

Labour underutilisation over the business cycle in Spain (2005-2019): underemployment, gender asymmetries and labour flows

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Abstract. This paper revisits the factors behind the different evolution for each gender of two labour underutilisation measures during the last Spanish business cycle (2005-2019) by paying special attention to the role of involuntary part-time work and its interaction with the typical women shelter mechanisms: the added worker effect and sectoral segregation. Basing on the Labour Force Survey flows microdata base, we are able to account for the labour flows for each period, thus shedding light on the importance of these effects. In terms of labour underutilisation, men and women are equally affected over the business cycle, when including the underemployed. Whereas sectoral segregation explains the numerical adjustment being mainly male-concentrated, it is less significant when considering gendered female bias in the adjustment through underemployment. Moreover, the added worker effect has a limited effect when compensating female job loss.

Keywords: gender, labour flows, added worker effect, underemployment, Spanish economy

JEL classification: E24, E32, J64

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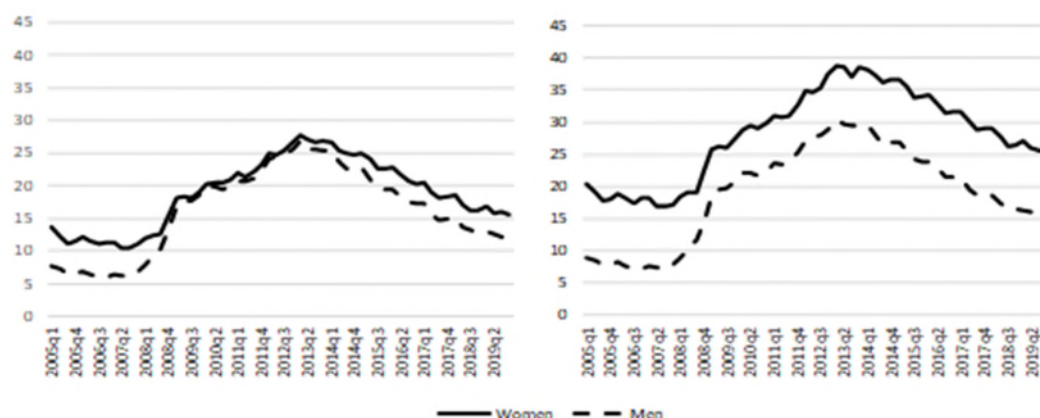
1. Introduction

After the outburst of the 2008 global and financial crisis there was a significant surge of studies analysing the gender effects of both the crisis and the austerity measures that were implemented to tackle the macroeconomic imbalances of peripheral European countries (Baccaro and Howell 2011; Perez and Matsaganis 2018). The literature focused mainly on the downward levelling of gender gaps in terms of employment adjustment, wages, and the role that the position of women in the job structure played in explaining the gender different responses to economic shocks (Belaire-Franch and Peiró, 2014; Rubery and Rafferty, 2013; López-Andreu and Rubery, 2018; Barba and Iraizoz, 2020).

Most of the attention was paid to the unequal evolution of the unemployment rates for men and women, generally finding a higher Okun's coefficient for men than for women (Boda and Povazanova, 2015 and 2021; Dunsch, 2017; Hutengs and Stadtmann, 2014). Because of sectoral gender segregation, the female unemployment rate has generally been found to be less sensitive to cyclical fluctuations than that of male, thus reducing the gender unemployment rate gap during the Great Recession (Rubery and Rafferty, 2013). This assertion holds for the Spanish case, where job destruction which can be referred to as numerical adjustment, concentrated in highly masculinised sectors such as construction and real estate (Uxó et al., 2016). Namely 77 % of job destruction during the period 2007-11 and 47,5 % in the 2011-14 period.

Nevertheless, when considering a different labour underutilisation measure, gender labour market dynamics cease to differ. The reason to consider an alternative measure to the unemployment rate lies in the fact that similar to the unemployed, people who involuntarily work part-time may also be seen as unused labour reserve and hence the consideration of both constitutes a more adequate measure of labour underutilisation. To simplify, we will denote the sum of unemployed and underemployed divided by the labour force as the extended unemployment rate or "U'" rate, as it is similar to the OECD definition. All marginally attached to the labour force and discouraged workers are not included in this rate. As can be seen in Figure 1, whereas the gender unemployment rate gap virtually disappears during the Great Recession and re-emerges during the expansionary period 2014-2019, the gender U' rate gap remains rather constant over the business cycle.

Figure 1. Unemployment (left-hand side) and extended unemployment (right-hand side) rates between 2005q1-2019q4, by gender



Source: Spanish Labour Force Survey

This paper addresses the gender labour market dynamics regarding business cycle fluctuations between 2005 and 2019 in Spain by exploring the evolution of the extended unemployment rate in contrast to the evolution of the unemployment rate. Following the work from Rubery and Rafferty (2013), where the authors summarise the factors behind the different gender labour market outcomes: the pattern of gender segregation, the added worker effect and the role of the state and employer policies, we focus on their interaction with underemployment. The aim is to shed light on the factors behind the unequal behaviour between the unemployment rate (U3) and the extended unemployment rate (U') by gender over the business cycle, yet with a focus on the recessionary period 2008-2013.

The reasons to focus on the Spanish case are threefold. First, contrary to other European economies, the evolution of the unemployment rate and the extended unemployment rate by gender present different patterns. Whereas the former converge during the crisis, mirroring the downward levelling of the unemployment rate gap, and diverge during the recovery; the latter present a parallel response to the business cycle, which implies a similar Okun coefficient (see Appendix A1). Second, despite the share of women and men working part-time over the labour force remaining relatively constant since 2005q1 around 20% and around 5% respectively, both female and male underemployment rates, have undergone significant variations over the business cycle, from 2007q4 until 2013q4 from 6.3% to 11.5% for women and 1.1% to 4.1% for men and falling to 10.1% and 3.4% in 2019q4, respectively. And third, despite the Spanish economy being characterised as a

Mixed Mediterranean Economy within the Varieties of Capitalism literature, where the adjustment during recessionary periods is mostly external, this increase in underemployment during the crisis reflects an adjustment through underemployment (Lallement, 2011), which is the typical form of adjustment in liberal economies. The main hypothesis is that women are as exposed to business cycle fluctuations as men when considering a more complete measure of labour underutilisation.

As a novelty to the literature, the empirical analyses of this paper will draw on microdata from the Spanish Labour Force Survey Flows estimates. The goal is to unravel to what extent the role of underemployment, the added worker effect and sectoral segregation, ultimately determine the gender differences between U3 and U' in Spain over the 2005-2019 period. We attempt to test the following three hypotheses:

Our first hypothesis (H1) holds that the main reason explaining the different behaviour between female and male U3 and U' rates is that underemployment was used as an adjustment mechanism for women, whereas the numerical adjustment greatly affected men.

The second hypothesis (H2) states that the added worker effect, since it increases the labour supply of women, acted as a shield for their employment, which is mirrored by an increase in gross flows from inactivity towards underemployment during the Great Recession and explains the U3 and U' gender differences.

And the third and last hypothesis (H3) defends that sectoral segregation is responsible for the feminised character of the adjustment through underemployment, as it is the main factor explaining the masculinised character of the numerical adjustment during the crisis. In this sense, sectoral segregation would be at the root of the distinct evolution of U3 and U', since it determines the gendered bias of the adjustment.

The paper is organised as follows. Section 2 reviews the main literature and introduces the theoretical framework. Section 3 carries along an analysis on the labour flows contributions to U3 and U' variations over the business cycle, in order to test the first hypothesis. To provide a clearer picture of the labour market transitions, the recessionary period will be divided into two subperiods (2008-2009 and the double-dip recession 2010-2013). Section 4 will deal with the added worker effect (AWE), and hence with the second hypothesis. According to the existing literature, during economic downturns women reinforce their role in the labour market, particularly after a negative labour market

outcome of their partners or in their household (Insarauto, 2021; Rubery, 2015). This effect could explain the increase in the female U' rate during the Great Recession if the transition from inactivity towards underemployment is significant. Section 5 analyses the role of sectoral segregation, by calculating the Karmel and MacLachlan index for the total employed and the underemployed and examining the sectoral distribution of the labour market adjustments. That is, section 4 tests the third hypothesis, i.e., the role of sectoral segregation in explaining the exposure of the underemployed to economic shocks. The last section summarises the central findings and concludes.

2. Literature review and theoretical framework

Despite the vast literature on the evolution of the Spanish economy from a macroeconomic perspective over the last business cycle, there is, to our knowledge, no paper analysing its evolution from a gendered macroeconomic perspective. According to Rubery and Rafferty (2013), who revisit the determining factors of the different performance in the labour market of women during recessionary periods, the main factor shaping the gender different employment outcomes is sectoral segregation. Indeed, gender segregation has received a lot of the attention when studying divergent gender employment outcomes since its pattern determines the extent to which women might be more protected or more exposed to economic downturns.

The pattern of gender segregation, as it is dependent on social norms, might lead to opposing trends. On one hand, under the assumption that women provide a flexible labour force supply, because of being regarded as secondary labour force participants (given their socially assigned carer role), they might be more likely employed in so called “buffer jobs”. These are in sectors, workplaces or occupations where employers can easily apply numerical adjustments in order to cope with a volatile demand. From a feminist perspective, women may also be deployed as cheaper labour force substitutes for men, given their lower wages and hence higher flexibility (substitution effect) (Felstead and Gallie, 2004). Therefore, this pattern of gender segregation is linked to business cycle volatility. Nevertheless, this is not the case for the Spanish labour market as suggested in the introduction.

On the other hand, gender segregation might also act as a shield from male competition and business cycle fluctuations by employing them in protected jobs, usually in services.

As opposed to the prior pattern, gender segregation might constrain employer's possibilities to use women to adjust their workforce, thus explaining the lower increase in the unemployment rate of women in Spain, particularly at the start of the Great Recession.

Recent literature on the relevance of gender segregation supports its protective pattern during the Great Recession. Barba and Iraizoz (2020) concentrate on the Great Recession effect on female sectoral employment across Europe carrying out an input-output analysis to decompose the segregation effect into the technological effect, the productivity effect and lastly the demand effect, which reinforce or reduce the level of sectoral segregation. These authors found that technical change has a greater negative impact on men employment, whereas final demand has a higher positive effect on female employment. Their evidence suggests the importance of the added worker effect and that of the substitution effect, while rejects the role of women as a buffer in explaining female labour market performance. Furthermore, Acosta-Ballesteros et al. (2021) study the impact of gender sectoral and occupational segregation on the underemployment² gender gap in Spain. These authors show that in female dominated occupations and sectors the level of underemployment is higher, particularly for women, thus pointing to the idea that the underemployment gap is dependent on the gender segregation level.

Another effect explaining the divergent employment outcomes between genders is the added worker effect. It is argued that during recessions women may reinforce their labour force commitment as they attempt to compensate for the income loss of the household by entering the labour market (Insarauto, 2021). Similar to the latter pattern of gender segregation, the added worker effect has been considered a shelter mechanism for women employment, since the employment loss of some women might be offset (Guner et al, 2021). Both mechanisms relate to gender norms, by which women do not hold the same position as men and are forced to combine paid work with unpaid domestic work. Given the limited take-up of part-time work in Spain, the increase of female participation in the labour market and the high degree of sectoral segregation, the gender regime in Spain can be characterised as a dual earner gender specialised model (Insarauto, 2021).

² These authors refer to all time-related underemployment; that is, involuntary part-time work and temporary work.

Prieto-Rodríguez and Rodríguez-Gutiérrez (2000), Addabo et al (2013) and Guner et al (2021) analysed the added worker effect for Spain, Italy and the USA. They all employed micro databases that provided information not only on the marital status of an individual but also on the economic outcome of their counterparts in the household. For both cases, the added worker effect was found to be significant and explanatory for the smaller shock on female employment as a consequence of a crisis, since the transitions of women out of inactivity and towards employment partially compensated for the loss of female employment. The literature has so far found opposing results on the added worker effect.

Turning to the literature on underemployment in Spain, most authors have mainly focused on the Great Recession effects, particularly on the variation of various gender gaps after the crisis. Among this literature and with a focus on underemployment, we highlight the work of Rodríguez (2018), who analyses the determinants of labour underutilisation differentiating by gender, paying special attention to the determinants of underemployment and unemployment. He observes that older age, higher education level, living with an elder parent or in-law and children reduce the probability to be unemployed or underemployed.

In the same line, Insarauto (2021) studies the evolution of involuntary part-time by comparing the Labour Force Data from 2007 and 2014, in order to detect the effects of the Great Recession. She particularly focuses on how the probability of women to be underemployed increased during the crisis. An interesting conclusion she reaches is the limited acceptance of women of part-time work in Spain, pointing to their rejection of gender norms in this matter. Indeed, this negative correlation between high underemployment and low levels of part-time work has been widely found among European countries (Parent-Thirion et al., 2007). Moreover, the author argues that the use of women underemployment to be an employers' strategy to cope with an economic downturn while profiting from a more flexible and cheaper labour force (Insarauto, 2021).

Kjeldstad and Nymoen (2011) published a paper analysing the evolution of underemployment and its relationship to economic fluctuations. Since their paper only draws on quarterly data from 2005 the estimation results on the cyclical behaviour of underemployment are inconclusive. Nevertheless, these authors introduced an interesting feature of underemployment. As per these scholars, the underemployed could be *Excluded*; as in the case of mostly women who are more often employed in female-dominated occupations where part-time is more common or *Expelled*; as in the case of

men been temporary in underemployment as an internal adjustment measure (as in short-time work schemes).

3. Net labour flows: decomposing the labour underutilisation rates

As mentioned in the introduction, this paper aims at unravelling the contrasting gender labour market dynamics over the business cycle. As a first approach, this section presents a decomposition of U' and $U3$ to analyse the origin of the increase in underemployment.

To study the variations of the extended unemployment rate by gender we exploit the Spanish Labour Force Survey Flows micro database from 2005q1 until 2019q4. Because of methodological changes, it is not possible to build the database back to 2000 to incorporate the whole expansionary period before the Great Recession. This database is akin to the Labour Force Survey (LFS) and provides information on the employment status of a person for six consecutive quarters. Unlike the LFS, the Spanish Labour Force Survey Flows micro database does not yield information on the economic situation of the remaining household members.

One of the main drawbacks of the Spanish Labour Force Survey flows estimates is that industries and occupations are disaggregated in a 1-digit NACE-09 and National Classification of Occupations (CNO-11) categorisations respectively, thus not allowing for a greater breakdown degree. An alternative micro database with greater disaggregation possibilities is the Continuous Sample of Working Lives (MCVL). Yet, since this database consists of administrative records, underemployment cannot be captured. For this reason, the following analyses will draw on the LFS flows estimates. Despite this being an aggregate exercise, it allows us to determine the transitions towards and out of underemployment during the different periods and detect the main net effects.

We summarise the potential variations at stake (Diagram 1). First, transitions from full-time other employment (FT) to unemployment (U) or the expelled effect/adjustment through unemployment. Second, the added worker effect might be appreciated through transitions from inactivity (I) to unemployment/underemployment ($Under$)/total other employment (OE) and transitions from part-time other employment (PT) towards underemployment. As discussed by the literature, changes in the participation rate have been significant in explaining the evolution of the unemployment rate during the Great Recession (Villanueva and Cárdenas, 2021). And finally, transitions from total other

employed/underemployed towards unemployed correspond to a numerical adjustment. Diagram 1 also shows the expected effect and the sign of the effect of a net positive transition on U3 and U' rates.

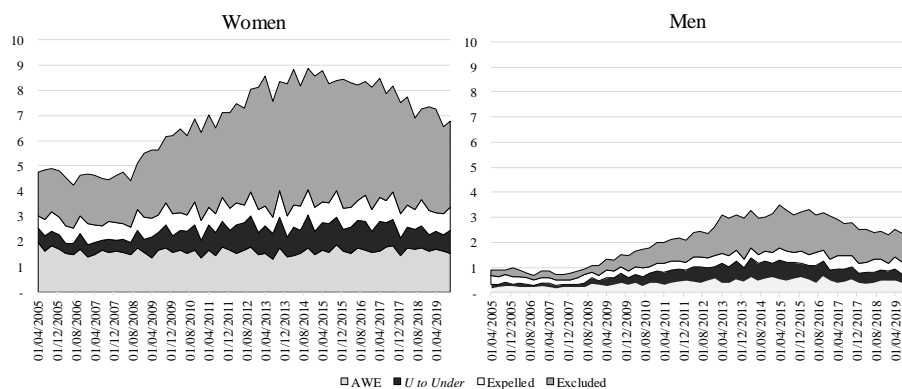
Diagram 1: Net flows and expected effects

Variations	Transitions	Expected effects	$\Delta U3$	$\Delta U'$
$\Delta U3$	<i>L effect(U3)</i>			
	<i>Under to U</i>	Numerical adjustment	>0	=
	<i>OE to U</i>		>0	>0
$\Delta U'$	<i>I to U</i>	Added Worker Effect	>0	>0
	<i>PT to Under</i>		=	>0
	<i>I to Under</i>		<0	>0
	<i>FT to Under</i>	Adjustment through underemployment	=	>0
	<i>L effect(U')</i>			

Source: Own elaboration

We now analyse which variables explain the differences between the unemployment rate and the extended unemployment rate (Figure 2), in order to capture those remaining underemployed. The transitions have been aggregated and categorised in order to ease their interpretation, following Diagram 1. According to Kjeldstad and Nymoén (2012), this effect would concentrate on women as they are structurally excluded from full-time contracts. And lastly, transitions from unemployment towards underemployment (*U to Under*).

Figure 2. Decomposition of the underemployment rate i.e., the U3 and U' differences



Source: Own elaboration basing on Spanish Labour Force Survey Flows estimates

Immediately after the outbreak of the crisis, there is a continued sharp increase in the number of women who remained underemployed. For men, the smaller difference between the rates is striking at first glance. In terms of the behaviour of the variables, there is an increase in the number of people remaining in underemployment during the crisis (*Excluded effect*), which is of higher magnitude among women, as suggested by Kjeldstad and Nymoen (2012).

To calculate the contributions to changes in the U3 and U' rates, we pay attention to the net flows affecting the numerator (unemployed and underemployed), whereas for the changes in the labour force (L) (denominator) we use the standard methodology. We are aware of the fact that this methodology does not allow to control for the added worker effect transition from inactivity towards other employment. Theoretically, a positive net flow of such transition would have a negative effect on both labour underutilisation measures. The applied expressions are the following:

$$U' = U3 + \frac{Under}{L} \quad (1)$$

$$\begin{aligned} \Delta U' &= \Delta U3 + \Delta \frac{Under}{L} = \frac{U_t}{L_t} - \frac{U_{t-1}}{L_{t-1}} + \frac{Under_t}{L_t} - \frac{Under_{t-1}}{L_{t-1}} = \frac{U_t + Under_t}{L_t} - \frac{(1+g_t)(U_{t-1} + Under_{t-1})}{(1+g_t)L_{t-1}} \quad (2) \\ &= \frac{U_t - U_{t-1}}{L_t} - \frac{(g_t)(U_{t-1})}{L_t} + \frac{Under_t - Under_{t-1}}{L_t} - \frac{(g_t)(Under_{t-1})}{L_t} \end{aligned}$$

$$\begin{aligned} U_t - U_{t-1} &= Inflows_{OE\ to\ U} - Outflows_{U\ to\ OE} + Inflows_{Under\ to\ U} - \\ &Outflows_{U\ to\ Under} + Inflows_{I\ to\ U} - Outflows_{U\ to\ I} = \\ &Net\ flows_{OE\ to\ U} + Net\ flows_{Under\ to\ U} + Net\ flows_{I\ to\ U} \quad (3) \end{aligned}$$

$$\begin{aligned} Under_t - Under_{t-1} &= Inflows_{OE\ to\ Under} - Outflows_{Under\ to\ OE} + \\ &Inflows_{U\ to\ Under} - Outflows_{Under\ to\ U} + \\ &Inflows_{I\ to\ Under} - Outflows_{Under\ to\ I} = \\ &Net\ flows_{OE\ to\ Under} + Net\ flows_{U\ to\ Under} + \\ &Net\ flows_{I\ to\ Under} \quad (4) \end{aligned}$$

$$\begin{aligned} \Delta U' &= \Delta U3 + \frac{Net\ flows_{OE\ to\ Under} + Net\ flows_{I\ to\ Under} - Net\ flows_{Under\ to\ U}}{L_t} \quad (5) \\ &\quad - \frac{(g_t) * (U_{t-1} + Under_{t-1})}{L_t} \end{aligned}$$

where g_t is the $q - q$ labour force growth

Table 1 collects the contributions to variations of U3 and U' rates by period and gender, thus allowing us to detect whether the net transitions present an anticyclical behaviour. In line with Figure 1, total U' variations are alike for men and women, particularly during the recessionary period, as opposed to U3 variations. The contribution of the transitions from *OE to U*, as well as those from *FT to Under* respond to business cycle fluctuations, thus pointing to both as being adjustment mechanisms. As expected, men were more affected by numerical adjustments than from adjustments through underemployment, whereas the opposite holds for women.

Table 1: Contributions to U3 and U' rates variations

		<i>U3</i>			<i>U'</i>						
		(a)	(b)	<i>External Adjustment</i>			<i>"Added Worker Effect"</i>			<i>Adjustment through underemp.</i>	
		$\Delta U3^*$	<i>Under to U</i>	<i>OE to U</i>	<i>I to U</i>	<i>I to Under</i>	<i>PT to Under</i>	<i>FT to Under</i>	<i>L effect</i>	$\Delta U'^*$	
Women	05q1-08q1	-1.65	-2.38	-5.12	5.26	1.14	0.25	-1.06	-2.28	-2.00	
Men	08q1-13q4	0.10	-0.36	-2.80	2.22	0.36	0.05	-0.39	-0.54	-0.05	
Women	13q4-10q4	14.87	-4.47	1.44	16.10	1.11	3.20	2.12	-1.88	20.05	
	10q4-13q4	8.79	-1.88	0.75	8.46	0.56	1.65	0.93	-1.60	11.56	
Men	08q1-13q4	17.44	-2.68	5.97	7.87	0.59	0.89	0.61	1.59	20.43	
	10q4-13q4	12.08	-0.78	4.20	4.05	0.26	0.33	0.18	0.37	13.43	
Women	13q4-19q4	-11.32	-6.28	-8.10	7.60	0.07	1.35	-1.34	-1.10	-12.91	
Men	19q4	-13.08	-3.72	-9.11	4.57	0.68	0.57	-1.63	-0.23	-13.83	

Source: Own elaboration basing FLS flows micro database

* $\Delta U3$ includes the *L effect* and *Error term* and $\Delta U'$ includes the *Error term*

It is worthwhile mentioning that gender differences are of great magnitude when considering transitions out of inactivity for the whole period, in a context of steady increases in the female labour force, while the male labour force started to shrink since 2008q3. During the Great Recession, transitions out of inactivity towards unemployment explained most of female U3 and U' rates, pointing to an added worker effect. Additionally, the *L effect* reflects the fall in male labour force during the Great Recession, which was responsible for the overall reduction of the participation rate during that

period. Lastly, over time flows from unemployment towards underemployment become more important for both genders, reflecting the persistence of underemployment even during the last expansionary period.

Returning to one of the points made in the introduction, the adjustment in the unemployment rate during the Great Recession took place mainly in male-dominated sectors (construction), especially in the first phase of the crisis. That is, the phase prior to the fiscal austerity and wage devaluation policies implemented through two consecutive labour market reforms. In Table 1, we divide the crisis period into two sub-periods 2008q1-2010q1 and 2010q1-2013q4, to see whether this policy strategy had a reflection into changes in the extended unemployment rate. Indeed, the increase in both rates is higher during the first sub-period of the crisis for men (with the notable contribution of the transition from employment to unemployment), while for the second sub-period it is the extended unemployment rate for women that experiences the greater increase as a consequence of higher contribution of the transition from other full-time employment towards underemployment and the added worker effect. The same holds when we compare the sum of the contributions of the transitions from employment to unemployment and from employment to underemployment.

This exercise was useful to examine the origin of underemployment, which is found to be in full-time employment and the added worker effect, which points to an adjustment through underemployment mechanism. This adjustment mechanism will also be referred to as the *Expelled effect*, following Kjeldstad and Nymoen (2012), since it comprises the transitions from full-time employment towards underemployment.

The added worker theory argues that in a recessionary period when one of the household members becomes unemployed, another household member (usually an inactive woman) enters the labour market (*I to U*, *I to Under*, *I to OE* and *PT to Under*). Considering the transitions that could account for the increase in underemployment, the contributions of net inflows from inactivity to underemployment, contributed to U' variations to a lesser extent, while contributions from part-time employment towards underemployment, i.e. those already working, become more relevant during the Great Recession.

Four issues emerge from this section. First, underemployment appears as the main adjustment mechanism for women, whereas the numerical adjustment greatly affected men. This evidence confirms our first hypothesis as these different adjustments constitute

the main factor behind the distinct evolution of both labour underutilisation measures by gender. Second, there is a significant difference in how the labour market adjustment occurred during the first stage of the crisis and the double-dip recession or debt crisis. Whereas men suffered a larger adjustment in terms of increased unemployment from employment (*OE to U*) in the first period and a smaller impact in the second (and more evenly distributed between the two forms of adjustment studied - unemployment and underemployment), women suffered adjustments from employment to extended unemployment of similar magnitude and composition in both periods, with a greater weight of transitions to underemployment. Third, the analysis at aggregate-level data is insufficient to assess a possible added worker effect, since this effect refers to gross flows from inactivity towards activity, as opposed to the net flows approach adopted in this section. Moreover, the added worker effect does not explain the differences at the aggregate level, despite it being of relevance for the increase in both U3 and U' for women. Fourthly and finally, in addition to transitions between different employment statuses, the increase in the female labour force that remains underemployed appears as the variable that most explains the difference between the female rates and is a good indicator of the lower outflows from underemployment in the wake of the crisis and that in the subsequent recovery period does not return, for either of the two cases, to pre-crisis levels.

As opposed to the existing literature, these results contradict the aprioristic outcomes expected for each gender. Both the *Expelled* and the *Excluded Effects* record higher impacts among women according to the U' variations decomposition (Table 1) and the differences between U3 and U' (Figure 2). Nevertheless, one must bear in mind that LFS flows reflect the employment status of a person during the reference week, so that short-term unemployment periods should not be dismissed.

Nonetheless, as studies have shown, female part-time employment has continued to expand even during periods of economic downturn, and increased levels of involuntary part-time work among women, mainly on a pro-cyclical basis.

4. Does the added worker effect act as a women shield from economic fluctuations?

We have seen in the previous section that the added worker effect does not seem to have much weight in explaining gender differences between both labour underutilisation measures, yet it does contribute to the increase of both U3 and U'. This is reflected by the minor contributions of net inflows from inactivity towards underemployment. Therefore, it is necessary to move away from the analysis of net transition flows to one of gross transition flows, by comparing similar population groups.

As already stated, the added worker effect is the effect whereby a household member (usually a woman) enters the labour market as a response to an adverse economic situation in the household. This analysis is framed within the debate on changes in gender regimes. While traditionally and in developing countries the gender regime is still characterised as a male breadwinner and female carer model, in many countries there are transitions towards dual models in which gender roles are somewhat blurring. Yet, recent literature points to a re-emergence of the added worker effect in developed economies during the Great Recession as a consequence of the higher level of education of women and stronger labour force attachment (Addabo et al, 2013)

This blurring of gender roles may be reflected in several ways. On the one hand, in an increase in underemployment by women who are rejecting their traditional role as caregivers or secondary labour force (as we have already seen). On the other hand, in the absence of an added-worker effect or, if there is one, by a gender-neutral added worker effect.

To capture the added worker effect (in terms of gross flows), we compute the probability to transit out of inactivity and that to transit for voluntary part-time to underemployment, since it reflects an increase in female labour supply. As clarified in the previous section, the added worker effect during recessionary periods consists of four possible transitions: from inactivity towards 1) underemployment, 2) unemployment 3) towards other employment and from part-time work towards underemployment. The net effect of transitions 1) and 2) was captured in Table 1, with a significant effect of the latter, whereas the transition towards other employment has yet to be seized.

Prieto-Rodríguez and Rodríguez-Gutierrez (2000) and Addabo et al (2013) employed cross-section data when analysing the added worker effects for two different crises, 1991 and 2011. The main advantage of these databases used (Survey of Structure, Conscience and Biography of Class of the year 1991 (SCBC-91) and the EU-SILC 2011) is that they

allow to control for a partners' employment status, while missing the transition analysis. Both studies found a positive added worker effect for women in Spain.

Eurofound (2017) analysed the different labour market transitions following the Great Recession using the EU-SILC panel data for European countries. Guner et al (2021) studied the added worker effect in the USA using data for the 1976-2018 period from the Current Population Survey (CPS). The advantage of these analyses is their ability to account for the employment transitions of a couple during a recessionary period. Whereas the latter found a positive and significant added worker effect for women, the former finds the transitions out of inactivity to be not significantly affected by the business cycle. Moreover, the level of occupational segregation does not play a role in explaining transitions into inactivity.

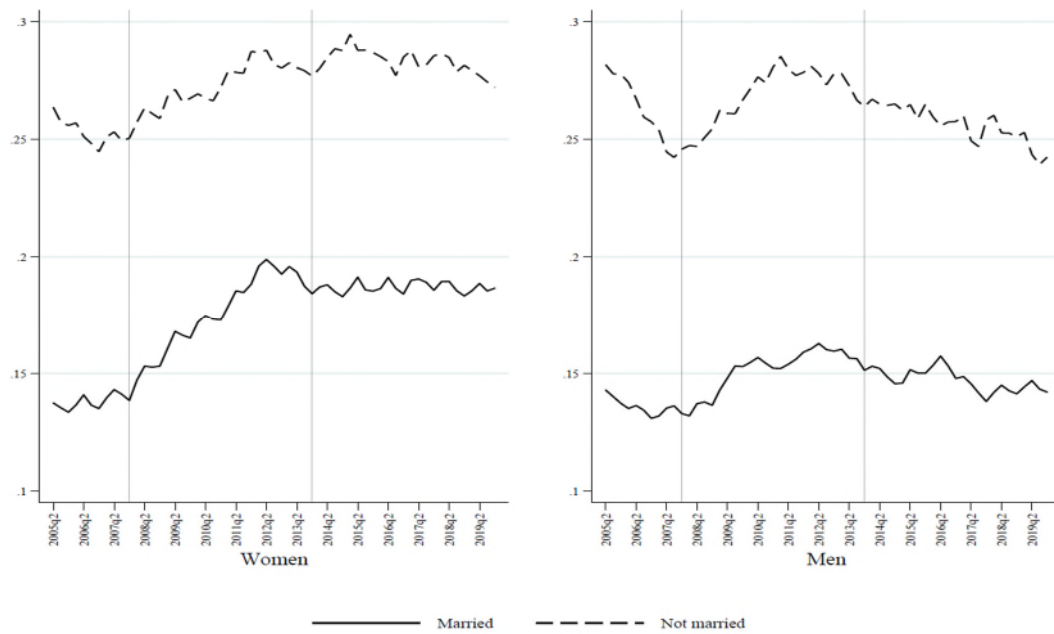
Unlike the LFS micro database, the LFS flows micro database do not report information on the economic situation of the other persons in the household, but on the household structure. Despite this lack of information to account for the added worker effect, this analysis contributes to the literature through a flows analysis.

We differentiate the behaviour of men and women by marital status, by selecting only the population in the 25-65 age range. Following the methodology in Dueñas et al. (2016) we consider the probabilities to transit from an employment status to another from one quarter to the following. Matrix P is a 5x5 matrix that collects the 20 possible probabilities to transit between quarters $t-1$ and t . Each of these 20 probabilities is obtained by calculating the ratio of the number of persons in a given employment status X in quarter $t-1$ and Z in quarter t , divided by the total number of persons in employment status X in quarter $t-1$. The last row constitutes the one of interest and the probability to transit part-time employment towards underemployment.

$$P = \begin{pmatrix} P_{FTFT} & P_{FTUn} & P_{FTPT} & P_{FTU} & P_{FTI} \\ P_{UnFT} & P_{UnUn} & P_{UnPT} & P_{UnU} & P_{UnI} \\ P_{PTFT} & P_{PTUn} & P_{PTPT} & P_{PTU} & P_{PTI} \\ P_{UFT} & P_{UUn} & P_{UPT} & P_{UU} & P_{UI} \\ P_{IFT} & P_{IUUn} & P_{IPT} & P_{IU} & P_{II} \end{pmatrix} \quad (6)$$

$$P_{out} = P_{IOE} + P_{IUUn} + P_{IU} + P_{PTUn}; P_{IOE} = P_{IFT} + P_{IPT} \quad (7)$$

Figure 3. Probabilities to transition out of inactivity: the Added Worker Effect



Source: Own elaboration basing on Spanish Labour Force Survey Flows estimates
5-month moving average of probabilities

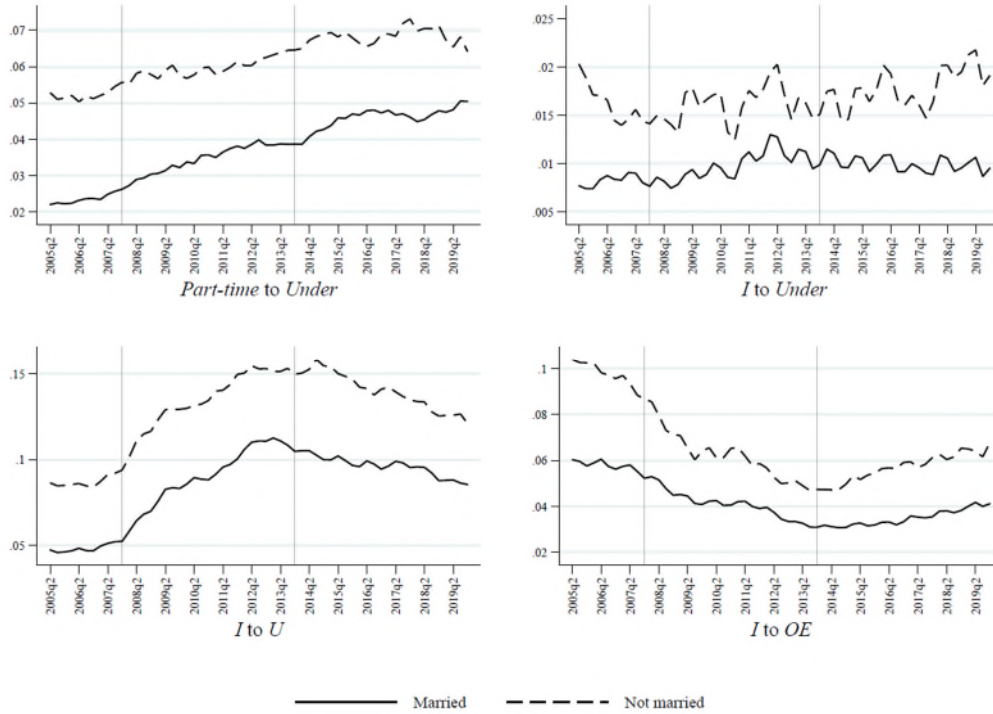
When dividing the selected population by marital status, we observe that the most counter-cyclical behaviour is that of the probabilities of married women to transit out of inactivity (Figure 3). The added worker effect for not married women, and men regardless of their marital status does not respond to cyclical fluctuations.

Moreover, when controlling by age groups the added worker effect varies among gender and marital status. As a general trend, the older the age group the more sensitive both married and not married women probabilities to transit out of inactivity over the business cycle are. In the case of men, only in the ages between 40 and 44 years old and 55 and 59 years we find a significant response of the added worker effect probability during the recession. Surprisingly, in these age ranges we find an increase in the added worker effect despite the marital status.

When further decomposing the added worker effect into the before mentioned transitions, one observes that the increase in the probability to transit out of inactivity into unemployment has a parallel behaviour for both married and not married women (5 pp for both from 2007q4 until 2013q4). Additionally, the divergence in the added worker effect among women is rooted in a sharper reduction of a woman's probability to

transition towards other employment for not married women than for married ones, as Figure 4 depicts (5 pp vs 3 pp over the recessionary period, respectively).

Figure 4. Decomposing the AWE for women, by marital status



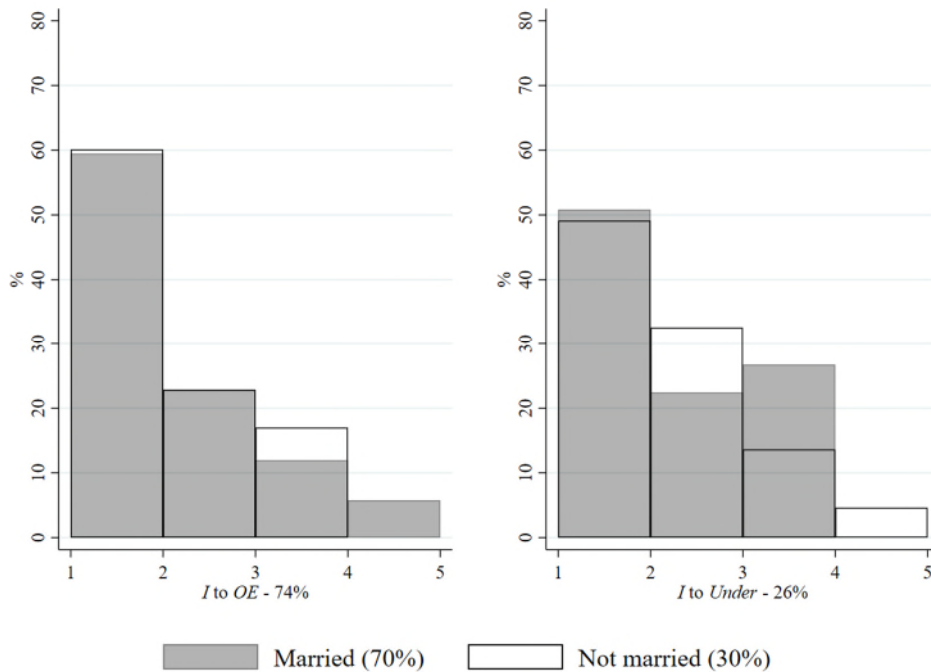
Source: Own elaboration basing on Spanish Labour Force Survey Flows estimates
 Note: y-axis represents the probabilities
 5-month moving average of probabilities

The evidence provided so far does not hint to the added worker effect being neither a relevant factor accounting for the distinct behaviour of U3 and U' over the business cycle, nor representing a shelter mechanism of women employment. If it were so, the transition from inactivity towards other employment or towards underemployment would have positively contributed to the increase of the added worker effect during the recession. Nevertheless, it should be borne in mind that transitions towards other employment or underemployed might occur some quarters after the entry in the labour force. For this reason, this section engages in a trajectory analysis of married women, who during the recessionary period transition from inactivity towards unemployment.

We select all the information on the transitions of married women and not married after having transited into unemployment from 2007q4 until 2013q4. We exclude successful transitions into employment after 2013q4 since the added worker effect is associated to recessionary periods. We distinguish between two possible transitions: 1) *I to U to OE*

and 2) *I to U to Under*. There is a third possible transition that would imply flows from *OE to Under* and vice versa. Yet, as these only represent 0.7% of the selected dataset, we do not include them in the analysis.

Figure 5: Quarters until an employment or underemployment transition



Source: Own elaboration basing on Spanish Labour Force Survey Flows estimates

First, the most common trajectory for both marital statuses during the recessionary period was to remain unemployed. Indeed, 75% of not married women who transitioned out of inactivity into unemployment during 2007q4 and 2013q4 remained unemployed, while 80% of married did. As can be seen from Figure 5, minor differences arise from this analysis.

According to the evidence provided in this section, it can be stated that the added worker effect had a limited impact on protecting female employment during the Great Recession, and that it concentrated on transitions into total other employment. The successful transitions towards underemployment account for 4.8% of gross flows, hence we can reject the second hypothesis that argued that the added worker effect acted both as a smooth factor of the unemployment rate and a countercyclical factor of U' . Nevertheless, as demonstrated in section 3, the added worker effect had a positive effect in increasing both U_3 and U' due to the net flow contribution from inactivity towards unemployment for women. By means of this effect, the different gender responses of both labour

underutilisation measures were reduced. Lastly, the added worker effect does not explain the differences between the U3 and U' behaviours, as reported by the empirical evidence.

5. Sectoral gender segregation as women' employment shelter

The role of gender segregation in explaining labour market distinct outcomes has received a lot of attention among scholars (Eurofound, 2017; Barba and Iraizoz, 2020; Rubery and Rafferty, 2013). Gender-based job segregation can be defined as the uneven distribution of employment through different labour market categories: 1) industries or sectors, 2) occupations and 3) positions. Sectoral segregation is that referring to industries being largely dominated by workers of one gender. Occupational or horizontal segregation reflects the supposition that men will take up different occupations than women. Lastly, vertical segregation is related to the glass ceiling concept, whereby men dominate decision making and leading positions within an occupation (Bettio and Veashchagina, 2009).

Not only has gender segregation been analysed as a key determinant of the different outcomes, but also as an explanatory variable of lower wages and social discrimination (Barba and Iraizoz, 2020). What is more, gender segregation may be also analysed through the lenses of the quality of employment, that is standard or typical versus non-standard or atypical contracts.

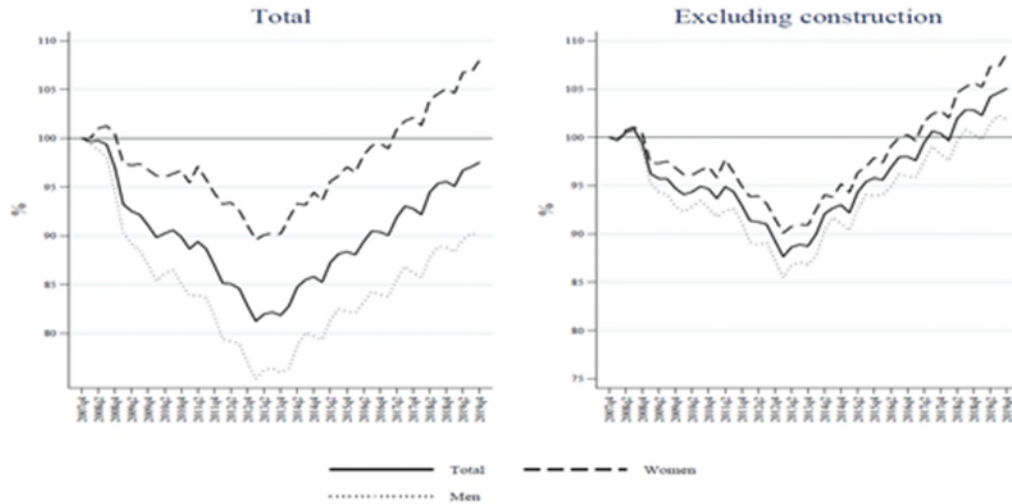
When it comes to determining the segregation type that most accounted for the job-loss patterns during economic crises, sectoral segregation appears to be the most important factor (Bettio et al., 2013). Indeed, according to Karamessini and Rubery (2014) sectoral segregation was the main factor behind the employment gender patterns during both the Great Recession.

In the Spanish case, when excluding construction, the leading sector of the Spanish economic activity during the expansionary period 2000-2007, both men and women employment returned to their pre-crisis levels between 2016-2018. As can be seen in Figure 6, this contrasts with the data when considering the employed as a whole; in the case of men the level of employment was 20pp below the pre-crisis level by 2019q4.

Moreover, on account of the austerity measures implemented between 2011 and 2013 affecting the so-called sheltered sectors which correspond to the public sectors (mostly

education, health, care and public administration), the female unemployment rate underwent a negative impact as well (Lombardo, 2016). These uneven effects mirror the Spanish gender regime, a dual earner gender specialised model (López-Andreu and Rubery, 2018). Additionally, despite their allegedly sheltered position in the labour market, women have suffered an increase in their employment instability and vulnerability (Cárdenas and Villanueva, 2020).

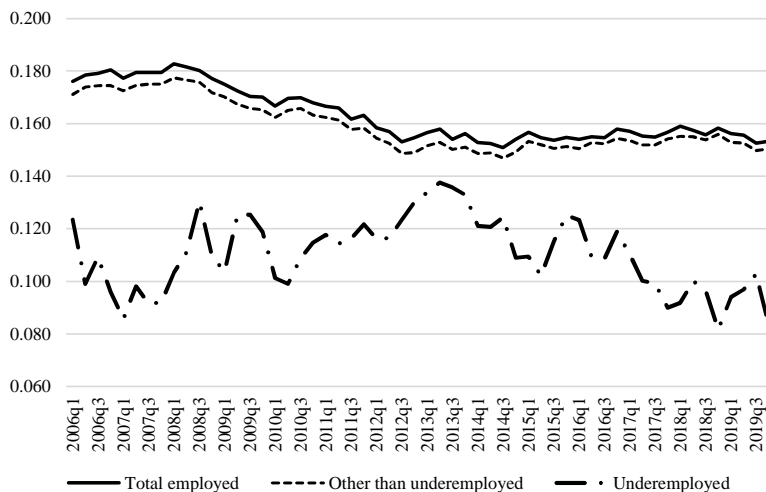
Figure 6. Employment evolution, 2007q4=100



Source: Spanish Labour Force Survey

With respect to the gender segregation level in the Spanish economy, the literature has found it to be one of the countries which is most segregated (Iglesias-Fernández et al, 2012). However, Dueñas et al (2016) found that the level of segregation decreased as a consequence of the Great Recession, mostly due to the weight of construction and real state during the first subperiod (2008-2010).

Figure 7: Karmel and MacLachlan Index



Source: Own elaboration based on the Spanish LFS micro database

By calculating the Karmel and MacLachlan Index for sectoral gender segregation by kind of employment (other employment and underemployed), one observes that the segregation level among total employed and that of other than underemployed present the same evolution, whereas sectoral segregation among the underemployed is lower.³ Taking into account that for the whole period of study 73.8% of the underemployed are women, this implies that this share is roughly similar in all sectors, regardless of an industry's share. Additionally, Figure 7 reveals that during the expansionary periods, overall gender sectoral segregation remained stable and decreased during the recession.

Moreover, when decomposing the sectoral, composition and gender effects that contribute to the variations in the Karmel and MacLachlan index, we observe that the sectoral effect plays a significant role in reducing gender segregation during the recession and has a minor relevance during expansionary periods (see Appendix).

Following upon these findings, this section deals with the role of sectoral gender segregation in clarifying the employment (other employment and underemployment) gender dynamics. This is related to our research question, as follows. In the light of Figure 6, sectoral segregation plays a determining role in explaining the different behaviour of the total employment during the business cycle and particularly during the Great Recession. Nonetheless, the parallel behaviour of the U' rates between men and women points to a compensation effect driven by female underemployment.

Because the adjustment in the labour market for women during the Great Recession is explained by transitions from full-time employment towards underemployment (Table 1), we focus on the gender segregation relevance in explaining women and men adjustments (adjustment through underemployment and numerical adjustment, respectively). To do this, we concentrate on the net transitions out of total employment towards unemployment and from full-time employment towards underemployment by industry and gender.

First, we test whether the numerical adjustment concentrated on male dominated sectors, thus sectoral segregation would be a key factor in the economic outcomes by gender. And

³ Alternative segregation indexes show the same evolution.

second, we test how the net transitions from employed other than underemployed towards underemployed are distributed among sectors.

Table 2a. Distribution of numerical adjustment from 2007q4 to 2010q1

	Total	Men	Women	% Women
Total	675,880	586,418	89,462	
Construction	69%	77%	17%	5%
Extractive industries	13%	14%	6%	17%
Manufacture of computer, electrical equipment, and transport equipment	10%	8%	20%	19%
Wholesale and retail trade and accommodation	10%	5%	48%	50%
Manufacture of food products, textiles, wood, and paper	8%	5%	27%	37%
Transportation and storage	4%	3%	12%	23%
Other services	5%	1%	32%	59%
Financial and insurance activities	5%	-1%	47%	49%
Agriculture, forestry, and fishing	-4%	-3%	-16%	27%
Public administration, education, human health and social work activities	-20%	-9%	-91%	70%

Table 2b. Distribution of numerical adjustment from 2010q1 to 2013q4

	Total	Men	Women	% Women
Total	297,476	224,956	72,520	
Construction	77%	96%	19%	8%
Extractive industries	14%	19%	-2%	19%
Manufacture of food products, textiles, wood, and paper	7%	5%	14%	36%
Other services	6%	-3%	33%	74%
Public administration, education, human health and social work activities	5%	11%	-16%	61%
Manufacture of computer, electrical equipment, and transport equipment	4%	7%	-6%	20%
Financial and insurance activities	3%	-8%	36%	51%
Transportation and storage	2%	3%	-2%	24%
Wholesale and retail trade and accommodation	-4%	-11%	17%	52%
Agriculture, forestry, and fishing	-12%	-19%	7%	26%

Source: idem

Note: % women for the initial period of each table

During both recessionary periods, the distribution of male numerical adjustment followed a similar pattern as that of the total, whereas women job loss did not respond to the sectoral adjustment (Table 2a and 2b). As expected, total and men job destruction concentrated in the highest masculinised sector (construction) in both periods. Female

adjustment concentrated in the first period in so-called gender-neutral sectors⁴, whereas in the latter other services was the sector that experiences the highest loss (33%). It is noteworthy mentioning that during the first period, female employment destruction in wholesale and retail trade and financial and insurance activities was almost offset by the increase in employment in the public administration, education and health care sector. Contrarily, during the second period, public administration only supposed 16% of the compensation of the total numerical adjustment derived from the fiscal austerity measures. This is in line with the existing literature on the effects of the Great Recession and the fiscal austerity measures (Lombardo, 2016).

All in all, 99% of numerical adjustment during the first period concentrated in male-dominated sectors (construction, manufacture of computer, electrical equipment, and transport equipment, extractive industries and agriculture and forestry). For the second period, the job loss concentration in male-dominated sectors fell to 91%, mostly because of public administration job loss driven by the introduction of fiscal austerity measures.

With respect to role of sectoral segregation in explaining the gendered character of the adjustment through underemployment (Expelled effect), we distinguish between the two crisis subperiods by aggregating the net transitions from full-time employment towards underemployment. To examine the relevance of gender sectoral segregation in net transitions from full-time employment towards underemployment, we organise the net transitions in a 10x10 matrix. If sectoral segregation played a role in explaining why women account for most of the “*Expelled adjustment*”, the net transitions would concentrate in female-dominated sectors. In other words, does the adjustment through underemployment concentrate in women because of gender sectoral segregation?

⁴ Those whose share of women is between 40% and 60%.

Table 3a. Distribution of OE adjustment through underemployment, 2007q4-2010q1

	Other services	Public administration, education, health care	Wholesale and retail trade and accommodation	Financial and insurance activities	Manufacture of food products, textiles, wood, and paper	Agriculture, forestry, and fishing	Transportation and storage	Manufacture of computer, electrical equipment, and transport equipment	Extractive industries	Construction	%
Other services	5.64	-3.27	-11.87	3.49	-3.34	-3.72	-2.35	-1.57	0.22	-2.00	-18.77
Public administration, education, health care	4.89	4.74	-0.87	-2.67	-0.77	-1.27	-0.63	-0.91	-0.77	-0.30	1.44
Wholesale and retail trade and accommodation	6.41	-3.05	26.52	6.98	-2.07	0.78	0.39	-0.99	-0.75	-4.34	29.88
Financial and insurance activities	5.62	-0.15	1.00	31.39	0.50	-0.80	-0.36	-1.03	-0.23	-1.04	34.89
Manufacture of food products, textiles, wood, and paper	1.64	1.05	1.98	0.53	6.38	-1.03	1.24	-0.12	0.52	-0.36	11.83
Agriculture, forestry, and fishing	5.28	0.61	0.12	1.20	0.24	10.54	0.27	-0.46	0.05	-0.72	17.14
Transportation and storage	-0.48	-0.82	2.39	-0.51	-0.83	0.16	0.32	-0.38	-0.44	-0.67	-1.27
Manufacture of computer, electrical equipment, and transport equipment	-0.58	0.27	1.96	0.23	-0.21	0.00	0.15	-0.89	0.26	0.25	1.44
Extractive industries	0.72	0.95	2.09	0.90	0.55	0.40	0.06	0.10	0.22	0.27	6.26
Construction	2.52	-0.25	7.32	3.23	0.05	0.32	-0.44	-0.04	0.15	4.32	17.16
%	31.64	0.08	30.64	44.76	0.49	5.38	-1.34	-6.29	-0.79	-4.59	

Source: Own elaboration based on the Spanish Labour Force Survey Flows estimates micro database

Table 3b. Distribution of adjustment through underemployment 2010q1-2013q4

	Other services	Public administration, education,	Wholesale and retail trade and accommodation	Financial and insurance activities	Manufacture of food products, textiles, wood, and paper	Agriculture, forestry, and fishing	Transportation and storage	Manufacture of electrical equipment, and transport equipment	Extractive industries	Construction	%
Other services	25.81	-2.89	-8.70	-3.67	0.44	-3.44	0.02	-0.36	-1.03	-0.10	6.08
Public administration, education activities	0.67	24.48	-1.30	1.20	-0.46	0.22	0.31	-0.21	-0.14	-1.46	23.32
Wholesale and retail trade	4.35	-0.23	22.23	-1.32	-0.84	-2.22	-0.87	-1.15	-2.41	0.21	17.75
Financial and insurance activities	1.54	-1.08	0.59	17.62	0.26	-0.10	-2.72	0.04	-0.48	-1.36	14.30
Manufacture of food products, textiles, wood, and paper	1.21	0.38	2.07	0.19	0.87	-0.98	-0.70	0.00	0.33	0.00	3.36
Agriculture, forestry, and fishing	1.84	-0.25	0.13	0.08	-0.05	0.16	0.49	0.00	0.62	0.46	3.49
Transportation and storage	1.07	-0.41	-0.19	1.38	-0.50	-0.28	5.84	0.16	0.00	-0.66	6.41
Manufacture of electrical equipment	0.49	0.38	0.43	0.64	0.10	0.00	0.30	1.87	-0.19	0.35	4.38
Extractive industries	-0.15	-0.07	0.86	-0.08	-0.06	-0.03	0.42	-0.25	1.58	0.38	2.58
Construction	0.88	1.91	2.36	0.20	-0.20	0.39	1.49	0.23	-0.49	11.57	18.34
%	37.73	22.22	18.48	16.23	-0.45	-6.28	4.58	0.32	-2.21	9.38	

Source: Own elaboration based on the Spanish Labour Force Survey Flows estimates micro database

The previous two matrices show the percentages of each transition during the sub-periods. The percentages have been organised following the logic in Matrix *P*, so that the row sectors are the sectors of origin, and the column sectors are those of destination. Moreover, sectors are presented in descending order of female participation. That is, other services have the highest share of female employed, whereas construction has the lowest.

As opposed to the numerical adjustment occurred during the Great Recession, net transitions within female-dominated sectors did not account for most the adjustment during the first subperiod, despite it being highly feminised (78%). For the period 2007q4-2010q1, 12% of the adjustment occurred within female-dominated sectors, with 64.3% taking place in gender neutral sectors. The share of the net transitions during the 2010q1-2013q4 concentrated in female-dominated sectors and reached 48.1% (Table 3a and 3b). Additionally, during both periods within sector's net flows account for most of the adjustment. The findings show that, regardless of the sector, women opted to lower their working hours and keep their job or at least remain employed. As in Insarauto (2021), this reinforces the argument that employers use underemployment in women as a means to cope with an economic shock, given that their wages are lower and their carer role.

Given the distribution of the *FT* to *Under* net transitions during both periods, we can conclude that sectoral segregation had a role in determining the adjustment being feminised during the second subperiod, thus partially confirming the third hypothesis.

6. Central findings and conclusions

Gender labour market dynamics have received a lot of attention in recent years, yet often yielding opposing results. In this paper we have attempted to unravelling the contrasting gender labour market dynamics over the business cycle by comparing two labour underutilisation measures, prior to the COVID-19 socioeconomic crisis. Precisely, we seek to determine to what extent the degree of sectoral segregation, the added worker effect and the role of underemployment help us capture these differences.

To answer this question, this research has drawn on the Spanish Labour Force Survey Flows estimates micro database, thus allowing to control for the labour market transitions.

First, the main transition that explains the greater increase of the U' rate for women, as opposed to the evolution of female unemployment rate, and presents a countercyclical

behaviour is the so-called *Expelled effect* or adjustment through underemployment effect. Despite this effect being generally attributed to men given their higher persistence in the labour force, this adjustment was highly feminised. This reveals that labour market adjustments are gender biased and that the adjustment through underemployment of women explains 41% of the difference between U3 and U' rates, whereas for men, this adjustment only accounts for 21% of the difference.

Second, the components of the added worker effect in explaining the gender U3 and U' rates differences appear not to be significant, except for the net flows from part-time employment towards underemployment, which increase to a greater extent during the recessionary period, as in the case of net transitions out of inactivity towards unemployment. Despite the constant increase in the probability not to settle for part-time jobs in the case of women, this added worker effect also mirror the fall in the acceptance of part-time jobs (transitions from underemployment towards part-time employment). Both examinations of net and gross flows from inactivity towards underemployment are minor and not sensitive to cyclical fluctuations. The decomposition of the added worker effect by comparing working age married men and women shows that both married and not married women chose to transit out of inactivity, yet these transitions were mostly unsuccessful. The theoretical implications are the following. The added worker effect did not act as a shield for female employment, because of the low (even decreasing) probability of successful transitions. All in all, the added worker effect remained a predominantly female effect, yet for some age groups gender differences are reduced. With regard to the feminist literature, these results imply that in Spain the condition of women as a flexible labour force reserve, that is with a labour force more sensitive to cyclical fluctuations than men, still prevails. Moreover, the added worker effect greatly affects married women.

And third, the role of sectoral segregation in determining the gendered bias of the adjustment through underemployment during the Great Recession is only significant for the second subperiod of the crisis. This has relevant implications. As opposed to the numerical adjustment during the Great Recession, that affected mostly men across the European countries given the nature of the crisis, the adjustment through underemployment in Spain did not concentrate on the most affected sectors and was only sectoral driven after the implementation of fiscal austerity measures and the internal devaluation policy. This evidence supports the argument that employers take advantage

of women' position in the labour market as secondary labour force participants and applied an alternative adjustment mechanism regardless of the sector of activity. It also implies that in Spain this mechanism is more gender biased than in its neighbouring countries, pointing to the vulnerable position of women in the Spanish labour market. Furthermore, it confirms the argument that gender sectoral segregation has acted as a shield mechanism only when considering the total employed women and that it may also be linked to business cycle fluctuations when underemployment is taken into account. Therefore, gender sectoral segregation fails to act as a shield from economic downturns when the extended unemployment rate is contemplated.

The contribution of this paper has been to emphasize the role of underemployment as a relevant measure when analysing labour market dynamics, especially when focusing on gender differences. The use of the Spanish Labour Force Statistics on Flows has provided further evidence to the existing literature, presenting some nuances.

According to the evidence provided in this paper, the typical mechanisms that prevent the female unemployment rate from increasing during a recession; that is, the added worker effect and gender sectoral segregation, have played an opposing role in determining the evolution of the extended unemployment rate of women, thus making male and female U' rates equally sensitive to business cycle fluctuations. These mechanisms have failed to protect the female U' rate from economic downturns for different reasons. Regarding the added worker effect, its capacity to prevent this higher sensitivity to cyclical fluctuations lies in the lack of successful transitions both towards other employment and underemployment, hence affecting both labour underutilisation measurements, and in the strong opposing of women to conform with part-time jobs during recessions. As for gender sectoral segregation, its role as a shelter mechanism is completely compensated for when the female-dominated adjustment through underemployment is accounted for.

Further research would benefit from microdata bases that account for family structures and the employment statuses of the other members of the household, in order to fully account for the added worker effect. Additionally, despite the evidence hinting towards a use of underemployment as an employer' means to adjust working hours during a recessionary period, the testing of this hypothesis would require other tools such as interviews with the main actors, which constitute a better suit to that purpose than the methodology adopted in this paper.

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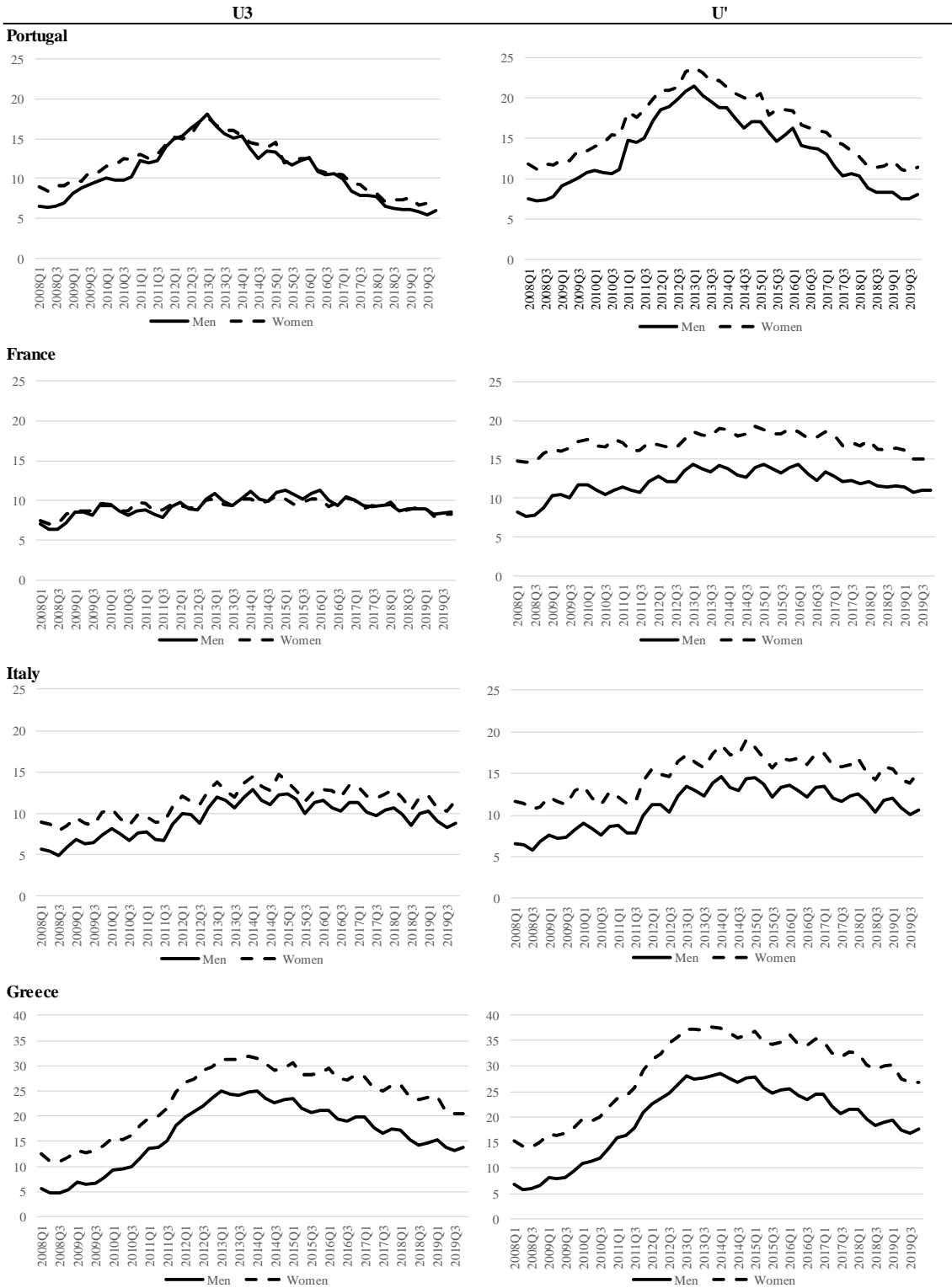
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8. Appendix

Figure A1: Unemployment and extended unemployment rates



Source: Eurostat

Table A1. Karmel and MacLachlan Index decomposition

$$KM = \frac{1}{E} \sum_{i=1}^S \left| \frac{W}{E} m_i - \frac{M}{E} w_i \right| \quad (A1)$$

$$KM = \frac{1}{E} \sum_{i=1}^S \left| \frac{W}{E} m_i - \left(1 - \frac{W}{E}\right) w_i \right| = \sum_{i=1}^S s_i \left| w_i - \frac{W}{E} \right| \quad (A2)$$

$$KM_t = \sum_{i=1}^S s_{i,t} \left| w_{i,t} - \left(\frac{W}{E}\right)_t \right| = \sum_{i=1}^S t_{i,t} \left| (w_{OE,i,t} + w_{Under,i,t}) - \left(\left(\frac{W_{OE}}{E}\right)_t + \left(\frac{W_{Under}}{E}\right)_t\right) \right| \quad (A3)$$

$$KM_S = \sum_{i=1}^S s_{i,t-4} \left| (w_{OE,i,t} + w_{Under,i,t}) - \left(\left(\frac{W_{OE}}{E}\right)_t + \left(\frac{W_{Under}}{E}\right)_t\right) \right| \quad (A4)$$

$$KM_{C,OE} = \sum_{i=1}^S s_{i,t} \left| (w_{OE,i,t-4} + w_{Under,i,t}) - \left(\left(\frac{W_{OE}}{E}\right)_t + \left(\frac{W_{Under}}{E}\right)_t\right) \right| \quad (A5)$$

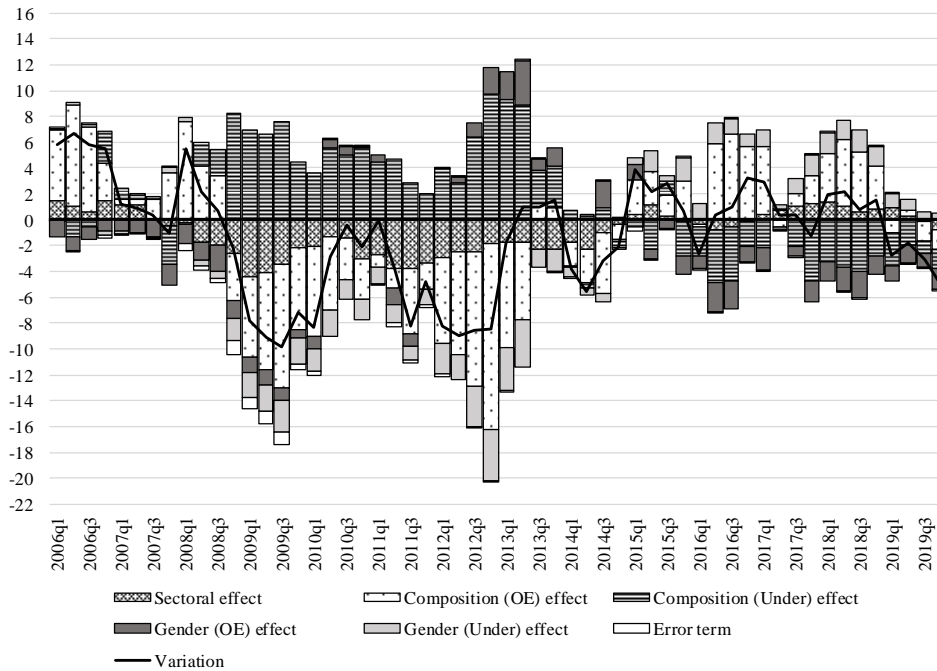
$$KM_{C,Un} = \sum_{i=1}^S s_{i,t} \left| (w_{OE,i,t} + w_{Under,i,t-4}) - \left(\left(\frac{W_{OE}}{E}\right)_t + \left(\frac{W_{Under}}{E}\right)_t\right) \right| \quad (A6)$$

$$KM_{G,OE} = \sum_{i=1}^S s_{i,t} \left| (w_{OE,i,t} + w_{Under,i,t}) - \left(\left(\frac{W_{OE}}{E}\right)_{t-4} + \left(\frac{W_{Under}}{E}\right)_t\right) \right| \quad (A7)$$

$$KM_{G,Un} = \sum_{i=1}^S s_{i,t} \left| (w_{OE,i,t} + w_{Under,i,t}) - \left(\left(\frac{W_{OE}}{E}\right)_t + \left(\frac{W_{Under}}{E}\right)_{t-4}\right) \right| \quad (A8)$$

$$KM_{Total\ effect} = KM_S + KM_{C,OE} + KM_{C,Un} + KM_{G,OE} + KM_{G,Un} + KM_R \quad (A9)$$

Figure A2. Decomposition of the Karmel and MacLahclan Index, 2006q1-2019q4



Source: Own elaboration based on the Spanish LFS micro database