8	0.2
220: Humanities (ISC 22)	1.9	-0.2	2.9	0.5	2.4	-0.1
310: Social and behavioural science (ISC 31)	1.7	0.1	1.6	-0.1	2.0	0.4
320: Journalism and information (ISC 32)	2.0	0.0	2.4	0.2	2.3	-0.3
340: Business and administration (ISC 34)	1.5	0.0	1.1	-0.2	1.4	0.0
380: Law (ISC 38)	1.3	-0.1	1.3	-0.1	1.6	0.4
420: Life sciences (ISC 42)	1.6	0.0	2.0	0.2	2.0	0.3
440: Physical sciences (ISC 44)	1.0	0.1	0.7	-0.3	0.8	0.3
460: Mathematics and statistics (ISC 46)	1.0	0.0	1.5	0.4	1.0	-0.1
480: Computing (ISC 48)	0.2	-0.5	0.2	0.1	0.3	-0.2
520: Engineering and engineering trades (ISC 52)	0.2	0.0	0.1	-0.4	0.2	0.7
540: Manufacturing and processing (ISC 54)	1.1	0.5	0.6	-0.5	1.5	0.6
580: Architecture and building (ISC 58)	0.6	0.2	0.6	0.1	0.6	0.7
620: Agriculture, forestry and fishery (ISC 62)	0.6	-0.1	0.5	-0.1	0.9	0.5
640: Veterinary (ISC 64)	2.1	0.6	5.3	1.5	3.3	0.8
720: Health (ISC 72)	2.8	0.0	3.1	0.1	3.2	0.2
760: Social services (ISC 76)	4.7	-0.4	4.9	0.0	6.4	0.3
810: Personal services (ISC 81)	0.9	-0.6	1.7	1.0	1.9	-0.7
840: Transport services (ISC 84)	0.3	0.7	0.3	0.2	0.3	0.4
850: Environmental protection (ISC 85)	0.4	-0.7	0.6	0.3	1.2	0.0
860: Security services (ISC 86)	0.6	99.8	0.5	-0.2	0.5	2.1
990000: Not known or unspecified	1.5	2.1	1.8	0.2	1.5	1.5

Own elaboration based on OECD database ISCED1997 2 digit-level

Table 4: Dissimilarity Index (2 digit-level)

	2006	2012	06-12
Austria	38.64	35.23	-0.09
Belgium	31.34	31.78	0.01
Czech Republic	38.01	34.26	-0.10
Denmark	34.21	31.68	-0.07
Finland	45.92	41.45	-0.10
Germany	38.83	36.77	-0.05
Greece	28.59	29.11	0.02
Hungary	27.92	30.81	0.10
Ireland	-	29.68	-
Italy	28.35	23.98	-0.15
Luxembourg	-	23.10	-
Netherlands	37.83	35.17	-0.07
Poland	24.50	25.86	0.06
Portugal	30.97	31.16	0.01
Slovak Republic	33.44	34.57	0.03
Spain	34.93	28.57	-0.18
Sweden	38.12	34.83	-0.09
United Kingdom	28.85	28.56	-0.01

Own elaboration based on OECD database ISCED1997 2 digit-level

Table 5: Composition of Tertiary Educational Systems by Field of Study

Field of Study	Spain		Germany		EU	
	2012	98-12	2012	98-12	2012	98-12
140: Education (ISC 14)	0.14	0.12	0.09	0.16	0.11	-0.48
210: Arts (ISC 21)	0.05	0.63	0.03	0.27	0.04	0.79
220: Humanities (ISC 22)	0.04	-0.41	0.13	0.86	0.07	0.32
310: Social and behavioural science (ISC 31)	0.06	-0.01	0.05	1.00	0.08	1.11
320: Journalism and information (ISC 32)	0.01	-0.44	0.01	1.16	0.02	1.66
340: Business and administration (ISC 34)	0.17	-0.23	0.15	0.05	0.19	0.12
380: Law (ISC 38)	0.03	-0.63	0.02	-0.46	0.05	0.32
420: Life sciences (ISC 42)	0.02	0.23	0.03	0.46	0.02	-0.19
440: Physical sciences (ISC 44)	0.02	-0.41	0.04	-0.06	0.02	-0.26
460: Mathematics and statistics (ISC 46)	0.00	-0.58	0.02	0.68	0.01	-0.18
480: Computing (ISC 48)	0.03	0.02	0.03	0.54	0.03	-0.07
520: Engineering and engineering trades (ISC 52)	0.09	0.02	0.11	-0.06	0.08	-0.18
540: Manufacturing and processing (ISC 54)	0.01	0.21	0.01	-0.09	0.01	-0.20
580: Architecture and building (ISC 58)	0.05	0.39	0.03	-0.50	0.04	0.23
620: Agriculture, forestry and fishery (ISC 62)	0.01	-0.49	0.01	-0.48	0.01	-0.31
640: Veterinary (ISC 64)	0.00	-0.48	0.00	-0.48	0.00	0.29
720: Health (ISC 72)	0.13	0.27	0.13	-0.37	0.12	0.25
760: Social services (ISC 76)	0.02	0.24	0.06	0.17	0.04	0.61
810: Personal services (ISC 81)	0.06	0.72	0.02	-0.30	0.02	0.52
840: Transport services (ISC 84)	0.00	-0.38	0.00	-0.13	0.00	0.65
850: Environmental protection (ISC 85)	0.01	3.76	0.00	-0.18	0.01	1.03
860: Security services (ISC 86)	0.02	1.07	0.01	0.80	0.01	0.87
990000: Not known or unspecified	0.05	201.15	0.00	-0.31	0.01	-0.78

Own elaboration based on OECD database ISCED1997 2 digit-level

Table 6: Association Index (Spain)

	1998	2006	2012
140: Education (ISC 14)	0.97	1.35	1.30
210: Arts (ISC 21)	0.20	0.18	0.40
220: Humanities (ISC 22)	0.58	0.46	0.94
310: Social and behavioural science (ISC 31)	0.50	0.47	0.52
320: Journalism and information (ISC 32)	0.64	0.75	0.76
340: Business and administration (ISC 34)	0.35	0.38	0.48
380: Law (ISC 38)	0.24	0.05	0.53
420: Life sciences (ISC 42)	0.45	0.46	0.59
440: Physical sciences (ISC 44)	-0.07	0.01	0.03
460: Mathematics and statistics (ISC 46)	-0.03	0.10	0.11
480: Computing (ISC 48)	-1.73	-1.54	-0.91
520: Engineering and engineering trades (ISC 52)	-1.49	-1.56	-1.32
540: Manufacturing and processing (ISC 54)	0.03	-0.01	-0.23
580: Architecture and building (ISC 58)	-0.57	-0.76	-0.59
620: Agriculture, forestry and fishery (ISC 62)	-0.59	-0.62	-0.28
640: Veterinary (ISC 64)	0.70	0.47	0.36
720: Health (ISC 72)	0.98	1.04	1.17
760: Social services (ISC 76)	1.51	1.80	2.11
810: Personal services (ISC 81)	-0.20	0.47	0.82
840: Transport services (ISC 84)	-1.38	-1.20	-1.74
850: Environmental protection (ISC 85)	-0.85	-0.16	0.57
860: Security services (ISC 86)	-0.62	-1.56	-5.07
990000: Not known or unspecified	0.39	-0.57	-0.58

Own elaboration based on OECD database ISCED1997 2 digit-level

Table 7: Association Index (Germany)

	1998	2006	2012
140: Education (ISC 14)	1.76	1.20	1.04
210: Arts (ISC 21)	0.62	0.55	0.52
220: Humanities (ISC 22)	1.16	1.06	0.91
310: Social and behavioural science (ISC 31)	0.41	0.49	0.35
320: Journalism and information (ISC 32)	0.91	0.75	0.74
340: Business and administration (ISC 34)	-0.11	-0.16	-0.02
380: Law (ISC 38)	0.13	0.03	0.09
420: Life sciences (ISC 42)	0.55	0.50	0.56
440: Physical sciences (ISC 44)	-0.70	-0.44	-0.47
460: Mathematics and statistics (ISC 46)	0.03	0.59	0.24
480: Computing (ISC 48)	-1.51	-1.60	-1.76
520: Engineering and engineering trades (ISC 52)	-2.41	-2.33	-2.13
540: Manufacturing and processing (ISC 54)	-1.06	-0.94	-0.70
580: Architecture and building (ISC 58)	-0.55	-0.70	-0.59
620: Agriculture, forestry and fishery (ISC 62)	-0.68	-1.01	-0.81
640: Veterinary (ISC 64)	1.32	1.39	1.54
720: Health (ISC 72)	1.12	0.94	0.98
760: Social services (ISC 76)	1.80	1.55	1.45
810: Personal services (ISC 81)	1.13	0.94	0.42
840: Transport services (ISC 84)	-1.82	-1.39	-1.26
850: Environmental protection (ISC 85)	-1.06	-0.85	-0.69
860: Security services (ISC 86)	-0.97	-0.84	-0.89
990000: Not known or unspecified	-0.07	0.26	0.46

Own elaboration based on OECD database ISCED1997 2 digit-level

Table 8: Association Index (Sectoral Segregation in Labour Markets)

	Spain			Germany		
	1998	2006	2012	1998	2006	2012
Agriculture	0.02	-0.26	-0.06	0.10	-0.10	-0.10
Construction	-2.11	-1.59	-1.97	-1.28	-1.28	-1.30
Manufacturing	-0.09	-0.25	-0.21	-0.27	-0.27	-0.36
Mining	-1.11	-0.71	-0.81	-0.91	-0.76	-0.72
Public Administration, Comm., Social , etc	1.45	1.39	1.42	1.11	1.20	1.34
Trade, etc	0.68	0.63	0.74	0.58	0.56	0.51

Own elaboration based on ILO-LABORSTA database

Table 9: Labour Market Facts

	PANEL A							
	Spain				Germany			
	2008		2016		2008		2016	
(% if otherwise stated)	Male	Female	Male	Female	Male	Female	Male	Female
Unemployment rate	10.1	12.8	18.1	21.4	7.4	7.7	4.4	3.7
Unemployment rate with tertiary education	5.1	12.8	10	21.4	2.9	3.9	2.1	2.3
Employment rate	73.3	55.4	64.8	54.3	75.8	64.3	78.5	70.8
Employment rate with tertiary education	86.2	77.9	81.6	74.8	89.3	81	90.9	84.3
Part-time employment rate	4	21.9	7.6	24.1	8.3	45.2	9.3	46.4
Care, family or responsibilities as the main reason of part-time	3.1	31.6	3.1	19.7	8.7	52.2	9.8	48.2
In-work at risk of poverty	12.1 (e)	10.2 (e)	13.7	12.4	6.5	7.7	8.9 (b)	10.5 (b)
NEET	13.2	18.9	17.7	21.4	8.6	17	7.4	13.6

	PANEL B			
	Spain		Germany	
	2008	2016	2008	2016
Occupational segregation	26.5 (a)	25.2 (b)	26.1 (a)	25.3 (b)
Sectoral segregation	20.4 (a)	19.4 (b)	19.4 (a)	19.5 (b)
Gender pay gap	16.1	14.9 (c)	22.8	22 (c)
Gender pay gap of tertiary education graduates	22 (d)	13.9 (b)	23.1 (d)	24.5 (b)
Public sector employment (thousands)	3006.7	2925.8	5840	6160.1
Unemployment benefits as a share of total social benefits	10.8	9.0 (b)	5.4	3.7 (b)
Family/childcare benefits as a share of total social benefits	6.3	5.3 (b)	10.6	11.4 (b)
Housing benefits as a share of total social benefits	0.9	0.4 (b)	2.3	2.0 (b)

a: 2010 b: 2015 c: 2015 provisional d: 2006 e: break in time series p: provisional Source: Eurostat "Source: Occupational and Sectoral Segregation Data from European Commission: 2017 Report on equality between women and men in the EU Justice and Consum" Source: public sector employment from ILOSTAT