



Facultad de Ciencias Económicas y Empresariales

TRABAJO FIN DE GRADO

**PROGRAMA INTERNACIONAL DEL DOBLE GRADO EN
ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS Y EN
ECONOMÍA**

**THE DETERMINANTS OF GENDER DIFFERENCES ON
LABOR SUPPLY IN SPAIN**

Cristina Greño Lasheras

DIRECTOR

Mikel Casares Polo

Pamplona-Iruña

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ABSTRACT

The main objective of this paper is to analyze the determinants of the gender differences observed in Spain using a micro-founded model of the labor market. Through the analysis of the evolution of several variables affecting the household's optimal choices of leisure, market work and home work, it is possible to offer a concise and clear understanding about the time allocation of the individuals. Furthermore, I forecast the evolution of the household's time allocation under different possible scenarios. For this purpose, I will solve the non-linear system of equations of the model using MatLab. The parameter calibration will adapt to the specific characteristics and working hours of the job market in Spain. Finally, I will run three different simulations to try to explain the evolution of both female and male labor supply.

KEY WORDS

Labor market, leisure, home production, female, male, active population.

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1. INTRODUCTION

The changes in household's composition and habits, from the democratic transition to now in Spain, have been the most significant and convulsive ones over the last twenty centuries.

The recognition of equal rights for male and female has been possible thanks to liberal democracy principles and Marxism socialism, that fought for fostering women rights and boosting female superior education, with the objective of achieving the same effectiveness and productivity as men in some job positions.

Legislative changes in the majority of the democratic countries have induced the massive incorporation of women to the labor market.

Some years ago, few women had the chance to access the labor market. Moreover, from the ones that accessed it, the great majority abandoned it when they got married or they had their first kid.

We could claim, that the huge reduction in the birth rate, the end of the traditional gender roles regarding to the household responsibilities and some other factors, have provoked that more men spend further amount of time working at home day by day and more women dedicate a huge amount of their time per day to work in the labor market.

The evolution of the active population in Spain is a curious issue to study. The way the number of people that are employed or actively seeking employment has evolved, has changed a lot from the Dictatorship of Francisco Franco to now. The active population started to grow in the last quarter of 1980. This was mainly due to the incorporation of women, baby boomers and immigrants to the labor market.

Nevertheless, even if the total active population has been increasing, female active population has increased more than male active population in the last years, achieving a point, in which the latter has been descendant and has made total active population decrease.

The aim of this paper is to study the evolution of the Spanish labor market in the last forty years and find out which are the determinants of gender differences on labor supply in Spain. For this purpose, I will develop my own optimizing dynamic model that will help us forecast household's time allocation depending on the different scenarios that have occurred or could take place in the Spanish labor market.

2. THE EVOLUTION OF THE SPANISH LABOR MARKET

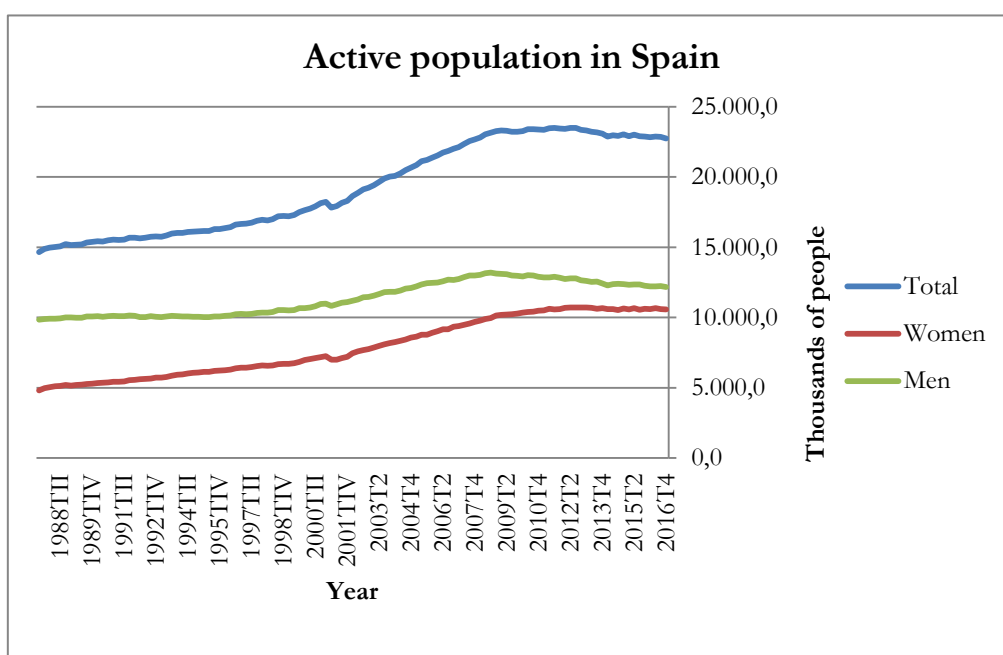
During the last years, one of the most significant changes that the Spanish labor market has experienced has been the incorporation of women to it. Concretely, since the early 80's, due to the democratic transition, women have changed their behaviour and their habits. Traditionally, only few women accessed the labor market and abandoned it when they got married or they became pregnant. However, nowadays the women retention rate is higher and we can claim that the number of married women with kids who work in the labor market has increased significantly.

There are different causes that explain this behaviour, but two of the most important ones are the economic growth that Spain has had between 1985 and 2007 and the women liberalization movement.

Nevertheless, there are remarkable gender differences both at the kind of jobs performed by women and men and at the salary perceived. Men's annual average gross salary in 2014 was 25.727, 2€, whereas women's average gross salary in the same year was 19.744, 8€. This means that women only earned on average the 76.7% of the salary earned by men.

Active population is defined as the number of citizens who are either employed or actively seeking employment. In Figure 1, we can observe the pattern followed by the active population in Spain from 1988 to 2016 separating between women and men.

Figure 1: Active population in Spain in thousands of people



Source: own- elaboration with data from INE database

If we do a skim reading of Figure 1, we can perfectly see that the total active population in Spain has been increasing year by year. Concretely, the total active population in the last quarter of 2016 was 22.745, substantially higher than in the same quarter of 1988 that was only 15.215. The highest increase in the total active population in Spain was in the second quarter of 2007. During this period, the total active population increased in 1.01%.

As we can observe, the period from 1975 to 1985 does not appear in the graph. However, in order to have some background, we should mention that during these years Spain was living a democratic transition and trying to recover from the huge protectionism imposed by Francisco Franco. Furthermore, Spain was immersed in a modernization process that was necessary due to the upcoming addition of Spain to the European Community.

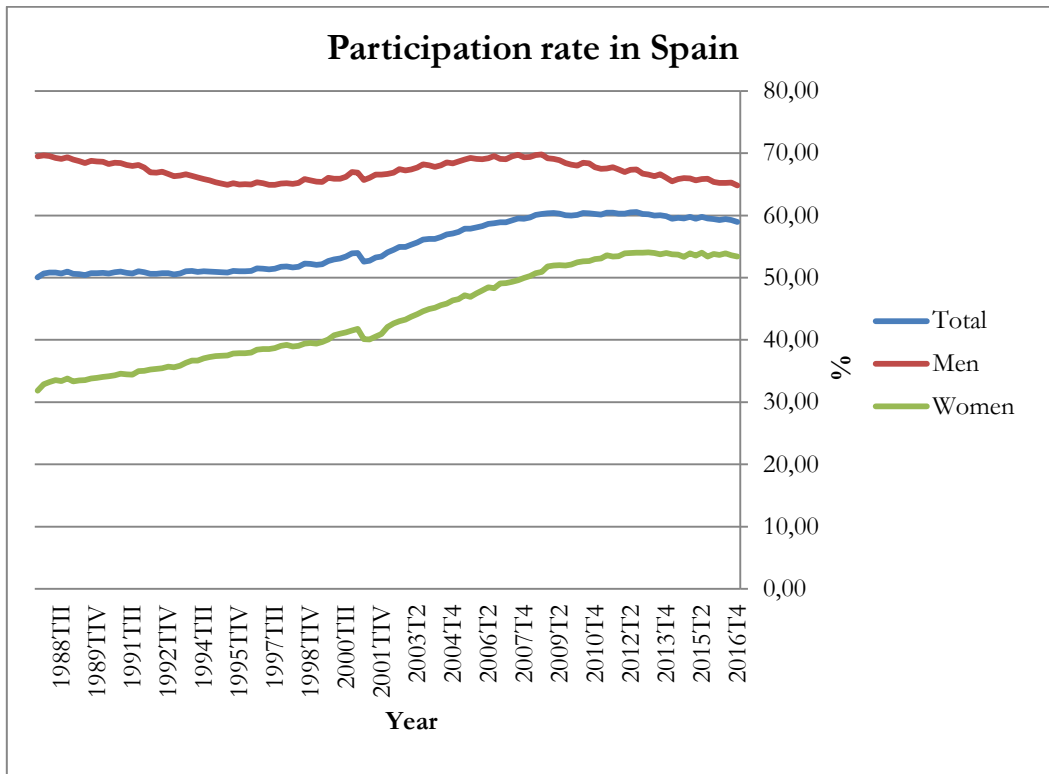
From 1985 to 1990, the Spanish economy lived an extraordinary period of economic growth that was clearly reflected in the increase of the active population, both of women and of men. This expansion was mainly due to the international recovery that the world in general was living and the decrease in the oil prices.

Spain suffered a big crisis from 1991 to 1994. One of the main facts that motivated this recession was the incorporation of the country to the European Monetary System that caused the exchange rate to be overvalued. Furthermore, there was an increase in the interest rates due to the German reunification. Nevertheless, this crisis did not affect the active population. Moreover, from the demographical point of view, the decrease in the birth rate endangered Spanish growth. As we can observe in Figure 1, the active population started to grow in the last quarter of 1980. This was mainly due to the incorporation of people born during the baby boom, women and immigrants to the labor market. At the beginning of 1987, only 4.807.000 women were employed or actively seeking employment. Nevertheless, just ten years later, the number of women that were part of the active population had increased significantly and was around 6.000.000.

From the year 2000 to now, there has been a greater increase in the active population of women than in the active population of men. Actually, the number of men who are either working or looking for a job has decreased in the last years. This is the main fact that motivates this paper. I am going to try to analyse which factors determine that people want to work at home or decide to look for a job in the labor market.

If we observe Figure 2, that reflects the evolution of the participation rate in Spain for both women and men, we see that it is not very different from the evolution of the active population.

Figure 2: Participation rate in Spain (%)



Source: own-elaboration with data from INE database

The labor force participation rate is the percentage of the working population in the age group of 16-64 in the economy, currently employed or seeking employment. It is calculated by dividing the active population by the working-age population. As can see in Figure 2, in the last years the women participation rate has increased but the one for men has decreased. This has forced the total participation rate to decrease in the last years. We can claim that men's participation rate is nowadays lower than it was in 1987. In that year, 69.5% of men between 16 and 64 years old in Spain were employed or seeking employment. However, in the year 2016 that number has decreased to 64.5%. Nevertheless, men's participation rate in 2016 is still higher than the one for women, that is only 53.4%. Women's participation rate has increased massively. We should mention that women participation rate in the year 1987 was only 31.8%.

As a curiosity, we have to point out that the total active population and the participation rate in Spain decreased in the year 2001 due to the introduction of new instructions to

interpret the active job search. Population censuses are performed at the beginning of each decade, so with each census the way of calculating the time series can be modified.

3. EMPIRICAL EVIDENCE

Next, we are going to analyse some factors that may have affected the active population and the participation rate in Spain.

3.1 Incorporation of women to the labor market

Some years ago it was typical for women to stop working when they got married or when they had their first kid. In some cases, women tried to start working again when their children education had finished, but this was not a common attitude. Normally, women never worked during their lifetimes or worked just for some years without having the chance of promoting in their careers.

Fortunately, trends have changed and active population of women has been increasing in the last years as we have seen before. Lately, there has been a social movement towards equality between men and women that has fostered this trend. Moreover, there has been greater access to superior education for women. We should highlight that for instance during the academic year 2002-2003, 53.34% of the university students were women.

Regarding demographical factors, the number of children per women has decreased as well, so there is less need of staying at home looking after the kids. The number of children per women in 1970 was 2.84, substantially higher than 1.33 in 2015.

In the past, men were the only ones that brought money home. Nevertheless, the standard of living in the last years has increased and one salary is not enough to maintain the whole family, so this provokes that more women go to the market in order to look for a job.

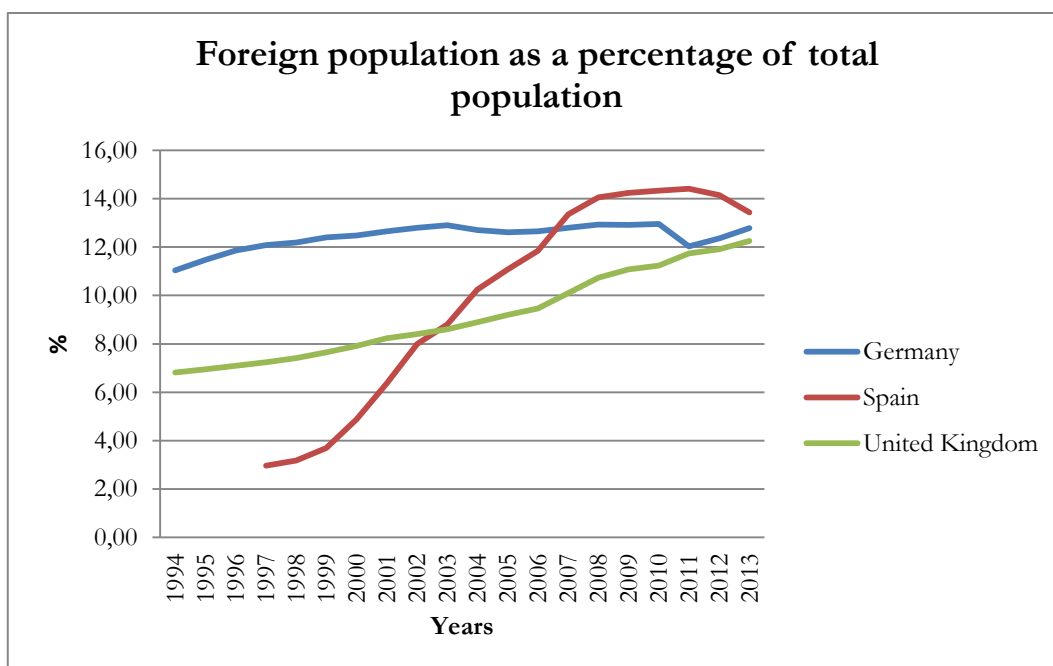
As reported by INE, we should highlight that from the 5 million jobs created in the decade from 1994 to 2004, 2.6 million corresponded to women and 2.3 million corresponded to men.

3.2 Migration flows

Migration flows have a direct impact in the composition of active population, making it change both in quantities and in characteristics. Immigration brings to a country like Spain people willing to incorporate to the labor market and also increases birth rate, as the number of children per woman is higher in developing countries.

Traditionally, Spanish residents were the ones that immigrated to countries in Latin America for instance. This is something that is being repeated nowadays due to the deep current economic crises that Spain is living but with European countries as destination. However, during the 90's lots of people from Marrakech, Latin America or Sub-Saharan Africa came to Spain trying to find the opportunities that they lacked in their countries of origin and this increased the active population. The magnitude of the immigration phenomenon in the last years converted Spain in one of the countries in the European Union with the highest foreign population in 2010, concretely; Spain had a higher number of immigrants than countries like Germany, France or United Kingdom. Spanish foreign-born population represented the 14.3% of its total population in 2010 as opposed to 13%, 11.7% and 11.2% in Germany, France and United Kingdom respectively. The amazing evolution of the foreign population in Spain can be observed in Figure 3. Non-native population went from representing the 2.96% of the total population in 1997 to represent the 13.44% in 2013.

Figure 3: Foreign population as a percentage of total population



Source: own-elaboration with data from OCDE

On the other hand, due to the current economic crises that we are living, a huge number of highly qualified people have decided to immigrate to other countries, as looking for a job in Spain has become very complicated. Additionally, fewer immigrants arrive day by day to our territory. These two factors can result in a decrease of the active population in the future. As reported by INE, net migration was positive in Spain in 2016 after three years

being negative. There was a positive migration flow as there were 186.059 immigrants coming from abroad and 155.555 migrants moving to other countries.

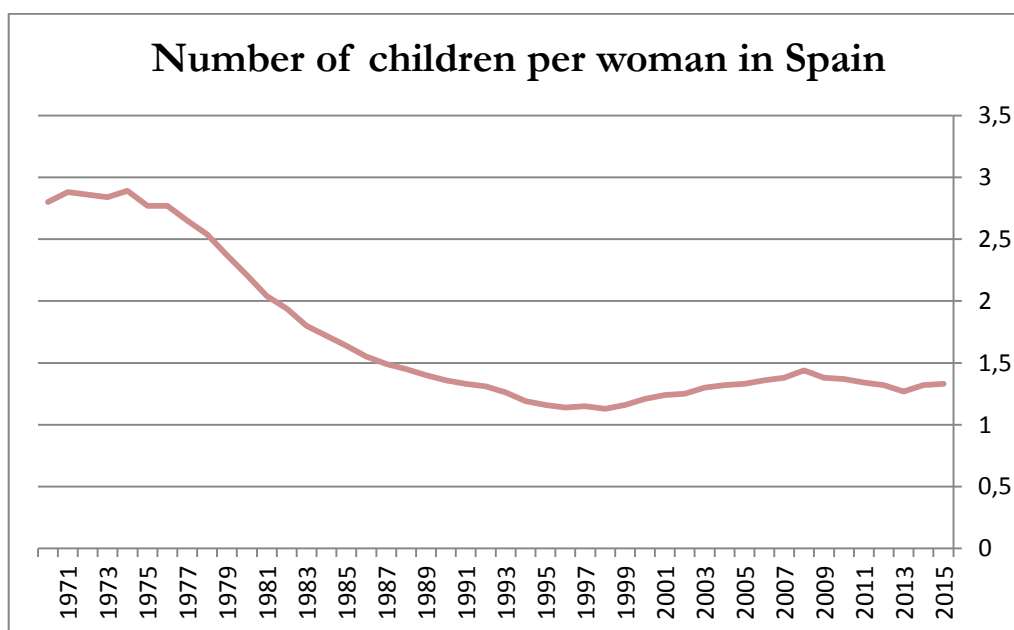
3.3 Demographical Trends

Studying the demographical trends is crucial if we want to understand the evolution of the population in Spain and as a consequence, the evolution of the active population and the participation rate. The two main explanations of the boost in the Spanish population in the last years have been the increase in the life expectancy and the decrease in the infant mortality. Due to the big technological advances in medicine that have been obtained in the last years in the most developed countries, life expectancy has increased tremendously. On the other hand, this same fact has also made the infant mortality decrease. These two factors together have caused the total active population increase from the year 1980, as there are more people working or looking for a job in the labor market.

Apart from that, as I have mentioned before, the number of children per women has been reduced. This decrease in the birth rate can be explained by the changes in the habits of the Spanish families. In the past, most of them dedicated their lives to agriculture. For that, they needed to have the maximum number of kids as possible in order to help them developing these tasks. Nowadays, traditions have changed a lot so this need has disappeared.

The evolution of the number of children per woman since 1970 can be seen in Figure 4.

Figure 4: Number of children per woman since 1970 in Spain



Source: own-elaboration with data from INE database

3.4 Gender distribution of labor supply

As I have mentioned before, the number of women that incorporate to the labor market day after day has increased a lot in the last years. However, the opposite has happened with men. This decrease in the active population of men has made the total active population decrease.

In the last years, there have been multiple attempts in trying to explain the family decision-making process and the factors that determine the allocation of goods and time inside a family.

Normally, an individual decides whether to work at home or in the market and how to allocate her time depending on the comparative advantage between market production and home production. This comparative advantage can be described by the relative wage obtained in the market and the efficiency the individual has in the production of goods at home.

In the past, it was typical that the wage of the husband would be higher than the one of the wife. That can explain why husbands dedicated their lives to work in the market and wives specialized in the production of home goods. The relative wage obtained in the market by men was higher than the one obtained by women and the efficiency of women in the production of goods at home was higher than the one of men. However, the social movement towards equality between men and women that we have experienced during the last years in our country can explain why a high number of women have decided to incorporate to the labor market.

Currently, we can observe different situations inside each family. The traditional alternative was that the husband divided his time between working in the market and leisure and the wife was the one working at home and had some time for leisure. Another alternative was that both the husband and the wife worked in the labor market, but the wife also spent some of her time taking care about the house. Apart from this, both of them had some time for leisure. Nevertheless, things have changed a lot lately and the decrease in the active population of men could be explained by the decision of some men of dedicating the time that they spent in the labor market in the past to home production. So now, it is the wife the one that brings money home. It is worth mentioning that there exist hundreds of alternatives more of dividing the time between working in the labor market, working at home and leisure for men and women.

One can think that the decision of the wife or the husband of working only at home is just determined by her or his own marginal wage rate, but this is not true. That the other member of the family has a high wage rate, or just having a high family income can influence the decision. We should highlight that the main difference between a family and a single person is that in a family, an individual does not have to rely only on his own talent to acquire the goods and services he or she desires. This is because there is another member in the family that can be productive as well.

In addition, we could mention that normally the decision of incorporating to the labor market can also be explained by the productivity an individual has in the home sector. Typically, those who decide to work in the labor market are those who are the least productive in the home sector.

These are just some points that can explain the decision of an individual of incorporating or not to the labor market. In this paper, I am going to try to explain which factors have made the active population of men decrease in Spain in the last years. Hence, I will use an optimizing dynamic model in order to find out which are the variables that encourage a person to dedicate his or her time to work at home or in the labor market.

4. DYNAMIC MACROECONOMIC MODEL

In this section I will explain what a dynamic macroeconomic model is and I will highlight its most relevant characteristics. Finally, I will defend why I believe that it is the most appropriate model to use to clarify the determinants of gender differences on labor supply in Spain.

After that, I will develop my own macroeconomic dynamic model relying on a model developed by Reuben Gronau (1973) that has been modified in order to adapt it to what I am looking for. Moreover, I will explain all the variables that are part of this dynamic macroeconomic model one by one. Once the model is built up, it will allow us represent different possible scenarios that could take place in the Spanish labor market such as a reduction in the gap between men's and women's salary, as it has occurred in the last years.

4.1 A dynamic macroeconomic model and its main characteristics

A macroeconomic model is an analytical instrument that is used to explain the functions of the economy. Normally, macroeconomic models are designed to study the dynamics of aggregate quantities of GDP, total income, total level of employment, the level of prices etc. In general, this provides a better understanding of the economy as a whole.

The Lucas critique (1976) claimed that it is not useful to predict the effects of a change in an economic policy exclusively basing on the relationships observed in historical data. Robert Lucas suggested that in order to predict the effects of a policy experiment, the “deep parameters” should be modeled. Deep parameters are the factors that govern individual behavior and are also called “microfoundations”. For this reason, we have decided to use an optimizing model.

Concretely, optimizing models are mathematical models using structural equations specially designed to help individuals and institutions decide how to allocate their resources and make the best decisions that are based on “microfoundations”.

Time plays a significant role in many areas of economics. Usually, economic agents do not react immediately to adjustments in taxes, wages or public spending. This explains the existence of both static and dynamic models, that is the terminology invented by Ragnar Frisch. According to Frisch (1933), static models are used to describe or predict relationships between state variables. On the contrary, dynamic models are used to describe or predict the relationship between variables that are in movement and refer to different moments in time.

The main advantage of a dynamic macroeconomic model is that it allows us to measure the time it takes an adjustment process to finish. Normally, a shock generates changes in the economy that last several periods until all variables adjust and a new equilibrium is reached. However, when this adjustment occurs immediately, the most appropriate model to use is the static one.

In the last years, there have been lots of shocks that have taken some time until a new equilibrium has been reached and that is why the importance and popularity of the dynamic macroeconomic models has increased. They are not useful just to analyze or measure the evolution of some economic aggregates after some years, but also to analyze the results of some hypothetical situations that we would like to study. Moreover, the future results of some policies taken in the present can be predicted, which will help the agents follow some strategies or others.

Due to all the points that I have just mentioned, I believe that a dynamic macroeconomic model is the best instrument that will help us explain which are the determinants of gender differences on labor supply in Spain.

4.2 Model description

In the model we are going to develop, we will take into account the time allocation between work in the market, work at home, and leisure. We will consider a household formed by two members, a man and a woman, that combine their leisure with spending some time working in the market and some time working at home in order to maximize their utility. According to Reuben Gronau (1973), changes in socioeconomic environment, for instance, changes in the wage rates, income, education and the number of children, have different effects on the allocation of time of men and women.

As we have mentioned, individuals can spend their time doing three different activities, so the household faces two different time constraints, one for female and the other one for male. As we can observe in the following equations, the total amount of time spent by a male (^m) or a female (^f) working in the market (t_t), working at home (h_t) and on leisure (l_t) cannot be greater than the existing total amount of time (T).

(1)

- **Female time constraint:** $T = l_t^f + h_t^f + t_t^f$ (1.1)

- **Male time constraint:** $T = l_t^m + h_t^m + t_t^m$ (1.2)

From constraints (1.1) and (1.2) we can deduce that if the time spent on the labor market increases, the time spent on leisure or the time spent on home production have to decrease. An increase in any of the variables implies a reduction in the other ones.

Furthermore, we can expect that an individual with fewer children will have less preference for home production, decreasing the amount of time the individual spends working at home and increasing the time he or she spends on leisure and working in the labor market.

As we have mentioned before, we will consider a family with two members who decide how they combine their time in order to maximize household utility.

(2)
$$U(C_t, H_t, l_t^f, l_t^m)$$

In this equation, C_t represents the total amount of market goods that the household consumes and H_t denotes the amount of home goods that are produced with a combination of market inputs (X_t) and time dedicated to home production (either h_t^m or h_t^f). Therefore, home goods can be produced by either male or female. Finally, as we have said, l_t^f refers to the amount of time that the female dedicate to leisure, whereas, l_t^m refers to the time male dedicate to leisure.

In particular, we will consider the following CRRA (constant relative risk aversion) utility function specification:

$$\frac{Ct^{1-\sigma}}{1-\sigma} + \varepsilon_H * \frac{H_T^{1-\gamma}}{1-\gamma} + \varepsilon_l \frac{(l_T^m)^{1-\kappa}}{1-\kappa} + \varepsilon_l \frac{(l_T^f)^{1-\kappa}}{1-\kappa}$$

In this case, σ represents the elasticity of the marginal utility of consumption with respect to consumption that explains how the marginal utility falls when there is an increase in consumption. As we can see, this elasticity is constant. However, there is diminishing marginal utility because as the household increases the consumption of market goods, there is a decline in the marginal utility they derive from consuming each additional unit. Diminishing marginal utility exists also with home goods produced and time dedicated to leisure by male and female. We should also highlight that we will use the same κ and ε for female and male. Regarding to the goods produced at home, we should stress that what distinguishes a household from a single individual is that in a household the male and the female exchange their talents instead of having to rely on their own capacities to produce their own goods. This is why the total amount of goods produced at home (H_t) are the combination of goods produced at home by female (H_t^f) and goods produced at home by male (H_t^m).

$$(4) \quad H_t = H_t^m + H_t^f$$

The quantity of goods produced at home by each of the individuals depends on the amount of market inputs (X_t) owned, the time spent working at home (h_t) and the productivity of the individuals in home production (Δ). As we can observe next, home production is obtained using Cobb-Douglas technology.

(5)

$$H_t^m = X_t^\alpha * (h_t^m)^{1-\alpha} * \Delta_m \quad (5.1)$$

$$H_t^f = X_t^\alpha * (h_t^f)^{1-\alpha} * \Delta_f \quad (5.2)$$

Where α and X_t are assumed to be the same for male and female. Nevertheless, we can expect that the productivity of female in home production is higher than the productivity of male. Normally, women are more involved with the household due to their union with the kids and cultural traditions. Thus, we will set $\Delta_f > \Delta_m$ in the parameter calibration. Moreover, men's wages are usually higher, so they find more incentives to work in the

labor market and this makes them have less time working at home, so their productivity decreases. Spain had a traditional role for women during the dictatorship of Francisco Franco; women should stay at home doing the housework while men should brought income home working in the labor market. Women were responsible of looking after the kids, cooking the food and buying all the necessary items for the family. Even if the things and thoughts have changed in our country, we have not achieved total equality between women and men yet. This is why I will assume that female's productivity working at home is higher than male's productivity in home production and male wage is higher than female wage.

Given (4) and (5), we can derive the following equation for home production;

$$H_t = X_t^\alpha * (h_t^m)^{1-\alpha} * \Delta_m + X_t^\alpha * (h_t^f)^{1-\alpha} * \Delta_f$$

Now it is time to construct the household optimizing problem;

$$(6) \quad \text{Max } E_t \sum_{j=0}^{\infty} \beta^j \left(\frac{C_{t+j}^{1-\sigma}}{1-\sigma} + \varepsilon_H * \frac{H_{T+j}^{1-\gamma}}{1-\gamma} + \varepsilon_l^m \frac{(l_{T+j}^m)^{1-k}}{1-k} + \varepsilon_l^f \frac{(l_{T+j}^f)^{1-k}}{1-k} \right)$$

where $\beta = \frac{1}{1+\rho} < 1$

and $\rho > 0$

ρ is a discount factor that represents that we are giving more importance to present utility than to future utility. (Rate of intertemporal preference)

Furthermore, the household aims of maximizing its intertemporal utility subject to both time constraints (1.1) and (1.2) and the budget constraint:

$$(7) \quad W_t^m t_t^m + W_t^f t_t^f = P_t C_t + P_x X_t + (1 + R_t)^{-1} * B_{t+1} - B_t$$

Where the left-hand side of the equation refers to the total family income, W_t^m denotes male's wage rate, W_t^f refers to female's wage rate and t_t^m and t_t^f refer to the amount of time that each of the individuals spends working in the labor market. Regarding to right-hand side of (7), we can observe that it represents the total expenditure on market goods and purchases of inputs for home production ($P_t C_t + P_x X_t$) plus the savings spent or net purchases of bonds $(1 + R_t)^{-1} * B_{t+1} - B_t$. What we can deduce from this equation is that the total expenditure on market goods and inputs cannot exceed family income. The part of the income that is not spent in the market buying goods and inputs will be savings that the household will use to invest in bonds.

On the other hand, we can find the other two constraints that we have explained before, female's time constraint and male's time constraint (1.1) and (1.2).

After developing the Lagrangian Function we are ready to compute the first order conditions for the variables that the household is choosing, $C_t, X_t, B_{t+1}, h_t^f, t_t^f, l_t^f, h_t^m, t_t^m, l_t^m$. All of them will be decided collectively by the members of the family. Moreover, total consumption of market goods and inputs and total savings are common variables for both members of the household.

In turn, we obtain the following optimality conditions:

$$(8) \quad (C_t)^{foc} \frac{\partial Lt}{\partial Ct} = Ct^{-\sigma} - \lambda_t P_t = 0$$

Where λ_t corresponds to the shadow value of an additional unit of income from the budget constraint.

$$(9) \quad (X_t)^{foc} \frac{\partial Lt}{\partial Xt} = \mathcal{E}_H * \frac{H_t^{1-\gamma}}{X_t} - \lambda_t P_t^x = 0$$

$$(10) \quad (B_{t+1})^{foc} \frac{\partial Lt}{\partial B_{t+1}} = -\lambda_t (1 + Rt)^{-1} + \beta E_t \lambda_{t+1} = 0$$

$$(11) \quad (h_t^f)^{foc} = \mathcal{E}_H H_t^{-\gamma} (1 - \alpha) \frac{H_t^f}{h_t^f} - \delta_t^f = 0$$

$$(12) \quad (h_t^m)^{foc} = \mathcal{E}_H H_t^{-\gamma} (1 - \alpha) \frac{H_t^m}{h_t^m} - \delta_t^m = 0$$

$$(13) \quad (t_t^f)^{foc} = W_t^f \lambda_t - \delta_t^f = 0$$

$$(14) \quad (t_t^m)^{foc} = W_t^m \lambda_t - \delta_t^m = 0$$

$$(15) \quad (l_t^f)^{foc} = \mathcal{E}_l (l_t^f)^{-k} - \delta_t^f = 0$$

$$(16) \quad (l_t^m)^{foc} = \mathcal{E}_l (l_t^m)^{-k} - \delta_t^m = 0$$

If we combine equations (13) and (15) we will get the following equation;

$$W_t^f \lambda_t = \mathcal{E}_l (l_t^f)^{-k}$$

The left side of the equation indicates the satisfaction the female gets from one unit of time of work in the labor market. Meanwhile, the right side indicates the satisfaction she gets if she spends one unit of time on leisure. From this equation and $(C_t)^{foc}$, we get the following female leisure function:

$$W_t^f \frac{Ct^{-\sigma}}{P_t} = \mathcal{E}_l (l_t^f)^{-k}$$

$$l_t^f = \left(\frac{\varepsilon_l C_t^\delta}{\frac{W_t^f}{P_t}} \right)^{1/k}$$

In this case, $\frac{W_t^f}{P_t}$ refers to female's real wage. As we can observe, an increase in the real salary that women would get in the labor market, implies a decrease in the time female spend on leisure. On the other hand, as C_t increases, the marginal utility female get from consumption decreases, so they would prefer to spend time on leisure than working in the labor market. **This will be the first equation of our model.**

Secondly, we will join equations (11) and (13) in order to compare the satisfaction that women get from either working one unit of time at home or working in the labor market:

$$\varepsilon_H H_t^{-\gamma} (1 - \alpha) \frac{H_t^f}{h_t^f} = W_t^f \frac{C_t^{-\delta}}{P_t}$$

As we can see, if the satisfaction gotten from working at home were greater than the one gotten from working in the labor market, the female would increase the time she spends working at home and the equilibrium would be reached again. From this equation we get the following equation of home time:

$$h_t^f = \frac{\varepsilon_H H_t^{-\gamma} (1 - \alpha) H_t^f C_t^\delta}{\frac{W_t^f}{P_t}}$$

Where substituting the home production function yields:

$$h_t^f = \left(\frac{\varepsilon_H H_t^{-\gamma} (1 - \alpha) X_t \Delta f C_t^\delta}{\frac{W_t^f}{P_t}} \right)^{1/\alpha}$$

As we can observe, as the productivity of female on home production increases, the time she wishes to spend working at home rises. On the other hand, as consumption increases, the marginal utility the female gets from consumption falls, so she would prefer to spend time working at home than working in the labor market. Furthermore, as the number of market inputs bought to produce home goods increases, the number of hours she would spend working at home will increase as well. Finally, an increase in the real salary got by the female in the labor market, provokes a decrease in the time she spends in home production. **This will be the second equation of our model.**

After having defined an equation for the time women spend working at home and the time they spend on leisure, we should find out an equation that determines the time women spend working on the labor market. In order to do this, we will use equation (1) and isolate de variable t_t^f .

$$t_t^f = T - l_t^f + h_t^f$$

We can conclude from this equation that if the time female spend working at home or on leisure increases, the time they spend working on the labor market has to decrease. **This will be the third equation of our model.**

After that, we are going to define the equation that determines the quantity of inputs bought in the labor market demanded by the household in order to produce home goods. We use its first order conditions to reach:

$$\begin{aligned} \mathcal{E}_H * \frac{H_T^{1-\gamma} * \alpha}{X_t} &= \lambda_t P_t^x \\ X_t &= \mathcal{E}_H * \frac{H_T^{1-\gamma} * \alpha}{\lambda_t P_t^x} \\ X_t &= \mathcal{E}_H * \frac{(X_T^\alpha * \Omega)^{1-\gamma} * \alpha}{\frac{C_t^{-\delta}}{P_t} P_t^x} \\ X_t &= (\mathcal{E}_H * \frac{((htf)^{1-\alpha} * \Delta f + (htm)^{1-\alpha} * \Delta m)^{1-\alpha} * \alpha}{\frac{C_t^{-\delta}}{P_t} P_t^x})^{1/(1-\alpha*(1-\gamma))} \end{aligned}$$

As we can observe, as productivity of either member of the household on home production increases, the number of inputs demanded from the labor market increases too. As their productivity increases, they will be willing to produce more goods at home, so they will need more inputs. Moreover, as the amount of time that the members of the household dedicate to home production increases, the number of inputs demanded will be greater aswell. On the other hand, as we can observe, if the price of these inputs increases, the quantity of inputs demanded will fall. Finally, as C_t increases, the marginal utility the household gets from consumption keeps decreasing, so they would prefer to buy inputs that will be used on home production instead of buying goods from the market. **This will be the fourth equation of our model.**

Equation (5) determines the quantity of home goods produced by female. The number of home goods produced, depends on the amount of inputs available, the time spent by female working at home and on the productivity they have in home production. As we assumed bellow, it is the Cobb-Douglas function. **This will be the fifth equation of our model.**

$$H_t^f = X_t^\alpha * (h_t^f)^{1-\alpha} * \Delta_f$$

If we focus on male's choices, the equations are obtained in a similar way than for the female. Regarding the time male spends on leisure, it will be determined by the following equation;

$$l_t^m = \left(\frac{\varepsilon_l C_t^\delta}{\frac{W_t^m}{P_t}} \right)^{1/k}$$

$$l_t^m = l_t^f \left(\frac{w_t^f}{w_t^m} \right)^{\frac{1}{k}}$$

As we can observe, as the gap between the salary got by female and men is reduced, due to an increase in the salary got by women, male decide to spend more time on leisure. **This will be the sixth equation of our model.**

The equation that refers to the time spent by male on home production, is formed by the same variables as the one for female, but with the variables corresponding to men. **The seventh equation of our model will be the following;**

$$h_t^m = \left(\frac{\varepsilon_H H_t^{-\gamma} (1-\alpha) X_t^\alpha \Delta_m C_t^\delta}{\frac{W_t^m}{P_t}} \right)^{1/\alpha}$$

From this equation we can conclude that as the productivity of male in home production increases, the time they spend working at home increases as well. On the other hand, as consumption increases, the marginal utility male get from consumption keeps decreasing, so they would prefer to spend time working at home than working in the labor market. Furthermore, as the number of market inputs bought to produce home goods increases, the number of hours male would spend working at home will increase as well. Finally, an increase in the real salary got by male in the labor market, provokes a decrease in the time they spend working at home.

After having defined an equation for the time men spend in home production and the time they spend on leisure, we should find out an equation that determines the time male spend working in the labor market. In order to do this, we will use equation (1) and isolate de variable t_t^m .

$$t_t^m = T - l_t^m + h_t^m$$

As we can see in this equation, if the time male spend working at home or on leisure increases, the time they spend working in the labor market has to decrease. **This will be the eighth equation of our model.**

As in the case of female, equation (5) determines the quantity of home goods produced by male. It depends on the quantity of inputs obtained from the labor market, the time spent by male on home production and on the productivity they have working at home. **This will be the ninth equation of our model.**

$$H_t^m = X_t^\alpha * (h_t^m)^{-\alpha} * \Delta_m$$

The sum of the home goods produced by male and the home goods produced by female will be the total amount of home goods owned by the household. **The equation that reflects this will be the tenth equation of the model.**

$$H_t = H_t^m + H_t^f$$

The last equation that we are going to use will determine the quantity of goods consumption demanded in the market.

$$\Lambda_t = \frac{C_t^{-\delta}}{P_t}$$

$$\Lambda_t * (1+R_t)^{-1} = \beta * E_t * \Lambda_{t+1}$$

$$\frac{C_t^{-\delta}}{P_t} * (1+R_t)^{-1} = \beta * E_t * \frac{C_{t+1}^{-\delta}}{P_{t+1}}$$

In this case, the left side of the equation represents the part of household's income that is dedicated to consumption in this period and not to savings. On the right hand, the part of family income that is devoted to savings and is spent on bond purchases, that will provide funding for consumption in the next period. This part of the equation is multiplied by the discount factor β , that is smaller than one. This means that the household gives more importance to the current period than to the future one. From this equation we get;

$$C_t^{-\delta} = \beta * E_t * C_{t+1}^{-\delta} * \frac{P_t}{P_{t+1}} * (1+R_t)$$

In which $\frac{P_t}{P_{t+1}}$ represents the inverse of the inflation rate. Finally, using the Fisher relation we will obtain what will be the last equation of our model.

$$C_t^{-\delta} = \beta * E_t * C_{t+1}^{-\delta} * (1+rt)$$

$$C_t = E_t * C_{t+1} * \left(\frac{1}{\beta(1+rt)} \right)^{\frac{1}{\alpha}}$$

Where rt is the real interest rate. This equation makes sense because as we can see, as the interest rate increases, total consumption done by the household gets reduced. This is

because people would prefer to invest their money in bonds instead of using it to buy goods in the market. **This will be the eleventh equation in our model.**

After having defined the eleven equations that we will use in our model, we could claim that we can find solution paths for the eleven endogenous variables ($C_t, H_t, H_t^m, t_t^m, h_t^m, l_t^m, H_t^f, X_t, t_t^f, h_t^f, l_t^f$) provided that W_t^m, W_t^f, r_t, E_t and C_{t+1} are determined exogenously.

5. BASELINE CALIBRATION OF THE PARAMETERS

After defining the model, we are ready to simulate the different possible scenarios that have taken place or could take place in the Spanish labor market. This will allow us observe how the different endogenous variables behave when there are changes in the other variables.

Infinite simulations can be made, however, we will chose the ones that are most significant for us taking into account the data regarding to the active population and the participation rate that we have analyzed at the beginning of the paper.

The first thing we are going to study is how does the time allocation of male and female change when there is a decrease in the gender pay gap due to a rise in the female relative wage received in the labor market. We have decided to make this simulation because it is linked with what has happened in the Spanish labor market in the last years.

After that, we will also make an analysis of how these variables change when there is decrease in the difference between the productivity that male have in home production and the productivity female have in home production. Some years ago, women were the responsible of working at home and looking after the kids. Meanwhile, men spent most of their time working in the labor market, so their experience at home was nonexistent. Due to this fact, we will assume that female productivity working at home was higher than male's productivity working at home. This gap is getting reduced year by year as there are lots of men that dedicate a high part of their day to home production.

Finally, we will analyze time allocation modifications when there are changes on the weight parameter on home goods utility, moving down from 100% to 50%. Technological improvements and the globalization process that we are living have caused that individuals place more value on market goods than on goods made at home.

In order to do these simulations, we will give different values to the variables in our model using MatLab. We have selected the values taking into account that an individual should work around eight hours per day in the labor market and should dedicate some amount of

time per day to each of the tasks. After trying with different values, the final numbers that we have selected for the baseline calibration and for each of the simulations are the ones in Table 1.

Table 1: Numerical values of time allocation in baseline

Parameter	Baseline	Simulation 1	Simulation 2	Simulation 3
O	2	2	2	2
Ξl	2,3	2,3	2,3	2,3
Ξh	1*0,8	1*0,8	1*0,8	X*1*0,8
β	0,99	0,99	0,99	0,99
Υ	2	2	2	2
k	2	2	2	2
r	0,02	0,02	0,02	0,02
W_m	1	1	1	1
W_f	0.7* W_m	X* W_m	0.7* W_m	0.7* W_m
α	0,4	0,4	0,4	0,4
px	1	1	1	1
T	3	3	3	3
Δ_m	1	1	1	1
Δf	1.1* Δ_m	1.1* Δ_m	X* Δ_m	1.1* Δ_m
C_1	1	1	1	1
C	$c1*(1/(\beta*(1+r)))^{(1/O)}$	$c1*(1/(\beta*(1+r)))^{(1/O)}$	$c1*(1/(\beta*(1+r)))^{(1/O)}$	$c1*(1/(\beta*(1+r)))^{(1/O)}$

Source: own-elaboration

Where;

Table 2: Description of the parameters

Elasticity of the marginal utility of consumption	O
Weight parameter on home goods utility	Ξl
Weight parameter on leisure utility	Ξh
Discount factor	β
Elasticity of the marginal utility of home goods	Υ
Elasticity of the marginal utility of leisure	k
Interest rate	r
Male wage	W_m
Female wage	W_f
Market inputs share in home production technology	α
Price of inputs for home production	px
Total time	T
Male productivity in home production	Δ_m
Female productivity in home production	Δf
Consumption in the next period	C_1
Current consumption	C

Source: own-elaboration

As we can observe, the values change depending on the simulation we are doing.

6. MODEL SIMULATION

6.1 Reduction in the gap between female's salary and male's salary

As we know, the difference between the salary collected by men and women in the labor market has decreased, but we have not achieved total equality yet. This has been thanks to the increase in women's salary earned in the labor market. Concretely, in 2014 the salary earned by women represented the 76.6% of the salary earned by men.

With this simulation, our objective is to see how time allocation of male and female changes when there is a reduction in the salary gap. We will start assuming that women's salary is the 60% of the salary earned by male and we will increase it until we achieve total equality. Even if nowadays women are paid less than men in the same job position, we expect to achieve total equality in the near future.

Few women took part in the labor market around 1980, just some years after the democratic transition, so we will assume that the salary collected by male was higher than the one collected by female, as they normally dedicated their time to home production, and decided not to take part in the labor market.

The calibration values used for this simulation are the ones appearing in Table 1. We have assumed that female productivity working at home is a 10% higher than the one of male.

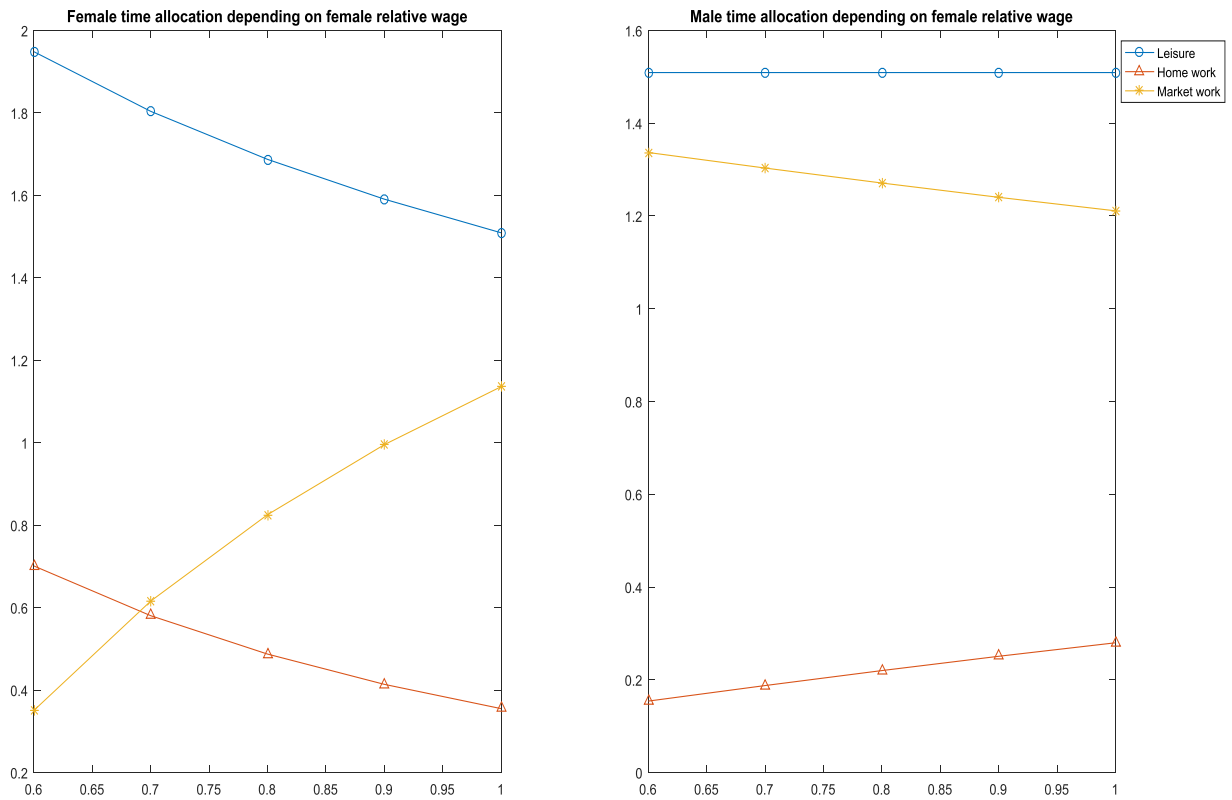
After running a Matlab code to solve a non-linear system of equations, we have obtained the following results, distinguishing between men and women:

Table 3: Individual's time allocation depending on female relative wage

Wf / Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
0,6*W _m	1,5092	0,1540	1,3368	1,9484	0,7010	0,3507
0,7*W _m	1,5092	0,1875	1,3033	1,8038	0,5804	0,6158
0,8*W _m	1,5092	0,2198	1,2710	1,6873	0,4873	0,8253
0,9*W _m	1,5092	0,2506	1,2402	1,5908	0,4139	0,9952
W _m	1,5092	0,2797	1,2111	1,5092	0,3550	1,1358

Source: own-elaboration with data from Matlab

Figure 5: Individual's time allocation depending on female relative wage



Source: Matlab

In these Tables 3 and 4, we can see both the optimal time allocation (Table 3) and the percentage increase in the time dedicated to each of the tasks when there is a reduction in the gender pay gap (Table 4).

Table 4: Percentage change effects due to female relative wage

Wf / Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
0,6*W _m	-	21,75%	-2,51%	-7,42%	-17,20%	75,59%
0,7*W _m	-	42,73%	-4,92%	-13,40%	-30,49%	135,33%
0,8*W _m	-	62,73%	-7,23%	-18,35%	-40,96%	183,78%
0,9*W _m	-	81,62%	-9,40%	-22,54%	-49,36%	223,87%
W _m	-					

Source: own-elaboration with data from Matlab

First of all, if we focus our attention on female, we can clearly see how a decrease in the gender pay gap affects female's time allocation. Regarding to leisure, we can claim that regardless of the salary, female spend most amount of their time per day on leisure. Nevertheless, this amount of time has decreased from 1.9484 to 1.5092. According to our model, as female wage increases from 60% to 100% of male wage, women would pass

from spending 15.58 hours per day on leisure to spending only 12.07, that is a 22.54% lower. Something very similar would happen to time dedicated to home production. As women's salary increases, they prefer to spend less time working at home and more time working in the labor market. Some years ago, women spent most of their time at home. This time could be devoted to cooking, looking after the kids, or for instance, doing the groceries. As we can observe, female would pass from dedicating 5.6 hours per day to home production, to dedicate just 2.84. This means that the time dedicated to this task would decrease in almost a 50%. When women earn the 60% of the salary earned by men, women decide to dedicate to home production more or less the same amount of time than the normal working time, that are assumed to be eight hours in Spain. Finally, the amount of time dedicated to work in the labor market also increases massively. If we increase the female relative wage from 60% to 100% of male salary, we can observe how the time that female are willing to dedicate to work in the labor market increases in a 223.87%. Women pass from spending almost no time working in the labor market to work a little bit more than 8 hours per day.

The results given by our model recall the situation occurred in Spain during recent years. Around forty years ago, men's salary was twice or more than the salary earned by women. Under these circumstances, most households consisted on a man that spent most of his day working in the labor market and a women that took care of the children and the house. Nevertheless, nowadays, women tend to work around eight hours per day and sometimes hold some job positions that were only occupied by men some years ago.

The results obtained with respect to men are very different. The first thing that has caught our attention is that men's leisure does not vary with changes in female's salary. Men normally spend 12.07 hours per day on leisure. The only thing that changes when female's salary increases, is the amount of time that male spend working at home and the time they spend working on the labor market.

As we can see, when female earn the 60% of the salary earned by male, male spend most of their time working in the labor market or on leisure. Concretely, they work 10.69 hours per day in the labor market and just 1 hour per day at home. However, the increase in female salary makes men dedicate less time to work in the labor market and spend that time working at home. When there is total salary equality, they are willing to work 9.68 hours per day in the labor market and 2 hours at home. The most significant result in this case, is that male increase their time working at home almost in an 80%.

We could say that our model's results regarding to men make sense and have also a relation with what has happened in Spain from the democratic transition to now. Men used to work more than eight hours in order to sustain their families and allow them to live in the best conditions as possible.

In general, in a situation of total wage equality, in which female earn the same as men, both individuals would dedicate the same amount of their time to leisure and a similar amount of time to work at home and in the labor market. However, as total equality has not been achieved, some differences exist. Male still dedicate more time to work in the labor market and women dedicate more time to home production. Concretely, female dedicate the 93.39% of the time dedicated by male to work in the labor market. Furthermore, male spend in home production just the 78.78% of the time spent by female. Under this situation, both members of the household spend most of their day on leisure.

These results could be explained by cultural traditions in which men were the responsible of bringing money home and women were the ones in charge of the house and the children. Due to this fact, men have more experience and are more productive working in the labor market and women have more experience and are more productive working at home. Customs take some time to change, so we should wait some more years until time allocation and salaries of both individuals are equivalent.

We could link the results given by our model with the ones commented at the beginning of this paper about the evolution of the active population and the participation rate in Spain. The fact that made me think about writing this paper was that female active population has increased in the last years and male's active population has decreased. One of the points that explains this evolution could be the tremendous reduction in the gap between female's wage rate and male's wage rate as explained by our model. Some years ago, as women's salary was that low, families preferred that women stayed at home taking care about the children and that men worked in the labor market, probably more than eight hours in order to bring money home and sustain the whole family. As salaries have increased and women have had more access to superior education, lots of women have decided to incorporate to the labor market and reduce the time they spent working at home and on leisure. As female's time dedicated to home production has decreased and has been replaced by time spent in the labor market, the other member of the household has had to increase the time he spends working at home and reduce the time he spends in the labor market. This explains the decrease in male's active population and the increase in female's active population.

Nowadays, women's salary is approximately 80% of the salary earned by men. If we join this with our model it was supposed that women would spend almost 7 hours per day of her time working in the labor market and men would spend 10.16 hours of their time per day working in the labor market. This means that women would spend just the 68.89% of the time spent by men working in the labor market. If we look at real data, we observe that in the last quarter of 2016, female's active population was 10578.9, as opposed to male's active population, that was 12166.9. We could claim that women's active population was a 13.05% lower than male's active population.

Even if we have not achieved total equality between male and female in the time dedicated to each of the tasks and at the salary perceived yet, we hope to achieve it in the near future.

6.2 Reduction in the gap between male's productivity working at home and female's productivity working at home

As we have mentioned, cultural traditions and some other facts, such as the big difference between male and female wages, have made women specialize in home production and male dedicate to work in the labor market.

Some years ago, few women had access to superior education and if they had the chance to study, they abandoned the labor market as soon as they got married. Thus, the husband was the one that brought money home and had few time to spend looking after the kids or taking care about the house.

Due to this fact, women tended to specialize in home production and had more attachment with the children than men. Men's home productivity was almost zero, as opposed to women's productivity, that was very high. At the same time, as we have commented before, the lack of experience made women's productivity in the labor market be almost nonexistent.

Fortunately, things have changed and there has been a high attempt and encouragement by countries to achieve total equality between men and women. For that reason, they have promoted the incorporation of women to universities and job positions that some years ago were only occupied by men, such as important political posts.

The participation of women into the labor market has provoked the decrease in the time they dedicate to home activities (cooking , looking after the kids, etc.). Lately, many husbands have decided to abandon the labor market in order to dedicate only to home

production substituting their wives. Some others, have just decreased the time they spend working in the labor market in order to increase their time working at home.

The incorporation of men to home production has reduced their productivity wedge with women relative to working at home. For that reason, we are going to make this simulation, in order to see how equalizing productivity affects household's time distribution. We will study the different results regarding to men's and women's time allocation, passing the female's home productivity from being 120% of male's productivity in home production to being the same, 100%.

The calibration values used for this simulation are the ones in Table 1. As we can observe, we will assume that female salary is 30% lower than male salary in the same job position.

After introducing our data in MatLab, we have obtained the following results, differentiating between men and women, both in levels (Table 5) and in percent effects with respect to the baseline case $\Delta f = 1,2 * \Delta m$ (Table 6).

Table 5: Individual's time allocation depending on male productivity in home production

Δf / Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
1,2* Δm	1,5092	0,1559	1,3349	1,8038	0,5998	0,5964
1,15* Δm	1,5092	0,1709	1,3199	1,8038	0,5911	0,6051
1,1* Δm	1,5092	0,1875	1,3033	1,8038	0,5804	0,6158
1,05* Δm	1,5092	0,2059	1,2849	1,8038	0,5674	0,6288
1* Δm	1,5092	0,2263	1,2645	1,8038	0,552	0,6442

Source: own-elaboration using Matlab

Figure 6: Individual's time allocation depending on male relative productivity in home production

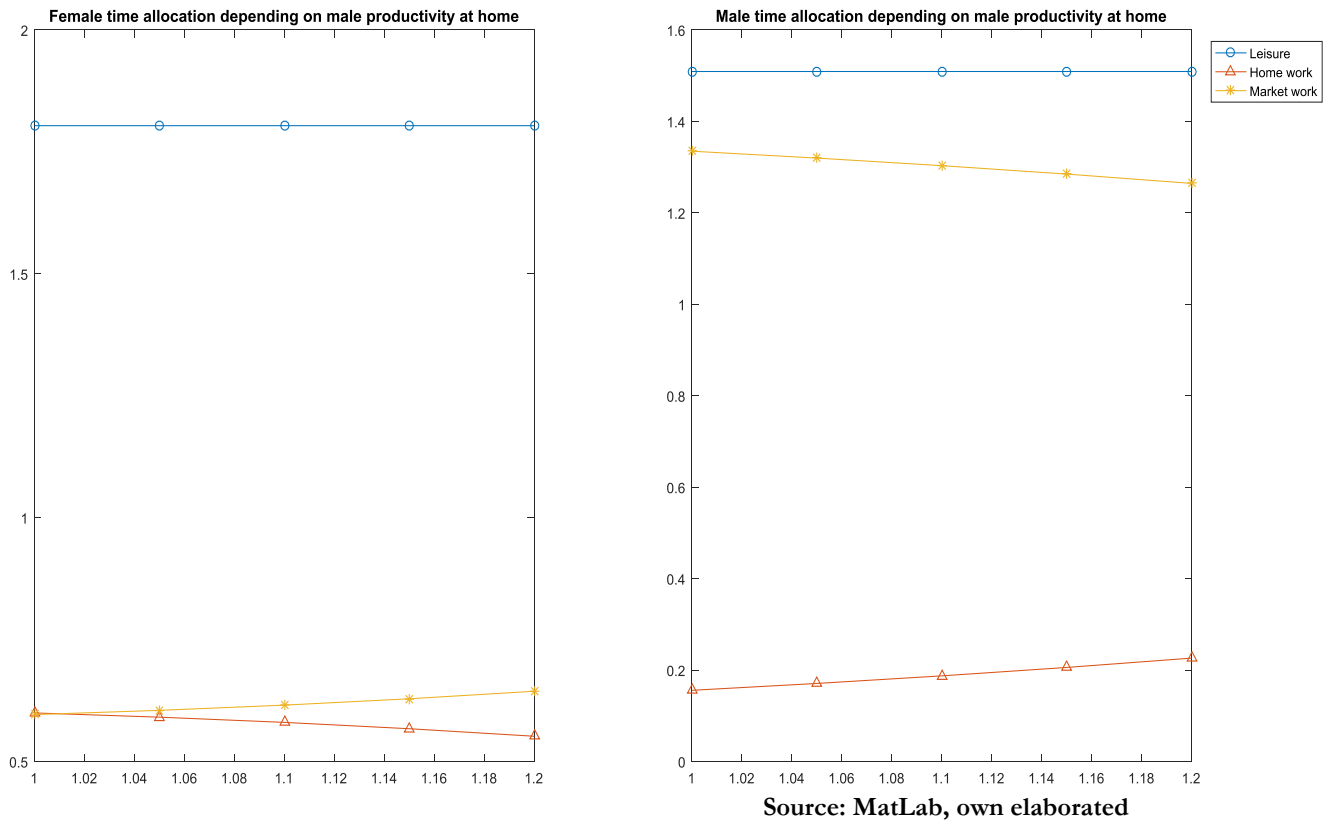


Table 6: Percentage change effects due to male productivity in home production

Δf / Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
$1,2*\Delta m$	-	9,62%	-1,12%	-	-1,45%	1,46%
$1,15*\Delta m$	-	20,27%	-2,37%	-	-3,23%	3,25%
$1,05*\Delta m$	-	32,07%	-3,75%	-	-5,40%	5,43%
$1*\Delta m$	-	45,16%	-5,27%	-	-7,97%	8,01%

Source: MatLab, own elaborated

First of all, we should mention that a change in any of the individual's home productivity does not affect the time they spend on leisure. As we can observe, it has only a direct effect on the time they spend working at home or the time they spend working in the labor market.

Regarding to females choices, when their home productivity is a 20% higher than the one of male, they spend a high part of their time on leisure, concretely 14.43 hours per day. At the same time, they devote 4.79 hours of their day to home production and 4.77 hours per day to work in the labor market. The time dedicated to home production and working in the labor market is almost the same.

As male's productivity in home production keeps increasing, women decrease the time they dedicate to home production and they increase the time they spend working in the labor market. Concretely, when both individuals have the same productivity in home production, female dedicate 4.41 hours per day to home production and 5.15 hours per day to work in the labor market. Female decrease almost an 8% the time they spend in home production and they increase their time working in the labor market in the same amount. This time allocation coincides more or less with what happens in our society these days. As we can observe, as male are more productive working at home, female decrease their time in home production and dedicate that time to work in the labor market. The results obtained with our model regarding to women are very similar to the data we have about the evolution of female population's time allocation in the last years in Spain.

If we focus our attention on men, we can claim that when their productivity working at home is a 20% lower than the one of female, they spend 12.07 hours per day on leisure and only one hour and a half per day working at home. The time they are willing to spend working in the labor market is 10.67 hours per day. These results are very different from the ones we obtained for women.

As men's productivity keeps increasing, the time they spend working at home increases aswell and the time they spend working in the labor market decreases. Finally, when both individual's relative productivities are equal, we achieve a situation in which even if male's and female's productivities are the same, both individual's time allocations are very different because of the wage gap. Women are willing to spend 4.41 hours per day working at home and 5.15 hours per day working in the labor market. Meanwhile, men are willing to spend almost two hours per day working at home and around 10 hours per day working in the labor market. As we can observe, when both individual's productivities are equal, male increase their time working at home in a 45%, whereas female decrease an 8% the time they spend in home production. Regarding to market work, male spend a 5% less time in the labor market, as opposed to women that increase the amount of time they spend working in the labor market an 8%.

Cultural traditions may have a lot to do with these results as they have a high effect on household's thoughts. In Spain there are still people who think that women should stay at home and men should dedicate their time to work in the labor market. Fortunately, things are changing little by little. Furthermore, encouragement for women's access to superior education has helped a lot.

If we link the results obtained from our model to the data we analyzed at the beginning of this paper about the active population and the participation rate, we could claim that they make sense. It is true that men's productivity in home production has increased, probably thanks to the increase in the time they spend working at home. Due to this fact, many households have decided that women should incorporate to the labor market and men could spend some time working at home. The reduction in the gap between male's home productivity and female's home productivity is one of the reasons that explains the high increase in female's active population and the decrease in male's active population, but it is not the only one. Men's experience working at home has fostered these results, but if we join this with the decrease in gender pay gap, the effect in the active population gets greater.

With the results obtained in these two simulations, it seems that the model we have created is appropriate to explain what has happened in the Spanish labor market during the last years.

6.3 Reduction in the weight parameter on home goods utility

Technological innovations and the globalization process that we are living are some of the facts that have made the preference for home goods decline. Nowadays, people are more willing to consume market goods that provide them things that they do not really need than consuming the goods they have produced on their own thanks to home production. The Internet and the appearance of new technologies have fostered this trend and have made people think that goods made at home are less useful or less meaningful than the ones bought in the market.

Some years ago, around 1980, it was very typical that the households bought the textiles and made their own clothes. Moreover, it was very common to get together with family and friends in a house and cook something with the ingredients bought in the city market or cultivated in the family's vegetable garden. However, nowadays it is more typical to go to have lunch to a restaurant, as it is more convenient and the exploitation of family owned vegetable gardens has decreased.

Marketing campaigns have also become more aggressive in the last years and have encouraged the consumers to buy more than what they need. In 1985 the Internet was hardly ever present in most of the households and now most of them own more than one television, several computers and some iPad or tablet. Due to all these facts, we could claim that preference for market goods has increased and predilection for goods made at home

has decreased. In this simulation, we will study how a reduction in the weight parameter on home goods utility, going down from 100% to 50% of its initial calibrated value, affects time allocation of the individuals forming the household.

Over this simulation, we will use the calibration values in Table 1. Hence, we will assume that female salary is a 30% lower than male salary and that female productivity working at home is 10% higher than the one concerning to male.

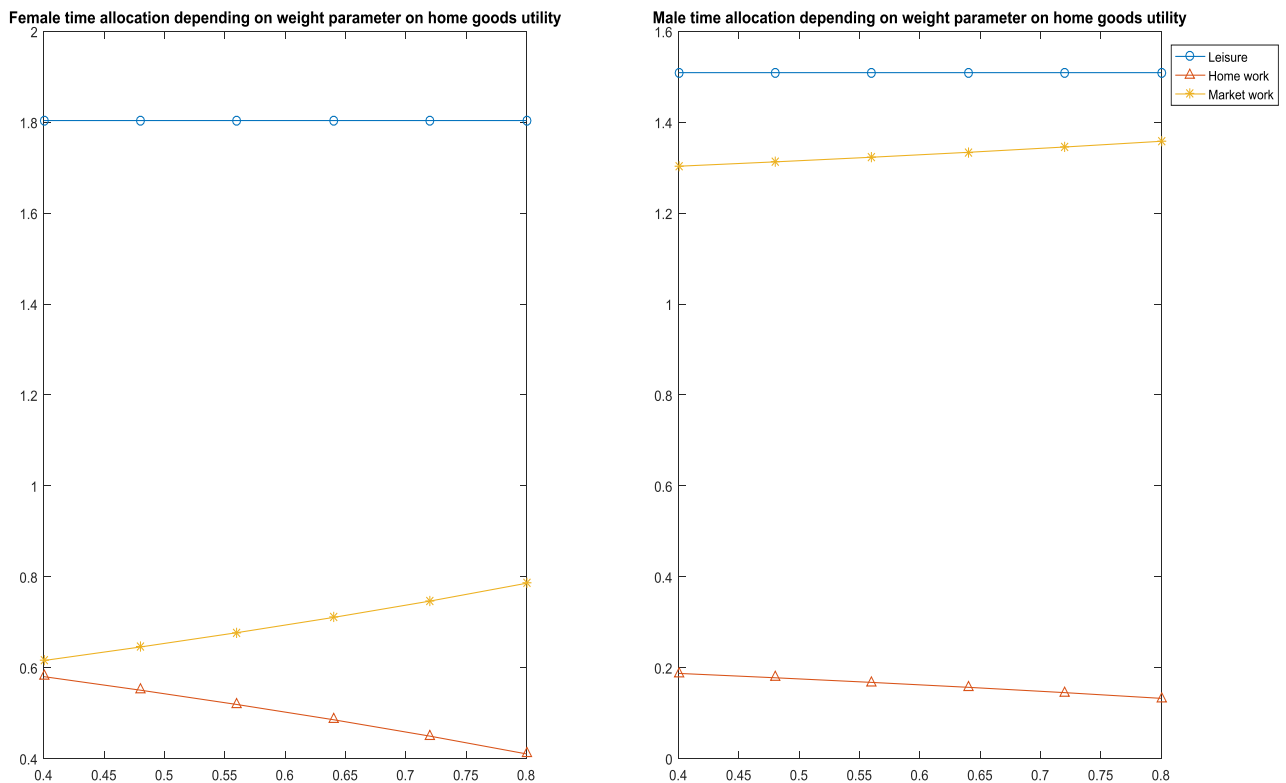
After introducing our data in MatLab, we have obtained the following results, differentiating between men and women and level and percent effects in Tables 7 and 8, respectively.

Table 7: Individual's time allocation depending on weight parameter on home goods utility

Ξ_h / Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
1	1,5092	0,1875	1,3033	1,8038	0,5804	0,6158
0,9	1,5092	0,1779	1,3129	1,8038	0,5506	0,6456
0,8	1,5092	0,1677	1,3231	1,8038	0,5191	0,6771
0,7	1,5092	0,1559	1,3339	1,8038	0,4856	0,7106
0,6	1,5092	0,1452	1,3456	1,8038	0,4495	0,7466
0,5	1,5092	0,1326	1,3582	1,8038	0,4104	0,7858

Source: MatLab, own elaborated

Figure 7: Individual's time allocation depending on male relative productivity in home production



Source: MatLab, own elaborated

Table 8: Percentage change effects due to weight parameter on home goods utility

Eh /Individual's time allocation	Male			Female		
	Leisure	Home work	Market work	Leisure	Home work	Market work
1						
0,9	-	-5,12%	0,74%	-	-5,13%	4,84%
0,8	-	-10,56%	1,52%	-	-10,56%	9,95%
0,7	-	-16,85%	2,35%	-	-16,33%	15,39%
0,6	-	-22,56%	3,25%	-	-22,55%	21,24%
0,5	-	-29,28%	4,21%	-	-29,29%	27,61%

Source: MatLab, own elaborated

As we can observe, a change in the weight parameter on home goods utility does not affect the amount of time the individuals spend on leisure. As it was expected, a decrease in the preference for home goods, makes both individuals reduce the amount of time they spend working at home. As we can observe, both individuals reduce the amount of time they are willing to work at home in the same amount, 29.28%.

Regarding to market work, the results are a little bit different. Both individuals increase the amount of time they dedicate to work in the labor market when there is a decrease in the weight parameter on home goods utility. Nevertheless, the increase is higher in the case of women, as they normally spend less time than men in this field. Male are willing to spend only a 4.21% more time working in the labor market, whereas women are willing to spend a 27.61% more time in this field. As individuals prefer goods bought in the labor market than goods produced at home, it is normal that they reduce the time they spend in home production and they increase their time working in the labor market. With this time allocation, less home goods will be produced and the family will earn more income that could be spent in market goods. In general, women pass from spending 4.92 hours per day working in the labor market, to spend 6.28 hours per day. Meanwhile, when the weight parameter on home goods utility decreases, male pass from spending 10.42 hours per day working in the labor market, to spend 10.86 hours per day.

The results provided by the model are reasonable. As the preference for home goods declines, thanks to the social media, marketing campaigns and the change in the Spanish traditions, individuals are willing to work more time in the labor market and less time at home. Households prefer to spend time in the labor market in order to earn some income to spend in market goods.

We could also link these results with the data analyzed at the beginning of the paper. According to our model, this preference for market goods would make both individuals

spend more time working in the labor market in order to buy market goods in the future. However, what has happened in reality in Spain is a little bit different. It is true that women active population has increased, but this has been due not only to the decrease in the preference for home goods, but to other facts like the increase in female's real wage in the labor market and the higher access to superior education women have nowadays, as we have commented before. In the case of men, if the increase in the preference for home goods was the only thing that would have occurred in the last years, men's active population would have increased significantly. Nevertheless, there are some other things like the increase in men's productivity working at home or the increase in female's salary in the labor market, that have induced men's active population to decrease in the last years.

7. CONCLUSIONS

One of the most meaningful changes that the Spanish labor market has experienced in the last years has been the incorporation of women to it. From the democratic transition to now, female have changed their attitudes and their habits thanks to the increase in their access to superior education and the significant reduction in the gender pay gap.

Around 1980, only few women had the chance to access the labor market. Moreover, from the ones that accessed it, the great majority of them abandoned it when they got married or they had their first kid.

Nevertheless, thanks to the economic growth that Spain has experienced from 1985 to 2007 and the tremendous attempts by countries to foster gender equality, women retention rate is higher nowadays and the time that married women and women with kids spend in the labor market has increased. At the same time, more men devote a significant part of their day to home production.

Even if time allocation of male and female has changed, there are still remarkable differences at the kind of jobs performed by men and women and at the salary perceived.

Regarding to the active population, it started to grow in the last quarter of 1980, thanks to the incorporation of women, immigrants and baby boomers to the labor market.

I have described a dynamic model of the labor market that allows us show which are the main facts that make individual's time allocation change and predict how much time they will optimally spend on leisure, working at home and working in the labor market depending on the main model's variables such as the relative wage, productivity and weight parameter on home goods utility.

The calibration of the model was difficult to do. However, I finally chose the values in order to obtain meaningful results. I took into account that the individuals spent at least some amount of time in each of the tasks and that their working hours were always around the standard working time in Spain, that as we know, are eight hours per day.

On the one hand, there has been a significant increase in female relative wage obtained in the labor market, that has caused the gender pay gap decrease. This reduction, along with the greater access to superior education that women have had, have provoked that female active population has increased, increasing women participation rate.

Despite these difficulties, the model has allowed us to simulate different possible scenarios that have occurred in Spain during the last years and will allow us forecast any conceivable situation in the Spanish labor market in the future.

As we have mentioned, the decrease in the gender pay gap has been one of the causes of the changes in the composition of the active population in Spain. During the Dictatorship of Francisco Franco, men were the ones in charge of bringing money home and most female decided not to take part in the labor market. Apart from the lack of educational background, wage differences also influenced this decision. For doing our simulation, we took into account that female salary was the 60% of the salary earned by male. Thanks to our model, we saw how household's time allocation changed. Women passed from spending almost no time working in the labor market to spending around eight hours on it. Moreover, they were willing to spend less time working at home. However, women time allocation was not the only one affected when there were changes in female relative wage. Men passed from spending almost ten long hours working in the labor market to spending only nine, and this was accompanied by an increase in the time they were willing to spend in home production.

On the other hand, the evolution and change of minds and roles, has caused men's productivity working at home increase, as they spend more time in home production day by day. Around forty years ago, women were the ones in charge of the house and that is why their productivity in this field was very high. However, as men spent most of their time in the labor market, their productivity in home production was almost non-existent. In our second simulation, we observed the change in time allocation when male relative productivity working at home passed from being a 20% less than the one for female, to being equal.

In this case, as it was expected, men increased the time they were willing to spend in home production and decreased the time they were willing to spend working in the labor market. At the same time, the opposite happened with women.

Some years ago, it was typical that most of the textiles used by the household were manufactured at home. Furthermore, most of the meals were composed of some vegetable or ingredient that had been cultivated in the household's vegetable garden. Nevertheless, none of these things happens with this intensity nowadays. After observing these trends, we decided to do our third simulation, in which we reduced the weight parameter on home goods utility from 100% to 50%. After reducing this parameter, we observed how both individuals decreased the time they spent in home production and they increased their time working in the labor market, in order to obtain more income to spend in market goods.

As a conclusion, we could say that it has not been only one of these facts which has made female active population increase and male active population decrease, but a combination of the three of them and some others more. The increase in female relative wage, the increase in male productivity in home production and the decrease in the preference for home goods, have caused that day by day more women are taking part in the labor market and more men are doing the housework.

Finally, I would like to stand out that the findings of the presented model are restricted to several conditions. Therefore, it is difficult to extrapolate them to reality. Probably, there are more factors affecting the household's time allocation than the ones included in this model, such as the number of children per women. However, the results offer a fair approximation of the events occurred in the Spanish labor market during the last years. Consequently, even if the outcomes are not absolutely accurate, I consider that they offer a general idea of what has happened in recent years in the job market in Spain.

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