

# The Burden of Putting Food on the Table: Cuisine Complexity and Women’s Labor Force Participation

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## Abstract

We study if more complex cuisines—requiring greater time and specialized skills for food preparation—lead to women bearing a disproportionate cooking burden that crowds out labor force participation. We propose a household time-allocation model with a cooking technology in which the accumulation of cooking-specific human capital interacts with cuisine complexity to generate persistent female specialization in cooking, arising from initial productivity differences in labor outside the household. Using nearly 70,000 online recipes from 137 countries, we construct a cuisine complexity index based on cooking time, ingredient variety, and spices. Merging this with individual-level data on women’s economic participation, we employ an instrumental variable strategy leveraging exogenous variation in native ingredient flavor versatility. Results show that an increase in cuisine complexity by one standard deviation reduces women’s labor force participation by 18 percent overall and 25 percent for married women. This effect operates through women’s cooking specialization: complexity reduces meals cooked by men but not women.

## I Introduction

Women globally continue to participate lesser in the labor market than men. In 2023, women’s global labor force participation rate was 48.7 percent, significantly lower than the rate of 73 percent for men. The underlying regional variation and country variation is significant, where in some high-income European countries, the gap is smaller with women’s participation exceeding 70 percent. While in other parts of the world, such as the Arab States, Northern Africa, and Southern Asia, the gender gap widens dramatically, ranging from 46 to 54 percentage points (pp). In this paper, we examine how much of these gender differences across the globe are rooted in differential cuisine complexity.

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The literature documents several drivers of these gender gaps (Heath et al., 2024). Cultural norms remain central, shaping expectations about women's roles in ways that constrain labor supply (Jayachandran, 2021). A related strand highlights women's greater need for job flexibility, including predictable hours and limited mobility demands, which constrains their occupational choices when such flexibility is scarce (Ho, Jalota and Karandikar, 2024).

Emerging research emphasizes the role of aspirations, showing that perceptions of feasible opportunities and exposure to role models shape young women's education and labor-market decisions (Orkin et al., 2023; Ahmed et al., 2024). Gender gaps in competitive preferences also matter, with women entering competitive environments at lower rates even conditional on ability (Niederle and Vesterlund, 2007), having implications not only for overall labor market participation but also in specific sectors. Constraints related to safety and mobility impose additional barriers, limiting women's human capital accumulation and their feasible job sets by shaping location and commute choices (Borker, 2021).

On the care side, women are substantially more likely than men to report child and home responsibilities as reasons for not engaging in paid labor (Addati et al., 2018). Unmet childcare needs have been found to affect women's labor supply on the extensive margin (Marcos, 2023), on the intensive margin (Delecourt and Fitzpatrick, 2021), the location (Delecourt et al., 2023) and even the type of work they do (Heath, 2017; Berniell et al., 2021).

This paper assesses how homecare burden, specifically the burden of food preparation affects women's labor force participation. Time-use data consistently show that women bear the primary responsibility for routine household tasks relative to men, especially when it comes to cooking where women provide 85–90 percent of the time spent on household food preparation (FAO, 2011). For example, when we analyzed time use surveys from over 30 countries around the world, as shown in Appendix Figure ??, we find that women spend more than four times the time men spend on food preparation, on a daily basis. This is an obligation that requires related human capital investments at an early

age, that imposes significant time cost of completing the task and also leads to specialization over time, potentially creating a trap that's hard to escape. We provide what to our knowledge is the first evidence on how the complexity of the food that is prepared and consumed in different contexts shapes women's participation in the workforce.

To identify the causal effect of cuisine complexity on women's labor force participation, we propose an instrumental variable (IV) based on the flavor versatility of a country's native ingredients. This measure captures the number of chemical flavor compounds shared between native ingredients and a broader set of ingredients used in world cuisines. We use this measure of flavor versatility to explain variation in contemporary recipe complexity. We define complexity as an index that combines cooking time, number of spices and number of other ingredients, to capture how involved the daily food burden is in a household. Using data on almost 70 thousand recipes across 137 countries that we scraped from the web, we find that a 1 SD change in cuisine complexity of a country is associated with a 18 percent decrease in women's labor force participation at extensive margin, and a 25 percent decrease in labor force participation by married or cohabiting women.

This paper contributes to several strands of literature. It closely relates to the broader persistence literature documenting how historical and geographic conditions shape contemporary economic behavior ([Acemoglu, Johnson and Robinson, 2001](#); [Galor and Özak, 2016](#); [Alsan, 2015](#)). Specifically, the studies showing how ancestral gendered division of labor continues to influence gender norms and labor allocation today ([Alesina, Giuliano and Nunn, 2013](#); [Carranza, 2014](#); [Becker, 2025](#); [Fredriksson and Gupta, 2023](#)). This paper assesses a new potential factor affecting division of labor rooted in countries' cuisines. The paper also contributes to the literature on structural transformation and time use ([Gottlieb et al. 2024](#), [Rendall 2018](#)). We contribute to these literatures by, first, introducing a new geographically determined instrument based on molecular flavor chemistry of ingredients and show that it predicts cuisine characteristics of countries. Second, because our mechanism operates partly through a *contemporary* human-capital channel, the policy implications are more actionable, than presently in the literature. For example, focusing on early-life investments in cooking skills for boys vs. efforts to shift deep-seated cultural norms.

## II Global Historical and Contemporary Cooking Patterns

Cooking has historically been a predominantly female activity, a pattern deeply rooted in the economic and social organization of pre-modern societies. Ethnographic evidence from the Standard Cross-Cultural Sample (SCCS, [Murdock and White \(1969\)](#)) shows that, across a wide range of subsistence systems, women were overwhelmingly responsible for food preparation.<sup>1</sup> Figure I (top panel) illustrates that female dominance in cooking was nearly universal, with only a handful of exceptions represented by islands in the Pacific Ocean.

There are several reasons why pre-modern cooking was so strongly gendered. One explanation is that gender divisions of labor were sharper in earlier economic systems, with productive activities often determined by biological and social constraints. A substantial literature links long-run gender norms to historical agricultural technologies and conditions—such as the adoption of the plough and deep-tillage soils, which tended to allocate heavy agricultural work to men ([Boserup et al., 2013](#); [Alesina, Giuliano and Nunn, 2013](#); [Carranza, 2014](#)), and irrigation-based agriculture which similarly favored male labor ([Fredriksson and Gupta, 2023](#)). In addition, lifeways involving pastoralism and reliance on animal husbandry are strongly associated with constraints on female mobility and lower female labor participation today ([Becker, 2025](#)). In non-agricultural societies, activities such as hunting ([Kaplan, Hooper and Gurven, 2009](#)) and fishing ([BenYishay, Grosjean and Vecchi, 2017](#)) have also been subject to sex-specific specialization. These are some aspects of premodern activities that may have hindered female involvement in labor market activities across a wide range of subsistence systems, and thereby reallocating female labor to household activities such as cooking.

Cooking skills that women accumulate through experience and transmit to other women across generations constitute a fundamental aspect of culture ([Teixidor-Toneu et al., 2021](#); [DeVault, 1991](#); [Beoku-Betts, 1995](#); [Gilkes, 1985](#)). Consistent with a gendered transmission

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<sup>1</sup>These ethnographic observations—while recorded around the late nineteenth and early twentieth centuries—were explicitly designed to capture lifeways believed to reflect pre-modern or early-contact conditions.

of cooking skills, Appendix Figure B1 shows that in pre-modern societies where women carry a larger share of cooking responsibilities, girls also tend to spend more time cooking than boys.

Over the twentieth century, however, the transformation of gender norms and structural change in the economy dramatically altered the organization of household labor. Urbanization, the rise of the service sector (Sayer, 2005; Bianchi et al., 2012), and the diffusion of time-saving household technologies (Goldin, 2006) substantially reduced the amount of time women spent cooking. However, for these developments to translate into higher female labor force participation, they must raise women's productivity in the labor market more than in domestic production (Afridi, Dinkelman and Mahajan, 2018).<sup>2</sup> In the next section, we formalize this idea by modeling women's productivity in the labor market relative to home production (cooking).

These long-run changes are reflected clearly in contemporary global cooking patterns (Figure I, bottom panel). Using data from the global Cookpad survey we observe that overall, women today cook a substantially smaller share of meals than ethnographic evidence suggests for pre-modern societies. Importantly, however, the decline in female cooking has been far from uniform. In some regions, especially South Asia, the Middle East, and North Africa, women remain responsible for the overwhelming majority of all cooking. In contrast, in Western Europe and North America, as well as parts of Southern Africa and East Asia, gender gaps in cooking have narrowed dramatically or, in some cases, nearly closed.

Thus, modernization has led to cross-country divergence in female cooking, with some regions maintaining traditional divisions of labor while others have undergone substantial shifts. Understanding the drivers of this divergence in cooking, and the implications for female labor force participation, motivates the simple model presented in the next section.

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<sup>2</sup>Afridi, Dinkelman and Mahajan (2018) show that in India, expansions in primary education increased home production relative to market work, because basic education raised the returns to domestic tasks more than to market production.

### III A model of intra-household division of labor

In this section, we present a simple model of intra-household labor allocation with two time periods. The model explains the persistence of women's specialization in cooking, arising from initial productivity differences in non-household labor, with the interaction between cooking-specific human capital, which accumulates through experience, and cuisine complexity which governs importance of human capital in the cooking technology.

#### III.A Setup

There are two periods  $t \in \{1, 2\}$ . A household consists of a man  $m$  and a woman  $f$ . With equal bargaining power, each period total household utility is the sum of individual utilities:  $U_t = \frac{1}{2}u_{m,t} + \frac{1}{2}u_{f,t}$ . Both spouses derive utility from household income  $Y_t$  and food quality  $F_t$ . Individual utility functions take the form:

$$u_{m,t} = \ln(Y_t/2) + w_c \ln(F_t), \quad (1)$$

$$u_{f,t} = \ln(Y_t/2) + w_c \ln(F_t), \quad (2)$$

where  $0 \leq w_c \leq 1$  measures the relative weight placed on food quality.

In each period, each spouse  $g \in \{m, f\}$  has time endowment  $T > 0$  that allocates between paid labor  $L_{g,t}$  and cooking  $C_{g,t}$ , with an individual time constraint:

$$L_{g,t} + C_{g,t} = T, \quad 0 \leq C_{g,t} \leq T. \quad (3)$$

Household income in period  $t$  is determined by the time each member allocates to paid labor, with wages  $\beta_{g,t}$  that vary across genders. Let  $\alpha_t = \frac{\beta_{m,t}}{\beta_{f,t}}$  the gender wage gap at period  $t$  and assume that there are no financial markets, so the household cannot transfer income across periods. Thus, household budget constraint in period  $t$  is:

$$Y_t = \alpha_t L_{m,t} + L_{f,t} = (\alpha_t + 1)T - \alpha_t C_{m,t} - C_{f,t}, \quad \alpha_t \geq 1. \quad (4)$$

### III.B Food production

Food quality is produced within the household using a CES production function that depends on the cooking time allocated by each household member  $C_{g,t}$  and their stock of cooking-specific human capital  $H_{g,t}$ .

$$F_t = \left[ (H_{m,t}^{\theta(\chi)} C_{m,t})^\rho + (H_{f,t}^{\theta(\chi)} C_{f,t})^\rho \right]^{1/\rho}, \quad \rho < 1. \quad (5)$$

The parameter  $\theta(\chi)$  governs the contribution of cooking human capital to food quality. Cuisine complexity, represented by  $\chi > 0$ , increases the importance of cooking human capital in the production of food quality, so that  $\theta'(\chi) > 0$ .

We assume that the stock of cooking human capital in period 1 is exogenous and identical across genders:  $H_{m,1} = H_{f,1} = \bar{H}$ . In period 2, it is endogenously determined by time allocation in period 1. Due to learning, cooking experience accumulated in period 1 increases the stock of human capital available in period 2 at a rate  $\phi$ . Thus, period 2 cooking human capital is given by

$$H_{g,2} = \bar{H} + \phi C_{g,1}, \quad \phi > 0. \quad (6)$$

### III.C Household utility maximization

The household chooses the time allocation that maximizes the discounted sum of instant utility functions  $U_t$  subject to its time, income, and cooking technology constraints. With a time discount factor  $\delta$ , the household maximization problem is

$$\max_{\{C_{m,1}, C_{f,1}, C_{m,2}, C_{f,2}\}} U_1 + \delta U_2, \quad \delta \in (0, 1),$$

subject to equations (3) to (6).

**Proposition 1** (Female share of cooking). *In any interior solution, the female share of cooking is increasing in the contemporaneous wage gap:*

$$\frac{\partial}{\partial \alpha_t} \left( \frac{C_{f,t}}{C_{m,t}} \right) > 0,$$

*Proof.* See Appendix A.1.

Intuitively,  $\alpha_t$  captures gender differences in the opportunity cost of cooking. A higher  $\alpha_t$  increases man's relative cost of cooking and thus induces a larger allocation of cooking time toward the woman.

**Proposition 2** (Inequality persistence). *A wage gap in favor of the man in period 1 leads to an unequal allocation of cooking time in period 2, with the woman bearing a larger share.*

*Proof.* See Appendix A.1.

Proposition 2 implies that even if wages equalize in period 2, cooking time does not. As shown in Proposition 1, a positive wage gap in period 1 induces the woman to allocate more time to cooking, leading her to accumulate more cooking-specific human capital. This, in turn, raises her marginal benefit of cooking in period 2, sustaining an unequal allocation of cooking time.

**Proposition 3** (Cuisine complexity). *Higher cuisine complexity amplify the effects of differences in cooking specific human capital on the share of cooking time.*

*Proof.* See Appendix A.1.

Cuisine complexity increases the marginal return to cooking-specific human capital. Because women accumulate more cooking human capital in period 1 due to the wage differential, they bear a larger cooking burden in period 2 even if wages equalize, with this effect being stronger with higher cuisine complexity. The resulting increase in cooking time also reduces women's allocation of time to paid labor as cuisine complexity increases.

If cooking-specific human capital is transmitted across generations by gender, the results of this two-period model extend naturally to a multiple generations and multiple

periods setting. In such an environment, an initial productivity advantage for men can generate persistent gender roles in the intra-household allocation of labor, even after economic development eliminates these productivity differences.

In Appendix Section [A.2](#), we extend the model to allow for technological progress in food preparation. We model food production as requiring both simple and complex tasks. Technological improvements, such as modern cooking appliances, increase labor productivity in simple tasks, whereas productivity in complex tasks depends on cooking-specific human capital. Under this framework, innovations in cooking appliances can reduce the gender gap in cooking time, but the magnitude of this reduction is smaller in more complex cuisines, where cooking-specific human capital plays a more predominant role.

## IV Data

We draw on multiple data sources to construct the components of our analysis. To measure countries' cuisine complexity, we compile recipe information and build a country-level dataset that records median total cooking time, average number of ingredients, and average number of spices. To construct the flavor versatility measure, our instrumental variable, we combine four country-level datasets that allow us to quantify the prevalence of flavor compound sharing among country ingredient baskets. Country-level controls were obtained from three additional data sources providing geographical and economic characteristics. Finally, we merge these datasets with individual-level data from Gallup's World Poll and Cookpad Home-Cooking Survey to obtain labor-force participation indicators. Below we describe each data set in detail and in [Table B1](#) we provide a summary of all our data sources.

### IV.A Recipe Data

To construct measures of cuisine complexity across countries, we relied on recipe data obtained through web scraping of online recipe platforms and digitized cookbooks. We

first designed a short survey for World Bank local staff to identify the most commonly used recipe websites in their respective countries. From these suggestions, we selected only sources that met our minimum data requirements, specifically the availability of total cooking time, ingredient lists, and preparation instructions.

During the scraping process, we developed a country-specific ingredient-tagging algorithm aimed at parsing unstructured ingredient lines. The algorithm identifies and extracts four key elements: quantity, unit, ingredient name, and any accompanying comments. While the core logic of the tagger is consistent across countries, adjustments were necessary to accommodate country-specific formatting conventions in ingredient descriptions. The final dataset contains almost 70,000 recipes from 138 countries representing 72% of the world population. For each recipe, we compiled detailed variables capturing multiple dimensions of preparation and composition, with our primary indicators of cuisine complexity being total cooking time, the number of ingredients, and the number of spices used in each recipe. Table I shows that on average in our data a recipe takes an 73 minutes to be prepared, uses about nine ingredients and over two spices.

## IV.B Flavor Versatility

We exploit exogenous variation in cuisine complexity arising from a measure of ingredient versatility, defined by the interactions between the flavor compounds present in each country's native ingredients and those found in non-native ingredients. To construct this measure, we first identified native ingredients using two data sources. The first source is the Crop Origin database developed by Milla (2020), which documents 866 food crop species and provides precise geographic coordinates for each. When a country had no native ingredients according to this database, we assigned the set of native ingredients corresponding to other countries in the same region.

The second source for native ingredients, is a dataset from the International Center for Tropical Agriculture (CIAT), which classifies agricultural crops by region. Since this dataset does not assign crops to specific countries within each region, we considered an ingredient to be native to a country when the suitability of that country for cultivating the

ingredient exceeded the global median suitability for that ingredient. Suitability information was obtained from data produced by the Food and Agriculture Organization of the United Nations (FAO). Suitability refers to the extent to which local soils can support a given crop, considering key factors such as nutrient availability, nutrient retention, rooting conditions, drainage, salinity or sodicity, and other physical constraints captured by soil phases (Fischer et al., 2021).

Flavor compound data were obtained from FlavorDB (2017), a database that documents ingredients and their associated flavor molecules or chemical compounds responsible for certain taste and smell in foods. The dataset covers 101 ingredients across major food categories such as fruits, vegetables, cereals, legumes, herbs, and spices. Combining this information, the versatility measure is defined as the number of shared flavor molecules between every pair of ingredients in a country, under the condition that at least one of the two ingredients is native. Section V.C.2 provides further details on the construction of this measure.

## IV.C Labor Force Participation

We use Gallup’s World Poll and Cookpad Home-Cooking Survey, which provides monthly observations from May 2018 to February 2023 for working-age individuals in more than 150 countries (including 109 covered in our recipe dataset). The survey offers detailed information on cooking habits, rich demographic characteristics, and comprehensive labor-market indicators such as employment, unemployment, hours worked, and income. In the analysis we use information the information collected before COVID-19 to avoid biases resulting from the heterogeneous effects of the pandemic across countries. Our main sample includes all working-age individuals, and we further split the sample across gender and marital status. In alternative specifications, we restrict the analysis to individuals between 24 and 55 years to exclude those likely to be studying or retired.

From Table I we can see that in full sample 54 percent of respondents are women of which 55 percent are participating in the labor force compared to 73 percent of men. Conditional on being in the labor force, 60 percent of women and 72 percent of men are

employed full time. In this data, we see a household prepared 6.6 meals last week, where a meal is either lunch or dinner. In terms of who cooks, 40 percent of women say that their spouse cooked vs. 89 percent of men.

#### **IV.D Country-Level Controls**

To account for cross-country heterogeneity in characteristics that may influence both cuisine complexity and labor-market outcomes, we include geographic and economic controls. We obtain average altitude from DIVA-GIS; total precipitation in 1999 (in millimeters) from Copernicus ERA5; and average soil pH from the Global Soil Data Task (IGBP-DIS). We also collect climate zone classifications and compute average agro-climatic suitability indices for the ingredients in our versatility dataset, as well as for a broader set of staple crops constructed using FAO data. We also incorporate additional geographical characteristics used in Galor and Özak (2016), including absolute latitude, average elevation, temperature, terrain roughness, distance to the sea or navigable rivers, a landlocked indicator, and a measure of colonial duration. Moreover, we use country-specific controls such as the number of recipes obtained from the scraping process; and economic and trade factors, including GDP per capita for 2019 from the World Bank and average trade distance, defined as travel distance between country capitals.

### **V Empirical Strategy**

We propose an empirical strategy that proxies for cuisine complexity using an index composed of median cooking time, average number of spices and average number of ingredients used in local recipes. Our identification strategy uses a novel instrumental variable that exploits plausibly exogenous variation in cuisine complexity arising from the interaction between flavor compounds in native and external ingredients in each country. In this section, we present our empirical specification, motivate the use of a combination of time, spices and ingredients as a proxy for cuisine complexity, and describe our identification strategy.

## V.A Main Specification

We use individual-level survey data to estimate the following equation separately for individuals of gender  $j \in \{\text{female, male}\}$ :

$$y_i^j = \alpha^j + \beta^j CC_{c(i)} + \mathbf{X}'_{c(i)} \boldsymbol{\Lambda}^j + \mathbf{W}'_i \boldsymbol{\Omega}^j + \epsilon_i^j, \quad (7)$$

where  $y_i^j$  represents labor market outcomes for individual  $i$  in country  $c$ , including an indicator variable for labor force participation and for full time employment conditional on participating in the labor force;  $\mathbf{X}_{c(i)}$  is a vector of country-level controls capturing heterogeneity in the quality of data available, as well as, geographic and economic characteristics of the countries that can influence both labor market conditions and cuisine complexity. In some specifications, we also control for individual and household characteristics,  $\mathbf{W}_i$ . Below, we describe in detail the control variables we include and our identification assumption conditional on these variables.

Our variable of interest,  $CC_{c(i)}$  is an index of cuisine complexity in local recipes for country  $c$ . We use a composite cuisine complexity index of cooking time, spices and ingredients computed using principal component analysis based on the assumption that each of the three parameters captures factors that contribute to the complexity of local recipes. In section V.B, we motivate the use of this proxy based on existing literature on food anthropology. With this proxy, the coefficient  $\beta^j$  captures the effect of cuisine complexity on labor market outcomes for individuals of gender  $j$ .

In our theoretical framework, cuisine complexity leads women to allocate more time to household food production relative to men, who allocate more time to work outside the household. If these effects operate in the extensive margin, this implies a negative effect of cuisine complexity on women's likelihood of labor force participation ( $\beta^{\text{female}} < 0$ ) and a positive effect for men ( $\beta^{\text{male}} > 0$ ). Moreover, cuisine complexity may also affect outcomes at the intensive margin among those who participate in the labor market, by reducing women's likelihood of full-time employment while increasing that of men.

Omitted variables, reverse causality, and measurement error may bias the OLS esti-

mates of  $\beta^j$ . Section V.C describes the identification strategy that we propose to estimate the causal effects of cuisine complexity on labor force participation and other labor market outcomes. We estimate Equation 7 separately for adult women and men, as well as for the subsample of married or cohabiting individuals. In alternative specifications, we pool all observations and include a gender dummy along with its interaction with the CC index. This allows us to identify how cuisine complexity affects the gender gap in labor market outcomes. Appendix Section C presents this analysis. Because our variable of interest varies at the country level while the outcomes are measured at the individual level, all specifications cluster standard errors at the country level.

## V.B Measuring Cuisine Complexity

Cuisine is described as the culturally constructed rules for food preparation (Crown et al., 2000). We use the average cooking time, the average number of spices and number of ingredients in local recipes to create an index of cuisine complexity, using principal component analysis. Each component separately contributes to the realization of more complex food. More cooking time has been associated with more complex food and cooking techniques across the world, from *Biryani* in South Asia to *Mole* in Mexico and *Doro Wat* in Ethiopia. Similarly for spices, due to their flavor enhancing properties, are a central ingredient in local cuisines around the world (Van Wyk, 2024). Their flavors derive from volatile compounds whose release and transformation depend on specific handling and preparation techniques (Briscone and Parkhurst, 2018). Several cooking practices have evolved to extract these compounds through controlled heating and staged incorporation of spices.<sup>3</sup> The appropriate technique varies by spice and type of preparation, and their effective use requires specialized knowledge and active time dedication. In this sense, cuisines that rely more heavily on spices are likely more demanding on cooking-specific skills and are less easily substituted by modern appliances or simplified preparation meth-

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<sup>3</sup>These techniques include blooming or tempering, where spices are briefly fried in hot fat to release aromatic oils; toasting, which heats whole spices in a dry pan to intensify flavor before grinding; flavor layering, which adds spices at different stages of cooking to build depth; and balancing flavor profiles by combining spices with complementary characteristics, among others.

ods. The same logic applies for a larger number of ingredients to work with, master their preparation and in many cases account for sequential cooking.

## V.C Identification Strategy

There are several sources of bias in our OLS estimates. On the one hand, richer countries may develop more complex cuisines—using a larger variety of ingredients, including spices—while also exhibiting stronger labor demand for women. This could lead to a downward bias of our estimates. It is also possible that countries with environmental conditions that generate a productivity advantage for male workers—and thus lower labor demand for women—develop more complex cuisines because women have more time available to innovate in cooking. Similarly, places with a higher cooking time might be places with the worst gender attitudes or gender norms that manifested in favoring foods that are time-intensive and, since there is inertia in tastes (Atkin, 2013), we still see the same recipes and food in those countries. This results in reverse causality and the overestimation of the negative effects of cuisine complexity on labor market outcomes.

Moreover, places with more favorable environmental conditions for diverse spices have also been historically associated with greater colonial presence to capture high-value spice trade rents (Findlay and O'Rourke, 2007; Chaudhuri, 1978; Acemoglu, Johnson and Robinson, 2001; Dell, 2010). At the same time, colonial institutions have been found to introduce gender-biased economic structures and norms that affected contemporary women's labor force participation (Boserup, 1970; Acemoglu, Johnson and Robinson, 2001; Iyer, 2010; Alesina, Giuliano and Nunn, 2013; Jayachandran, 2021). This could lead to an overestimation of the cuisine complexity effect on women's labor force participation. Finally, measurement error may arise because the set of recipes in our data may not perfectly represent the meals households typically prepare at home, leading to attenuation bias.

We propose an identification strategy that includes control variables capturing countries' economic conditions and institutional characteristics, and exploits plausibly exogenous variation in cuisine complexity arising from the flavor-profile versatility of native

spices. Our set of control variables and the instrumental variable we propose are described in detail below.

### V.C.1 Control Variables

We include in our specifications a battery of controls capturing geographic and economic characteristics of the countries that can influence both labor market conditions and cuisine complexity, as well as differences across countries in the quality of data available.

First, we control for the number of recipes and native ingredients identified in each country and for period of data collection. These variables account for the accuracy of the recipe and flavor–compound information used to measure cuisine complexity, as well as for time-specific factors that may have influenced survey responses in each country. Second, we include region fixed effects, GDP per capita, average trade distance,<sup>4</sup> and dummy variables for the country’s predominant climate zone to account for overall economic conditions and potential productivity that might determine labor demand in each country.

We further control for variables capturing countries’ agro-climatic conditions, accessibility, and other location specific factors that have been considered in previous work as relevant determinants of economic development ([Acemoglu, Johnson and Robinson, 2002](#); [Putterman and Weil, 2010](#); [Alsan, 2015](#); [Ashraf and Galor, 2013](#); [Nunn and Puga, 2012](#); [Galor and Özak, 2016](#)). These variables include altitude, annual precipitation, average soil pH, mean temperature, absolute latitude, and longitude, terrain roughness, a landlocked indicator, and the distance to the nearest coast or navigable river. Finally, to account for the potential correlation between spice use and colonial history, we include a measure of the duration of colonial rule for countries that were ever colonized, and assign a value of zero otherwise.

This set of controls helps us isolate the effect of cuisine complexity on labor market outcomes, conditional on countries’ potential labor demand and level of economic development. Moreover, by examining the stability of the coefficient estimates as we progres-

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<sup>4</sup>Average trade distance is defined as the sum of the ingredient-distance weights described in section V.C.2.

sively introduce these controls, we assess the potential for omitted variable bias in our estimates (Oster, 2019).

In additional specifications, we also include individual- and household specific controls such as educational attainment, household size, and household income. Although these variables might themselves be shaped by gender norms, the robustness of our results to the inclusion of these controls might be informative of the potential mechanisms driving our estimated effects.

## V.C.2 Instrumental Variable

We construct an instrumental variable based on the flavor versatility of native spices. The idea is to combine native ingredient suitability at the country-level with exogenous ingredient-level chemical composition data. Following the work on food chemistry, we use a measure of flavor versatility based on shared flavor molecules between ingredient pairs, which has been shown to predict the combinations of ingredient pairs used in recipes around the world (Ahn et al., 2011; Briscione and Parkhurst, 2018). The instrument is constructed as follows.

For each native spice  $k$  and ingredient  $j$  in  $P(k)$ , the set of all ingredients in our dataset, we compute the common flavor score  $c_{j,k}$ , defined as the number of shared flavor molecules between the native spice and paired ingredient.<sup>5</sup> The spice versatility score  $S_{i,k}$  for a country  $i$  and native spice  $k$  is defined as:

$$S_{i,k} = \sum_{j \in P(k)} c_{j,k} w_{i,j} \quad (8)$$

where  $w_{i,j} = 1$  if the paired ingredient  $j$  is native, or  $w_{i,j} \in (0, 1)$  if the paired ingredient is non-native.

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<sup>5</sup>There are on average 179 native spice-ingredient pairs per country. See section IV.B for more details on the data.

$$w_{i,j} = \begin{cases} 1, & \text{if ingredient } j \text{ is native in country } i, \\ \frac{1}{1 + \frac{\text{dist}_{i,j}}{h}}, & \text{if ingredient } j \text{ is non-native in country } i. \end{cases} \quad (9)$$

The distance weight  $w_{i,j}$  is computed using the distance  $\text{dist}_{i,j}$  between the capital of country  $i$  and the capital of the closest native origin country of ingredient  $j$ . This represents the well-established negative relationship between distance and trade, where the elasticity with regards to distance is typically close to -1 (Baier, Kerr and Yotov, 2018).<sup>6</sup> We use the capital as the reference location in a country, because capitals are typically hubs of population density and cultural influence, and research has found that innovations in capital cities and larger towns tend to diffuse over wider distances (Bokányi et al., 2022). Here, capitals function as entry points for new ingredients and as centers from which culinary practices diffuse to the rest of the country.

To make the distance measure scale free,  $\text{dist}_{i,j}$  is divided by a half-life parameter  $h$ , which in our baseline specification is set to 2000 km. Under this specification, the influence of an ingredient declines by 50 percent with each additional 2000 km between country  $i$  and the closest native origin of ingredient  $j$ . This follows the standard “half-life” exponential decay formulation widely used in the international trade and technology diffusion literatures (Eaton and Kortum, 2002; Keller, 2002; Lychagin et al., 2016).<sup>7</sup>

The final versatility score  $V_i$  for each country  $i$  is defined as the average spice score of its  $N_i$  native spices.<sup>8</sup>

$$V_i = \frac{1}{N_i} \sum_{k=1}^{N_i} S_{i,k} \quad (10)$$

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<sup>6</sup>The formulation of our distance weight is consistent with this literature, since the exponent on  $\text{dist}_{i,j}$  is -1.

<sup>7</sup>2000 km represents roughly the distance from Delhi to Tehran, or Istanbul to Paris. In robustness checks we vary the half-life measure to 3000 km and find similar results, see Tables B4 and B5

<sup>8</sup>In our ingredient suitability data, 104 countries are listed as having at least one native spice and are included in the IV sample.

This instrument contains both an endogenous and an exogenous component. The endogenous component is the sum of ingredient-distance weights  $w_{i,j}$  in (5), which operates similarly to the exposure-share term in a shift-share (Bartik-type) instrument (Borusyak, Hull and Jaravel, 2022). Countries with larger weights are more centrally positioned in the trade network, which may itself influence economic development and therefore must be treated as potentially endogenous. The exogenous component, in contrast, arises from the distribution of common flavor molecules between ingredients and functions as an exogenous “shock” that is plausibly orthogonal to country-level characteristics. Following Borusyak, Hull and Jaravel (2022), we therefore explicitly control for the sum of exposure shares in our main specifications to isolate the causal effect of interest.

Our identification assumption is then that conditional on countries’ overall agricultural potential, the variation in native spices versatility is orthogonal to economic development and labor-market conditions, since it relates to the chemical complementarity of the basket of goods that are available in a country.

## VI Results

### VI.A Labor Force Participation

Table II presents the OLS estimates of Equation (7) when using an indicator for labor force participation as dependent variable. Panel A presents the results for all adult women in our data. Column 1 shows that in our baseline specification there is a negative relationship between the cuisine complexity and female labor force participation. This relationship is stronger for married and cohabiting women, as shown in Panel B. Columns 3 to 5 show that the negative relationship remains in more stringent specifications that include a broader set of control variables. Panels C and D show a negative but smaller in magnitude coefficient for men. This heterogeneity in the coefficient estimates across gender implies a wider gender gap in places with higher cuisine complexity. In Appendix Section C, we show that this effect on the gender gap also holds in a specification that pool all observations and includes country fixed effects.

Table III reports our instrumental variable estimates, for which first-stage results are presented in Appendix Table B2. As before, Panel A shows results for all women, and Panel B focuses on married or cohabiting women. Consistent with the possibility that the OLS estimates understate the true effects, the IV coefficients are larger in magnitude. In contrast, the coefficient estimates for men become positive, close to zero, and lose statistical significance. Overall, the estimates remain broadly stable across specifications, providing validating evidence for our instrumental variable.

In column 5, the most stringent specification with the full set of country-level controls, the coefficient estimate implies that a one-SD increase in cuisine complexity reduces the likelihood of labor force participation among married or cohabiting women by about 14 percentage points. This effect corresponds to a 25% reduction in average labor force participation.

Column 6 shows that the negative effect of cuisine complexity on married or cohabiting women persists even after controlling for individual- and household-level characteristics that influence labor force participation and may themselves be shaped by gender norms—specifically, educational attainment, household size, and household income. Including these controls reduces the estimated effect of complexity on labor force participation among married or cohabiting women by nearly 23%.

The extent to which the remaining effect can be interpreted as a direct impact of cuisine complexity—rather than one mediated through these variables—depends on their correlation with unobserved determinants of labor force participation (Deuchert and Huber, 2017). Because these controls are likely correlated with such unobservables, we are cautious in interpreting the results as evidence on underlying mechanisms. Nonetheless, the persistence of a negative and statistically significant effect is informative about the robustness of the relationship.

## VI.B Other Labor Market Outcomes

We examine whether cuisine complexity affects labor market outcomes beyond labor force participation. Table IV reports the IV estimates for the sample of women who participate

in the labor market. Panels A and B use as dependent variable an indicator for full-time employment—either self-employment or wage employment—while Panels C and D focus specifically on full-time wage employment. We find negative, but imprecisely estimated effects of cuisine complexity on the likelihood of full-time employment. Again, Appendix Table B3 shows statistically insignificant effects of these outcomes for men.

## VI.C Mechanisms

The theoretical framework in Section III highlights women’s specialization in cooking within the household as the mechanism through which cuisine complexity reduces female labor force participation. We now examine whether we find evidence consistent with this mechanism. Table V reports the IV estimates for the number of meals cooked over the past week (Panels A and B) and for indicator variables capturing whether the spouse cooked at home in the past week (Panels C and D), for married or cohabiting women and men, respectively.

Consistent with a pattern of specialization in cooking by women, the results show that complexity in local recipes reduces the number of meals cooked by men and lowers the likelihood that women’s partners cook at home, while increasing the likelihood that men’s partners do so. Interestingly, we find no effect on the number of meals cooked by women. Taken together with the decline in men’s cooking, this suggests that women’s involvement in meal preparation remains relatively constant, in the extensive margin. While in the intensive margin, any additional cooking tends to be supplied—or withdrawn—by men, which ultimately shapes the extent to which women can free up time to participate in the labor force. Consistent with our model, the results suggest that this is more likely in places with less complex cuisines, that have lower requirements in terms of cooking specific human capital.

## VI.D Robustness

We conduct several robustness checks to our main results. First, we construct an alternative instrumental variable with a half-life value of 3,000 km. Appendix Tables [B4](#) and [B5](#) show that our results are robust to this alternative calculation of the IV.

Second, we estimate the results for the sample of respondents between 15 and 55 years of age to rule out that our results are driven by differences in the likelihood of being a full-time student or retired. Appendix table [B6](#) shows that our main results also hold for this sample.

## VII Conclusion

Across diverse settings, the burden of daily meal production is reflected in the metaphors that encode gender norms: India's "patriarchy of roti", Japan's "inside sphere" West Africa's "economy of the pot" Mexico's "slavery of the kitchen" and France's "tyranny of the daily meal." Despite their cultural variation, these expressions describe a common institution that systematically structures women's time. Together, they underscore a shared economic reality in which societies assign food preparation to women, generating inflexible time constraints we show have a significant role to play in explaining the realized labor force participation rates for women relative to men across the world.

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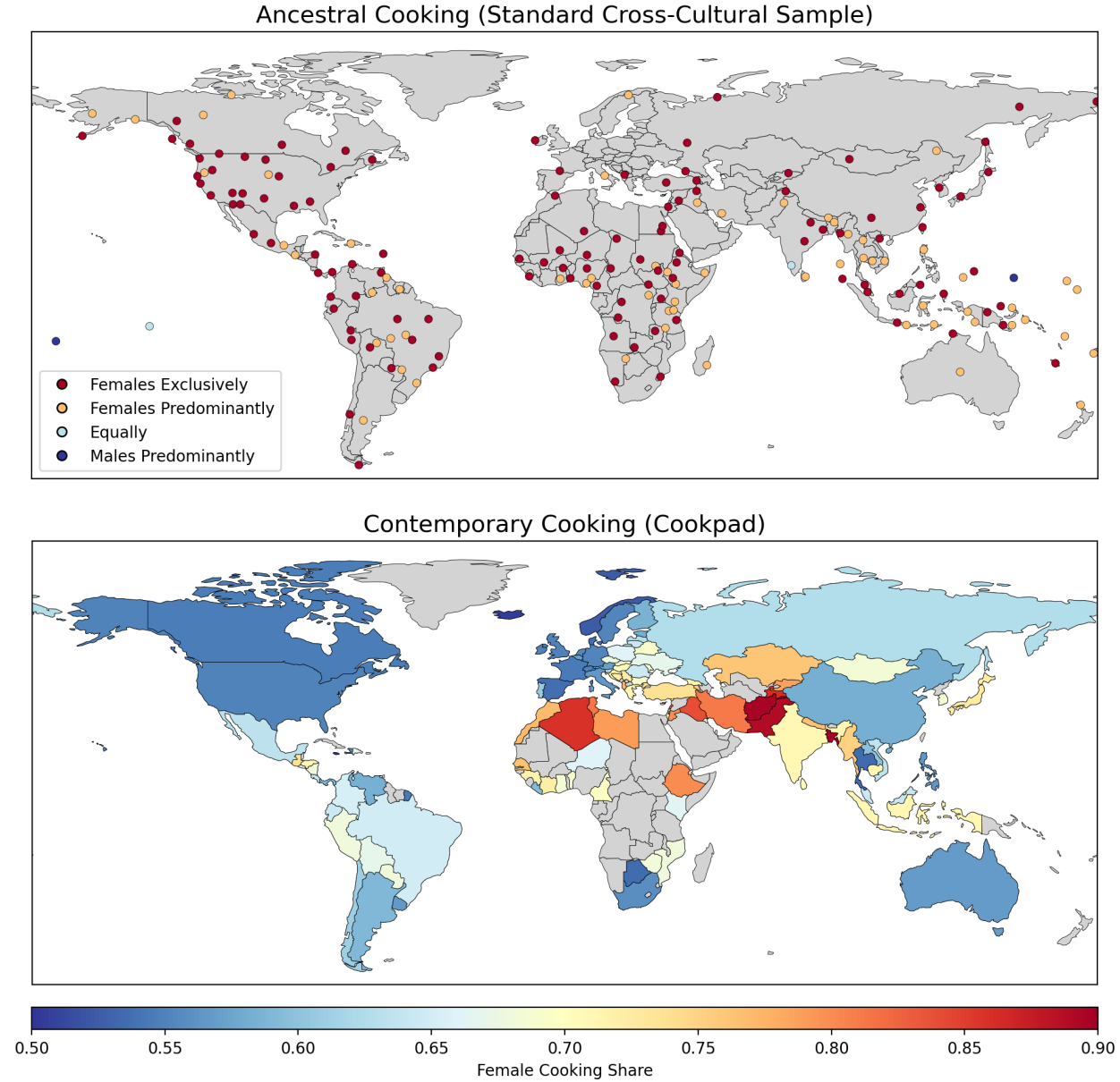
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# Figures and Tables

Figure I: Ancestral and Contemporary Labor Division of Cooking



Note: The top panel shows the distribution of the variable *Food Preparation: Cooking (sexual division of labor)* from the Standard Cross-Cultural Sample (Murdock and White, 1969) for 186 ancestral societies around the world. The bottom panel represents the share of total meals cooked by women according to the Cookpad survey data.

Table I: Descriptive statistics

	Mean	SD	Median	Min	Max
<i>Panel A. Cuisine complexity</i>					
Cuisine Complexity Index	0.00	1.00	-0.14	-3.49	3.57
Cooking time	72.55	207.09	40.00	5.00	21605.00
Number of ingredients	9.46	4.00	9.00	1.00	53.00
Number of spices	2.24	2.21	2.00	0.00	21.00
Countries	138				
Observations	77722				
	Total	Female		Male	
	Mean	Mean	SD	Mean	SD
<i>Panel B. Labor Market</i>					
Female	0.54				
Age	44.09	44.53	18.65	43.58	18.29
Labor Force Participation	0.60	0.52	0.50	0.71	0.46
Employed full-time	0.66	0.61	0.49	0.70	0.46
Employed full-time for employer	0.46	0.44	0.50	0.48	0.50
Number of meals cooked	6.50	8.79	4.75	3.86	4.67
Spouse cooked	0.62	0.36	0.48	0.90	0.30
Household size	3.63	3.59	2.44	3.68	2.59
<i>Religion</i>					
Christian	0.53	0.56	0.50	0.49	0.50
Islam	0.23	0.21	0.41	0.25	0.43
Other	0.19	0.16	0.37	0.22	0.41
<i>Education</i>					
Elementary education	0.28	0.30	0.46	0.26	0.44
Secondary education	0.52	0.50	0.50	0.53	0.50
4 years education beyond high school	0.20	0.19	0.39	0.20	0.40
Other	0.01	0.01	0.08	0.00	0.07
Countries	89	89		89	
Observations	193624	103890		89734	

*Notes:* This table reports summary statistics for cuisine complexity and labor market variables. Cuisine-related measures are constructed using recipe data, while labor market variables are derived from the Cookpad dataset. The recipe sample covers 138 countries, comprising a total of 77,722 recipes. Labor market statistics are reported for the 74 countries included in the regression analysis. Although the Cookpad dataset contains information for 109 countries, versatility measures can only be computed for 74 countries, as these are the only countries for which native spices are identified. In the labor market sample, 39.63% of respondents are out of the workplace.

Table II: Labor Force Participation, OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Cuisine complexity	-0.074*** (0.025)	-0.087*** (0.025)	-0.087*** (0.024)	-0.101*** (0.028)	-0.100*** (0.027)	-0.064*** (0.019)
Mean dep. var.	0.517	0.516	0.514	0.514	0.514	0.511
Observations	103,890	101,741	100,462	100,462	100,462	94,915
<i>Panel B. Married or cohabiting women</i>						
Cuisine complexity	-0.089*** (0.032)	-0.109*** (0.031)	-0.109*** (0.031)	-0.116*** (0.036)	-0.113*** (0.032)	-0.080*** (0.022)
Mean dep. var.	0.545	0.544	0.543	0.543	0.543	0.539
Observations	58,083	56,824	56,373	56,373	56,373	52,283
<i>Panel C. All men</i>						
Cuisine complexity	-0.040* (0.023)	-0.056** (0.023)	-0.055** (0.023)	-0.063*** (0.023)	-0.066*** (0.024)	-0.045** (0.021)
Mean dep. var.	0.706	0.705	0.704	0.704	0.704	0.705
Observations	89,734	87,777	86,976	86,976	86,976	82,082
<i>Panel D. Married or cohabiting men</i>						
Cuisine complexity	-0.037 (0.023)	-0.051** (0.023)	-0.050** (0.024)	-0.056** (0.025)	-0.059** (0.025)	-0.035 (0.024)
Mean dep. var.	0.741	0.742	0.741	0.741	0.741	0.743
Observations	53,066	51,859	51,526	51,526	51,526	48,089
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is an indicator variable for labor force participation. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table III: Labor Force Participation, IV Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Cuisine complexity	-0.276*** (0.091)	-0.248*** (0.070)	-0.249*** (0.069)	-0.229*** (0.064)	-0.237*** (0.064)	-0.137** (0.063)
Mean dep. var.	0.517	0.516	0.514	0.514	0.514	0.511
Observations	103,890	101,741	100,462	100,462	100,462	94,915
First stage F-statistic	9.403	13.568	13.421	21.379	16.344	12.817
<i>Panel B. Married or cohabiting women</i>						
Cuisine complexity	-0.363*** (0.095)	-0.318*** (0.073)	-0.317*** (0.073)	-0.287*** (0.074)	-0.281*** (0.075)	-0.193*** (0.068)
Mean dep. var.	0.545	0.544	0.543	0.543	0.543	0.539
Observations	58,083	56,824	56,373	56,373	56,373	52,283
First stage F-statistic	13.688	18.788	18.577	24.812	17.633	14.229
<i>Panel C. All men</i>						
Cuisine complexity	0.232 (0.148)	0.211* (0.116)	0.212* (0.120)	0.073 (0.076)	0.040 (0.073)	0.139 (0.092)
Mean dep. var.	0.706	0.705	0.704	0.704	0.704	0.705
Observations	89,734	87,777	86,976	86,976	86,976	82,082
First stage F-statistic	6.811	9.351	9.175	18.087	12.509	10.133
<i>Panel D. Married or cohabiting men</i>						
Cuisine complexity	0.194* (0.107)	0.190** (0.093)	0.189** (0.095)	0.039 (0.067)	0.022 (0.066)	0.130 (0.088)
Mean dep. var.	0.741	0.742	0.741	0.741	0.741	0.743
Observations	53,066	51,859	51,526	51,526	51,526	48,089
First stage F-statistic	9.597	12.723	12.463	20.304	13.745	10.870
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is an indicator variable for labor force participation. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table IV: Other Labor Market Outcomes, Women, IV Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Employed full-time, all working women</i>						
Cuisine complexity	-0.569 (0.421)	-0.479 (0.318)	-0.488 (0.333)	-0.038 (0.106)	-0.060 (0.106)	-0.012 (0.113)
Mean dep. var.	0.610	0.606	0.609	0.609	0.609	0.606
Observations	53,735	52,496	51,673	51,673	51,673	48,472
First stage F-statistic	3.103	4.626	4.582	19.781	14.646	14.144
<i>Panel B. Employed full-time, married or cohabiting working women</i>						
Cuisine complexity	-0.600 (0.369)	-0.511* (0.288)	-0.514* (0.301)	-0.064 (0.100)	-0.082 (0.102)	-0.049 (0.109)
Mean dep. var.	0.636	0.633	0.635	0.635	0.635	0.631
Observations	31,634	30,904	30,615	30,615	30,615	28,158
First stage F-statistic	5.094	7.001	6.943	24.165	17.146	15.816
<i>Panel C. Employed full-time for employer, all working women</i>						
Cuisine complexity	-0.054 (0.178)	-0.069 (0.151)	-0.062 (0.156)	0.198* (0.102)	0.158 (0.115)	0.210* (0.120)
Mean dep. var.	0.438	0.432	0.435	0.435	0.435	0.437
Observations	53,735	52,496	51,673	51,673	51,673	48,472
First stage F-statistic	3.103	4.626	4.582	19.781	14.646	14.144
<i>Panel D. Employed full-time for employer, married or cohabiting working women</i>						
Cuisine complexity	-0.078 (0.157)	-0.071 (0.134)	-0.065 (0.140)	0.170* (0.088)	0.148 (0.110)	0.194* (0.115)
Mean dep. var.	0.442	0.436	0.437	0.437	0.437	0.440
Observations	31,634	30,904	30,615	30,615	30,615	28,158
First stage F-statistic	5.094	7.001	6.943	24.165	17.146	15.816
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

Notes: The dependent variable is an indicator for full-time employment in Panels A and B, while in Panels C and D it is an indicator for full-time wage employment. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \*p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Table V: Specialization in Household Cooking, IV Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Dependent variable: Number of meals cooked, married or cohabiting women</i>						
Cuisine complexity	0.459 (0.709)	0.496 (0.637)	0.526 (0.617)	-0.294 (0.643)	-0.727 (0.854)	-1.695* (1.017)
Mean dep. var.	9.699	9.720	9.705	9.705	9.705	9.656
Observations	58,083	56,824	56,373	56,373	56,373	52,283
First stage F-statistic	13.688	18.788	18.577	24.812	17.633	14.229
<i>Panel B. Dependent variable: Number of meals cooked, married or cohabiting men</i>						
Cuisine complexity	-6.250** (2.525)	-5.692*** (2.117)	-5.637*** (2.133)	-3.150*** (1.037)	-3.427*** (1.133)	-4.046*** (1.393)
Mean dep. var.	3.424	3.441	3.433	3.433	3.433	3.247
Observations	53,066	51,859	51,526	51,526	51,526	48,089
First stage F-statistic	9.597	12.723	12.463	20.304	13.745	10.870
<i>Panel C. Dependent variable: Spouse cooked, married or cohabiting women</i>						
Cuisine complexity	-0.288** (0.122)	-0.273** (0.107)	-0.264** (0.107)	-0.228** (0.094)	-0.207* (0.109)	-0.247* (0.131)
Mean dep. var.	0.358	0.358	0.358	0.358	0.358	0.354
Observations	55,922	54,689	54,243	54,243	54,243	50,457
First stage F-statistic	13.845	18.855	18.639	24.582	17.594	14.053
<i>Panel D. Dependent variable: Spouse cooked, married or cohabiting men</i>						
Cuisine complexity	0.139** (0.066)	0.133** (0.059)	0.133** (0.058)	0.036 (0.031)	0.052* (0.030)	0.070** (0.036)
Mean dep. var.	0.903	0.902	0.903	0.903	0.903	0.909
Observations	50,921	49,737	49,410	49,410	49,410	46,294
First stage F-statistic	9.720	12.870	12.611	20.147	13.660	10.723
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

Notes: The dependent variable is the number of meals cooked over the past week in Panels A and B, while in Panels C and D it is an indicator capturing whether the spouse cooked at home in the past week. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \*p<0.1, \*\*p<0.05, \*\*\*p<0.01.

# Online Appendix for “The Burden of Putting Food on the Table: Cuisine Complexity and Women’s Labor Force Participation”

## A Model Derivations and Extensions

### A.1 Proofs and Derivations

Household utility maximization can be written as

$$\begin{aligned}
 \max_{\{Y_1, Y_2, F_1, F_2, C_{m,1}, C_{f,1}, C_{m,2}, C_{f,2}\}} \mathcal{L} = & U(Y_1, F_1) + \delta U(Y_2, F_2) \\
 & + \sum_{t=1}^2 \lambda_t \left( Y_t - [(\alpha_t + 1)T - \alpha_t C_{m,t} - C_{f,t}] \right) \\
 & + \sum_{t=1}^2 \mu_t \left( F_t - \left[ (H_{m,t}^{\theta(\chi)} C_{m,t})^\rho + (H_{f,t}^{\theta(\chi)} C_{f,t})^\rho \right]^{1/\rho} \right) \\
 & + \sum_{g \in \{m, f\}} \eta_g \left( H_{g,2} - \bar{H} - \phi C_{g,1} \right) + \sum_{g \in \{m, f\}} \xi_g \left( H_{g,1} - \bar{H} \right).
 \end{aligned} \tag{A1}$$

**Proof of Proposition 1.** We analyze the optimal allocation of cooking time  $\{C_{m,t}, C_{f,t}\}$  in both periods, starting with period 2.

*Period 2 (Static Optimization):* In the second period, there is no future benefit to accumulating human capital. The household maximizes period 2 utility given the accumulated stocks  $H_{m,2}$  and  $H_{f,2}$ . To maximize utility in this period, the household equates the ratio of marginal cooking products to the ratio of opportunity costs (wages).

The marginal product of cooking time  $C_{g,2}$  in the CES production function is:

$$\frac{\partial F_2}{\partial C_{g,2}} = F_2^{1-\rho} \cdot H_{g,2}^{\theta\rho} \cdot C_{g,2}^{\rho-1}.$$

Taking the ratio of the first-order conditions for  $C_{m,2}$  and  $C_{f,2}$  eliminates common terms and yields

$$\frac{\partial F_2 / \partial C_{m,2}}{\partial F_2 / \partial C_{f,2}} = \frac{\alpha_2}{1} \implies \frac{H_{m,2}^{\theta\rho} C_{m,2}^{\rho-1}}{H_{f,2}^{\theta\rho} C_{f,2}^{\rho-1}} = \alpha_2.$$

Rearranging for the ratio of cooking times yields:

$$\frac{C_{f,2}}{C_{m,2}} = \alpha_2^{\frac{1}{1-\rho}} \left( \frac{H_{f,2}}{H_{m,2}} \right)^{\frac{\theta\rho}{1-\rho}}. \quad (\text{A2})$$

Since  $\rho < 1$ , the exponent  $\frac{1}{1-\rho}$  is positive. Thus,  $\frac{\partial(C_{f,2}/C_{m,2})}{\partial\alpha_2} > 0$ .

*Period 1 (Dynamic Optimization):* Here, the household optimizes cooking and labor allocation in period 1 taking into account their effects on discounted utility in period 2.

To capture the dynamic structure, we define the period 2 value function as

$$V_2(H_{m,2}, H_{f,2}) \equiv \max_{C_{m,2}, C_{f,2}} \{ \ln Y_2 + w_c \ln F_2 \},$$

subject to the period 2 budget constraint and food production technology. Because  $\ln Y_2 + w_c \ln F_2$  is concave in cooking time for  $\rho < 1$ , the value function  $V_2$  is concave and increasing in  $(H_{m,2}, H_{f,2})$ .

In period 1, the household internalizes the effect of current cooking time on period 2 human capital, given by  $H_{g,2} = \bar{H} + \phi C_{g,1}$ . The first-order condition for spouse  $g$  equates the marginal utility cost of cooking time (the foregone wage) to the sum of the current marginal utility gain from cooking and the discounted marginal value of additional cooking human capital:

$$\text{MC}_g = \underbrace{w_c \frac{1}{F_1} \frac{\partial F_1}{\partial C_{g,1}}}_{\text{current benefit}} + \underbrace{\delta \phi \frac{\partial V_2}{\partial H_{g,2}}}_{\text{future benefit}} \equiv \text{MB}(C_{g,1}).$$

Here,  $V_2$  denotes the period 2 value function. The marginal utility cost of cooking time equals  $\text{MC}_m = \alpha_1$  for the man and  $\text{MC}_f = 1$  for the woman, up to the common factor  $1/Y_1$ ,

which cancels when taking ratios. Let  $MB_{g,1}$  denote the total marginal benefit of cooking time for spouse  $g$ .

Since at  $t = 1$  human capital is identical across genders ( $H_{m,1} = H_{f,1} = \bar{H}$ ), the functional forms of the marginal benefits are symmetric: if  $C_{m,1} = C_{f,1}$ , then  $MB_m = MB_f$ .

The ratio of the first-order conditions is:

$$\frac{MB_m(C_{m,1})}{MB_f(C_{f,1})} = \frac{\alpha_1}{1}.$$

Suppose, for contradiction, that  $\alpha_1 > 1$  but  $C_{f,1} \leq C_{m,1}$ . Because  $MB_g(C_{g,1})$  is decreasing in own cooking time and the problem is symmetric at  $t = 1$ , this implies  $MB_f(C_{f,1}) \geq MB_m(C_{m,1})$ , so that  $MB_m/MB_f \leq 1$ . However, the first-order condition requires  $MB_m/MB_f = \alpha_1 > 1$ , a contradiction. Therefore,  $C_{f,1} > C_{m,1}$ . Moreover, since  $MB_m/MB_f$  is strictly decreasing in  $C_{m,1}/C_{f,1}$ , an increase in  $\alpha_1$  implies an increase in  $C_{f,1}/C_{m,1}$ .

Note that when the discount factor  $\delta \rightarrow 0^+$ , such as when contrasting a historical and modern period, the household places little weight on the future returns to cooking-specific human capital. In this case, period 1 behavior approximates the static allocation derived for period 2.

**Proof of Proposition 2.** The first order conditions with respect to  $C_{m,2}$  and  $C_{f,2}$  imply

$$\frac{\partial \mathcal{L}}{\partial C_{m,2}} = \lambda_2 \alpha_2 - \mu_2 \frac{\partial F_2}{\partial C_{m,2}} = 0. \quad (\text{A3})$$

$$\frac{\partial \mathcal{L}}{\partial C_{f,2}} = \lambda_2 - \mu_2 \frac{\partial F_2}{\partial C_{f,2}} = 0. \quad (\text{A4})$$

From Equation (5)

$$\begin{aligned} \frac{\partial F_2}{\partial C_{m,2}} &= \left[ (H_{m,2}^{\theta(x)} C_{m,2})^\rho + (H_{f,2}^{\theta(x)} C_{f,2})^\rho \right]^{1/\rho-1} H_{m,2}^{\theta(x)\rho} C_{m,2}^{\rho-1} \\ \frac{\partial F_2}{\partial C_{f,2}} &= \left[ (H_{m,2}^{\theta(x)} C_{m,2})^\rho + (H_{f,2}^{\theta(x)} C_{f,2})^\rho \right]^{1/\rho-1} H_{f,2}^{\theta(x)\rho} C_{f,2}^{\rho-1}. \end{aligned}$$

Substituting into (A3) and (A4), and rearranging yields

$$\frac{C_{f,2}}{C_{m,2}} = \alpha_2^{\frac{1}{1-\rho}} \left( \frac{H_{f,2}}{H_{m,2}} \right)^{\frac{\theta(\chi)\rho}{1-\rho}}, \quad (\text{A5})$$

With  $\alpha_2 = 1$

$$\frac{C_{f,2}}{C_{m,2}} = \left( \frac{H_{f,2}}{H_{m,2}} \right)^{\frac{\theta(\chi)\rho}{1-\rho}},$$

From Proposition 1,  $\alpha_1 > 1$  implies  $C_{f,1} > C_{m,1}$ , thus by human capital accumulation (6),  $H_{f,2} > H_{m,2}$ , and  $C_{f,2} > C_{m,2}$ .

**Proof of Proposition 3.** From expression in (A5) we can write the elasticity of that ratio of cooking time with respect to human capital at time  $t = 2$ , as

$$\epsilon = \frac{\partial \ln\left(\frac{C_{f,2}}{C_{m,2}}\right)}{\partial \ln\left(\frac{H_{f,2}}{H_{m,2}}\right)} = \frac{\theta(\chi)\rho}{1-\rho}.$$

Thus,

$$\frac{\partial \epsilon}{\partial \theta(\chi)} = \frac{\rho}{1-\rho} > 0$$

## A.2 Model Extension: Food Production with Simple and Complex Tasks

### A.2.1 Setup

There are two periods  $t \in \{1, 2\}$ . A household consists of a man  $m$  and a woman  $f$ . With equal bargaining power, each period total household utility is the sum of individual utilities:  $U_t = \frac{1}{2}u_{m,t} + \frac{1}{2}u_{f,t}$ . Both spouses derive utility from household income  $Y_t$  and food quality  $F_t$ . Individual utility functions take the form:

$$u_{m,t} = \ln(Y_t/2) + w_c \ln(F_t), \quad (\text{A6})$$

$$u_{f,t} = \ln(Y_t/2) + w_c \ln(F_t), \quad (\text{A7})$$

where  $0 \leq w_c \leq 1$  measures the relative weight placed on food quality.

In each period, each spouse  $g \in \{m, f\}$  has time endowment  $T > 0$  that allocates between paid labor  $L_{g,t}$  and cooking  $C_{g,t}$ , with an individual time constraint:

$$L_{g,t} + C_{g,t} = T, \quad 0 \leq C_{g,t} \leq T. \quad (\text{A8})$$

Household income in period  $t$  is determined by the time each member allocates to paid labor, with wages  $\beta_{g,t}$  that vary across genders. Let  $\alpha_t = \frac{\beta_{m,t}}{\beta_{f,t}}$  the gender wage gap at period  $t$  and assume that there are no financial markets, so the household cannot transfer income across periods. Thus, household budget constraint in period  $t$  is:

$$Y_t = \alpha_t L_{m,t} + L_{f,t} = (\alpha_t + 1)T - \alpha_t C_{m,t} - C_{f,t}, \quad \alpha_t \geq 1. \quad (\text{A9})$$

### A.2.2 Food production with simple and complex tasks

Food quality is produced within the household using cooking time allocated by each household member across two types of tasks: simple tasks and complex tasks. Simple

tasks correspond to routine activities that can be automated using appliances, while complex tasks are skill-intensive and rely on cooking-specific human capital.

Each household member  $g \in \{m, f\}$  allocates cooking time  $C_{g,t}$  between simple and complex tasks:

$$C_{g,t} = C_{g,t}^S + C_{g,t}^K. \quad (\text{A10})$$

Simple-task output is produced using cooking technology  $A_t$ :

$$S_{g,t} = A_t C_{g,t}^S. \quad (\text{A11})$$

Complex-task output is produced using cooking-specific human capital  $H_{g,t}$ :

$$K_{g,t} = H_{g,t} C_{g,t}^K. \quad (\text{A12})$$

Cuisine requires a combination of simple and complex tasks. The effective cooking input provided by household member  $g$  is given by a Cobb–Douglas structure:

$$Z_{g,t} = (S_{g,t})^{1-\kappa} (K_{g,t})^\kappa, \quad \kappa \in (0, 1). \quad (\text{A13})$$

The parameter  $\kappa$  measures cuisine complexity. A higher  $\kappa$  implies that complex, skill-intensive tasks are more important in food production.

Substituting (A11) and (A12) into (A13) yields

$$Z_{g,t} = A_t^{1-\kappa} H_{g,t}^\kappa (C_{g,t}^S)^{1-\kappa} (C_{g,t}^K)^\kappa. \quad (\text{A14})$$

Given total cooking time  $C_{g,t}$ , the optimal intra-task allocation satisfies

$$\frac{C_{g,t}^K}{C_{g,t}} = \kappa, \quad \frac{C_{g,t}^S}{C_{g,t}} = 1 - \kappa. \quad (\text{A15})$$

Substituting back, effective cooking input can be written as

$$Z_{g,t} = \tilde{H}_{g,t} C_{g,t}, \quad \tilde{H}_{g,t} = A_t^{1-\kappa} H_{g,t}^\kappa. \quad (\text{A16})$$

Thus, cuisine complexity determines the relative importance of cooking technology and cooking-specific human capital in effective productivity.

Household food quality is produced by aggregating effective cooking inputs using a CES technology:

$$F_t = \left[ (\tilde{H}_{m,t} C_{m,t})^\rho + (\tilde{H}_{f,t} C_{f,t})^\rho \right]^{1/\rho}, \quad \rho < 1. \quad (\text{A17})$$

The stock of cooking-specific human capital in period 1 is exogenous and identical across genders:

$$H_{m,1} = H_{f,1} = \bar{H}.$$

In period 2, human capital is accumulated through experience in complex cooking tasks:

$$H_{g,2} = \bar{H} + \phi C_{g,1}^K = \bar{H} + \phi \kappa C_{g,1}, \quad \phi > 0. \quad (\text{A18})$$

### A.2.3 Household utility maximization

The household chooses the time allocation that maximizes the discounted sum of instant utility functions  $U_t$  subject to its time, income, and cooking technology constraints. With a time discount factor  $\delta$ , the household maximization problem is

$$\max_{\{C_{m,1}, C_{f,1}, C_{m,2}, C_{f,2}\}} U_1 + \delta U_2, \quad \delta \in (0, 1),$$

subject to equations [A8](#) to [A18](#).

**Proposition A1** (Female share of cooking). *In any interior solution, the female share of cooking*

is increasing in the contemporaneous wage gap:

$$\frac{\partial}{\partial \alpha_t} \left( \frac{C_{f,t}}{C_{m,t}} \right) > 0,$$

*Proof see section A.2.4*

Intuitively,  $\alpha_t$  captures gender differences in the opportunity cost of cooking. A higher  $\alpha_t$  increases man's relative cost of cooking and thus induces a larger allocation of cooking time toward the woman.

**Proposition A2** (Inequality persistence). *A wage gap in favor of the man in period 1 leads to an unequal allocation of cooking time in period 2, with the woman bearing a larger share.*

*Proof see Section A.2.4.*

Proposition 2 implies that even if wages equalize in period 2, cooking time does not. As shown in Proposition A1, a positive wage gap in period 1 induces the woman to allocate more time to cooking, leading her to accumulate more cooking-specific human capital. This, in turn, raises her marginal benefit of cooking in period 2, sustaining an unequal allocation of cooking time.

**Proposition A3** (Cuisine complexity). *Higher cuisine complexity  $\kappa$  amplifies the effect of differences in cooking-specific human capital on the gender allocation of cooking time.*

*Proof see Section A.2.4.*

Cuisine complexity increases the marginal return to cooking-specific human capital. Because women accumulate more cooking human capital in period 1 due to the wage differential, they bear a larger cooking burden in period 2 even if wages equalize, with this effect becoming stronger with higher cuisine complexity. The resulting increase in cooking time also reduces women's allocation of time to paid labor as cuisine complexity increases.

If cooking-specific human capital is transmitted across generations by gender, the results of this two-period model extend naturally to a multi-period setting. In such an environment, an initial productivity advantage for men can generate persistent gender roles in

the intra-household allocation of labor, even after economic development eliminates these productivity differences.

**Proposition A4** (Technology and complexity). *An increase in cooking technology  $A_t$  raises effective cooking productivity. The magnitude of this effect is decreasing in cuisine complexity  $\kappa$ . Consequently, the impact of improvements in cooking technology on the gender allocation of cooking time and paid labor supply is smaller in more complex cuisines.*

*Proof see Section A.2.4.*

#### A.2.4 Proofs of Model Extension

Household utility maximization can be written as

$$\begin{aligned}
\max_{\{Y_1, Y_2, F_1, F_2, C_{m,1}, C_{f,1}, C_{m,2}, C_{f,2}\}} \mathcal{L} &= U(Y_1, F_1) + \delta U(Y_2, F_2) \\
&+ \sum_{t=1}^2 \lambda_t \left( Y_t - [(\alpha_t + 1)T - \alpha_t C_{m,t} - C_{f,t}] \right) \\
&+ \sum_{t=1}^2 \mu_t \left( F_t - [(\tilde{H}_{m,t} C_{m,t})^\rho + (\tilde{H}_{f,t} C_{f,t})^\rho]^{1/\rho} \right) \\
&+ \sum_{g \in \{m, f\}} \eta_g \left( H_{g,2} - \bar{H} - \phi \kappa C_{g,1} \right) + \sum_{g \in \{m, f\}} \xi_g \left( H_{g,1} - \bar{H} \right).
\end{aligned} \tag{A19}$$

**Proof of Proposition A1.** We analyze the optimal allocation of cooking time  $\{C_{m,t}, C_{f,t}\}$  in both periods, starting with period 2.

*Period 2 (Static Optimization):* In the second period, there is no future benefit to accumulating human capital. The household maximizes period 2 utility given the accumulated stocks  $H_{m,2}$  and  $H_{f,2}$ . To maximize utility in this period, the household equates the ratio of marginal cooking products to the ratio of opportunity costs (wages).

The marginal product of cooking time  $C_{g,2}$  in the CES production function is:

$$\frac{\partial F_2}{\partial C_{g,2}} = F_2^{1-\rho} \cdot \tilde{H}_{g,2}^\rho \cdot C_{g,2}^{\rho-1}.$$

Taking the ratio of the first-order conditions for  $C_{m,2}$  and  $C_{f,2}$  eliminates common terms and yields

$$\frac{\partial F_2 / \partial C_{m,2}}{\partial F_2 / \partial C_{f,2}} = \frac{\alpha_2}{1} \Rightarrow \frac{\tilde{H}_{m,2}^\rho C_{m,2}^{\rho-1}}{\tilde{H}_{f,2}^\rho C_{f,2}^{\rho-1}} = \alpha_2.$$

Rearranging for the ratio of cooking times yields:

$$\frac{C_{f,2}}{C_{m,2}} = \alpha_2^{\frac{1}{1-\rho}} \left( \frac{\tilde{H}_{f,2}}{\tilde{H}_{m,2}} \right)^{\frac{\rho}{1-\rho}}. \quad (\text{A20})$$

Since  $\rho < 1$ , the exponent  $\frac{1}{1-\rho}$  is positive. Thus,  $\frac{\partial(C_{f,2}/C_{m,2})}{\partial \alpha_2} > 0$ .

*Period 1 (Dynamic Optimization):* Here, the household optimizes cooking and labor allocation in period 1 taking into account their effects on discounted utility in period 2.

To capture the dynamic structure, we define the period 2 value function as

$$V_2(H_{m,2}, H_{f,2}) \equiv \max_{C_{m,2}, C_{f,2}} \{ \ln Y_2 + w_c \ln F_2 \},$$

subject to the period 2 budget constraint and food production technology. Because  $\ln Y_2 + w_c \ln F_2$  is concave in cooking time for  $\rho < 1$ , the value function  $V_2$  is concave and increasing in  $(H_{m,2}, H_{f,2})$ .

In period 1, the household internalizes the effect of current cooking time on period 2 human capital, given by  $H_{g,2} = \bar{H} + \phi \kappa C_{g,1}$ . The first-order condition for spouse  $g$  equates the marginal utility cost of cooking time (the foregone wage) to the sum of the current marginal utility gain from cooking and the discounted marginal value of additional cooking human capital:

$$\text{MC}_g = \underbrace{w_c \frac{1}{F_1} \frac{\partial F_1}{\partial C_{g,1}}}_{\text{current benefit}} + \underbrace{\delta \phi \frac{\partial V_2}{\partial H_{g,2}}}_{\text{future benefit}} \equiv \text{MB}(C_{g,1}).$$

Here,  $V_2$  denotes the period 2 value function. The marginal utility cost of cooking time equals  $\text{MC}_m = \alpha_1$  for the man and  $\text{MC}_f = 1$  for the woman, up to the common factor  $1/Y_1$ ,

which cancels when taking ratios. Let  $\text{MB}_{g,1}$  denote the total marginal benefit of cooking time for spouse  $g$ .

Since at  $t = 1$  human capital is identical across genders ( $H_{m,1} = H_{f,1} = \bar{H}$ ), the functional forms of the marginal benefits are symmetric: if  $C_{m,1} = C_{f,1}$ , then  $\text{MB}_m = \text{MB}_f$ .

The ratio of the first-order conditions is:

$$\frac{\text{MB}_m(C_{m,1})}{\text{MB}_f(C_{f,1})} = \frac{\alpha_1}{1}.$$

Suppose, for contradiction, that  $\alpha_1 > 1$  but  $C_{f,1} \leq C_{m,1}$ . Because  $\text{MB}_g(C_{g,1})$  is decreasing in own cooking time and the problem is symmetric at  $t = 1$ , this implies  $\text{MB}_f(C_{f,1}) \geq \text{MB}_m(C_{m,1})$ , so that  $\text{MB}_m/\text{MB}_f \leq 1$ . However, the first-order condition requires  $\text{MB}_m/\text{MB}_f = \alpha_1 > 1$ , a contradiction. Therefore,  $C_{f,1} > C_{m,1}$ . Moreover, since  $\text{MB}_m/\text{MB}_f$  is strictly decreasing in  $C_{m,1}/C_{f,1}$ , an increase in  $\alpha_1$  implies an increase in  $C_{f,1}/C_{m,1}$ .

Note that when the discount factor  $\delta \rightarrow 0^+$ , such as when contrasting a historical and modern period, the household places little weight on the future returns to cooking-specific human capital. In this case, period 1 behavior approximates the static allocation derived for period 2.

**Proof of Proposition A2.** The first order conditions with respect to  $C_{m,2}$  and  $C_{f,2}$  imply

$$\frac{\partial \mathcal{L}}{\partial C_{m,2}} = \lambda_2 \alpha_2 - \mu_2 \frac{\partial F_2}{\partial C_{m,2}} = 0. \quad (\text{A21})$$

$$\frac{\partial \mathcal{L}}{\partial C_{f,2}} = \lambda_2 - \mu_2 \frac{\partial F_2}{\partial C_{f,2}} = 0. \quad (\text{A22})$$

From Equation (A17):

$$\begin{aligned} \frac{\partial F_2}{\partial C_{m,2}} &= \left[ (\tilde{H}_{m,2} C_{m,2})^\rho + (\tilde{H}_{f,2} C_{f,2})^\rho \right]^{1/\rho-1} \tilde{H}_{m,2}^\rho C_{m,2}^{\rho-1} \\ \frac{\partial F_2}{\partial C_{f,2}} &= \left[ (\tilde{H}_{m,2} C_{m,2})^\rho + (\tilde{H}_{f,2} C_{f,2})^\rho \right]^{1/\rho-1} \tilde{H}_{f,2}^\rho C_{f,2}^{\rho-1}. \end{aligned}$$

Substituting into (A21) and (A22), and rearranging yields

$$\frac{C_{f,2}}{C_{m,2}} = \alpha_2^{\frac{1}{1-\rho}} \left( \frac{\tilde{H}_{f,2}}{\tilde{H}_{m,2}} \right)^{\frac{\rho}{1-\rho}}, \quad (\text{A23})$$

With  $\alpha_2 = 1$

$$\frac{C_{f,2}}{C_{m,2}} = \left( \frac{\tilde{H}_{f,2}}{\tilde{H}_{m,2}} \right)^{\frac{\rho}{1-\rho}},$$

From Proposition A1,  $\alpha_1 > 1$  implies  $C_{f,1} > C_{m,1}$ , thus by human capital accumulation (A18),  $H_{f,2} > H_{m,2}$ , and  $C_{f,2} > C_{m,2}$ .

**Proof of Proposition A3.** From period 2 first-order conditions we obtain

$$\frac{C_{f,2}}{C_{m,2}} = \alpha_2^{\frac{1}{1-\rho}} \left( \frac{\tilde{H}_{f,2}}{\tilde{H}_{m,2}} \right)^{\frac{\rho}{1-\rho}}.$$

Taking logs,

$$\ln \frac{C_{f,2}}{C_{m,2}} = \frac{1}{1-\rho} \ln \alpha_2 + \frac{\rho}{1-\rho} \left[ \ln \tilde{H}_{f,2} - \ln \tilde{H}_{m,2} \right].$$

Using  $\tilde{H}_{g,2} = A_2^{1-\kappa} H_{g,2}^\kappa$ ,

$$\ln \tilde{H}_{g,2} = (1-\kappa) \ln A_2 + \kappa \ln H_{g,2}.$$

Since  $A_2$  is common across spouses, differences in effective productivity depend on  $\kappa \ln(H_{f,2}/H_{m,2})$ .

Therefore,

$$\frac{\partial}{\partial \kappa} \ln \frac{C_{f,2}}{C_{m,2}} = \frac{\rho}{1-\rho} \ln \frac{H_{f,2}}{H_{m,2}}.$$

When  $H_{f,2} > H_{m,2}$ , this derivative is positive. Hence higher cuisine complexity ampli-

fies the effect of human capital differences on cooking time allocation.

**Proof of Proposition A4.** From (A16),

$$\tilde{H}_{g,t} = A_t^{1-\kappa} H_{g,t}^\kappa.$$

Taking logs,

$$\ln \tilde{H}_{g,t} = (1 - \kappa) \ln A_t + \kappa \ln H_{g,t}.$$

Differentiating with respect to  $\ln A_t$  gives

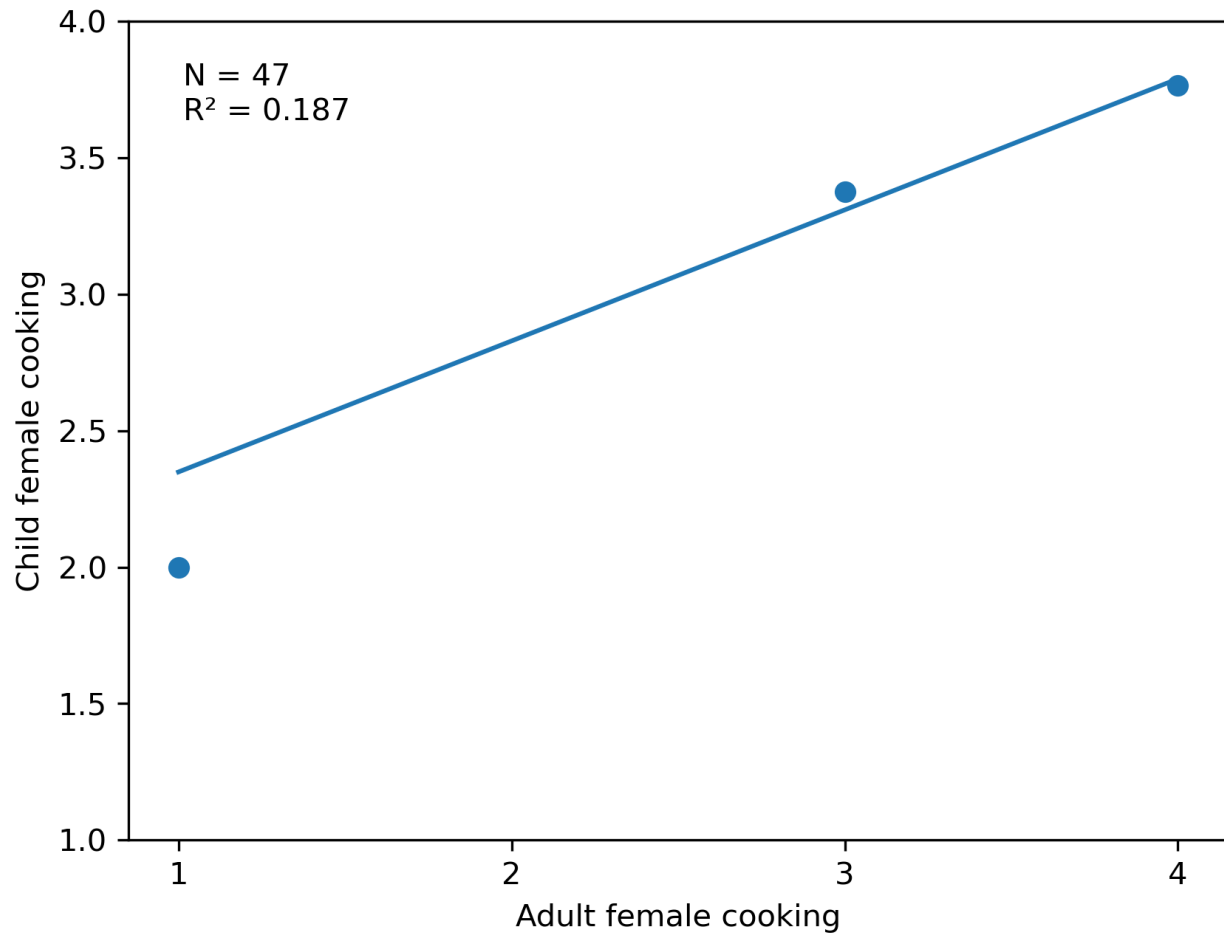
$$\frac{\partial \ln \tilde{H}_{g,t}}{\partial \ln A_t} = 1 - \kappa.$$

Thus, improvements in cooking technology increase effective productivity proportionally to  $1 - \kappa$ . When cuisine complexity is high ( $\kappa$  close to one), effective productivity depends primarily on human capital, and technology plays a limited role.

Since cooking time allocation depends on effective productivity through the first-order conditions, the responsiveness of cooking time and paid labor supply to changes in  $A_t$  is decreasing in cuisine complexity.

## B Additional Figures and Tables

Figure B1: Ancestral Transmission of Cooking Skills



*Note:* The figure shows the correlation between women cooking specialization and girls from the Standard Cross-Cultural Sample (Murdock and White, 1969) for 186 ancestral societies around the world.

Table B1: Summary of Data Sources

Dataset	Source	Description	Key information / Content
Recipe Data (Cuisine complexity)	Web scraping of online recipe platforms and digitized cookbooks	Country-level dataset capturing recipe details for 139 countries	Total cooking time, number of ingredients, number of spices, preparation instructions
Native ingredients	Crop Origin Database (Milla), CIAT	Classifies countries' native and non-native ingredients	Native ingredients identification. Used to construct the versatility measure
Common compounds	FlavorDB	Contains detailed information on the chemical compounds present in each ingredient	Number of shared flavor molecules between ingredient pairs. Used to construct the versatility measure
Suitability data	FAO	Measures countries' suitability to each ingredient	Crop suitability information. Used to construct the versatility measure
Labor Force Participation	Gallup and Cookpad Home-Cooking Survey	Individual-level survey data covering 109 countries from recipe dataset, May 2018–Feb 2023	Demographics, labor-market indicators (employment, income, work hours), well-being, household composition, cooking practices
Geographical Controls	DIVA-GIS; Copernicus ERA5; Global Soil Data Task; FAO; Galor and Özak (2016)	Geographic controls for country-level analysis	Altitude, precipitation, soil pH, climate zone, latitude, elevation, terrain roughness, distance to sea/rivers, landlocked
Economic Control	World Bank	Economic control for country-level analysis	GDP per capita

Table B2: Cuisine Complexity, First Stage Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Flavor versatility	0.289*** (0.094)	0.339*** (0.092)	0.340*** (0.093)	0.552*** (0.119)	0.518*** (0.128)	0.445*** (0.124)
Mean dep. var.	0.022	0.021	0.027	0.027	0.027	0.036
Observations	103,890	101,741	100,462	100,462	100,462	94,915
F-statistic	3.693	7.774	6.903	9.050	9.820	12.030
<i>Panel B. Married or cohabiting women</i>						
Flavor versatility	0.305*** (0.082)	0.346*** (0.080)	0.348*** (0.081)	0.579*** (0.116)	0.523*** (0.125)	0.457*** (0.121)
Mean dep. var.	0.059	0.058	0.062	0.062	0.062	0.076
Observations	58,083	56,824	56,373	56,373	56,373	52,283
F-statistic	6.628	10.211	9.260	11.969	12.442	11.101
<i>Panel C. All men</i>						
Flavor versatility	0.267** (0.102)	0.310*** (0.101)	0.310*** (0.102)	0.517*** (0.121)	0.468*** (0.132)	0.401*** (0.126)
Mean dep. var.	0.045	0.044	0.049	0.049	0.049	0.059
Observations	89,734	87,777	86,976	86,976	86,976	82,082
F-statistic	3.098	6.685	5.763	9.472	8.849	11.203
<i>Panel D. Married or cohabiting men</i>						
Flavor versatility	0.275*** (0.089)	0.315*** (0.088)	0.315*** (0.089)	0.539*** (0.120)	0.483*** (0.130)	0.412*** (0.125)
Mean dep. var.	0.069	0.068	0.072	0.072	0.072	0.085
Observations	53,066	51,859	51,526	51,526	51,526	48,089
F-statistic	6.183	9.199	7.934	12.331	10.889	12.125
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is the cuisine complexity measure. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table B3: Other Labor Market Outcomes, Men, IV Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Employed full-time, all working men</i>						
Average spices	0.021 (0.026)	0.028 (0.024)	0.026 (0.024)	0.054* (0.028)	0.035 (0.027)	0.038 (0.028)
Mean dep. var.	0.701	0.698	0.699	0.699	0.699	0.700
Observations	63,310	61,912	61,257	61,257	61,257	57,847
First stage F-statistic	16.800	22.801	22.911	37.942	33.753	30.338
<i>Panel B. Employed full-time, married or cohabiting working men</i>						
Average spices	0.006 (0.023)	0.017 (0.022)	0.017 (0.023)	0.042* (0.024)	0.026 (0.024)	0.020 (0.025)
Mean dep. var.	0.751	0.749	0.749	0.749	0.749	0.752
Observations	39,307	38,473	38,198	38,198	38,198	35,717
First stage F-statistic	25.283	32.636	33.148	45.168	38.615	33.743
<i>Panel C. Employed full-time for employer, all working men</i>						
Average spices	0.001 (0.038)	-0.003 (0.031)	-0.002 (0.029)	0.026 (0.033)	0.030 (0.034)	0.032 (0.034)
Mean dep. var.	0.482	0.478	0.480	0.480	0.480	0.482
Observations	63,310	61,912	61,257	61,257	61,257	57,847
First stage F-statistic	16.800	22.801	22.911	37.942	33.753	30.338
<i>Panel D. Employed full-time for employer, married or cohabiting working men</i>						
Average spices	-0.009 (0.026)	-0.005 (0.023)	-0.004 (0.022)	0.017 (0.027)	0.024 (0.030)	0.018 (0.031)
Mean dep. var.	0.507	0.503	0.505	0.505	0.505	0.510
Observations	39,307	38,473	38,198	38,198	38,198	35,717
First stage F-statistic	25.283	32.636	33.148	45.168	38.615	33.743
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

Notes: The table shows the results only for men. The dependent variable is an indicator for full-time employment in Panels A and B, while in Panels C and D it is an indicator for full-time wage employment. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \*p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Table B4: Labor Force Participation, IV Estimates, half-life 3000 km

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Cuisine complexity	-0.265*** (0.095)	-0.240*** (0.073)	-0.242*** (0.072)	-0.228*** (0.070)	-0.232*** (0.067)	-0.128** (0.063)
Mean dep. var.	0.517	0.516	0.514	0.514	0.514	0.511
Observations	103,890	101,741	100,462	100,462	100,462	94,915
First stage F-statistic	8.179	11.646	11.612	19.477	15.145	12.680
<i>Panel B. Married or cohabiting women</i>						
Cuisine complexity	-0.359*** (0.098)	-0.314*** (0.075)	-0.314*** (0.075)	-0.288*** (0.080)	-0.276*** (0.078)	-0.187*** (0.068)
Mean dep. var.	0.545	0.544	0.543	0.543	0.543	0.539
Observations	58,083	56,824	56,373	56,373	56,373	52,283
First stage F-statistic	11.771	16.183	16.045	23.004	16.282	13.886
<i>Panel C. All men</i>						
Cuisine complexity	0.263 (0.173)	0.235* (0.136)	0.235* (0.139)	0.096 (0.086)	0.061 (0.081)	0.156 (0.097)
Mean dep. var.	0.706	0.705	0.704	0.704	0.704	0.705
Observations	89,734	87,777	86,976	86,976	86,976	82,082
First stage F-statistic	5.731	7.783	7.689	15.806	11.325	10.030
<i>Panel D. Married or cohabiting men</i>						
Cuisine complexity	0.219* (0.126)	0.210* (0.108)	0.211* (0.111)	0.059 (0.075)	0.043 (0.073)	0.145 (0.093)
Mean dep. var.	0.741	0.742	0.741	0.741	0.741	0.743
Observations	53,066	51,859	51,526	51,526	51,526	48,089
First stage F-statistic	8.058	10.691	10.482	18.167	12.607	10.683
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is an indicator variable for labor force participation. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table B5: Cuisine complexity, First Stage Estimates, 3,000 km half-life

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Flavor versatility	0.245*** (0.086)	0.285*** (0.084)	0.286*** (0.084)	0.444*** (0.101)	0.420*** (0.108)	0.368*** (0.103)
Mean dep. var.	0.022	0.021	0.027	0.027	0.027	0.036
Observations	103,890	101,741	100,462	100,462	100,462	94,915
F-statistic	3.453	7.612	6.782	9.093	9.756	12.457
<i>Panel B. Married or cohabiting women</i>						
Flavor versatility	0.257*** (0.075)	0.292*** (0.073)	0.292*** (0.073)	0.469*** (0.098)	0.425*** (0.105)	0.377*** (0.101)
Mean dep. var.	0.059	0.058	0.062	0.062	0.062	0.076
Observations	58,083	56,824	56,373	56,373	56,373	52,283
F-statistic	6.165	9.950	9.101	12.227	12.680	11.720
<i>Panel C. All men</i>						
Flavor versatility	0.221** (0.092)	0.255*** (0.092)	0.256*** (0.092)	0.407*** (0.102)	0.373*** (0.111)	0.327*** (0.103)
Mean dep. var.	0.045	0.044	0.049	0.049	0.049	0.059
Observations	89,734	87,777	86,976	86,976	86,976	82,082
F-statistic	2.837	6.501	5.619	9.354	8.807	11.300
<i>Panel D. Married or cohabiting men</i>						
Flavor versatility	0.229*** (0.081)	0.261*** (0.080)	0.261*** (0.081)	0.430*** (0.101)	0.387*** (0.109)	0.337*** (0.103)
Mean dep. var.	0.069	0.068	0.072	0.072	0.072	0.085
Observations	53,066	51,859	51,526	51,526	51,526	48,089
F-statistic	5.675	8.988	7.779	12.342	10.965	12.215
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is the average of the spices. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \*p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Table B6: Labor Force Participation, IV Estimates (sample 24-55 years old)

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. All women</i>						
Cuisine complexity	-0.372*** (0.102)	-0.336*** (0.080)	-0.326*** (0.078)	-0.221*** (0.079)	-0.204** (0.084)	-0.180** (0.083)
Mean dep. var.	0.664	0.661	0.659	0.659	0.659	0.657
Observations	57,841	56,674	55,919	55,919	55,919	52,626
First stage F-statistic	15.659	20.624	20.200	20.803	15.266	12.796
<i>Panel B. Married or cohabiting women</i>						
Cuisine complexity	-0.398*** (0.099)	-0.364*** (0.078)	-0.352*** (0.077)	-0.262*** (0.086)	-0.217** (0.092)	-0.207** (0.090)
Mean dep. var.	0.629	0.626	0.625	0.625	0.625	0.621
Observations	39,698	38,911	38,588	38,588	38,588	35,773
First stage F-statistic	20.624	26.576	25.978	21.631	15.903	13.752
<i>Panel C. All men</i>						
Cuisine complexity	0.157* (0.081)	0.147** (0.067)	0.148** (0.066)	0.097 (0.059)	0.105* (0.062)	0.160** (0.078)
Mean dep. var.	0.866	0.864	0.864	0.864	0.864	0.864
Observations	50,445	49,488	49,059	49,059	49,059	46,548
First stage F-statistic	9.645	12.142	11.930	17.248	12.056	10.230
<i>Panel D. Married or cohabiting men</i>						
Cuisine complexity	0.110** (0.052)	0.111** (0.047)	0.112** (0.045)	0.061 (0.050)	0.079 (0.054)	0.125* (0.066)
Mean dep. var.	0.882	0.880	0.880	0.880	0.880	0.880
Observations	33,561	32,979	32,777	32,777	32,777	30,816
First stage F-statistic	17.583	20.945	20.592	17.168	11.745	10.029
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Suitability	No	Yes	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	Yes
Climate & location	No	No	No	Yes	Yes	Yes
Other geographic	No	No	No	No	Yes	Yes
Ind. & hh. controls	No	No	No	No	No	Yes

*Notes:* The dependent variable is an indicator variable for labor force participation. Baseline controls include number of recipes, number of native ingredients, and trade distance. Suitability: suitability for the ingredients in the versatility data and staple suitability. Climate and location: precipitation, temperature, absolute latitude, longitude, and landlocked status. Other geographic: duration of colonial rule, altitude, soil pH, terrain roughness, and distance to the coast or major rivers. Robust standard errors clustered at country level reported in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

## C Country Fixed Effects and the Gender Gap

We can exploit our individual level data to study differences across individuals within the same country. We do this by pooling all observations and estimating the following variation of Equation (7).

$$y_i = \alpha + \beta_0 female_i + \beta_1 CC_{c(i)} \times female_i + \mathbf{W}'_i \boldsymbol{\Omega} + \mu_{c(i)} + \epsilon_i, \quad (\text{A24})$$

where  $female_i$  is a gender indicator that takes the value of 1 for women and  $\mu_{c(i)}$  is a country fixed effect. This country fixed effects accounts for all observable and unobservable factors common across genders within a country that determine both labor market outcomes and cuisine complexity. The coefficient  $\beta_1$  captures the effect of cuisine complexity on the gender gap in the outcome of interest.

Tables C7 presents the OLS estimation results. Consistent with a negative gender gap in labor force participation, Panel A of Table C7 shows a negative and statistically significant coefficient on the female indicator for the full sample, while the interaction between cuisine complexity and gender is negative but small in magnitude and imprecisely estimated.

Consistent with the effects of cuisine complexity being driven by intrahousehold allocation of time, when we restrict the sample to married or cohabiting individuals, the pattern changes. The gender dummy loses statistical significance, and the entire gender gap is instead explained by cuisine complexity. These results remain stable across specifications in columns 1 through 6.

Column 7 presents a more stringent specification that includes country fixed effects. This specification allows us to estimate how differences in the complexity of cuisine shape the gender gap within countries. In particular, the coefficient on the interaction between cuisine complexity and the gender indicator, captures how the gap between women and men in the same country varies with that country's level of cuisine complexity. The interaction coefficient remains largely stable across specifications.

Table C7: Gender Gap in Labor Force Participation, OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Panel A. Single</i>							
Cuisine complexity	-0.038 (0.028)	-0.049* (0.029)	-0.048* (0.029)	-0.064** (0.028)	-0.068** (0.027)	-0.043* (0.023)	
Female=1	-0.166*** (0.009)	-0.165*** (0.009)	-0.165*** (0.009)	-0.164*** (0.009)	-0.164*** (0.009)	-0.141*** (0.010)	-0.138*** (0.009)
Female=1 × Cuisine complexity	-0.031 (0.020)	-0.029 (0.020)	-0.030 (0.020)	-0.029 (0.020)	-0.028 (0.020)	-0.019 (0.020)	-0.027 (0.021)
Mean dep. var.	0.559	0.557	0.555	0.555	0.555	0.554	0.556
Observations	81,990	80,353	79,058	79,058	79,058	76,183	77,820
F-statistic	62.315	47.901	43.256	33.920	26.471	36.673	54.078
<i>Panel B. Married or cohabiting</i>							
Cuisine complexity	-0.013 (0.026)	-0.030 (0.026)	-0.030 (0.026)	-0.039 (0.030)	-0.038 (0.029)	-0.011 (0.026)	
Female=1	-0.189*** (0.016)	-0.191*** (0.016)	-0.190*** (0.016)	-0.191*** (0.016)	-0.190*** (0.016)	-0.187*** (0.016)	-0.182*** (0.016)
Female=1 × Cuisine complexity	-0.096** (0.040)	-0.096** (0.040)	-0.097** (0.041)	-0.096** (0.041)	-0.097** (0.041)	-0.095** (0.041)	-0.100** (0.041)
Mean dep. var.	0.638	0.638	0.638	0.638	0.638	0.636	0.636
Observations	111,149	108,683	107,899	107,899	107,899	100,372	102,838
F-statistic	23.064	17.737	16.469	13.364	14.468	48.158	49.175
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	No
Suitability	No	Yes	Yes	Yes	Yes	Yes	No
GDP	No	No	Yes	Yes	Yes	Yes	No
Climate & location	No	No	No	Yes	Yes	Yes	No
Other geographic	No	No	No	No	Yes	Yes	No
Ind. & hh. controls	No	No	No	No	No	Yes	No
Fixed effects	Region	Region	Region	Region	Region	Region	Country

Notes: The dependent variable is an indicator variable for labor force participation. Robust standard errors clustered at country level reported in parentheses. \*p<0.1, \*\*p<0.05, \*\*\*p<0.01.