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A Structural Model of the Labor Market to Understand Gender Gaps among Marginalized Roma Communities

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Abstract

This paper constructs and estimates a household-level search model to analyze Roma spouses' utility maximization for leisure, home production, and work. The paper aims to explain labor market gender gaps in a marginalized Roma population with low labor market participation rates (males 53 percent and females 17 percent). The analysis uses data from the 2017 Regional Roma Survey for six Western Balkan countries. The simulation results show that the main source for gender differentials in the labor market is the unequal opportunities in favor of males—not gender preferences or differences in home production productivity. Therefore, most of the gender differences in the labor market can be closed by providing wives the same labor market conditions as husbands. Counterfactual policy experiments show that policies that increase the frequency of receiving a job offer, decrease the frequency of laying off workers, and reduce search increase Roma husbands' labor participation. Policies that equalize wages induces more wives to join the labor market and husbands to withdraw from it. This outcome signals that the wage gap is the dimension that deters the greatest number of Roma wives from joining the labor market.

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A Structural Model of the Labor Market to Understand Gender Gaps among Marginalized Roma Communities[1]

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1. Introduction

This paper aims to understand gender inequality in the labor market and time use among marginalized Roma communities in the Western Balkans, using a household search model of the labor market with labor and fertility shocks and idiosyncratic spouses' home production preferences. The model contributes to our understanding of Roma spouses' strategies when facing utility maximization over leisure, home production, and labor income.

Although there are no recent reliable estimates of the Roma population in the Western Balkans, available estimates suggest that this ethnic minority may represent between 700,000 and 1,360,000 individuals in the region, approximately. Census data allow for ethnic self-identification, likely leading to significant undercounting. According to the Council of Europe (CoE) estimates, the Roma population ranges from 20,000 in Montenegro to as high as 600,000 in Serbia. Proportionally, the Roma population represents from 1.7 percent of the total population of Kosovo, to as high as 9.6 percent of the population in North Macedonia (Robayo-Abril and Millan 2019).

Roma women are one of the most deprived groups in Europe, as they suffer a double layer of exclusion: as women, and as members of Europe´s largest ethnic minority. According to the 2017 UNDP-WB-EC Regional Roma Survey[2] (hereafter RRS), Roma face higher unemployment rates than non-Roma populations living in close proximity, with females being particularly affected. On average, 53 percent of marginalized Roma females aged 15–64 in the Western Balkans are unemployed compared with 41 percent among Roma males. The labor force participation rate among Roma women is extremely low: in 2017, just 21.3 percent of Roma women participated in the labor market, compared to 49 percent of Roma males.[3] Limited access to jobs and socioeconomic rights keep Roma people trapped in a vicious cycle of poverty and social exclusion, where Roma women suffer the most, as they experience "double discrimination" (O'Higgins 2012).

In the economic literature studying the labor market decisions of males and females, a strand of research has shown that biased conclusions can result from omitting the effects of family structure and the interdependence between one family member's decisions and other family members' conditions. Moreover, household gender roles and restrictive social norms can create barriers for some members wishing to participate in the labor market. Becker (1981) considered that in order to navigate these barriers, family members should specialize in the production of the resource in which they have a comparative advantage. Our model focuses on spouses' decision making, considering that the household head and his/her spouse are the main providers of resources. Additionally, defining the spouses as the unit of study helps to disentangle whether the observed gender gaps are due to differences in the labor market or due to differences in gender roles regarding leisure and home production.

Given the Roma population's low labor participation rate and lack of labor market opportunities, we are modeling the household decisions with a Unitary Spouses Joint Labor Search model. Search models are useful to understand labor market dynamics given the existence of frictions,

[2] The 2017 UNDP-WB-EC Roma Regional Survey is the most comprehensive survey to date on living conditions and human development outcomes among marginalized Roma households in the Western Balkans, as well as non-Roma households in the vicinity of Roma.

[3] Population weighted regional statistics constructed with the 2017 Roma Regional Survey.

imperfect information, and heterogeneity in environments of high unemployment, high nonparticipation, job instability, wage disparity, and uneven opportunities among groups. To explain the Roma's decisions on those margins, we are extrapolating from marriage formation and we use a unitary model for a married couple. We demonstrate that the predictions of our dynamic model can account for the multiple variables underlying spouses' decision making on time allocation, labor supply, and wages, for couples with and without children.[4]

Previous Unitary Labor Household Search Models studying spouses' labor market decisions considered only employment and nonemployment labor market status with health insurance (Dey and Flinn (2008)), and sometimes with multiple locations (Guler, Guvenen, and Violante (2012). Flabbi and Mabli's (2018) model included the participation decision (extensive margin), on-the-job search, part-time or full-time jobs (intensive margin), and an exogenous fertility shock. Choi (2018) studied parental leave policies and labor supply. Our model is an extension of the work by Flabbi and Mabli (2018). We expand the comprehension of gender gaps and household decisions by introducing for each spouse continuous time allocation between leisure and home production, while still allowing job offers to be part time and full time.

The results from the RRS suggest a strong gender specialization. If in a given household a spouse has a job, usually it is because the husband is working. Also, data from the time usage module reveal that females on average devote more time to home production. For instance, wives reported spending 34.7 percent of their time on home production[5] when no children are present, and a slightly higher amount when children are present (39.4 percent). Husbands reported much lower shares, spending 22.4 and 22.2 percent of their time on home production, respectively. Also, in the 35.2 percent of Roma households where at least one spouse works, both spouses work in only 2.0 percent of households, and only the husband works in 28.3 percent. To describe the spouses' behavior where only one spouse has a job, Guler, Guvenen, and Violante (2012) described the *breadwinner cycle* as the process where unemployment spells and accepted wages are a result of the insurance that joint labor search provides against each spouse's life shocks. In this sense, the couples' labor market behavior is another source of labor friction that a neoclassical model can hardly explain. Following Flabbi and Mabbli (2018), this paper expands spouses' joint decisions regarding employment, unemployment, and nonparticipation.

These gender discrepancies will be incorporated into the model as follows. The household maximizes intertemporal utility that depends on consumption, leisure of each spouse, and the home production level. The household utility includes parameters that weight how much the household values each one of its components. Home production is an increasing function of spouses' time allocation on it and spouses' productivity. The model includes an exogenous rate that measures when the household has children, and when they leave the household. Regarding the labor market, the model includes arrival

[4] In the past, for static situations, the unitary model was rejected because of its unrealistic predictions on spouses' resource optimization.

[5] Home production time is defined as time spent by a household member on non-commercialized activities aiming to produce goods and services for himself/herself or another household member inside the household (laundry, cooking, childcare, taking care of other members in the household). Leisure is defined as time spent on entertainment and private activities without the aim of producing (dancing, sleeping, eating, spiritual and religious activities). Working is the reported time spent on paid employment or activities outside the household in exchange for something (wages, earnings from self-employment, nonpecuniary payments).

and layoff arrival rates, and parameters that characterize the wage offer distribution. All the labor market parameters and leisure preferences are gender specific. Home production productivities are spouse specific where gender distributions over the productivities are defined. The estimated parameters show that males receive more frequent job offers, have extended periods without unilateral layoff, and perceive higher costs to participate in the labor market. Households give more weight to male leisure than to female leisure, and males substitute less leisure at different labor market states. More females belong to the high productive type, making them less likely to participate in the labor market.

The model adjusts the household utility parameters that weight consumption, leisure of each spouse, and the home production level to reflect how the number of children in a household changes labor market decisions. Hence, when a couple has a child, the spouses will reoptimize their choices regarding time allocation, wages (if quitting or staying in the current job), and labor force participation. When Roma couples have children, the share of husbands who work full time increases by 6 percentage points and husbands' non-participation rate drops by 13 percentage points. The labor market participation of Roma wives does not change dramatically, but they nevertheless work less, both full and part time. Irrespectively of their labor market status, husbands and wives increase home production supply when there are more children in the household.

The paper contributes to the emerging literature in three ways.

First, the paper estimates for the first time a structural labor model for the marginalized Roma population with a gender perspective. The model assumes that the household head and the spouse are the primary household decision makers, or equivalently, that they are the main providers of goods and services inside the family. This assumption was made because of simplicity. Estimating the joint decisions of several members regarding labor market status and time allocation is a complex exercise. Even with this simplifying assumption, the model exhibits the spouses' optimal strategies when facing utility maximization over time usage and labor income. Following this idea, the model includes the distributions of home production productivity by gender. The identification of these distributions relies on the mean and variance of home production time reported by husbands and wives in the RRS survey, conditional on labor market states.

Second, the paper provides a methodological contribution within the search literature; the model presented here goes beyond the existing search model literature that either focused on intensive and extensive labor market decisions while ignoring household production (Flabbi and Mabli 2018), or focused on the simple binary choice between employment or household production (Choi 2018). This paper combines these two strands of search literature in a dynamic model that explains the intensive and extensive margins of spouses' decisions, as well as spouses' time allocation over the full range of activities available to them (work in the market, work in the household, and enjoying leisure time).

Finally, the model allows us to decompose gender gaps from two potential sources: the structural labor market and the preference parameters. Therefore, the model can measure the effects of gender roles on males' and females' willingness to participate in the labor market.

Additionally, our estimated structural model is useful for evaluating the ex-ante impact of gender-specific policies on labor market gender gaps, including the gender-disaggregated labor market status and time allocations of Roma couples. These may include gender policies affecting

females' and males' wage offers, job tenure, and job offer arrival rates; gender roles regarding leisure or home production and fertility patterns; or more generally, policies affecting overall Roma labor market conditions.

Counterfactual experiments show that males and females do not react symmetrically to policy interventions, and that most labor gender gaps can be closed by providing wives the same labor market conditions as husbands. All the policy experiments increase or reduce Roma husbands' and wives' parameter values. Focusing on husbands, increasing the frequency of receiving a job offer, decreasing the frequency of layoffs, and reducing the search cost are the policies that most increase the husbands' labor participation. Focusing on wives, the policy that induces more wives to participate in the labor market is increasing Roma husbands' and wives' wages.

Future extensions of the model could endogenize the fertility decision to reflect the impact of labor market changes on the number of children. Another useful extension could introduce the role that taxes and subsidies have on the spouses' decisions. Moreover, because the Roma population in many cases live in extended families, including other household members' labor market states and time decisions should adjust better the Roma labor market decisions. Sharing a dwelling with extended family could be a strategy for Roma households facing reduced labor opportunities. Currently, the RRS only applies the time usage module to a random household individual; to apply the modeling to extended families, time usage modules must collect data from all household members.

Another useful future extension could make a General Equilibrium Search Model like the one developed by Hanming and Shephard (2019), but this development will rely on future data availability. Hanming and Shepard have labor supply and demand information and data from employer-provided health insurance. In this paper we do not have firms' information; the estimated labor market parameters do not allow us to disentangle whether the values found are coming from reduced labor market productivity or from employer discrimination against Roma males or females. Given this limitation, in the policy experiments we will include only male and female labor parameters to simulate if there is a reduction in discrimination, or if Roma wives' productivity increases over Roma husbands. We then calculate spouses' optimal time allocation, labor supply, and wages for these scenarios.

This paper is organized as follows. Section 2 describes the model. Section 3 describes the data. Section 4 discusses the identification of the model. Section 5 interprets and presents estimates from the model parameters and compares them to the Roma data. Section 6 presents policy experiments, and section 7 offers a gender decomposition of the time usage and labor market gaps. Section 8 discusses this paper's limitations and proposes future research, and section 9 concludes.

2. Model

The model aims to explain married couples' optimal decisions regarding participation in the labor market, which job offers to accept, wages, as well as time allocations. It also describes how these allocations change when children are present. The model was developed in Salazar-Saenz (2020) and is closely related to Flabbi and Mabli (2018) and Choi (2018). Flabbi and Mabli (2018) modeled intensive and extensive margin decisions in the labor market but restricted the allocation of time between leisure and work. Choi (2018) introduced home production into spouses' decisions to explain specialization in the labor market or chores, and how paternity leave impacts spouses' decisions. This model was

restrictive due to the allocation of time to either household production or working time. The model presented here extended the decision space of the household by allowing spouses to choose their time allocation over a broader range of available activities: work in the market, work in the household, enjoy leisure time; it also explains intensive and extensive margin decisions in the labor market.

There is a long debate about the modeling strategy on fitting household decisions. The strategies used most often are known as cooperative models. McElroy and Horney (1981) first developed the theory and the axiomatic properties of the cooperative models that solve for static household employment, resource allocation, and marriage formation through Nash bargaining. Their algorithm works as follows: marriage is decided if everyone gets higher benefits than remaining single. When deciding the resource allocations inside the household, the single optimal allocation determines the outside option for each spouse. The spouse with the highest outside option will have an advantage regarding the optimal employment and resource allocation inside the marriage.

To incorporate dynamics, the cooperative models first introduce heterogenous agents, and then individual transitions over the types are defined.[6] Once a transition to a new type is realized, both the single and the married characteristics change, employment and resource optimizations are re-calculated, and the marriage decision is updated. In the periods without a shock, there is no update of the decisions. In the labor market dimension, only being a full-time worker or a nonworker are considered as feasible labor states.

Given the Roma population's low labor participation rate and lack of labor opportunities, we are modeling the household decisions with a Unitary Spouses Joint Labor Search model. In our model, the household is assumed to behave as a single unit (unitary search model). With this model we expand the labor market decisions to nonparticipation, unemployment, part-time and full-time jobs. We assumed that spouses are the leading decision makers in the household and are the ones who have more similar conditions. To explain the labor supply, and the wages that the Roma couples exhibit, each spouse will face a labor structure that is gender specific.

The novelty of our model is using the different mean and variance of each spouse's time allocation in home work and leisure to bring an additional explanation of labor supply, including the capacity to augment comprehension of gender roles in production inside and outside the market. To capture these margins, the model includes a home production function. This function has as inputs spouses' time allocation in home production and spouse-specific home production productivity. Additionally, the model includes gender-specific leisure parameters that capture household valuation of the leisure of the wife and the husband.

A husband is denoted by index *i* and a wife by *j*. The instantaneous household utility is a function of (i) the income that a household produces (labor income, c_{ij}),[7] (ii) each spouse's leisure (l_i, l_j), (iii) the time that members dedicate to home production (Z), and (iv) a search cost that unemployed individuals assume (nonparticipants do not incur this search cost, but they do not receive any job offer, s_i, s_j).

$$U = u\left(c_{ij}, l_i, l_j, s_i, s_j, Z\right) \tag{1}$$

[6] For recent cooperative models over marriage and taxation, see Gayle and Shepard (2019); for models over marriage, labor supply, home production, and family values, see Gousse, Jacquemet, and Robin (2017).

[7] $c_{ij} = w_i h_i + w_j h_j$. This means the household labor income is a function of the market wage for each spouse and the hours worked in the labor market.

It is assumed that Z is an increasing function of household members' time dedicated to home production. Spouses' time constraints[8] and wages define the feasible values of the instantaneous household utility. Theoretically, spouses could decide any optimal time allocation that maximizes their instantaneous utility. In this paper, the household chooses each spouse's home production and leisure time continuously, but only two discrete working schedules are allowed (part time and full time).

2.1 Value Functions

As a dynamic model, households have a discount rate (ρ) and are composed of two infinitely lived agents. The dynamics of a given household are described by three potential individual gender-specific labor market shocks (λ_A, γ_A, and η_A) and a household fertility shock (τ_C). Unemployed agents receive job offers at the exogenous rate λ_A. Employed agents receive job offers (on-the-job search) with parameter γ_A, and, jobs can be exogenously terminated at the rate η_A. At the household level, τ_C will represent the fertility shock: children can enter or leave the household. All the model's shocks follow the Poisson processes. Subscript C specifies the presence or absence of children in the household (denoted by *c*, *nc*, respectively). When a given shock hits a household, it will maximize the utility over the feasible available options defined by the choice set associated with each shock.

The model has four possible labor states per spouse: full-time employment (FT), part-time employment (PT), unemployment (U), and nonparticipation (NP). Combining the wife and husband's possible states yields 16 possible states per household. Within this environment, the model can explain intensive margin (PT, FT) and extensive margin (participating or not) decisions. This labor market participation environment will explain gender gaps in the labor market and time allocations, including why female nonparticipation among Roma females is higher, why males participate more in the labor market, and why the share of the individual time devoted to home production is higher among Roma females.

Each household values the contingent state as a function of the flow utility, the expected future shocks available, and the optimal behavior given by any of these shocks. Table 1 presents an illustrative notation for the value functions for some labor market states,[9] with the flow utility and the shocks affecting each state. In this table, E-E represents households where both spouses work, E-U represents households where one spouse works and the other is unemployed, E-NP represents households where one spouse works and the other is a nonparticipant, U-U represents households where both spouses are unemployed, U-NP represents households where one spouse is unemployed and the other is a nonparticipant, and NP-NP represents households where both spouses are nonparticipants. Each of the spouses will choose the optimal leisure and home production time; but to keep notation simple, the paper does not use these dimensions as inputs into the value functions.

Table 1: Value Functions, Flow Utility, and Shocks

	Value Function	Flow Utility	Shocks
1	E-E(w_i, h_i, w_j, h_j, c)	$u(w_i h_i + w_j h_j, 1 - h_i - hp_i, 1 - h_j - hp_j, 0,0, Z)$	γ_M,η_M,γ_w,η_W,τ_C
2	E-U(w_i, h_i, s_j, c)	$u(w_i h_i, 1 - h_i - hp_i, 1 - hp_j, 0, s_j, Z)$	γ_M,η_M,λ_w,τ_C

[8] Total time per spouse = leisure (l_a) + hours worked (h_a) + household production time (hp_a):
1=$l_a + h_a + hp_a$, where a = i for husbands and j for wives.

[9] For simplicity, Table 1 reports 9 value functions, as if the model only had employment, unemployment, and nonparticipation states. As the functions include hours worked in full or part-time employment as inputs, (h_a), the employment state represents FT or PT states. Thus, 9 states in Table 1 represent 16 states of the model.

3	U-E(s_i, w_j, h_j, c)	$u(w_j h_j, 1-hp_i, 1-h_j-hp_j, s_i, 0, Z)$	$\lambda_M, \gamma_w, \eta_W, \tau_C$
4	E-NP(w_i, h_i, c)	$u(w_i h_i, 1-h_i-hp_i, 1-hp_j, 0,0, Z)$	γ_M, η_M, τ_C
5	NP-E(w_j, h_j, c)	$u(w_j h_j, 1-hp_i, 1-h_j-hp_j, 0,0, Z)$	γ_w, η_W, τ_C
6	U-U(s_i, s_j, c)	$u(0,1-hp_i, 1-hp_j, s_i, s_j, Z)$	$\lambda_M, \lambda_w, \tau_C$
7	U-NP(s_i, c)	$u(0,1-hp_i, 1-hp_j, s_i, 0, Z)$	λ_M, τ_C
8	NP-U(s_j, c)	$u(0,1-hp_i, 1-hp_j, 0, s_j, Z)$	λ_w, τ_C
9	NP-NP(c)	$u(0,1-hp_i, 1-hp_j, 0,0, Z)$	τ_C

Every household is susceptible to receiving a specific children shock ($\boldsymbol{\tau_C}$). The first row shows that when both spouses are working their flow utility is given by the labor income earned by the couple $(w_i h_i + w_j h_j)$, their individual leisure $(1 - h_i - hp_i, 1 - h_j - hp_j)$, and their household production outcome Z that has the spouse's time as inputs (hp_i, hp_j). In the future, each spouse could receive a job offer (γ_M, γ_W) or lose his/her job exogenously (η_M, η_W).

On lines 6–8 of Table 1, s_i, s_j indicate that when either agent i or j is unemployed and looking for job offers, that agent faces a search cost to receive job offers. Once a spouse is unemployed, he/she can receive job offers (λ_M, λ_W). A nonparticipant does not lose time searching for a job, but also does not receive any job offers. Finally, the value function *NP-NP* denotes the case where both spouses are nonparticipants on the labor market and the flow utility will come from spouses' leisure and home production outcome; in this case the only available shock for spouses is the fertility shock.

As an example, equation 2 presents the value function where both spouses are employed, each one can be laid off, can receive a new job offer that could be PT or FT, and the household can receive a fertility shock. To reduce the number of inputs for the value function at any labor market state, time on leisure and household production is not reported, because it is taken as a given that at any labor market state, spouses are optimizing their time allocations. Then the value function and their inputs are represented by $E - E[w_i, h_i, w_j, h_j/C]$. In the notation, we are keeping the work hours (h_a) as they can be PT or FT. When a given shock is realized, the household will maximize their decisions by moving to the option with the highest value function on the feasible set provided by the arriving shock.[10]

(2)

$$2(\rho + \gamma_M + \eta_M + \gamma_W + \eta_W)E - E(w_i, h_i, w_j, h_j/C) = u(w_i h_i + w_j h_j, 1 - h_i - hp_i, 1 - h_j - hp_j, 0,0, Z)$$

$$+\gamma_M \int max\{E - E[w_i, h_i, w_j, h_j/C], E - E[w', h', w_j, h_j/C], E - U[w', h', s_j/C], E - NP[w', h'/C]\} dF_M(w', h')$$

$$+\eta_M \max\{U - E[s_i, w_j, h_j/C], NP - E[w_j, h_j/C], U - U[s_i, s_j/C], U - NP[s_i/C], NP - U[s_j/C], NP - NP[c]\}$$

$$+\gamma_W \int max\{E - E[w_i, h_i, w_j, h_j/C], E - E[w_i, h_i, w', h'/C], U - E[s_i, w', h'/C], NP - E[w', h'/C]\} dF_W(w', h')$$

$$+\eta_W \max\{E - U[w_i, h_i, s_j/C], E - NP[w_i, h_i/C], U - U[s_i, s_j/C], U - NP[s_i/C], NP - U[s_j/C], NP - NP[C]\}$$

$$+\tau\_C\, max\{E - E[w_i, h_i, w_j, h_j/\neg C], U - E[s_i, w_j, h_j/\neg C], E - U[w_i, h_i, s_j/\neg C], NP - E[w_j, h_j/\neg C],$$

$$E - NC], U - U[s_i, s_j/\neg C], U - NP[s_j/\neg C\dashv], NP - U[s_i/\neg C], NP - NP[\neg C]\}$$

[10] The max operator represents the couples' optimal behavior.

For equation 2, C represents the current children possession, while $\neg C$ represents the opposite state, once a fertility shock is in effect. The second term on equation 2 represents the event where the husband receives a job offer, the available wages offered are represented with w', and the PT or FT schedules are represented with h'. When the household faces a new job offer, the spouses can choose between four labor choices, the first of which is that both spouses work at the current wages. If a new offer is accepted by the husband then the three remaining choices are possible: the wife keeps her current job, the wife moves to unemployment, or the wife moves to nonparticipation. Also, for each labor state, the couple needs to decide how much chore time each spouse will perform. If a fertility shock arrives, then the valuation of the available choices changes, in which case the couple will move to a new maximizing state in terms of the labor market and chore time decisions.

Given that the household moves to the maximum states from the options made available by the shock, with known value functions, simple decision rules were applied to represent households' behavior. Then, with a closed-form solution for the value functions, for every state, we could identify the acceptable minimum wage (reservation wage) for which a spouse would accept a job offer, and for what amount the working spouse would endogenously quit (if he/she had a job). Given the complexity of household interactions and the endogeneity that both spouses' decisions have, the alternative chosen in this paper applies fixed-point algorithms over the value functions until numerical convergence is achieved for the states on every wage and time allocation that a household might select.

This environment increases the model's outputs and the possibility of discussing gender gaps in time use, and also allows us to develop a framework that explains in more detail the observed labor market gender gaps. Conditional that each spouse belongs to a particular home productivity type, our mechanism works as follows: husbands and wives of the high home productivity type will allocate more time to home production, relative to their low home productivity counterparts. This characteristic will be active at any labor market state that the couple might be in: for high productivity types, the labor market options are less appealing since eventually they will need to give up home production time. Gender search costs will be shared by all husbands and wives and will directly affect the nonparticipation or unemployment decision. Therefore, high home productivity husbands and wives have a higher probability of staying out of the labor market because the value of their nonmarket option is high. Conversely, low home productive types will participate more in the labor market and given that production at home is not so valuable, they are more prone to work; consequently, they are more willing to accept jobs at lower wages.

Thus, the heterogeneity in our model has both impacts on the allocation between leisure and home production, and a direct effect on participation rates and accepted wages. The framework in this paper, including spouses as the unit of study,[11] helps to disentangle whether observed gender gaps are due to differences in the labor market or differences in gender roles regarding leisure and home production.

3. Stylized Facts for the Regional Roma Survey Sample

This paper relies on data from the 2017 Regional Roma Surveys (RRS), the most comprehensive surveys to date on income, living conditions, and human development outcomes among

[11] Modeling other adults' decisions is out of the scope of this paper because including them as decision-makers will increase the household decision space substantially.

marginalized Roma households in six countries in the Western Balkans.[12] The 2017 RRS is a multitopic household survey representative of communities in which the share of the Roma population is larger than the Roma share in the national population. The survey encompasses both the Roma population and neighboring non-Roma. The RRS also has a time usage module, in which a randomly selected individual reported time spent in several activities during the previous day; the section was administered to only one randomly selected respondent. The survey, implemented by the United Nations Development Programme (UNDP) with the support of the World Bank, was commissioned by the European Commission (EC) Directorate-General for Neighborhood and Enlargement Negotiations (DG NEAR) to explore changes in core development outcomes among Roma and non-Roma who lived nearby. A full inclusion of gender dimensions across all the modules of the survey, including decision making, gender gaps in outcomes (labor, health, education, and other), time use, and gender norms, were included in the survey with the objective of capturing gender dynamics and gender gaps among the Roma population. The World Bank also conducted parallel qualitative research in Serbia to help to understand the mechanisms behind gaps in education and labor markets, with special attention to gender.

In the 2017 RRS, Roma refers to those who self-identified as Roma,[13] **Ashkali, or Egyptians, and the sample targeted marginalized Roma and their non-Roma neighbors**. The Roma are not a homogeneous population, but rather encompass diverse groups. The Roma sample was constructed based on the implicit endorsement of external identification (or implicit self-identification).[14] The sample focused on settlements where the Roma population's share equals or is higher than the national share of Roma population, also known as "marginalized Roma."[15] "Non-Roma" refers to the non-Roma population living in close vicinity to the marginalized Roma and is not meant to be representative of the total population of the country.[16] The Roma estimates presented from now on in this paper do not include non-Roma.

The analysis in this paper relies on labor market and time usage data from the 2017 RRS. The data were collected in 4 modules: management section, household members profile, the status of the household, and attitudes of the randomly selected respondent. For the labor market and labor income variables, modules 2 and 3 were used.[17] We estimate wives' and husband's labor market status and

[12] The 2017 RRS was conducted in Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Serbia, and Montenegro.

[13] Those who self-identified as "Gypsies" in the survey are categorized as Roma by interviewers.

[14] In a first phase, enumerators approached the externally identified Roma household and in a second stage the implicit self-identification is used. Questions on self-identification, interviewer identification, and language were included in both survey rounds so that the surveys allow for different definitions of ethnicity and a more nuanced discussion of the different groups.

[15] In 2011, the sample was restricted to areas within settlements in which Roma represented 40 percent or more of the population. In 2017, areas in which Roma represented between 10 and 40 percent of the population were also included. These areas represent between 36 and 55 percent of the unweighted country samples.

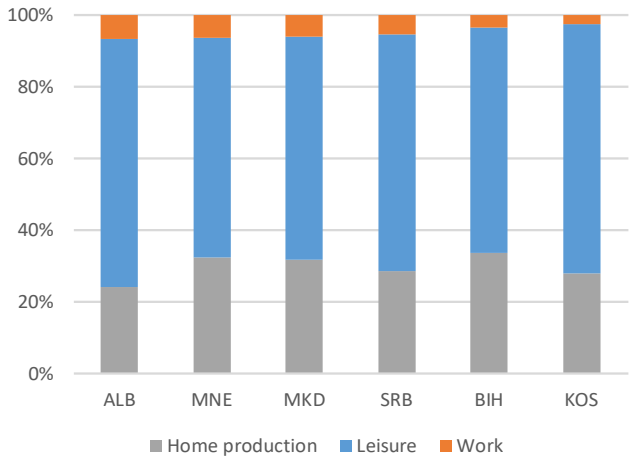
[16] The non-Roma neighboring population refers to population living within 300 meters of the Roma settlements.

[17] Definitions for employment and unemployment are consistent with the International Labour Organization (ILO) definitions. The employed comprise all persons of working age (15–64) who: (a) worked during the reference period (last week) in paid work (in cash or in kind) for at least one hour; paid job may include wage or salary employment as well as profits or self-employment income; and/or (b) have a paid job or business but were temporarily absent during the reference period. The unemployed comprise all persons of working age (15–64) who: (a) were without work during the reference period, i.e. were not in paid employment or self-employment;

hourly wages and full-time/part-time status for those currently employed.[18] We also differentiate between families with and without children. Table A3 of the appendix presents the sample size for each country.

In the time usage section of module 4, a randomly selected individual reported time spent in activities during the previous day.[19] For this paper, we clustered the section's 40 detailed activities into three groups—leisure, work, and home production—and we report the time allocation between these three categories. Because the time usage section was administered to a randomly selected person inside the dwelling, the final number of husbands and wives who responded is less than the overall sample used in the labor characterization.

Figure 1: Distribution of time usage by country



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Each bar represents the average time allocation between home production, leisure, and work of husbands and wives on each labor market state.

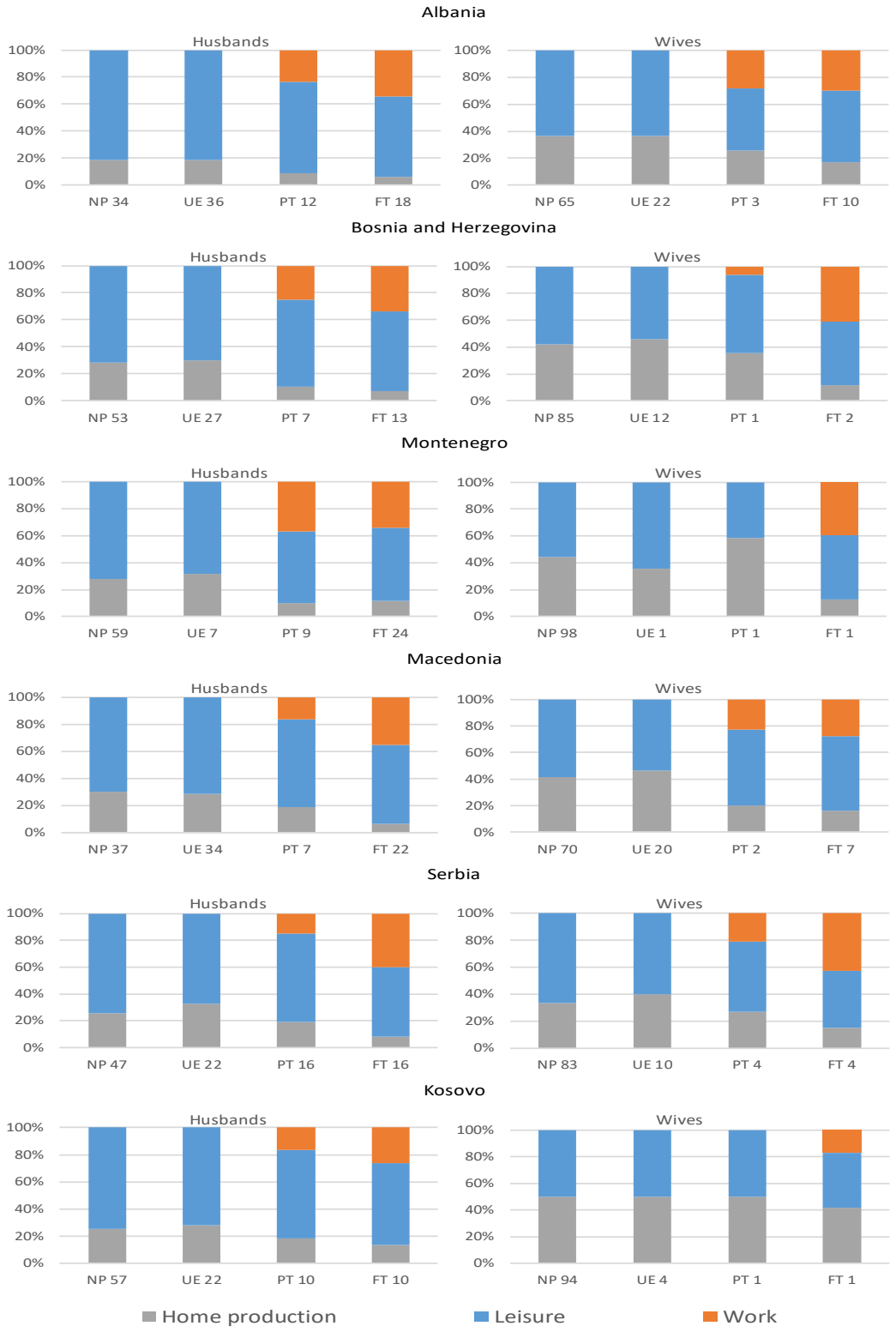
Figure 1 shows the time allocation profile for the marginalized Roma population, without differentiating by gender. In Albania, husbands and wives spent more time working outside of household than in other RRS countries, about 6.6 percent of total activity time. In Bosnia and Herzegovina and Kosovo, husbands and wives spent less time working, about 3.2 percent and 2.6 percent of the total time, respectively. In terms of time spent in home production, Bosnia and Herzegovina, Montenegro, and North Macedonia reported 33.8 percent, 32.5 percent, and 31.8 percent of total activity time, respectively; while in Albania husband and wives dedicated only 24.2 percent of total time to home production.

(b) were seeking work in the past four weeks; and/or (c) are currently available for work, i.e. were available for paid employment or self-employment for the next two weeks.

[18] The definition for the euro zone is used: part-time work is equal to 30 hours or fewer per week.

[19] Activities are listed in table A1 of the appendix.

Figure 2: Distribution of time usage for husbands and wives by country and labor market state



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.

Note: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= nonparticipant. The numbers next to the labor market labels are the proportion of husbands and wives in each labor market state for each country. Per panel, the proportion of husbands and wives should sum up to 100. Because of approximation, for some panels, the sum is equal to 101. Each bar represents the average time allocation between home production, leisure, and work of husbands and wives on each labor market state.

To disentangle the gender disparities in time allocation, figure 2 presents the country time usage for husbands and wives for each labor market state. It also shows the labor market proportions of husbands and wives in each labor state. The labor market states are as follows: nonparticipation (NP), unemployment (UE), part-time job (PT, less than 30 hours per week), and full-time job (FT). In each panel of figure 2, the number next to each labor market label is the proportion of husbands and wives in each labor market state.

The results shown in figure 2 suggest strong gender differences in time use across all countries in the sample; dependent on the labor market state, Roma wives dedicated significantly more time to home production relative to their husbands. The burden of housework and care remains mainly on women's shoulders, which can be an important barrier for female participation in the labor market. Albania presents the most extreme gender difference in time dedicated to home production: conditioning on labor market state, wives devoted twice the time to home production as their husbands. Not surprisingly, the proportion of husbands with either full-time or part-time jobs is always higher than wives. Montenegro and Kosovo show quite striking results: only 1 percent of wives who answered the time usage module are employed, and a few are unemployed. Albania is the country where Roma wives are much more likely to be employed (13 percent). For husbands, Montenegro has the highest job attainment (33 percent) while Kosovo and Bosnia and Herzegovina have the lowest attainment (18 percent).

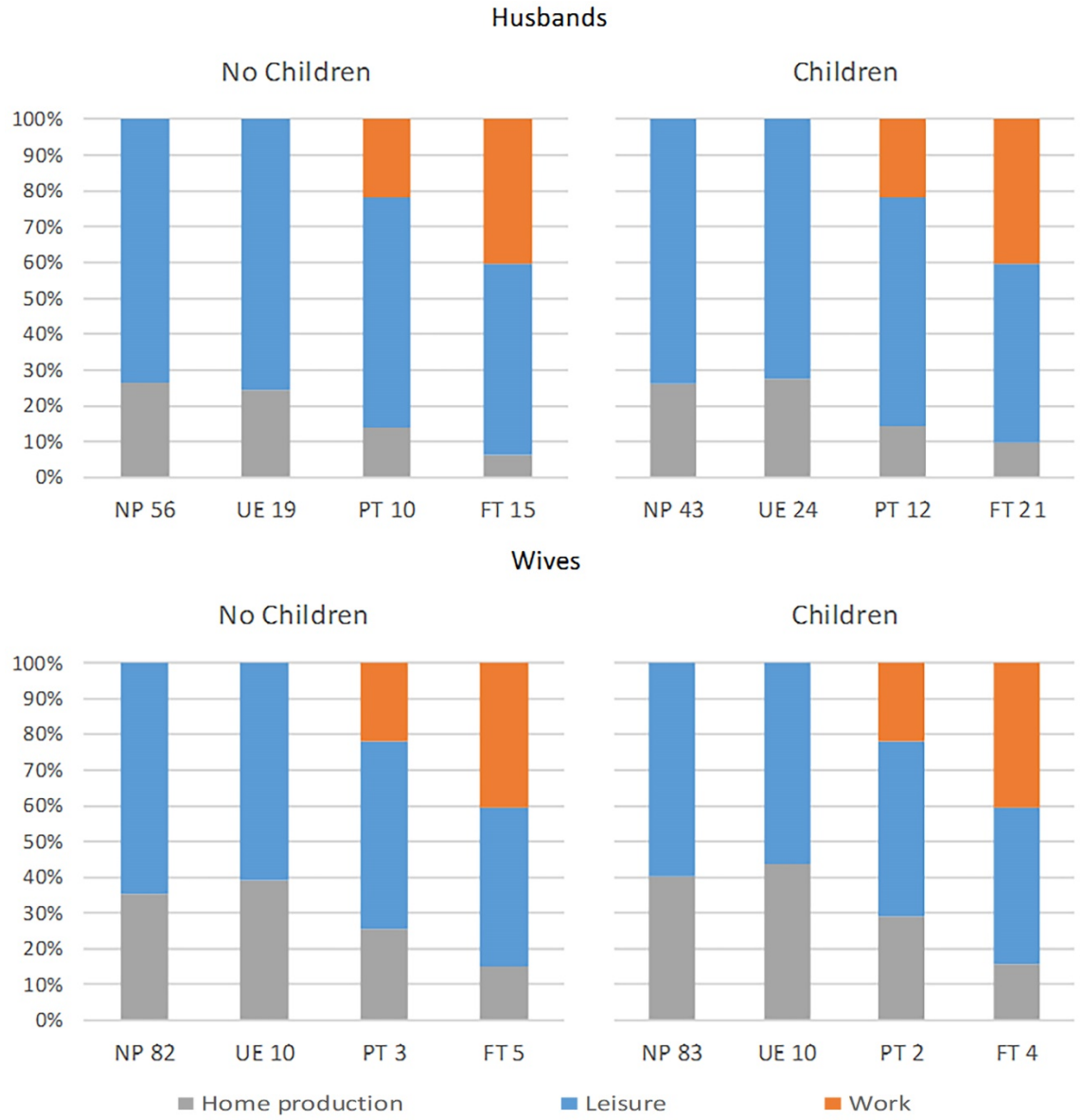
In terms of the share of husbands with full-time jobs, Montenegro and North Macedonia have the highest rates (24 percent and 23 percent, respectively) while Kosovo only has 11 percent. Among wives, Albania and North Macedonia are the countries in which a larger share of wives holds full-time jobs (10 percent and 7 percent, respectively), while only about 2 percent of Roma wives in Montenegro, North Macedonia, and Bosnia and Herzegovina are in full-time employment.

Because the time usage module has fewer observations than the full sample, and because nonparticipation is high among Roma, there are some categories with few observations. For example, Montenegro and Kosovo have only 1 percent of wives working full-time; consequently, using that information to describe the trade-off between leisure, work, and home production would be inaccurate. To avoid estimation problems, a regional sample containing the six countries is used; this allows us to have a larger sample when the time usage statistics are calculated depending on labor market status and the presence of children (Figure 3).

Figure 3 reports the statistics for husbands and wives in the pooled regional sample. Separate profiles are presented for households with and without children,[20] in order to identify the effects of children on time usage. Some stylized facts are maintained: husbands tend to participate more in the labor market, and wives are more inclined to dedicate more time to home production even when controlling for labor market states.

[20] A child is defined as any household member 15 years old or younger. Sample sizes are presented in table A2 of the appendix.

Figure 3: Distribution of time usage for husbands and wives by labor market state and presence of children, pooled regional sample



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= nonparticipant. The numbers next to the labor market labels are the proportion of husbands and wives in each labor market state for each country. Per panel, the proportion of husbands and wives should sum up to 100. Because of approximation, for some panels, the sum is equal to 101. Each bar represents the average time allocation between home production, leisure, and work of husbands and wives on each labor market state.

Having children implies a stronger need for additional financial resources and home production time for the household. Figure 3 shows that Roma couples with children increase their monetary resources through the work of husbands, while the labor market involvement of wives changes only slightly with children. Controlling for labor market state, in average husbands and wives dedicate more time to home production in households with children. Figure 3 indicates that husbands in households with children are 13 percent more likely to participate in the labor market than husbands in households without children. Greater labor market participation by husbands mainly increases the unemployment and the full-time shares of time usage. Husbands tend to allocate more

time to home production, especially in the labor participation states. Interestingly, Roma wives do not change their labor market decisions significantly when having children; nonparticipation goes from 82 percent to 83 percent; and, conditioning on labor market state, the share of time spent on home production time increases.

Some descriptive statistics relevant to the present exercise are the assortative mating[21] of spouses in terms of the labor market and the mean observed wages. Table 2 (left panel) presents the male and female labor market states. The data inside the borders is the percentage of households with spouses in the associated labor market states, while the 5th column and row represents the percentages of males and females in each labor market state, without conditioning on the spouse labor market state. That panel shows that in 35.2 percent of the Roma households at least one spouse works, in only 2.0 percent both spouses work, and in 28.3 percent only the husband works. The share of households where both spouses are nonparticipants is high (39 percent) compared to international standards.

Table 2: Regional spouses labor status and mean wages

		Females' labor state				
		NP	UE	PT	FT	All males
Males' labor state	NP	39	4	1	2	47
	UE	19	3	1	1	23
	PT	9	1	0	0	11
	FT	16	2	1	1	19
All females		83	10	2	4	100

Mean hourly wages (USD 2011 PPP)	
PT Males	1.5
FT Males	0.6
PT Females	1.2
FT Females	0.5

Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= nonparticipant. The numbers next to the labor market labels are the proportion of husbands and wives in each labor market state for each country. Per panel, the proportion of husbands and wives should sum up to 100. Because of approximation, for some panels, the sum is equal to 101.

Table 2, (right panel) shows that in terms of hourly wages, there is a wage gender gap of 27 and 24 percent for part-time and full-time jobs, respectively. Additionally, irrespective of gender, part-time workers earn in hourly terms more than twice the salary of full-time workers.

4. Estimation and Identification

The identification is provided by groups of parameters; first, we selected some moments from the RRS, and we assumed nine functional forms to identify 35 model parameters. As mentioned, the model aims to explain spouses' behavior in terms of their labor market status (full-time, part-time, unemployment, and nonparticipation), as well as their time allocation (leisure, work, and home production). Presence of children in the household is used as a shifter for spouses' nonparticipation and intensive margin decisions. All the gender-specific parameters rely on gender differences found in participation rates, labor market participation, the ratio of people working on FT and PT work, wages, and time usage found among the marginalized Roma population, as in most of the countries worldwide.

First, to identify the gender parameters for labor market frictions (λ_A,γ_A, η_A^{PT}, and η_A^{FT}), we use a similar identification strategy as in Flinn and Heckman (1982). In this identification strategy,

[21] Assortative mating is the process by which people with similar characteristics choose a partner. In the present study, we used that definition to present the proportion of couples married on each of the cells defined by both spouses' labor market. Table 2 shows that, besides NP-NP, the Roma population does not practice much assortative mating in the labor market.

observed durations in labor market states are sufficient to estimate the hazard rate of going out from a particular labor market state, once the discount rate (ρ) is fixed. For this exercise, we assume a fixed discount rate of 5 percent per year.[22] Durations or transitions provide the same identification properties. Then, for identifying part- or full-time laid off shocks, transitions between part- or full-time jobs to unemployment are sufficient. Finally, since the RRS provides self-reported durations, labor market transitions are estimated assuming exponential durations. Table 6 (left panels 2 and 3) shows the observed labor market transitions.

Flinn and Heckman (1982) showed that to decompose the hazard rate from unemployment to employment between the arrival rate of job offers and the distribution over the accepted wages, a recoverable wage offer distribution function must be assumed. The first functional form assumed is a log-normal wage offer distribution conditional on gender equation 3. As this is a recoverable function, identification of primitives parameters μ_A^h, σ_A^h, and λ_A comes from means and variances of observed wages, from unemployment to employment transitions (see table 2); γ_A is identified from employment to employment transitions.

$$3f\left(\mathrm{w};\mu_{\mathrm{A}}^{\mathrm{h}},\sigma_{\mathrm{A}}^{\mathrm{h}}\right) = \frac{1}{\mathrm{w}\,\sigma_{\mathrm{A}}^{\mathrm{h}}}\phi\left[\frac{ln(w)-\mu_A^h}{\sigma_{\mathrm{A}}^{\mathrm{h}}}\right], w > 0 \qquad (3)$$

For computational tractability, the second functional form assumption comes from the simplification of the working schedule to PT or FT, where full-time is a working schedule of at least 30 hours per week. In the model, part- or full-time hours are calculated as the average time for each group. Moreover, to differentiate a part-time from a full-time offer, the probability of receiving a part-time offer is estimated and is equal to p. This probability identification relies on accepted part-time and full-time jobs (see table 2). The part-time or full-time wage parameters are identified separately as there is a wage differential between these two states. The third functional assumption is a discretization of the wage range by a grid equal to 50 to simplify the computational problem. We assumed that labor market rates and parameters of the wages distribution are not different in terms of having children or household composition, so they are only gender specific.

Time is continuous, and the search model is dynamic and stationary; therefore, transitions in the model should be consistent with stable steady-state proportions, meaning that the inflow to a given state is equal to the outflow out of it. To identify children transition parameters, we use the law of motion restriction: $\tau_C = \tau_{NC}\frac{n_C}{n_{NC}}$, where τ_C is the arrival rate of young children, τ_{NC} is the aging children shock, and n_C is the proportion of households with children.[23] One of these parameters is identified from the household transitions of having and losing children, and the steady-state proportion over these groups.

An unemployed individual is one who is actively searching for job offers, while incurring a search cost. In the current version of the model, this search cost is represented by another gender-specific parameter, s_A. Individuals who are not participating in the labor market do not have any search costs, but do not receive job offers. The fourth functional form assumption is on the instantaneous utility

[22] Even though there is no consensus about the discount rate value, Flabbi and Mabbli (2018) used it and it is in between other values used in the household search models literature; Choi (2018) used 4 percent and Dey and Flinn (2008) used 8 percent.

[23] Note that $n_C = 1 - n_{NC}$.

function, which is assumed to be Constant Relative Risk Aversion (CRRA). We choose CRRA for household interactions because as shown by Flabbi and Mabli (2018), risk aversion in the unitary model is identified from spouses' joint labor market decisions (δ, $\beta_1, \beta_2, \beta_3$). The household utility will be composed by consumption (c_{ij}),[24] leisure (l_a), search cost when unemployed (s_A), and the household production level (Z), where $a = i, j$. All these terms enter into the following weighted CRRA:[25]

$$4u\left(c_{ij}, l_i, l_j, s_i, s_j, Z; \beta', \alpha'\right) = (1 - \alpha_M^C - \alpha_W^C - \alpha_3^C)\frac{c_{ij}^{\delta}-1}{\delta} + \alpha_M^C \frac{(l_i)^{\beta_1}-1}{\beta_1} + \alpha_W^C \frac{(l_j)^{\beta_2}-1}{\beta_2} + \alpha_3^C \frac{Z^{\beta_3}-1}{\beta_3} - s_M - s_W \qquad (4)$$

The RRS data show that when couples have children, husbands deliver more labor supply and, conditional on labor status, husbands and wives increase the home production time. The fifth functional form assumption is that children affect the flow utility directly through changes in household type-specific tastes for spouses' leisure $\left(\alpha_A^C\right)$ and for household production (α_3^C). To identify those six parameters, we use changes in time allocation, comparing couples with and without children as well as change information in all the steady states (see figure 3 and table A2 in the appendix).

Flabbi and Mabli (2018) established that for unitary models with leisure and consumption, the flow utility's risk aversion parameters are identified from the interdependence of spouses` decisions in the labor market. The model introduces time in household production as another identification source for couples' simultaneous choices. Figure 3 shows that males' home production time allocation can range from almost 27 percent when NP or UE to 6 percent when males have a FT job. The observed degree of reduction of home production and leisure that spouses exhibit across different labor market states provides the identification for the risk-aversion parameters. The intuition is as follows: if the household is risk averse for male leisure, then the parameter will tend to zero. Thus, males will demand almost the same leisure in any labor market state. On the contrary, if the risk aversion parameter tends to 1, males will reduce the consumption of leisure significantly when changing the labor market state. The same will apply to home production, but as home production is a public good for the household, identification is trickier.

Defining the household production function is vital for the model to capture the trade-off between working and home production, and the substitution/complementarity that wives' and husbands' times exhibit in the data. If the production function is linear, spouses' times in home production would have large substitution: that is, if a wife gives more time to chores, the husband can spend significantly less time in home production. If the production function is Cobb-Douglas, then home production time could not be close to zero by a spouse. In the literature, Gayle and Shepard (2016) used a Cobb-Douglas function that employed spouse time as inputs. Albanesi and Olivetti (2009) and Siegel (2013) used a constant elasticity of substitution (CES). Choi (2018) used a Cobb-Douglas composed by a CES: the CES part was explaining the chores time that spouses were performing, while the Cobb-Douglas was between the CES output and the economic resources that any additional children demand.

The sixth functional form assumed is a CES for the home production function. It was chosen because the CES can characterize a Cobb-Douglas or a linear function. This flexibility should help the model to fit the data better, and the θ parameter is identified through spouses' times in household

[24] Consumption by household is equal to household income: $c_{ij} = w_i h_i + w_j h_j + y_{ij}$. No information about expenditures is available in the database. Including the costs of inputs for a household and the cost of raising children could be areas of future research. Including these features would raise the model's heterogeneity and/or the decision space.

[25] The vectors are defined as follows: $\beta' = \{\delta, \beta_1, \beta_2, \beta_3\}$; $\alpha' = \{\alpha_M^C, \alpha_W^C, \alpha_3^C\}$.

production (see equation 5). As males participate actively in the labor market and females dedicate more time to home production, it is argued that females are more productive than men in home production.[26] Consequently, females should work more at home, and men work more in the labor market. Following this argument, the spouses' home production productivities[27] are introduced in the model.

The seventh distribution assumption is that there are three levels of spouse home productivity: high, medium, and low. This paper is one of the first in which a labor search model is estimated over a marginalized population with extremely low labor market participation, not only for women but also for men. Typically, labor search models were estimated on labor contexts with more labor participation. For this reason, the time usage information is useful: it allows us to create a measure of nonmarket production valuation to capture why many people are out of the labor market. Home production is modeled as frictionless and continuous. This characteristic is crucial to explain a labor market where even with information about wages and transitions, participation is lower. For this reason, we created 3 home production types per spouse (9 per household). By contrast, for a "developed" labor market as Colombia, Salazar-Saenz (2020) needed only 2 states per spouse (4 per household). With the current parametrization, other factors such as nonlabor income and health status are not taken into account; they can be subjects for future research.

Therefore, in equation 5, the total home production utility is achieved with spouses' home time ($\boldsymbol{hp_a}$) and productivity ($\boldsymbol{\gamma^{H1}}$ or $\boldsymbol{\gamma^{H2}} = \{\boldsymbol{\gamma^L}, \boldsymbol{\gamma^M}, \boldsymbol{\gamma^H}\}$) as inputs. A low productivity type is fixed and equal to 1. If two spouses with high productivity are together, then they are obtaining higher benefits from allocating time in household production, and labor market participation would be an unlikely option. When only one spouse has high productivity, his working time will reduce household utility compared to the situation where the other spouse is in the market. As there are still working women and nonparticipant men, a differential gender distribution would have the potential to explain different labor market behaviors between men and women, and within each gender group. Therefore, a gender probability per type needs to be defined ($\mathrm{p}^L, \mathrm{p}^M, \mathrm{p}^H$ per gender). In this version of the model, the eighth functional form assumption is an exponential distribution function per gender over home productivities, and the gender probabilities per type can be found numerically with the mean of each distribution ($\mu_{M\_\gamma}, \mu_{W\_\gamma}$) (equation 5):

$$_5Z = f\left(hp_i, hp_j, \gamma^{H1}, \gamma^{H2}, \theta\right) = \left(\gamma^{H1} {hp_i}^{\theta} + \gamma^{H2} {hp_j}^{\theta}\right)^{\frac{1}{\theta}} \tag{5}$$

To illustrate the Roma time allocation and labor participation, the identification of $\boldsymbol{\beta_3}, \boldsymbol{\gamma^M}, \boldsymbol{\gamma^H}, \boldsymbol{\mu_{M\_\gamma}}, \boldsymbol{\mu_{W\_\gamma}}, \boldsymbol{\theta}, \boldsymbol{s_A}$ is discussed. First, as $\gamma^L = 1$, the ninth functional form assumption is that γ^M is the mid-point between γ^L, γ^H.[28] Therefore, only γ^H needs to be identified and only the identification of five parameters is needed: the curvature of the home production CRAA, the higher home production productivity, the gender's home production parameter, the CES coefficient, and the search cost per gender. For that, we have built the mean and standard deviation of home production time allocation per spouse, unconditional and conditional to the labor market and spouses' labor market

[26] Becker (1974) defined two sectors: market and nonmarket. Inside the families the individuals with more relative productivity between nonmarket and market production should devote more time to the nonmarket sector (household production). Since females specialize more in the nonmarket sector, they are more productive in household production.

[27] Hereafter productivity is capturing the productivity/requirements/social norms/utility of time spent on chores.

[28] $\gamma^M = \frac{\gamma^L + \gamma^H}{2}$ The productivity of the medium type is defined as the midpoint between the high and the low productivity.

states. To identify six parameters, 168 home production moments are calculated,[29] and nonparticipation rates are used.

To identify s_A, the nonparticipation and unemployment proportions are mainly used. Setting this value to zero will place everyone in the labor market. As mentioned before, the level of a spouses' home productivity will cause different time allocation and different incentives for participating in the labor market. As the current specification has three home production types per gender, the model has nine household types. Without any heterogeneity, every couple will make the same decisions in the same labor market and children state. This means there is no variance in home production, conditional on the same labor market and children state. If the home productivity levels are similar, then there will be less variance in home production and maybe not a lot of heterogeneity on the time allocations from spouses that participate or not in the labor market. Thus, identification for $\gamma^H, \mu_{M\_\gamma}, \mu_{W\_\gamma}$ comes from the mean and standard deviation of home production per gender. Additionally, the NP-NP couples helps to identify the proportion of high home producers.

Given that in the Roma survey one person per household is surveyed regarding time usage, correlation of spouses' times cannot be used in the current estimation; consequently, the identification of $\boldsymbol{\theta}, \boldsymbol{\beta_3}$ is compromised. Hopefully, the 168 home production moments provide enough information to estimate accurately these two parameters. Future estimations must include both spouses' time allocations.

All the parameters form the vector of parameters, $\boldsymbol{\theta}$. To estimate the optimal vector of parameters ($\widehat{\theta_{SMM}}$), the method of simulated methods of moments is used as follows:

$$\widehat{\theta_{SMM}} = \arg\min_{\theta}(Q(\theta) - q_s)' \, W^{-1}(Q(\theta) - q_s), \tag{6}$$

where $Q(\theta)$ are the simulated moments, q_s are the sample moments, W^{-1} is the bootstrap weighting matrix, and the diagonal is the inverse of the bootstrapped standard errors and zeros everywhere else.

5. Estimation Results and Model Fit

Table 3 shows the arrival rates of shocks, the primitives of the lognormal distribution on wage offer parameters, the gender's probability to receive a part-time offer, the search costs, and the flow utility function the fertility parameters, and the home production parameters.

In terms of the leisure and household utility parameters, when the household has no children, the male's leisure utility parameter is higher than the female parameter. When having children, males' parameters decrease. Conversely, household production utility parameters increase when children are present (see table 3).

The curvatures of the CRAA terms show that Roma households are more risk averse in terms of income, followed by home production male's leisure, and female's leisure, respectively. This hierarchy means that males are less willing to change their leisure time when changing among labor market states than females.

Jointly, these two sets of parameters have the potential to replicate households' decisions where husbands enjoy more leisure, and having children increases spouses' housework time, increases

[29] 168 moments= 8 unconditional, 32 conditional on labor status, and 128 conditional on own and spouse labor status.

husbands' labor participation, but does not change wives' labor participation time. Roma households without children will allocate more time to husbands, as their leisure is the individual factor that weights the most in the flow utility. However, when children are present, as husbands' leisure weight parameter decreases, husbands will reduce leisure at any labor market state. Simultaneously, spouses will allocate more time to home production, as it weighs more in the flow utility. Female leisure is weighted almost the same, and, by complement, consumption now weighs more in the flow household utility. These are the elements that help explain why husbands increasingly enter the labor market and wives allocate more time to home production when having children.

Table 3: Estimated parameters, meaning, and arrival time

Parameter	Description	Male	Female
λ_A	job offers to unemployed	0.09	0.08
η_A^{PT}	termination shock to part-time employed	0.04	0.04
η_A^{FT}	termination shock to full-time employed	0.04	0.04
$\mu_{wage\_A}^{PT}$	lognormal part-time wage offer location parameter	2.48	2.40
$\mu_{wage\_A}^{FT}$	lognormal full-time wage offer location parameter	1.78	1.60
$\sigma_{wage\_A}^{PT}$	lognormal part-time wage offer scale parameter	0.46	0.41
$\sigma_{wage\_A}^{FT}$	lognormal full-time wage offer scale parameter	0.52	0.52
p	probability of part-time job offer	0.31	0.31
α_A^c	weight of leisure when having children	0.278	0.271
α_3^c	weight of home production when having children	0.15	
α_A^{nc}	weight of leisure when no children	0.283	0.271
α_3^{nc}	weight of home production when no children	0.14	
δ	CRRA consumption parameter	0.10	
β_A	CRRA leisures parameters	0.39	0.63
β_3	CRAA home production parameter	0.11	
μ_{A_γ}	exponential home production parameter	1.00	1.85
γ_H	home productivity of the high type	3.32	
θ	home production CES substitution parameter	0.20	
τ_C	arrival rate of children	0.01	
τ_{NC}	children leave the house	0.005	
s_A	search cost	0.82	0.74

Source: Authors' calculations.

Table 3 also shows that high household productivity types are 3.3 more productive than low productivity types. The CES parameter, θ, is equal to 0.20; this means that Roma spouses' home production times presents higher substitution than in a Cobb-Douglas (θ=0), but they are still far from being a linear production function (θ=1).

Arrival rates of the labor market show that husbands have an advantage in the labor market. They receive job offers more often; and once they accept one, the laid-off shock will occur less frequently. The model's unit of time is a month, so for example λ_M means that unemployed males receive 0.09 job offers in a month. The model predicts that about 30 percent of the overall job offers for males and females are part-time offers.

Table 4 shows the relevant implied values for the estimated wage offer distributions and the implied durations (in months) consistent with Poisson arrival shocks. We found that unemployed males receive job offers slightly more frequent than unemployed women (11.3 vs. 11.9 months,

respectively). Males have a more frequent laid-off shock when working in part-time employment compared to females (23.8 versus 24.5 months respectively); the opposite happens in full-time jobs (24.8 versus 24.2 months respectively).

Table 4: Mean and variance of wage offered distribution (2011 USD PPP) and implied months for arrival shocks

Mean and variance of Wage offered distribution (USD PPP) and implied months for arrival shocks

	Male	Female
E[w|pt]	1.3	1.2
V[w|pt]	4.2	2.7
E[w|ft]	0.7	0.6
V[w|ft]	1.4	1.0
job offers to unemployed (months)	11.3	11.9
laid-off shock to part-time employed (months)	23.8	24.5
laid-off shock to full-time employed (months)	24.8	24.2
arrival of children (years)	7.0	
aging of children (years)	16.6	

Source: Authors' calculations.

Note: Abbreviations: FT= employed full-time; PT= employed part-time. As the assumed wage offer distributions are log-normal and the mean accepted wages were close to 1, the wage moments in the model were multiplied by 10 (then the units in the model are tens of PPP/USD). This table presents the converted values in 2011 USD PPP dollars. Average months per shock are calculated as the inverse of the Poisson parameters.

Table 5 shows the gender proportions implied by the exponential gender parameters and the three productivity/taste levels. The exponential home production parameters show that husbands are less productive or have less taste for home production than wives. This difference will fuel the decision-making process of time allocations between household production and labor market, making males more prone to search in the labor market and less productive inside the household. However, the estimated search cost is higher for males than for females.

Table 5: Home production type, productivity, and gender proportions

		Proportions	
Type	Productivity	Males	Females
1	1	44%	27%
2	2.2	38%	34%
3	3.3	18%	39%

Source: Author's calculations.

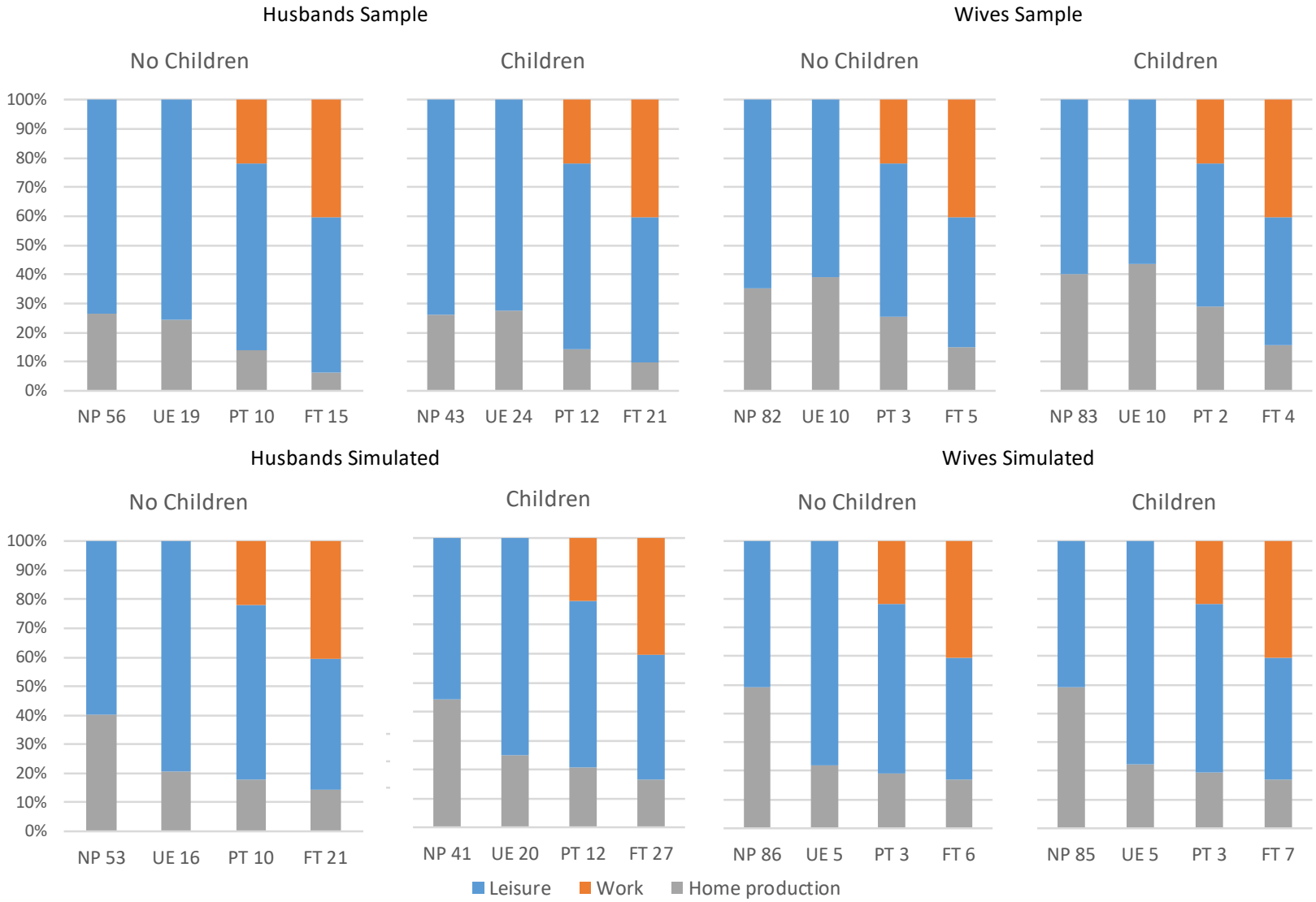
The fit of the model is analyzed in terms of labor market proportions, time use, assortative mating in the labor market, and wages. Standard deviations are not analyzed, but they are used in the simulated method of moments (SMM) to minimize the distance between the model and the data.

Figure 4 shows that the model overestimates the proportion of Roma males in full-time jobs. The figure is capturing that, due to fertility, husbands participate more in the labor market, and the participation change has a similar magnitude to the data. Wives' nonlabor participation is high in the data, and the model slightly overestimates it.

In terms of home production, the model captures the trade-off between working and not working. In the data, the home production time of nonparticipants and unemployed are almost the same. The model captures a decreasing gradient, but, in the model, the unemployed dedicate less time to chores than nonparticipants.

Table 6 (top panels) presents the assortative mating of Roma spouses by labor states. One moment particularly difficult to match is the couples with both members out of the labor market. The model successfully predicts this as the highest proportion, but the model underestimates it by 10 percentage points. In the top-right panel, the model exhibits no dual-earner couples; this undesirable prediction is off for moments with less than 1 percent each.

Figure 4: Observed and simulated labor market status proportions and time usage per spouse and having children



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.

Note: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= nonparticipant. The numbers next to the labor market labels are the proportion of husbands and wives in each labor market state for each country. Per panel, the proportion of husbands and wives should sum up to 100. Because of approximation, for some panels, the sum is equal to 101. Each bar represents the average time allocation between home production, leisure, and work of husbands and wives on each labor market state.

Table 6: Labor market assortative mating and labor market transitions

Observed Assortative mating husbands and wives' labor marker state					Simulated Assortative mating husbands and wives' labor marker state				
	Wives' Labor Mkt. Status:					Wives' Labor Mkt. Status:			
	NP	UE	PT	FT		NP	UE	PT	FT
Husbands:					Husbands:				
NP	39.3	4.2	1.1	2.3	NP	29.9	5.0	2.9	6.9
UE	18.6	2.7	0.7	0.8	UE	18.9	0.0	0.0	0.0
PT	9.3	1.2	0.1	0.4	PT	11.1	0.0	0.0	0.0
FT	15.8	2.0	0.5	0.9	FT	25.2	0.0	0.0	0.0

Observed Labor market transitions from a year to the present.					Simulated Labor market transitions from a year to the present.				
	Males					Males			
From\To	NP	UE	PT	FT	From\To	NP	UE	PT	FT
NP	41.81	-	-	-	NP	44.19	-	-	-
UE	-	16.50	7.26	13.77	UE	0.24	6.60	4.48	10.26
PT	-	-	3.82	-	PT	-	-	5.86	-
FT	-	-	-	5.42	FT	-	-	-	13.41
EMP	5.17	6.27	-	-	EMP	0.35	12.31	0.77	1.53
	Females					Females			
From\To	NP	UE	PT	FT	From\To	NP	UE	PT	FT
NP	81.31	-	-	-	NP	85.11	-	-	-
UE	-	9.17	1.45	3.29	UE	-	1.68	1.26	2.69
PT	-	-	1.03	-	PT	-	-	1.51	-
FT	-	-	-	1.13	FT	-	-	-	3.72
EMP	1.63	0.99	-	-	EMP	-	3.36	0.16	0.51

Notes: Author's calculations based on 2017 UNDP-WB-EC Roma Regional survey. Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= non-participant; EMP= Past Employment. Each matrix sum up to 100. Transitions are found from self-reported transitions. Past job schedule is not available in the survey, for this reason past jobs can only be characterized as EMP.

From the self-reported changes in the labor market, we build male and female transitions. All the matrices in the middle and bottom panel of table 6 sum up to 100. In the survey, only the time from the last job for the nonworkers and job tenure for the workers were collected. Consequently, only changes from previous employment to the nonwork states can be identified. Moreover, as we assumed that the current worker moved from unemployment, we only have transitions from unemployment to work. Due to this data limitation, other extensions such as on-the-job search cannot be implemented. Even when the model does not have job-to-job transitions, there are some workers who found a job within the 12 months considered, and we have simulated transitions from employment to PT or FT, but they have frequencies of less than 1 percent. Table 6 shows that the model does not predict many transitions from the labor market to nonparticipation. Besides that, the model is capturing the labor market dynamics decently for the Roma population.

Finally, the simulated wages fit the data closely (table 7).

Table 7: Observed mean hourly wages (2011 PPP USD)

	Observed	Simulated
FT Males	1.5	1.3
PT Males	0.6	0.7
FT Females	1.2	1.2
PT Females	0.5	0.6

Source: Authors' calculations.
Note: Abbreviations: FT= employed full-time; PT= employed part-time. This table presents the converted values in 2011 USD PPP dollars.

6. Policy Experiments

In the region, some national action plans[30] exist for Roma inclusion, and some countries in the Western Balkans have funding for activities that promote employment specifically for Roma. On the other hand, current monitoring and evaluation of policies are not adequate mostly because of the lack of ethnic disaggregated data (Robayo-Abril and Millan 2019). In this context, it is critical to evaluate ex-ante the impact of some policy measures that can have on Roma labor market participation and time allocation decisions. In this section, we perform seven counterfactual policy experiments designed to (i) improve Roma labor market conditions, and (ii) change the home production productivity distributions or the arrival of the fertility shock.

The intervention policies affecting the labor demand include antidiscrimination measures and employers' economic incentives to employ Roma population. Examples of these policies are quota requirements in job positions and laws against labor discrimination and any type of violence. Positive action measures are being implemented in the region, including quotas in public administration in Albania, North Macedonia, and Serbia, and quotas for active labor market policies in Kosovo. Serbia spends a considerable amount on employment, as referenced in the 2016 National Progress Report. Most of the regional budget in employment and labor markets is spent on affirmative action measures to enhance employment and economic empowerment of Roma business activities. In North Macedonia, for instance, the Ministry of Education is also implementing affirmative measures to support the Roma population employment. Other policies include outreach to Roma communities to increase their registration with local public employment services (PES). This outreach includes Roma mediators and information campaigns in Bosnia and Herzegovina, North Macedonia and Montenegro; a dedicated career counseling program in Albania; and measures to reduce discrimination from the PESs themselves, such as Roma-sensitive training for PES staff in of Serbia and Montenegro.[31]

Among the economic incentives to employ the Roma population are stick-and-carrot measures for the private sector focused on bringing Roma into companies, such as tax incentives, better tools for skills assessments, and employment protection legislation (EPL). Albania, North Macedonia, Montenegro, and Serbia implement financial incentives to hire Roma employees. Albania offers subsidized employment, affordable credit lines for businesses employing Roma, and tax breaks for Roma firms. Countries also are implementing financial measures aimed at employment promotion include the employment subsidy program, the self-employment program, subsidy programs under the persons with disabilities vocational rehabilitation and employment system, and the public works

[30] These are documents that outline the strategic framework of policy actions and priorities for the next 5 to 10 years.
[31] Source: Robayo- Abril and Millan (2019).

program (Robayo-Abril and Millan 2019). Auer et al. (2004) found that EPL often influenced the length of job tenure.

Table 8 presents the definitions for the policy experiments. The first three policy experiments are directly affected by the policies affecting labor demand. For instance, a decrease in the expected months to receive a job offer or an increase in expected months to receive a laid-off shock can reflect a Roma quota law, affordable credit lines for business employing Roma, tax breaks, and subsidies. EPL mainly increases the expected months to receive a laid-off shock and PESs will mainly decrease in the expected months to receive a job offer as they aim to improve the labor market efficiency. Better tools for skill assessment, such as education opportunities and on-the-job training, mainly increase the expected wages offered to the Roma population. Increasing the part-time offers was shown to corroborate the effects, if any, of labor market flexibility measures that allows a combination of market and home-based work on Roma labor market decisions.

Table 8: Policy experiments definitions

Label	Meaning
Arrival	Increase the arrival rates by 10%
Laid-off	decrease laid-off rates by 10%
Wages	increase wages by 10%
Pt	increase pt-offers by 10%
Home_P	reduce home production productivity by 10%
Fertility	reduce fertility by 10%
Search	reduce search costs 10%

Policies affecting the Roma labor supply include laws changing the cultural attitudes towards working with the Roma population, better access to public services that engage Roma in the labor market, and demographic changes on fertility. In the model, the parameters reflecting these policies are search costs, home production productivity, and the fertility shock. As mentioned by Fernandez (2013), social norms and beliefs affect the disutility of market work.[32] England and Farkas (1986) also indicate that disutility reflects nonpecuniary costs. Therefore, search costs are composed by nonpecuniary cost to participate, time use dedicated to search,[33] distance to work (Selod and Zenou 2006; Gobillon et al. 2011), and lack of language proficiency, and even lack of proper identification cards. Then, a decrease in the search costs is interpreted as policy interventions in any of those components. The home productivity reduction will reflect changes in the social norms for individual roles in society; for example, Roma mediators can potentially contribute to changing social rules that have discouraged the uptake of employment services. Given the current specification, the reduction in fertility reflects changing social norms toward the number of children in the household and an increase in the marriage age among Roma females.

For the presentation of the effects of policies, figure 5 presents the changes in labor market proportions between the experiments and the benchmark, table 9 shows the observed and

[32] Fernandez (2013) is based on female labor participation, but the conclusion applies to other marginalized groups.

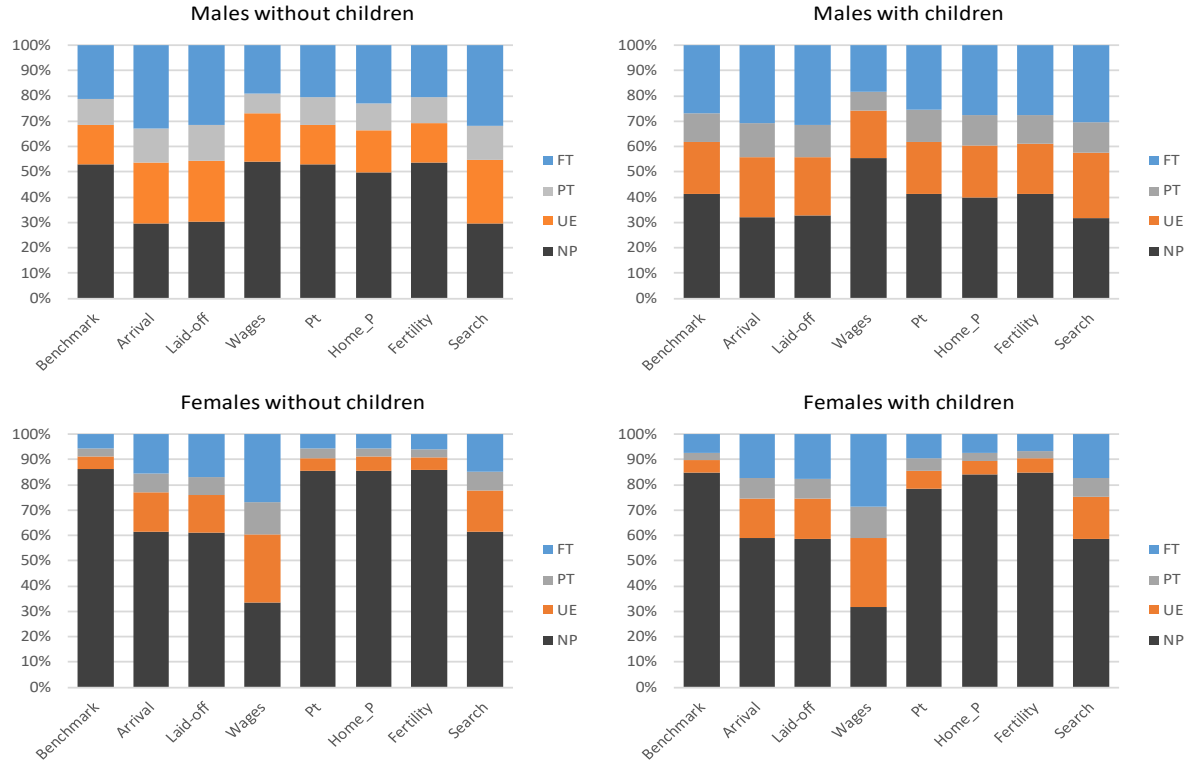
[33] Unfortunately, the RRS does not have search time. For the United States, Campolmi and Gnocchi (2016) reported that while unemployed workers searched an average of 23 minutes daily for jobs, nonparticipants and employees dedicated less than a minute.

simulated wages, and figure 6 presents the changes in devoted home production time. The first seven policies are analyzed in the following paragraphs, while the gender decomposition is examined later.

Note that the presentation of the time use results in figure 6 is different from figure 4. Because the working states have a fixed number of hours, if someone in the couple works or both are in nonworking states, then each spouse's leisure time is always the complement of home production time and work time. For this reason, figure 6 only presents home production time as it represents similar information to the previous presentation in figure 4 and is more parsimonious in its display of the effects of the many policy experiments.

The first seven policy experiments have differential effects on Roma husbands and wives, and sometimes heterogeneous time usage. Focusing on husbands, increasing the frequency of receiving a job offer, decreasing the rate of lay-offs, and reducing the search cost are the policies that most increase the husband's labor participation. Considering time usage, these three experiments increase the home production supply of husbands out of the labor market by about 3–5 percentage points. This result reflects the higher number of married worker wives than nonparticipant wives. The specialization of those couples requires more home production time from husbands (see table A2 in the appendix).

Figure 5: Observed and simulated labor market status proportions



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= non-participant. Each bar represents the proportion of husbands and wives on each labor market state.

The policy that induces more wives to participate at higher rates in the labor market is increasing Roma husbands' and wives' wages. The nonparticipation rates of wives are magnitudes lower than

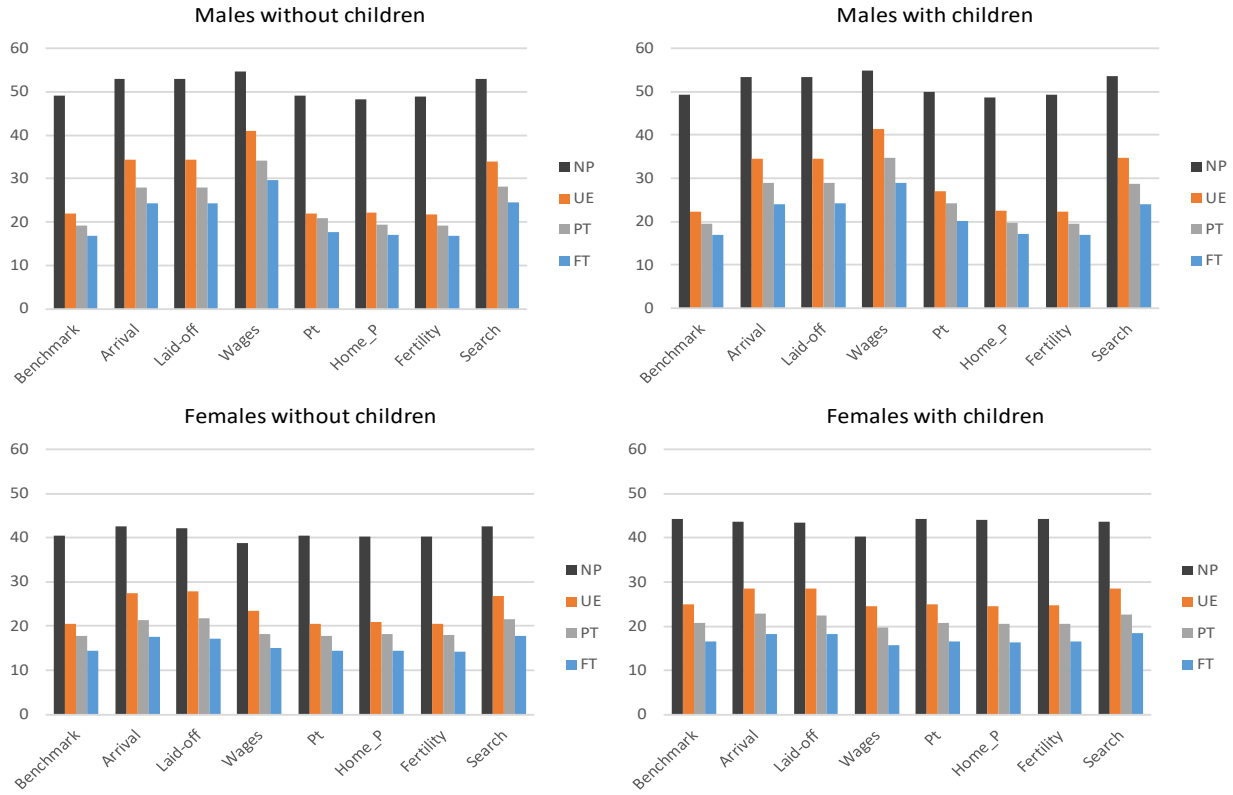
male nonparticipation. In that experiment, wives' home production times do not change, but, interestingly, males increase their time in all labor markets. This reflects how household optimization processes interact with policies, making spouses reallocate the portfolio activities. In this experiment, as wives go more to the labor market, husbands increase home production time, and some decide to not participate in the labor market.

Table 9: Observed and simulated mean accepted wages

	Benchmark	Arrival	Laid-off	Wages	Pt	Home_P	Fertility	Search
pt_m	1.3	1.3	1.3	1.5	1.3	1.3	1.3	1.3
ft_m	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
pt_w	1.2	1.2	1.2	1.5	1.1	1.2	1.2	1.2
ft_w	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6

Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Abbreviations: FT= employed full-time; PT= employed part-time. This table presents the converted values in 2011 USD PPP dollars.

Figure 6: Mean time in home production by labor market state (%)



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Each bar represents the average time allocation in home production of husbands and wives on each labor market state.

7. Gender Gap Decomposition

The gender gap decomposition equalizes female parameters to male values; this describes a Roma labor market and time use without gender differences.[34] Table 10 presents the definitions for the six

[34] As males' search cost is higher than that for females, the search costs implemented in this experiment are those of the females.

experiments that allow us to evaluate the ex-ante impact of policies aiming to close the Roma gender gaps. The first experiment equates all the structural gender-specific parameters to the males' values.

Table 10: Policy experiments definitions

Label	Meaning
Benchmark	
= gender	All female parameters have the males' values
LabMarFri	Female job offers and termination shocks have the males' values
WageDist	Female wage distribution parameters and PT proportions have the males' values
Home_P	Female home productivity distribution have the males' values
Leisure	Female leisure flow utility parameters have the males' values
Search	reduce search costs 10%

The second experiment is directly affected by the policies affecting labor demand. For instance, a decrease in the expected months to receive a job offer or an increase in expected months to receive a laid-off shock reflect the impact of polices such as a Roma quota law, affordable credit lines for business employing Roma, tax breaks and subsidies. EPL mainly increases the expected months to receive a laid-off shock and PESs will mainly decrease in the expected months to receive a job offer as they aim to improve the labor market efficiency. Better tools for skill assessment, such as education opportunities and on-the-job training, mainly increase the expected wages offered to the Roma population. Increasing the part-time offer was shown to corroborate the effects, if any, of labor market flexibility that allows a combination of market and home-based work on Roma labor market decisions.

The third experiment is a direct application of equal pay policies between Roma spouses. Some international examples[35] of policies to increase females' wages offered to set the wage offers to male values. Other policy interventions required large enterprises to disclosure the earnings of the employees to promote transparency and close wage gender gaps (Oelz, Olney, and Tomei 2013).

Policies 4 to 6 are directly affected by labor supply policies, and specifically, changing the gender roles over home production, leisure valuation, and search cost. Although the pass-through for policies for specific parts of the labor supply is difficult, this exercise should be interpreted as an attempt to understand spouses' behavior and how each factor helps explain the observed gender gaps.

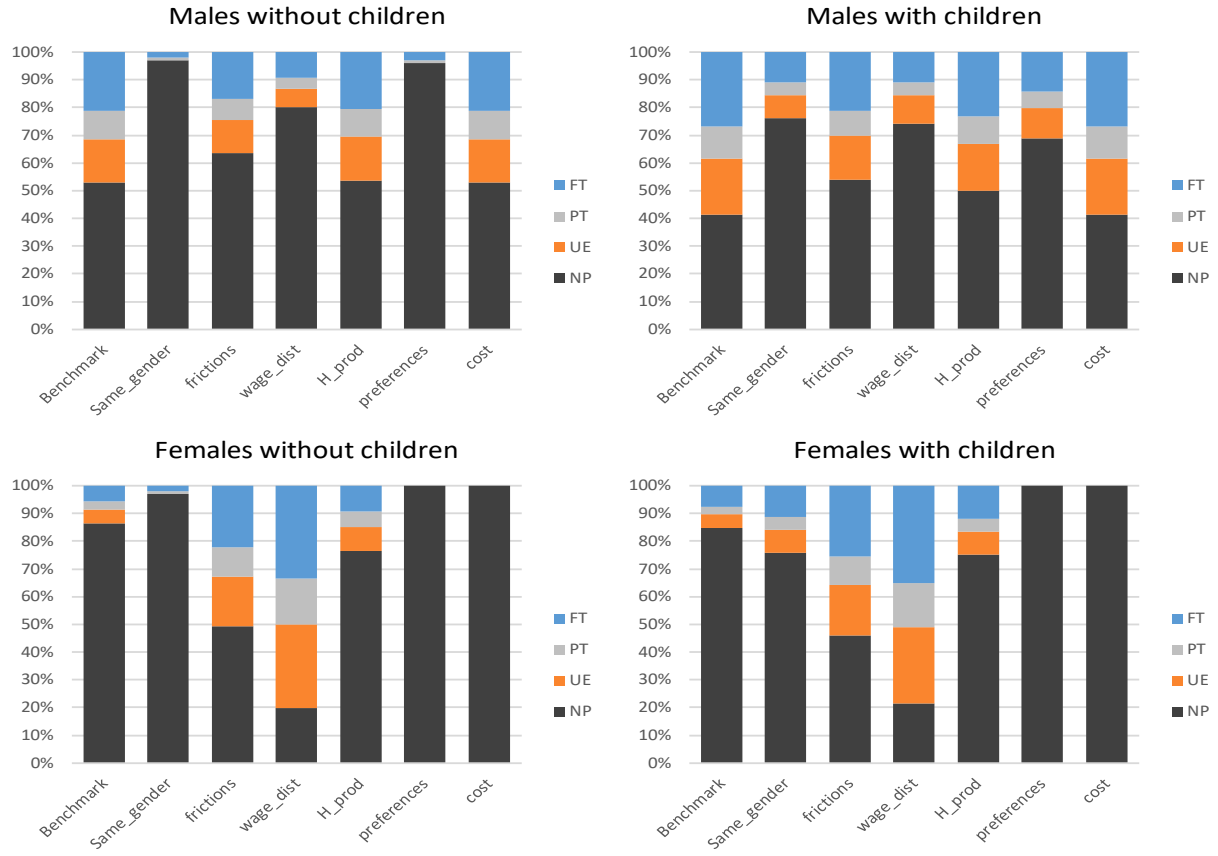
A combination of women's self-help measures and promotional campaigns that highlight the success stories of Roma women can shift social norms and gender preferences for leisure and home production. Changing gender-based cultural norms is hard, but there is a broad research strand in behavioral economics that studies how influencing cultural norms can change behaviors in certain contexts and situations.[36] Also, a qualitative study carried out in Serbia by the World Bank (2019) highlights the need for integrating Roma women into self-help groups of women from diverse communities, but similar socioeconomic backgrounds. Such groups can help women—Roma women in particular—to build social capital and new capabilities through a new network. Using these capabilities and capital, Roma women can have a long-term positive impact: they can strengthen their voices; alter the bargaining power within households in ways that deeply defy entrenched conventions of gender, and more importantly increase notions of self-worth among Roma; and potentially increase access to

[35] Examples include Germany in 2018 and the United Kingdom in 2019.

[36] A systematic review of over 90 empirical studies that have applied behavioral change interventions based on social norms in field settings is presented in Yamin et al (2019).

financial opportunities. The most successful interventions will create multiple, repeated instances of situations where men and women, Roma and non-Roma, participate (more) equally and are acknowledged as equally competent at socially valued tasks.[37] Second, public and promotional campaigns can highlight successful women entrepreneurs and students, to help encourage girls and women to pursue education and business activities and to bring men on board regarding the benefits of women's increased agency and employment opportunities. Roma women (particularly youth), unlike their non-Roma counterparts, believe that there are only limited role models in their community to aspire to, which makes it difficult for them to visualize career pathways. Showcasing a diverse range of successful Roma students and businesswomen at the neighborhood, village, or municipality level would go a long way in helping Roma girls (Robayo-Abril and Millan, 2019). The last experiment assigns females' preference parameters values to males as a result of an application of the mentioned policies above.

Figure 7: observed and simulated labor market status proportions



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.

Notes: Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= non-participant. Each bar represents the proportion of husbands and wives on each labor market state.

[37]Even though we are simulating the policy experiments as equating women's parameters to men's, policies aiming to promote cultural changes can also change men's preferences and should target men. Hara and Rodriguez-Planas (2020) evaluated the effects of a Japanese reform in the 1990s that ended gender segregation in junior-high school. Their evaluation is on married men's and women' time spent in home production. They found that men and women of the cohorts that took classes under the reform share more equal home production: men augmented home production time while women diminished it.

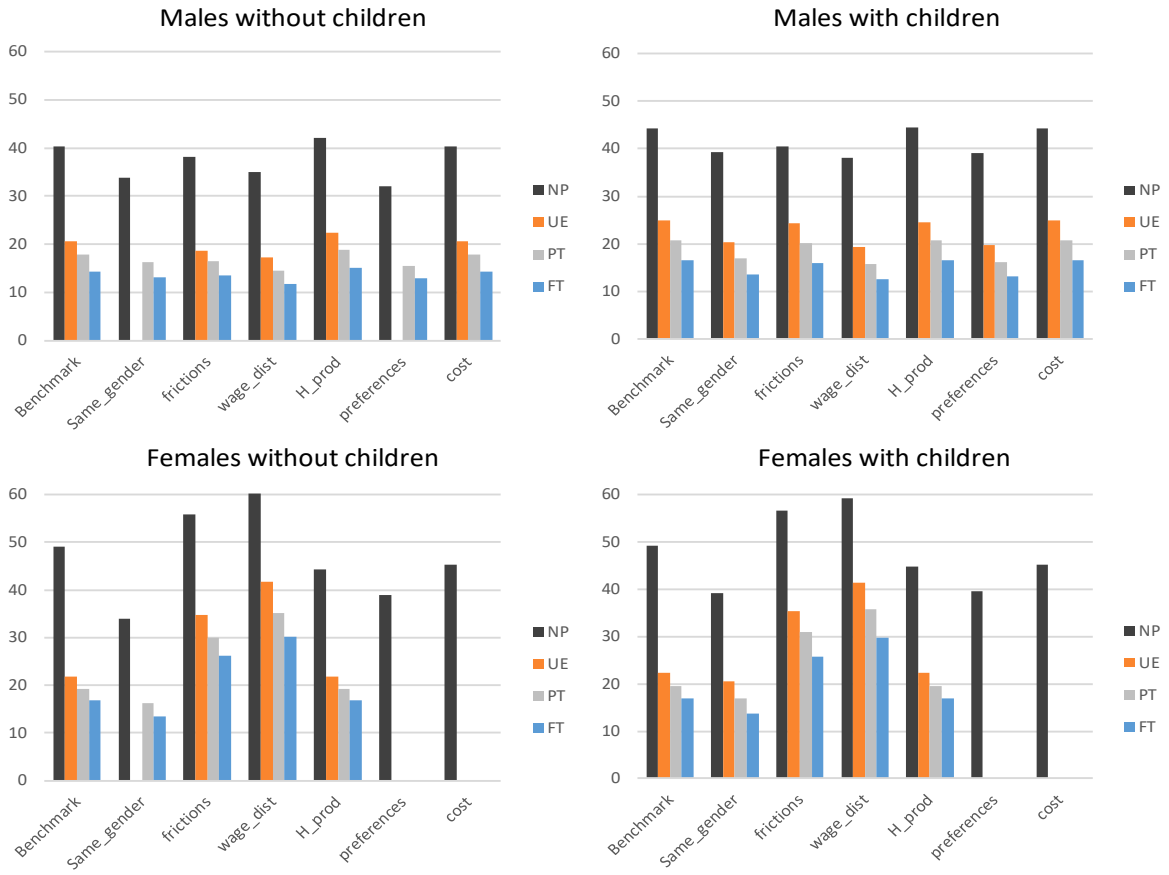
Table 11: Observed and simulated mean accepted wages

	Benchmark	Same_gender	frictions	wage_dist	H_prod	preferences	cost
pt_m	1.3	1.3	1.3	1.3	1.3	1.3	1.3
ft_m	0.7	0.7	0.7	0.7	0.7	0.7	0.7
pt_w	1.2	1.3	1.2	1.3	1.2	0.0	0.0
ft_w	0.6	0.7	0.6	0.7	0.6	0.0	0.0

Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Abbreviations: FT= employed full-time; PT= employed part-time. This table presents the converted values in 2011 USD PPP dollars.

To understand the results of these counterfactual experiments, it is important to recall findings from the estimated parameters. For example, the parameters indicated that husbands have a labor market advantage in wages offered, as well as a higher probability of finding or losing jobs. Moreover, the leisure preferences of husbands are weighted more heavily than for wives in the instantaneous utility, husbands' search costs are higher, and wives are on average more productive in home production.

Figure 8: Mean time in home production by labor market state (%)



Source: Author's calculations based on 2017 UNDP-WB-EC Roma Regional Survey.
Note: Each bar represents the average time allocation in home production of husbands and wives on each labor market state.

As expected, when the structural parameters are the same for males and females, there are no differences in any of the mentioned dimensions. In that scenario, labor participation of Roma is almost zero for spouses without children, and both husbands and wives enter the labor market when having children. This happens because males' leisure weight is reduced, home production weight augments, but income weight also augments. Therefore, spouses with lower home production productivity will enter the labor market, given the increasing need for labor income.

The experiments that equalize wives' labor demand parameters to the husbands' values increase wives' labor participation, reduce husbands' participation, relative to the benchmark; and mean home production time remains altered for husbands, but increased for wives in all labor market states. This means that wives of all productive types are entering the labor market, which raises average home production time by wives. This applies to the policies that equate the expected months to receive a job offer or an increase in expected months to receive a laid-off shock and equal pay policies between Roma spouses.

In particular, equalizing wages is the policy that induces more wives to join the labor market and husbands to withdraw from it. This outcome signals that the wage gap is the dimension that deters the greatest number of Roma wives from joining the labor market.

The experiment that equates the wives home production distribution with the husbands' values would increase wives' participation by 10 percentage points; husbands' nonparticipation only changes when the household has children, and it is the only policy that equates home work time.

When the leisure preferences parameters or the search cost are the same between genders, no wives enter the labor market. When we equalize these parameters between husbands and wives, the wives' leisure now has more weight in household utility and income is less valued. Moreover, as the labor market is disadvantaged for wives relative to husbands, the result of the household optimization is that both spouses only enjoy leisure and home production in the nonparticipation state.

8. Limitations and Future Research

This paper constructs and estimates a structural model to understand gender differentials in the labor market among marginalized Roma. The model is based on the household search model of Guler, Guvenen and Violante (GGV) (2012), and extended to allow for (i) full-time versus part-time work, (ii) time inputs into home production, and (iii) household utility defined over labor income, home production and leisure. The model is estimated using data from the Regional Roma survey, which was collected in six Western Balkans countries. To the best of our knowledge, this is the first time that a model with these features has been used to study gender dynamics among the Roma population. However, many challenges remain to fully comprehend the behavior of the Roma population in the labor market.

First, because of cultural reasons but also due to lack of economic resources, extended Roma families in many cases live together and share economic and time resources. Therefore, exploring how extended families make choices in the labor market seems promising in the Roma population context; the current specification has 16 possible couples' labor market states, multiplied by husband's

and wives' optimal home production time. Adding an additional member's labor decisions will increase the household labor market states to 64, plus home production optimal time allocation per agent. Including that dimension (extended families rather than spouses making choices) into the current specification is computationally costly and complex to program/code.

Second, this paper uses search cost and taste/productivity/social norms to explain nonparticipation, but other sources of nonparticipation such as nonlabor income and health status should also be studied. The nonparticipation rates for Roma are high compared to international standards. Among the usual explanations for high nonparticipation rates are the disincentive effects of nonlabor income (which also includes household subsidies, social assistance schemes, pensions, and transfers from other households) or health status. The RRS includes these dimensions but analyzing them was out of the scope of this paper. These are areas that can be further explored in future research.

In this direction, even when we included gender norms over leisure, home production, and search cost, we are not explicitly modeling cultural norms such as the imposed restriction on females to only do housework and not enter the labor market. Therefore, our results should be interpreted as an upper bound for household reactions to different policies. Further work could explore the introduction of such social barriers into the modeling.

Another useful future extension could produce a General Equilibrium Search Model like the one developed by Hanming and Shepard (2019), but this will rely on future data availability. Hamming and Shepard have labor supply and demand information and employer provided health insurance. In the present exercise we did not have firms' information. Our estimated labor market parameters did not allow us to ascertain if the values found were coming from less labor market productivity or from employer discrimination against Roma males or females. Considering this limitation, in the policy experiments we one increased male and female labor parameters to simulate if there is a reduction in discrimination, or if Roma wives' productivity increases over Roma husbands. We then calculate spouses' optimal time allocation, labor supply, and wages for these scenarios.

The presence of any source of nonlabor income changes the marginal utility of labor income against leisure and home production; thus, the behavior of couples with this income might differ significantly from couples without it. In their analysis, Flabbi and Mabli (2018) include the effects of two levels of nonlabor income (or the absence of it) for U.S. couples' labor decisions. Even in a labor market closer to Roma conditions, labor and nonlabor income of other household members is an important factor in determining female labor participation (Hafez and Ahmad 2002; Andres et al. 2017).

Health status may also be highly correlated to employment status and labor force participation. The Roma are often not able to invest in their health due to lack of access to medical care. In all countries, the prevalence of self-reported unmet need for medical care is high among the marginalized Roma, ranging from 16 percent in North Macedonia to as high as 36 percent in Albania. Self-perceived health is also lower among the Roma than the neighboring non-Roma, possibly indicating lower objective health outcomes among the marginalized Roma.[38] Health status is a condition that changes

[38] Subjective health measures cannot be constructed using the 2017 RRS.

the probability of employment and tenure (Blau and Gilleskie 2001); therefore, exploring how health deters labor market opportunities could help to explain the Roma's nonparticipation.

9. Conclusions

A household search model of the labor market, implementing Salazar-Saenz (2020), was applied to the Roma population in the six Western Balkan countries. The model explains the different time allocations and labor supply of couples with or without children where gender gaps are present: females work more than males in home production, and males work more than females in the labor market. The model focuses on spouses' decision-making, considering that the household head and his/her spouse are the main providers of resources. Defining that unit of study helps to disentangle whether the observed gender gaps are due to differences in the labor market or due to differences in gender roles regarding leisure and home production. Consequently, the model allows heterogeneous types in terms of household labor productivity to explain the different time allocations observed across agents with the same labor market state and participation decisions.

The estimation shows that there are gender asymmetries in labor market opportunities; in particular, the arrival rates of a job offer, laid-off shocks, mean and standard deviation of wage offered, and search costs differ between Roma males and Roma females. Furthermore, the model captures spouses' cultural attitudes toward leisure and home production. The estimation result shows that Roma households value husbands' leisure more than wives' (which explains partially why conditional to every labor market state, husbands allocate less home production time), and estimates that wives' home production distribution has more weight for the high productive types. Having a child has heterogeneous effects on household values for income, leisure, and home production. Once a couple has children, the home production taste parameter increases, leisure decreases, but males' leisure weight decreases more, making them more prone to enter the labor market. These combined ingredients give the model the ability to replicate Roma spouses' differentials on job participation, home production time, and wages of wives and husbands with or without children.

Counterfactual experiments improving the Roma labor market conditions show that males and females do not react symmetrically to policy interventions and that most of the gender gaps can be closed by providing wives the same labor market conditions as husbands. All the policy experiments increase or reduce the parameters of Roma husbands and wives. Focusing on husbands, increasing the frequency of receiving a job offer, decreasing the frequency of the laid-off shock, and reducing the search cost are the policies that most increase the husband's labor participation. Focusing on wives, the policy that induces more wives to participate at higher rates in the labor market is increasing the wages of Roma husbands and wives.

Counterfactual experiments equating female parameters to male values show that asymmetric gender labor market opportunities are the biggest barriers deterring Roma females' participation. If the gender roles over home production were equally distributed, then wives' labor market participation could be increased by as much as 10 percentage points.

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Appendix

Time usage module: Activities for coding

Table A1: Activities for coding

1	sleep	42	informal help to other households
2	eating	43	participatory activities
3	other personal care	51	social life
11	main job and second job	52	entertainment and culture
12	activities related to employment	53	resting - time out
20	unspecified study	61	physical exercise
21	school or university	62	productive exercise
22	free time study	63	sports-related activities
30	unspecified household and family care	71	arts and hobbies
31	food management	72	computing
32	household upkeep	73	games
33	making and care for textiles	81	reading
34	gardening and pet care	82	tv, video and dvd
35	construction and repairs	83	radio and recordings
36	shopping and services	91	travel by purpose
37	household management	93	spiritual/religious activities
38	childcare	99	na (no answer)
39	help to an adult family member		
41	organisational work		

Table A2: Sample sizes: total sample and time usage module

	RSS sample size					Time usage module sample size				
	Child		No child				Child		No child	
	Male	Female	Male	Female			Male	Female	Male	Female
NP	858	1655	469	688		NP	312	596	192	235
UE	483	203	160	84		UE	197	79	55	36
Pt	233	46	80	24		Pt	75	10	28	10
Ft	412	82	130	43		Ft	137	29	41	10
obs:	1986	1986	839	839		obs:	721	714	316	291
total:	5650					total:	2042			

Table A3: Time usage module sample size per country

	Male	Female	Male	Female	Male	Female
	Albania		Montenegro		Serbia	
NP	61	101	116	170	63	133
UE	63	35	14	2	30	16
PT	21	5	18	1	21	6
FT	32	15	47	1	21	6
obs:	177	156	195	174	135	161

	Bosnia and Herzegovina		North Macedonia		Kosovo	
NP	94	157	60	117	110	153
UE	48	23	55	33	42	6
PT	12	2	11	4	20	2
FT	22	3	36	12	20	2
obs:	176	185	162	166	192	163
total:	2042					

Table A4: Mean home production time allocation

	Mean home production time allocation' proportion by gender and having children					**Standard deviation of home production time allocation' proportion by gender and having children**			
	Males		Females			Males		Females	
	No Child	Child	No Child	Child		No Child	Child	No Child	Child
	Sample					Sample			
NP	26.5	26.3	35.3	40.1	NP	40.4	44.3	49.0	49.2
UE	24.5	27.5	39.0	43.6	UE	20.5	24.9	21.9	22.3
PT	13.9	14.4	25.6	28.9	PT	17.8	20.7	19.1	19.5
FT	6.2	9.6	15.0	15.7	FT	14.4	16.5	16.8	17.0
	Simulated					Simulated			
NP	16.7	17.0	15.6	15.0	NP	5.8	4.9	10.0	10.3
UE	15.5	17.2	14.7	13.5	UE	3.5	6.5	1.7	1.8
PT	15.9	16.9	16.5	15.5	PT	3.9	5.2	1.6	1.6
FT	7.0	10.3	3.9	8.8	FT	3.2	4.2	1.2	1.3

Notes: Author's calculations based on 2017 UNDP-WB-EC Roma Regional survey. Abbreviations: FT= employed full-time; PT= employed part-time; U= unemployed; NP= non-participant; EMP= Past Employment. Each matrix sum up to 100. Transitions are found from self-reported transitions. Past job schedule is not available in the survey, for this reason past jobs can only be characterized as EMP.

Table A5: Assortative mating—spouses' labor market states

M-W	Data	Benchmark	Arrival	Laid-off	Wages	Pt	Home_P	Fertility	Search	Same_gender	frictions	wage_dist	H_prod	preferences	cost
NP-NP	39.3	29.9	0.0	0.0	0.0	25.4	27.3	30.1	0.0	64.6	3.8	0.0	26.4	77.0	44.8
UE-NP	18.6	18.9	14.8	14.6	6.0	18.9	19.5	18.5	15.9	5.9	14.8	6.0	16.7	7.6	18.9
PT-NP	9.3	11.1	13.4	13.2	7.6	12.4	11.5	11.0	12.6	3.4	8.6	4.4	10.0	4.5	11.1
FT-NP	15.8	25.2	31.5	31.6	18.7	24.0	26.4	25.5	30.9	8.3	19.9	10.5	22.3	10.9	25.2
NP-UE	4.2	5.0	6.7	7.0	14.3	6.5	5.3	5.4	7.2	5.7	17.9	25.1	8.5	0.0	0.0
UE-UE	2.7	0.0	9.1	8.6	12.8	0.0	0.0	0.0	9.4	0.0	0.0	3.3	0.0	0.0	0.0
PT-UE	1.2	0.0	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FT-UE	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NP-PT	1.1	2.9	7.8	7.5	12.5	4.4	3.0	2.9	7.5	3.5	10.5	16.1	5.0	0.0	0.0
UE-PT	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PT-PT	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FT-PT	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NP-FT	2.3	6.9	16.9	17.5	28.2	8.5	7.0	6.6	16.5	8.6	24.5	34.7	11.1	0.0	0.0
UE-FT	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PT-FT	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FT-FT	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW-NW	64.8	53.8	30.5	30.3	33.0	50.7	52.1	54.0	32.6	76.3	36.6	34.3	51.6	84.6	63.7
NW-E	4.9	9.9	24.6	25.0	40.7	12.9	10.1	9.5	24.0	12.1	35.0	50.8	16.1	0.0	0.0
E-NW	28.3	36.3	52.5	44.8	26.3	36.4	37.8	36.5	43.5	11.7	28.4	14.9	32.3	15.4	36.3
E-E	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: Author's calculations based on 2017 UNDP-WB-EC Roma Regional survey. Abbreviations: M-W: males and women labor market state; FT= employed full-time; PT= employed part-time; U= unemployed; NP= non-participant; NW=non-workers (non-participants and unemployed); E= Employees (full-time and part-time workers); NW-E= non-worker husband with employed wife.