Degenderization and Collective Labor Supply

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Abstract

I propose a gender-neutral collective model to examine how degenderization—the tendency for individuals in same-sex relationships to adopt more flexible gender identities—shapes labor allocation. This model not only addresses the limitations of existing theories, such as those by Becker and Gronau, which inadequately explain the labor behaviors of same-sex couples through the lens of comparative advantage, but also extends the analysis to include household-level collective labor supply. A Chiappori-style framework captures shifts from traditional norms, showing that gay men allocate less time to market work and more to home production, while lesbian women do the opposite. With narrower bargaining power gaps and more aligned preferences, same-sex couples demonstrate more balanced labor distributions, converging in both paid work and housework. Empirical evidence from the British Household Panel Survey supports this framework, emphasizing labor supply convergence among same-sex partners and highlighting the critical role of degenderization in shaping household dynamics.

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Intrahousehold bargaining, Labor supply, Sexual orientation, Gender norms

JEL Classification codes

J12, D13, J16, D15

Introduction

If the assertion of time allocation in the Becker-Gronau model holds true—the allocation of time for leisure, home production, and market work within a couple is solely determined by the comparative advantages of the partners (Becker, 1965; Gronau, 1977)—then there should be no discernible distinction in time allocations and labor supplies between a same-sex couple and an opposite-sex couple with equivalent earning capacities. Nevertheless, numerous studies provide evidence that individuals in same-sex relationships exhibit different labor supply behaviors than those in opposite-sex relationships (Baumle et al., 2009; Del Río & Alonso-Villar, 2019; Hansen et al., 2020).

This paper addresses labor supply patterns in same-sex couples, focusing on the impact of shifting preferences, equitable bargaining power, and similar comparative advantages between partners. A revised collective model is proposed, independent of gender, introducing the concept of degenderization to measure deviations from traditional gender roles. The model reveals that gay men typically have a reduced aversion to housework, while lesbian women show a diminished aversion to market work. It assumes that comparative advantages in same-sex couples shift toward a gender-neutral spectrum and are often more similar between partners, contributing to greater equality in bargaining power. Theoretical analysis suggests that degenderization increases gay men's involvement in housework and reduces their market work, while lesbian women allocate more time to market work and less to housework than heterosexual counterparts. Empirical evidence supports these findings, showing that being in a same-sex partnership reduces inequality by 11% for gay men and 17% for lesbian women. Labor supply patterns reveal that, on average, gay men spend 30–40% more time on housework than straight men, while lesbian women spend 50–60% less time on housework than straight women.

The model addresses how similar comparative advantages within same-sex couples are insufficient to fully explain their labor supply behaviors. The study compares labor supply disparities between same-sex and opposite-sex couples while considering the earning potential of individuals. This investigation complements the theories presented by Gronau (1977) and Becker (1965), which assert that earnings play a pivotal role in

labor supply decisions when other factors are kept the same. The primary distinction of the model in this paper from the Becker-Gronau model is its differentiation of preferences and comparative advantages in labor supply, where gay men and lesbian women deviate from traditional gender roles.

One fundamental distinction between same-sex couples and opposite-sex couples lies in the similarity of preferences among same-sex partners. Consequently, in order to comprehensively understand the shared behaviors of same-sex partners, it also becomes imperative to examine this question through a household lens instead of individuals. Nevertheless, there is a dearth of research regarding intrahousehold bargaining among same-sex partners. Oreffice (2011) utilizes a collective-household framework to show that couples of all types exhibit a significant response in labor supply to bargaining power shifts, as measured by age and non-labor-income differences between partners. Among gay, lesbian, and heterosexual cohabiting couples, a relatively young or rich partner has more bargaining power and supplies less labor. However, the research adopts a setting similar to that used for studying opposite-sex couples, but it fails to capture the nuances of similar preferences within same-sex couples since it is based on an individual level research.

I propose a gender-neutralized collective model building upon the classic works of Chiappori (1992) and Chiappori et al. (2002) whilst also incorporating the concept of shifting preferences among same-sex partners away from traditional gender roles. To capture this phenomenon, I adopt the term "degenderization" from psychology, which suggests that lesbian, gay, and bisexual (LGB) individuals have more flexible gender identities. Same-sex couples may exhibit heightened attentiveness and sensitivity to issues of equality and inequality within their relationships, as discussed by Goldberg (2013). In my model, this preference shift is reflected through changes in the spouses' preferences. Specifically, based on a given set of characteristics, market work incurs less marginal disutility for lesbian women but more disutility for gay men, with other factors fixed. Conversely, housework yields less marginal disutility for gay men and more disutility for lesbian women. Additionally, same-sex couples exhibit a smaller power gap, as heterosexual couples tend to display greater inequality on average (Patterson et al., 2004).

By controlling for comparative advantages—as reflected in their hourly earnings—I aim to elucidate the

additional differences by exploring the shifting preferences that arise from being in a same-sex relationship. This helps to shed light on why a gay man, who possesses a comparable comparative advantage relative to his heterosexual partner, tends to allocate less labor towards market work and more towards home production. Conversely, a lesbian woman tends to contribute more labor to market work and less to home production in comparison to her heterosexual counterpart.

This paper also offers empirical evidence to substantiate the theoretical claims regarding time allocation and labor supplies in same-sex couples. While there is ample evidence provided for time allocations in opposite-sex couples, the available literature for same-sex couples is presently limited, focusing primarily on their market work. Hansen et al. (2020) found gay men participate in paid work less than heterosexual men and lesbian women work outside the home more than heterosexual women in the US. They did not find there is a statistically significant difference between homosexual and heterosexual people regarding their time spent on housework. In addition, they noticed marriage equality laws have limited effects on homosexual individuals and only lead to a minor reduction in lesbian women's paid work hours. At the industry level, Baumle et al. (2009) discussed the general trend that lesbian women are more likely to be found in male-dominated occupations than their straight counterparts, whereas gay men tend to be less concentrated in highly masculinized occupations relative to straight men. Del Río & Alonso-Villar (2019) found lesbian women are the group with the lowest segregation level across occupations, whereas the unevenness is higher for either homosexuals or heterosexuals.

In addition to differences in labor participation, individuals in same-sex relationships also experience variations in actual earnings. Extensive literature consistently demonstrates a distinct pattern when analyzing data, indicating that lesbians tend to earn significantly higher incomes compared to heterosexual women, while gay men tend to earn less than heterosexual men (e.g., Blandford (2003) and Jepsen (2007) in the United States; Carpenter (2008) in Canada; Plug & Berkhout (2004) in the Netherlands; Frank (2006) in the United Kingdom and a meta-analysis from Klawitter (2015)). Even within relationships, same-sex partners exhibit distinct patterns that differ from those observed in opposite-sex relationships. Del Río & Alonso-Villar (2019) unveiled that the earning gap of men in same-sex households is larger than that of women in same-sex households. How-

ever, lesbian women face a lower wage disadvantage compared to straight women, while the wage advantage of gay men is higher than that of straight men. Antecol & Steinberger (2009) classified the spouses in a lesbian couple into primary and secondary earners. They discovered that secondary lesbian earners exhibit labor supply measures more closely aligned with married women, whereas primary lesbian earners show labor supply measures more akin to married men. In addition, Frank (2006) did not find evidence that LGB workers suffer any disadvantage in salaries relative to heterosexuals, whereas they found evidence that gay and bisexual men suffer from glass ceilings comparable to those faced by heterosexual women.

I provide empirical evidence supporting the trend of labor supply convergence among same-sex partners, drawing on data from the British Household Panel Survey (BHPS) spanning 1992 to 2009 in the UK. This dataset includes detailed information on individuals' time allocation in market work and housework, as well as household income and consumption data, alongside demographic and economic status indicators. This rich dataset enables me to analyze how preferences towards degenderization and comparable comparative advantages influence labor supply patterns among same-sex couples. I test both individual labor supply and the collective labor supply between partners.

First, I analyze how a gay man's response to his own and his partner's hourly wage differs from that of a heterosexual man, and how a lesbian woman's response compares to that of a heterosexual woman. Next, using the collective labor supply formula, I examine whether there is convergence in labor supply, both in market work and housework, between same-sex partners and their heterosexual counterparts. This literature is consistent in suggesting that same-sex couples divide market work and housework more equally than heterosexual couples (Perlesz et al., 2010; Goldberg et al., 2012; Solomon et al., 2005).

My analysis yields comprehensive reduced-form evidence, revealing that being in a same-sex relationship, coupled with comparable comparative advantages, leads to a decrease in working hours for gay men and an increase in time devoted by lesbian women compared to their heterosexual counterparts. Additionally, the shifting of preferences plays a significant role in altering labor supply patterns in housework, with gay men spending more time than heterosexual men, and lesbian women spending less time than heterosexual women.

Furthermore, I delve into the level of comparative advantage among men and women to explore the significance of degenderization in shaping their labor supply behaviors.

These findings directly contradict the predictions of the Becker-Gronau model, enhancing our understanding of the distinct dynamics that shape economic behaviors and preferences within same-sex relationships. The insights gained from this research shed valuable light on this topic and contribute to the broader comprehension of economic dynamics within diverse relationship structures.

1 Gender Role in the Household and Degenderization

Most of the existing intra-household literature focuses heavily on gender roles, irrespective of the methodologies employed. These studies generally conclude that men tend to have greater bargaining power than women. In the context of a single setting, introducing the role of gender in Pareto weights or preferences may not be necessary. However, given that gender significantly differentiates same-sex and opposite-sex couples, it is crucial to examine how deviating from traditional gender roles might alter the dynamics and behaviors of same-sex couples in a predominantly heterosexual society.

Prior literature often attributes intra-household dynamics to economic factors such as comparative advantages. This approach faces two primary challenges. First, it is difficult to distinguish the dominant partner in same-sex relationships. Second, individuals in same-sex relationships may find it challenging to conform to traditional gender roles due to physical constraints, such as childbearing, or ideological differences. These factors can influence their roles within the family. To date, no economic research has specifically addressed the shifting of gender roles among individuals in same-sex relationships as they move away from traditional masculine and feminine spheres. Thus, this review combines insights from psychology and sociology to explore how these identity shifts can lead to changes in economic behavior.

Similar to previous literature, different genders possess different comparative advantages regardless of sexual orientation. However, the differences between partners in same-sex relationships tend to be less pronounced. Traditional household economics literature suggests that the partner with fewer resources (e.g., lower income,

education, or occupational status) tends to perform less paid work and more housework. For instance, Bittman et al. (2003) indicate that wives' contributions to housework decline as their earnings increase, but they often retain primary responsibility for housework regardless of their income's proportional contribution (Gupta, 2006).

Various theoretical frameworks have been used to explain the persistent gendered and unequal divisions of housework. The time-availability hypothesis offers a factual explanation, suggesting that the individual with more available time should undertake a greater share of domestic labor (Davis & Greenstein, 2004). Because women typically work fewer hours in paid employment, they often take on more housework (Bianchi & Milkie, 2010).

Sociological explanations, such as the "doing gender" approach, have also been proposed to explain gendered time differences. This perspective suggests that housework is a way for individuals to construct gender in their daily lives. Even when contributions to paid work and income are similar, women may do more housework as a means of expressing femininity, while men may avoid housework to assert masculinity Brines (1994). Bartley et al. (2005) use this approach to explain why women still perform more household labor despite similar work hours and financial contributions. Gender theory posits that traditional gender ideologies or challenges to femininity or masculinity can influence household labor division (Greenstein, 2000). These theories explain the gender spectrum and its influence on labor supply but have predominantly been formulated within the context of heterosexual couples, often overlooking those who fall outside traditional gender boundaries.

Since gender alone cannot fully explain the behaviors of men and women in same-sex relationships, queer theory, which critiques rigid binary categories like male versus female and homosexual versus heterosexual, provides a more nuanced perspective. Same-sex couples who adopt specialized divisions of labor often view these arrangements as pragmatic choices rather than imitations of heterosexual norms. Studies suggest that same-sex couples divide housework more equally due to more flexible gender identities and a heightened sensitivity to equality in their relationships (Kurdek & Schmitt, 1986; Goldberg, 2013). Queer theory, combined with the doing-gender perspective, offers a valuable lens for understanding how housework can be a site for

"undoing" or "queering" gender, challenging the stability and usefulness of traditional binaries (Patterson et al., 2004).

2 Gender-Neutral Intra-household Bargaining Model

2.1 The Collective Model Setting

In this study, I develop a revised collective model by incorporating the effect of degenderization, drawing mainly on insights from Chiappori (1992) and Chiappori et al. (2002). The model considers a household's utility, which consists of weighted individual utilities. Initially, the model assumes a traditional gender setting for individuals' preferences and posits that the observed allocations of consumption and labor are Pareto efficient. Subsequently, it investigates the effects of preference shifting away from traditional masculine and feminine spheres. In the second step, the study addresses the optimization problem with an egoistic utility function to uncover the sharing rule within the household. Furthermore, it delves into understanding the impacts of degenderization on this sharing rule, thereby providing valuable insights into the dynamics of household decision-making.

2.1.1 The General Framework of A Household

Individual utilities have the form $U^i(\mathbf{c^i}, \mathbf{h^i}; \mathbf{s^i})$, where U^i is strictly quasi-concave, increasing, and continuously differentiable for $i = 1$ or 2. An individual i's utility doesn't directly depend on $j(j \neq i)$. However, within the framework of the collective models, this leads to the same results as an altruistic utility function (e.g., Beckerian caring preference: $V^i = U^i(\mathbf{c^i}, \mathbf{h^i}, \mathbf{s^i}) + v^i \cdot U^j(\mathbf{c^j}, \mathbf{h^j}, \mathbf{s^j})$; see Browning et al. (2006)).

An individual's consumption comes from final goods and home production: $\mathbf{c^i} = (c_G^i, c_H)$. An individual's labor supply include time spent on paid work and housework: $h^i = h_P^i + h_H^i$. They both bring disutility to an individual, while different margins might be observed. Home production involves the investment of both spouses' time: h_H^1 and h_H^2.

$\mathbf{s^1}$ and $\mathbf{s^2}$ are K-vector of preference factors for individuals 1 and 2 that present in functions U^1 and U^2.

$\mathbf{s^i} = (\mathbf{X^i}, g^i, s^i)$, where $\mathbf{X^i}$ is the vector of demographic and social characteristics shared by everyone. g^i stands for the individual's gender. s^i is the degree of degenderization, which reflects an individual's shifts from traditional gender roles. For heterosexual individuals: $s^i = 0$.

A household's utility consists of the weight of an individual's utility with a weight of μ on individual 1, and the sum of the two is 1. μ and $1-\mu$ are called Pareto weights since they maximize the household's utility. Pareto weights are functions of shifting factors, such as wages and non-labor income, which are usually exogenous. This set of factors is denoted as $\mathbf{d}$ and is in addition to the effect of gender. It appears only in Pareto weight $\mu(g, \mathbf{d})$.

$$\max_{\mathbf{c^1},\mathbf{c^2},\mathbf{h^1},\mathbf{h^2}} U^H(\mathbf{c^1}, \mathbf{h^1}, \mathbf{s^1}, \mathbf{c^2}, \mathbf{h^2}, \mathbf{s^2}, \mathbf{d}) = \mu \cdot U^1(\mathbf{c^1}, \mathbf{h^1}, \mathbf{s^1}) + (1-\mu) \cdot U^2(\mathbf{c^2}, \mathbf{h^2}, \mathbf{s^2}) \tag{1}$$

Traditional literature often directly associates Pareto weights with genders, assigning a weight (μ) specifically to males or females. Consequently, the arrangement of individuals within a household becomes crucial in their equations. However, the research focus on this topic complicates matters, particularly when households include spouses of the same gender, making it impractical to establish a strict order. Therefore, I propose constructing Pareto weights that disconnect an individual's utility from gender. The formulation of these Pareto weights adheres to the following criteria:

$$\mu^1(g^1, \mathbf{d}^1) = \mu(g^1, \mathbf{d}^1), \quad \mu^2(g^2, \mathbf{d}^2) = 1 - \mu = 1 - \mu^1 \tag{2}$$

and

$$\mu^1(g^2, \mathbf{d}^2) \cdot U^1(\mathbf{c^2}, \mathbf{h^2}, \mathbf{s^2}) = \mu^2(g^2, \mathbf{d}^2) \cdot U^2(\mathbf{c^2}, \mathbf{h^2}, \mathbf{s^2}) \tag{3}$$

Home production is a function of both's time on housework from the couple:

$$c_H = c_H(h_H^1, h_H^2) \tag{4}$$

The household's consumption is subject to the budget constraint:

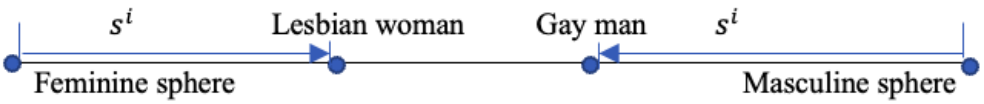
$$\sum_{j=1}^{n} c_j^1 + \sum_{j=1}^{n} c_j^2 = w^1 h_P^1 + w^2 h_P^2 + y \tag{5}$$

where j denotes various categories of consumption. To maintain simplicity in notation, I also include home production as one of these consumption types. $y = y^1 + y^2$ is the non-labor income. The time constraint for each individual is:

$$h_P^i + h_H^i + \ell^i = 1 \tag{6}$$

The degree of degenderization is reflected in an individual's preferences and comparative advantage in labor supply. In the function form, given the same set of exogenous characteristic variables, heterosexual men and women experience more genderized comparative advantage in labor supply. In the explicit form of utility functions, it is reflected in the parameters of home production function, where women are more efficient. Since home production is a part of the consumption, which enters into an individual's utility, the degenderization is also indirectly reflected in the utility function.

To simplify the question, I assume s^i is individual i's level of shifting from their corresponding gender's sphere. This guarantees a positive value of s^i for men and a negative vaue for women and makes the analysis easier. The same results should be expected if we assume the shifts are from the gender-neutral point.



2.2 Optimization under the Egotistic Preferences

I have defined labor supplies and consumption under the previous collective framework. This allows me to uncover the coordinated labor supply behavior within a couple. However, additionally, we would also like to

know the labor supply behavior of an individual, reacting to their partner. Equally importantly, the equilibrium is not fully defined unless the transfer of between the two spouses is also defined, since the household budget only considers the pooled income of the couple. According to the second fundamental theorem of welfare, we should expect the same bundle of consumption and labor supply under the egoistic setting.

Individual 1 faces utility maximization as follows:

$$\max_{\mathbf{c^1},\mathbf{h^1}} U^1(\mathbf{c^1},\mathbf{h^1};\mathbf{s^1}) \tag{7}$$

For individual 1, their consumption is subject to the budget constraint:

$$\sum_{j=1}^{n} c_j^1 = w^1 h_P^1 + \phi^1 \tag{8}$$

where $\phi^1 = \phi(w^1, w^2, y, \mathbf{s^1}, \mathbf{s^2}, \mathbf{d}) = \psi^1 + y^1$ is the transfer from individual 2 to individual 1. ϕ is called the sharing rule and can be either positive or negative.

$$-w^1 h_P^1 < \phi < w^2 h_P^2 + y \tag{9}$$

In this analysis, the source of the non-labor income does not have an impact. Since $\phi^1 = \psi^1 + y^1$ and $\phi^2 = \psi^2 + y^2$, $\psi^1 + \psi^2 = 0$. We can derive $y - \phi^2 = y - (\psi^2 + y^2) = y^1 + \psi^1 = \phi^1$.

Individual 2 faces a similar problem:

$$\max_{\mathbf{c^2},\mathbf{h^2}} U^2(\mathbf{c^2},\mathbf{h^2};\mathbf{s^2}) \tag{10}$$

Similarly, the consumption constraint for individual 2 is:

$$\sum_{j=1}^{n} c_j^2 = w^2 h_P^2 + \phi^2 \tag{11}$$

where $\phi^2 = y - \phi^1$.

When the labor supply vector $(\bar{h}_P^1, \bar{h}_H^1, \bar{h}_P^2, \bar{h}_H^2)$, the solutions for Problem 1, there are two pairs of functions of $(\bar{\mathbf{c}}^{\mathbf{1}}, (\bar{\mathbf{c}}^{\mathbf{2}})$ and $(\bar{\phi}^1, \bar{\phi}^2)$ that are the solution to Problem 7 and Problem 10.

2.2.1 Labor Supplies

With the collective model setup of the household, it is possible to further look into the decision-makings of the two partners, especially the labor supply and consumption behaviors, and how the fact of partnering with a same-sex partner impact the behaviors. The more interesting part is the difference in the labor supply behaivors between same-sex and opposite-sex couples since they are more straightforward and more distinguishable than consumption behaivors. The labor supply behaviors include how a couple (same-sex or opposite-sex) divide their time in marketwork and housework. The labor supply decisions consists of individuals' labor supply decision and the couple's collecitve labor supply. First, for any individual, they make the labor supply decision based on their egoistic utility and their partner's charactistics. In this case, there is also a transfer of wealth between the partners for their budget constraints. Second, when we look at the household at the collective level, the couple make a joint decision on labor supply which maximize the household's utility. For clarification, the word "collective" in "collective model" refers to the conventional bargaining approach where the resource allocations reflect the optimal results from intrahousehold bargaining, contrasting to the traditional unitary models where household behavior as resulting from the decisions of a single individual. Meanwhile, the word "collective" in "collective" labor supply refers to the relative labor supply behaviors between the two partners, which is contrast to an individual's labor supply decision. Even though the two labor supply solutions reflect two aspects, the acutually labor supply amount should be the same when estimated with the two approaches. The following sections present the solutions with the two approaches.

2.2.1.1 Individual Labor Supplies

Let us assume that labor supply functions are unrestricted. $h_T^i(w^1, w^2, y, \mathbf{s^1}, \mathbf{s^2}, \mathbf{d})$, $T = P, H$, are continuously differentiable. With interior solutions assumed, these labor supply functions for market work and

housework can also be written as Marshallian labor supply functions:

$$h_T^1 = H_T^1(w^1, \phi(w^1, w^2, y, \mathbf{s^1}, \mathbf{s^2}, \mathbf{d}), \mathbf{s^1}) \tag{12}$$

$$h_T^2 = H_T^2(w^2, y - \phi(w^1, w^2, y, \mathbf{s^1}, \mathbf{s^2}, \mathbf{d}), \mathbf{s^2}) \tag{13}$$

where H^i is is member i's Marshallian labor supply function.

In the general collective setting with interior solutions assumed, I first investigate how labor supplies react to degenderization. For the traditional gender setting, I denote M as the absolute masculine sphere and W as the absolute feminine sphere.

For labor supply:

$$\left|\frac{\partial U^W}{\partial h_P^W}\right| > \left|\frac{\partial U^M}{\partial h_P^M}\right|, \quad \left|\frac{\partial U^M}{\partial h_H^M}\right| > \left|\frac{\partial U^W}{\partial h_H^W}\right| \tag{14}$$

This can be interpreted as a heterosexual man getting less disutility from market work than a heterosexual woman; a heterosexual woman gets less disutility from housework than a heterosexual man.

Hence, the effect of degenerization is presented as follows:

$$\frac{\partial U^W_{h_P^W}(s^1)}{\partial s^1} > 0, \quad \frac{\partial U^M_{h_P^M}(s^i)}{\partial s^i} < 0 \tag{15}$$

$$\frac{\partial U^M_{h_H^M}(s^i)}{\partial s^i} > 0, \quad \frac{\partial U^W_{h_H^W}(s^i)}{\partial s^i} < 0 \tag{16}$$

where U_X^i is the derivative of U^i with respect to X.

Proposition 1: Same-sex couples tend to have a more similar pattern of labor supply in both paid work and housework, conditional on wages.

Individuals who diverge from the traditional masculine sphere tend to decrease their hours in market work

while increasing their involvement in housework. Conversely, those who deviate from the feminine sphere experience the opposite effects. As a result, a convergence in labor supplies, both in paid work and housework, can be observed within same-sex couples.

$$\frac{\partial(h_P^1/h_P^2)}{\partial s^i} < 0, \quad \text{and} \quad \frac{\partial(h_H^1/h_H^2)}{\partial s^i} > 0 \tag{17}$$

Proof. See Appendix A1.1.

2.3 Collective Model Structural Estimation

2.3.1 Parametric Specification

Building upon the collective model theory discussed earlier, it becomes viable to perform structural estimation to examine how changes in preferences towards degenderization and other comparative advantages affect household inequality and subsequently influence labor supply in both market work and housework. To achieve this, I specify the utility functions explicitly and introduce the parameters essential for the theoretical model.

To account for the different marginal (dis)utilities associated with different types of production and considering the data structure, I assume preferences are separable in consumption and time use. These preferences are modeled using a quasi-linear utility function, following the econometric framework outlined by Berry et al. (1993); Brown & Calsamiglia (2007). While this approach is standard in the labor supply literature (see, e.g., Greenwood et al. (2005); Olivetti (2006); Siegel (2017)), my model incorporates differentiated marginal (dis)utilities to enhance the analysis. Specifically, I consider period utility functions of the forms:

For an individual i:

$$U^i = logU_c^i + \varphi_P^i \frac{(1-h_P^i)^{1-\eta_P^i} - 1}{1-\eta_P^i} - \varphi_H^i h_H^i \tag{18}$$

$$U_c^i = (\mathbf{c^i})^{\alpha^i} \equiv (c_1^i)^{\alpha_1^i} \cdot (c_2^i)^{\alpha_2^i} \cdots (c_n^i)^{\alpha_n^i} \cdot (c_H)^{\alpha_H^i} \tag{19}$$

The consumption part is modeled using a Cobb-Douglas function, which implies that when the Cobb-Douglas utility function is quasi-concave, the corresponding indifference curves will be strictly convex. The model's time component is divided into two separable parts: one related to market work and the other to housework. The (dis)utility functions for these activities are expressed in a quasi-linear form, with the non-linear component modeled using a Constant Relative Risk Aversion (CRRA) utility function.

One challenge in constructing this utility function lies in determining the sequence of time allocation. When time is unitized, it is divided among three activities: leisure, market work, and housework, each represented as a percentage of total weekly time. The sequence of time allocation is critical. Consistent with the literature, supported by both theoretical and empirical evidence (e.g., (Gronau, 1977; Aguiar & Hurst, 2007)), the model assumes that individuals first decide the allocation of time to market work. The remaining "spare time" is then divided between housework and leisure. This approach allows for differentiated marginal (dis)utility between the two types of time use and ensures the unitization of total time. Additionally, the CRRA form facilitates the incorporation of constant relative risk aversion in labor supply. This setup accounts for the fact that while consumption is always positive, labor supply—whether in market work or housework—can reach corner solutions of zero.

φ_P^i and φ_H^i are an individual's (dis)utility associated with "spare time" (in relation to market work) and housework, respectively. In line with the earlier discussion and model framework, these (dis)utility levels are influenced by both gender and sexual orientation. Consequently, the preference parameters φ_P^i and φ_H^i exhibit the following order:

$$\varphi_P|_{H,W} > \varphi_P|_{S,W} > \varphi_P|_{S,M} > \varphi_P|_{H,M} \tag{20}$$

$$\varphi_H|_{H,M} > \varphi_H|_{S,M} > \varphi_H|_{S,W} > \varphi_H|_{H,W} \tag{21}$$

where H, S, M, and W denote whether an individual is in a heterosexual or same-sex relationship, and

whether they are male or female, respectively. The parameters are assigned discrete values; however, a similar conclusion can be drawn using a continuous spectrum for individuals.

The parameters η_P^i represents the degree of relative risk aversion in the CRRA utility function for market work in the first step of time allocation. The degree of risk aversion is idiosyncratic to each individual. Traditionally, literature has used the population or sample averages for these values, as they have minimal impact on the estimation of key variables and are not the primary focus of interest. Empirical tests have shown that wealth level (or reservation wage, in the context of individuals) is the primary factor influencing the degrees of relative risk aversion. This influence is more significant than other factors such as age, gender, education, and partnership status (Schotter & Braunstein, 1981; Layard et al., 2008). Therefore, I assume that relative risk aversion is related to an individual's personal wage, which serves as a good proxy for wage potential, to avoid redundancy in the model.

The preference parameters satisfy:

$$\alpha_1^i + \alpha_2^i + \cdots + \alpha_n^i + \alpha_H^i = 1 \tag{22}$$

Building on the traditional framework of specialization in time allocation (e.g., Olivetti (2006); Bredemeier & Juessen (2013); Knowles (2013); Siegel (2017)), and to include a broader gender spectrum in labor supply specialization and comparative advantages, I model home production as a function of both partners' time and respective productivities, using a CES form. This approach allows for constant elasticity of substitution and importantly accommodates corner solutions for individual labor input.

$$c_H = \left[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\right]^{\frac{1}{1-\rho}} \tag{23}$$

where e^i is individual i's productivity, which varies across the gender spectrum. The parameter $\rho > 0$ is the inverse of the elasticity of substitution between the two individuals' inputs. For finite ρ, this definition of c_H as a CES aggregator allows for substitutability between the two individuals' inputs to home production—as

long as both individual's productivity is larger than zero. Even though the production function allows corner solutions, where neither partner engages in market work, this limitation hampers the analysis of collective labor supply between partners. Similarly, the model allows for both partners to contribute zero housework. Yet, not only does this constrain the analysis of collective labor supply, but it also imposes costs on the household. As illustrated in the upcoming data summary, households where neither partner participates in market work or housework are exceptionally rare.

where e^i represent the productivity of individual i, which can vary across the gender spectrum. The parameter $\rho > 0$ is the inverse of the elasticity of substitution between the inputs of the two individuals. With finite $\rho > 0$, defining c_H as a CES aggregator allows for substitutability between the individuals' contributions to home production, provided both have non-zero productivity. While the production function permits corner solutions—where neither partner engages in market work—this assumption limits the analysis of collective labor supply within the partnership. Similarly, the model accommodates scenarios where both partners contribute no housework. However, this not only limits the analysis of shared labor efforts but also requires substantial non-labor income for the household. As demonstrated in the forthcoming data summary, households where neither partner engages in market work or housework are exceptionally rare.

For the household:

$$U^H = \mu^1 \cdot U^1 + \mu^2 \cdot U^2 \tag{24}$$

For every catagory of consumption, the household level is the sum of the two individuals'.

$$c_j = c_j^1 + c_j^2 \tag{25}$$

The household maximization is subject to the budget constraint:

$$\sum_{j=1}^{n} c_j^1 + \sum_{j=1}^{n} c_j^2 = w^1 h_P^1 + w^2 h_P^2 + y \tag{26}$$

The F.O.C. of individual's consumption indicates that it can be represented with the household aggregated consumption (see. Appendix). An individuals' comsumption can be presented with:

$$c_j^1 = \frac{\mu^1 \alpha_j^1}{\mu^1 \alpha_j^1 + \mu^2 \alpha_j^2} c_j, \qquad c_j^2 = \frac{\mu^2 \alpha_j^2}{\mu^1 \alpha_j^1 + \mu^2 \alpha_j^2} c_j \tag{27}$$

These two expressions allude that the individuals' consumption or intrahousehold allocation would be deided once the household level consumption and bargainin power are determined.

Thus, the utility maximization problem can be written as:

$$\begin{aligned} logU^H = {} & \mu^1 \cdot \{\alpha_1^1 log(c_1^1) + \cdots + \alpha_n^1 log(c_n^1) + \frac{\alpha_H^1}{1-\rho} log\big[e^1 (h_H^1)^{1-\rho} + e^2 (h_H^2)^{1-\rho}\big] + \varphi_P^1 \frac{(1-h_P^1)^{1-\eta_P^1} - 1}{1-\eta_P^1} - \varphi_H^1 h_H^1\} \\ & + \mu^2 \cdot \{\alpha_1^2 log(c_1^2) + \cdots + \alpha_n^2 log(c_n^2) + \frac{\alpha_H^2}{1-\rho} log\big[e^1 (h_H^1)^{1-\rho} + e^2 (h_H^2)^{1-\rho}\big] + \varphi_P^2 \frac{(1-h_P^2)^{1-\eta_P^2} - 1}{1-\eta_P^2} - \varphi_H^2 h_H^2\} \\ & + \sum_{j=1}^{n} \frac{(\mu^1 \alpha_j^1)^2 + (\mu^2 \alpha_j^2)^2}{\mu^1 \alpha_j^1 + \mu^2 \alpha_j^2} + \lambda(c_1^1 + \cdots + c_n^1 + c_1^2 + \cdots + c_n^2 - w^1 h_P^1 - w^2 h_P^2 - y) \end{aligned} \tag{28}$$

The F.O.C. with respect to all choice variables in this maximization problem remain unchanged, even when the distribution terms are omitted.[1] The seperatable distribution terms indicate a great feature in the household utility function that the distribution of expenditure on different catagories are independent of the distribution between the two partners in every catagory. It can also be observed that the preference parameters and Pareto weights align with Equation 28. According to the Envelope Theorem, the optimal choice of consumption and labor supply variables will not affect the selection of the optimal parameters used to maximize the utility functions.

I model the Pareto weight as:

$$\mu^i = \frac{exp(\nu \cdot \mathbf{z}^i)}{exp(\nu \cdot \mathbf{z}^i) + exp(\nu \cdot \mathbf{z}^j)}, \qquad i \neq j \tag{29}$$

The existing traditional heterosexual household setup means the Pareto weights of the man and woman can

[1] The defination of the distribution terms is $\sum_{j=1}^{n} \frac{(\mu^1 \alpha_j^1)^2}{\mu^1 \alpha_j^1 + \mu^2 \alpha_j^2} + \sum_{j=1}^{n} \frac{(\mu^2 \alpha_j^2)^2}{\mu^1 \alpha_j^1 + \mu^2 \alpha_j^2}$.

be individually estimated. However, the case in my model includes households with no man or woman. Hence, it would be impossible to directly compare intra-household bargaining power. To solve that, I focus on the bargaining power gap within the household. I constructed the indicators in the following format:

$$\Delta\mu = |\mu^1 - \mu^2| = \Big|\frac{exp(\nu \cdot \mathbf{z}^i) - exp(\nu \cdot \mathbf{z}^j)}{exp(\nu \cdot \mathbf{z}^i) + exp(\nu \cdot \mathbf{z}^j)}\Big|, \qquad i \neq j \tag{30}$$

$$\divideontimes\ \mu = \mu^1/\mu^2 = exp(\nu \cdot \mathbf{z}^1 - \nu \cdot \mathbf{z}^2) \tag{31}$$

The absolute value form allows to calculate the difference of bargaining power gap across the households with different gender composition. Meanwhile, the division form helps to understand the shift of bargaining power relative to individual 1 due to different characteristics of the household. To calculate the average bargaining power gaps within male or female groups, I focus only on the absolute difference between the two partners' bargaining powers. This approach also ensures that the calculation is unaffected by the order of the individuals in the household.

I model the preference parameters as:

$$\alpha_j^i = \frac{exp(\tau_j^\alpha \cdot \mathbf{x}_\alpha^i)}{1 + \sum_{j=1}^{n+1} exp(\tau_\mathbf{j}^\alpha \cdot \mathbf{x}_\alpha^i)} \tag{32}$$

The preference on home production can be calculated from the unitization as $\alpha_H^i = \frac{1}{1+\sum_{j=1}^{n+1} exp(\tau_\mathbf{j} \cdot \mathbf{x}^i)}$.

An individual's home production productitivty is heavily related to gender. This is has been evidenced in previous literature, even though only absolute binary gender indentity senorio is considered. However, since I consider

For the labor supply in both market work and housework, I can solve the collective labor between individual 1 and 2 as:

$$\frac{(1-h_P^1)^{\eta_P^1}}{(1-h_P^2)^{\eta_P^2}} = \frac{\mu^1\varphi_P^1}{\mu^2\varphi_P^2}\frac{w^2}{w^1} \tag{33}$$

$$\frac{(h_H^1)^\rho}{(h_H^2)^\rho} = \frac{\mu^2 \varphi_H^2}{\mu^1 \varphi_H^1} \frac{e^1}{e^2} \tag{34}$$

The two fractions reflect the collective labor supplies of market work and housework between two partners. The constant terms in front of the two labor supplies were due to the unitization of time usage.

by loglinearize Equation 33 and 34:

$$\eta_P^1 log(1 - h_P^1) - \eta_P^2 log(1 - h_P^2) = log(\mu^1) - log(\mu^2) + log(\varphi_P^1) - log(\varphi_P^2) + log(w^2) - log(w^1) \tag{35}$$

$$\rho log(h_H^1) - \rho log(h_H^2) = log(\mu^2) - log(\mu^1) + log(\varphi_H^2) - log(\varphi_H^1) + log(e^1) - log(e^2) \tag{36}$$

For the collective labor supply of market work, this equation indicates the relationship between the collective labor supply behavior and the bargaining power gap, individuals' preference, degress of risk aversion, and wages. Given the relationship, we can discuss how degenderization can affect the collective labor supply behavior. First, if individual 1 is male, φ_P^1 is higher for a gay man than heterosexual man. Considering individual 2 as his partner, φ_P^2 is higher for the heterosexual man's partner than a gay man's same-sex partner. Additionaly, the bargaining power gap $\Delta\mu$ narrows in a same-sex relationship. Thus, the more similar comparative and degenderized preference and narrower bargaining power gap in a same-sex relationship will shift down the household collective labor supply for men. The direction for each individual's market work labor supply is uncertain, which is not supposed to be measured with the collective labor supply. The decreased collective labor supply simply implies that the market labor supply between same-sex partners tend to converge. If individual 2 is female, φ_P^1 is higher for a lesbian woman than heterosexual woman and φ_P^2 is lower for the lesbian woman's same-sex partner than a heterosexual woman's partner. Thus, the more similar comparative and degenderized preference in a same-sex relationship will shift up the collective labor supply for women. Similar, it is not feasible to know the changing of the direction of individuals. The collective market labor supply between to

lesbian partners converge. However, the individual's labor supply has already been seperately proved in the egostic utility part.

This equation describes the relationship between the collective labor supply in market work and factors including the bargaining power gap, individual preferences, degrees of risk aversion, and wages. Based on this relationship, I can analyze how degenderization affects collective labor supply behavior.

First, consider individual 1 as male. The parameter φ_P^1 is higher for a gay man compared to a heterosexual man. When considering individual 2 as his partner, φ_P^2 is higher for the heterosexual man's partner than for a gay man's partner. Additionally, the bargaining power gap, $\Delta\mu$, narrows in a same-sex relationship. As a result, the more similar comparative advantages, degenderized preferences and the narrower bargaining power gap in a same-sex relationship tend to reduce the household's collective labor supply for men. The decrease in collective labor supply suggests that the market labor supply between same-sex partners tends to converge. However, the direction of each individual's market labor supply is uncertain and cannot be directly measured using the collective labor supply.

If individual 2 is female, φ_P^1 is higher for a lesbian woman than for a heterosexual woman, while φ_P^2 is lower for the lesbian woman's partner than for a heterosexual woman's partner. In this case, there is an increase in the collective labor supply for women. As with male couples, it is not feasible to determine the direction of change for each individual's labor supply, but the collective market labor supply between lesbian partners converges. As demonstrated earlier, individual labor supply changes have already been separately discussed in the analysis of egoistic utility.

The collective labor supply for housework is more straightforward. Based on the previous assumptions about labor supply preferences, for a male individual 1, being in a same-sex relationship is associated with a higher collective housework labor supply index. This suggests a smaller gap in housework labor supply between the two gay partners. While it is theoretically inconclusive to determine changes in an individual's labor supply, we can indirectly estimate it by using sample averages to compare housework labor supply across different genders and sexual orientations, which will be explored further in the empirical section. Conversely,

for a female individual in a same-sex relationship, the collective housework labor supply index tends to be lower, also indicating a narrower gap in housework labor supply between the two lesbian partners.

3 Empirical Application

With the theoretical framework above, this part provides supporting empirical evidence to the hypptheses. The challenging parts in the empirical part is mainly from the available sample. The data must be inclusive that same-sex couples are included. Secondly, the household survey must comprise a large total sample if it is not LGBT focused. Lastly, the survey must contains both partners' infomation, including labor supplies and consumption. Thus, limited countries are available for this purpose. In this paper, I utilize the British Household Panel Survey (BHPS), which is the only dataset satisfies the purpose, to the best of my knowledge.

With this data, I mainly test two possible differences between same-sex and opposite-sex couples. The first is how being in a same-sex relationship changes intra-house bargaining power (bargaining power gap) compared to heterosexual couples. The second is how an individual with a same-sex partner supply labor differently from their heterosexual counterpart.

3.1 Data and Summary Statistics

3.1.1 British Household Panel Survey

This study draws primarily on data sourced from the British Household Panel Survey, spanning from the second to the 18th wave, covering the years 1992 to 2009. Conducted by the Institute for Social and Economic Research (ISER), the BHPS annually surveys a nationally representative sample of approximately $5,500$ households, initially recruited in 1991, comprising around $10,000$ interviewed individuals. Over successive years, participants were re-interviewed, and if they formed new households or joined existing ones, they were followed up, with all adult members being interviewed. Additionally, extension samples of 1,500 households each were included in Scotland and Wales in 1999, and in Northern Ireland in 2001, augmenting the main BHPS

sample to approximately 10,000 households across the UK.

The core questionnaire of the BHPS encompasses various social science and policy domains, including household composition, education, labor market behavior, household activities, socio-economic values, and income from employment, benefits, and pensions. A large advantage of the survey is that it suveyed the core information on both sides seperately, especially the labor supply and income information. This is a significant advantage over datasets such as American Time Use Survey (ATUS), where a single individual is surveyed. Thus, this allows me not only to investigate an individual's labor supply behaviors but also the collective labor supplies of the couple.

3.1.2 Summary Statistics

Given the research focus, only households with two adult partners are considered. Given that same-sex marriage wasn't legalized in the UK until 2013 (in England and Wales), relationships are categorized as cohabitation, civil union, or marriage if they involve opposite-sex couples. Civil partnerships among same-sex partners were legalized in the UK in 2005 and in Great London in 2001. Individuals are included in the analysis only during the period of their relationship.

There is a common perception that LGBTQ+ individuals tend to be younger, a trend supported by the data. Among partnered individuals, the average ages for heterosexual men and women are 43.12 and 41.04 respectively. In contrast, the average ages for gay men and lesbian women in relationships are 40.91 and 35.94 respectively. To ensure a fair comparison between same-sex and opposite-sex couples, the propensity score matching (PSM) method is employed to select opposite-sex samples at a ratio of 1 to 10 based on age. This ratio is chosen to reflect a reasonable understanding of the LGBTQ+ population distribution. The distance matching method is the nearest neighbor matching. Given the unique characteristics of same-sex couples, the matching process is constrained to a relatively young group with a limited number of children. For the demographic information, among same-sex couples, the number of children is notably low, especially for gay couples who have an average of only 0.058 children. The rest of the summary statistics at both individual and

household levels are as follows:

[Insert Table 1 here]

The data strongly supports the hypotheses regarding labor supply, revealing notable distinctions between genders and sexual orientations. Men generally exhibit higher engagement in market work compared to women. Straight men, on average, dedicate 36.10 hours weekly to market work, surpassing gay men who commit only 32.15 hours. Conversely, lesbian women contribute more hours than heterosexual women, with an average of 29.09 compared to 22.14 hours per week, respectively. Gender influences participation rates in market work. Over 87% of both straight and gay men participate, while only 75% of straight women engage in market work, contrasting with nearly 84% of lesbian women. I delineate individuals working over 30 hours weekly as full-time workers. While the proportions of full-time workers and market work participants among straight men exhibit minimal disparity, all gay men notably demonstrate a significant 10% lower rate of full-time employment compared to their straight counterparts. This discrepancy amplifies among straight women, where merely 43% engage in full-time work, contrasting with lesbian women who boast a significantly higher rate, surpassing straight women by 23 percentage points. It's crucial to note that these distinctions align with the gender dynamics outlined in the hypotheses, where straight men and women represent the masculine and feminine sides, respectively, while the gay men and lesbian women groups encompass a mix of both.

Conversely, regarding housework, women shoulder a greater burden regardless of sexual orientation. Straight men devote the least time to housework, averaging 5.76 hours per week, while gay men contribute significantly more at 8.27 hours weekly. Participation rates also diverge, with less than 90% of straight men involved compared to nearly 100% of gay men. On average, straight women spend substantially more time on housework (17.15 hours per week) than lesbian women (8.49 hours per week). However, participation rates between straight and lesbian women remain similar, with both groups ranging from $98 - 99\%$.

Hourly wage serves as a measure of an individual's comparative advantage in the workforce. On average, men command higher hourly wages than women, regardless of sexual orientation. Among men, gay individuals earn slightly more than their straight counterparts, with hourly wages of 11.52 compared to 10.41. Although

this difference is statistically significant, it remains relatively modest at 1.11 per hour.

Conversely, the wage gap between straight women and lesbians is substantial and noteworthy. Lesbian women earn significantly higher hourly wages at 11.26, in contrast to straight women at 6.58. This disparity may stem from factors such as lower participation rates or predominantly part-time employment among straight women, a matter I intend to explore further in subsequent analyses. When examining hourly wages exclusively among full-time workers, the disparities between straight and gay men, as well as lesbian women, are relatively minor. However, full-time straight women workers command significantly higher hourly wages compared to their counterparts, yet they still earn notably less than lesbian women.

While the weekly income disparity between gay and straight men is negligible, lesbian women notably out-earn straight women on average, with weekly incomes of 376.66 compared to 188.36, respectively. Non-labor income levels remain relatively consistent across all groups, ranging between 30 and 40 weekly.

At the household level, due to their composition of two men, gay families demonstrate a notably higher average household labor income (792.03) compared to opposite-sex families (604.96). Conversely, lesbian families exhibit a slightly higher average household income (685.72) than heterosexual counterparts. However, the difference is not statistically significant. The difference may be attributed to the fact that both women in a lesbian family have a high likelihood of participating in market work. The results align with the literature indicating that male same-sex couples may have an advantage, as they typically earn more than female same-sex couples on average (Badgett, 1998). Non-labor income doesn't significantly differ among the groups.

Weekly household expenditures encompass short-term items, categorized into food and groceries, housing, and nondurable goods. Heterosexual couples, on average, allocate more of their budget towards food and groceries than both gay and lesbian couples. While the difference between gay and heterosexual families isn't statistically significant, it remains notably larger than that between lesbian and heterosexual families. However, both gay and lesbian couples tend to spend more on housing than their heterosexual counterparts. Expenditure on nondurable goods ranks lower across all groups and doesn't significantly differ among them.

3.1.3 Structural Estimation

The F.O.C. conditions for labor supply in the utility maximization problem with aggregate consumption stay the same as Equation A32, A34, A33 and A35. Thus, it allows the constructions of moments from the F.O.C.s from different types of consumption in the form as:

$$\frac{\mu^1\alpha_j^1 + \mu^2\alpha_j^2}{\mu^1\alpha_m^1 + \mu^2\alpha_m^2} = \frac{c_j}{c_m}, \qquad 1 \leq j, m \leq n, \quad \text{and} j \neq m \tag{37}$$

This presents C_2^n moments. The combinations of F.O.C.s from the consumption and market labor supply lead to:

$$\frac{\mu^1\alpha_j^1 + \mu^2\alpha_j^2}{c_j} = \frac{\mu^i\varphi_P^i(1-h_P^i)^{-\eta_P^i}}{w^i}, \qquad 1 \leq j \leq n, \quad i = 1 \text{ or } 2 \tag{38}$$

This presents $2n$ moments.

In addition, similar to the collective labor supply construction, the combinations of h_P^i and h_H^i

$$\frac{\mu^1\varphi_P^1(1-h_P^1)^{-\eta_P^1}}{\mu^2\varphi_P^1(1-h_P^1)^{-\eta_P^1}} = \frac{w^1}{w^2} \tag{39}$$

$$\frac{e^1(h_H^1)^{-\rho}}{e^2(h_H^2)^{-\rho}} = \frac{\mu^1\varphi_H^1}{\mu^2\varphi_H^2} \tag{40}$$

provides another two moments. Lastly, combining the F.O.C. with respect to h_H^i with the set of F.O.C.s of c_j, h_P^i provides another $2 * (n+1)$ moments.

With the moments constructed above, I can estimate the parameters using data. The nonlinear generalized method of moments (GMM) is the ideal approach for this estimation, as it addresses potential endogeneity issues that may arise in linear regression when collective labor supply is correlated with other factors in the error term. GMM has recently proven effective in estimating certain nonlinear models with endogenous explanatory variables, especially when these variables do not enter the equation additively. This method is particularly effi-

cient in cases involving exponential functions with endogenous variables. GMM is often applied to unobserved effects models, especially when explanatory variables are not strictly exogenous, even after controlling for unobserved effects. By using GMM, estimation accuracy can be improved in situations where standard estimators are inadequate due to the failure of auxiliary assumptions (Wooldridge, 2001).

The parameters that need to be estimated are the bargaining powers μ^i, the preference parameters α^i, φ_P^i, and φ_H^i, the home production parameters e^i and ρ, as well as the risk aversion parameters η_P^i. Conventional collective model literature typically measures intrahousehold bargaining dynamics by estimating Pareto weights for male and female partners. However, this approach is limited to heterosexual couples in the dataset, as it does not differentiate between same-sex partners. Consequently, my structural estimation of intrahousehold inequality focuses on the absolute disparity between partners, irrespective of gender.

The construction of those parameters should be univerally applicable to the individual in the household. The strctures of Pareto weights and preference parameters have been constrcuted previously in Equation 32 and 32. In this empircal part, I incorporate key factors into these two sets of vectors to reflect how these parameters are shifted by related factors. For $\mathbf{z}^i$, it includes the individual's gender and other demographic characteristics such as education. The main focus is the bargaining power gap caused by gender. The structure of the Pareto weight gap means sexual orientation is correlated with gender, where the sexual orientation vairble would be cancelled out in the calculation of the bargaining power gap. However, the exclusion of sexual orientation factor does not mean sexual orientation does not shift the bargaining power. For preference parameters, I assume they are related to the gender, considering the consumptions are in four broad catagories.

The time use part reflects the degenrization part, aligned with the previous assumption on labor supply. The two time preference parameter φ_P^i and φ_P^i are related to gender and degenderization, where degenderization is reflected whether the individual is in a same-sex relationship.

$$\varphi_P^i = exp(\tau_0^{\varphi_P} + \tau_j^{\varphi_P} \cdot \mathbf{x}_{\varphi_P}^i) \tag{41}$$

$$\varphi_H^i = exp(\tau_0^{\varphi_H} + \tau_j^{\varphi_H} \cdot \mathbf{x}_{\varphi_H}^i) \tag{42}$$

The vector φ_P and φ_H includes the individual's gender and theri sexual orientation, which reflects the main degenderization assumption. For the risk aversion parameter, I follow the exisiting literature mentioned above and assume it is affected by an individual's earning potential.

$$\eta_P^i = exp(\tau_0^{\eta_P} + \tau_1^{\eta_P} \cdot x_{\eta_P}^i) \tag{43}$$

Table 2 presents the estimation outcomes, with Pareto weights presented as sample averages.

[Insert Table 2 here]

The gap across all couples averages around 0.12, aligning with prior studies examining British data (e.g., Lise & Seitz (2011)). Male individuals notably contribute to widening intrahousehold inequality, while a trend towards degenderization significantly narrows the gap between partners. When incorporating gender into the analysis, being in a same-sex partnership reduces inequality by approximately 11% for gay men and 17% for lesbian women, based on sample averages. This finding underscores the significant role gender plays in shaping intra-household bargaining dynamics.

Compared to other factors, the gender gap between partners has 86% greater explanatory power in these dynamics. Consistent with previous research, men generally exhibit lower advantages in home production. However, being in a same-sex relationship significantly narrows the productivity gap, reducing it by 37.13%.

3.2 Reduced-form Evidence

3.2.1 Degenderized Preference, Comparative Advantage and Labor Supply

In this section, I present reduced-form evidence that supports the theoretical model proposed earlier. Specifically, I examine how different types of relationships and wage disparities influence individuals' labor supply

decisions, encompassing both market work and home production.

The basic specification for testing the effect of shifting preferences towards degenderization on labor supply is as follows:

$$Labor\_Supplies_i = \beta_0 + \beta_1 \cdot Same\_Sex + \beta_2 \cdot Earning + \beta_3 \cdot Partner\_Earning + \beta_4 \cdot Nonlabor\_income + \varepsilon_i \tag{44}$$

where the dependent variable $Labor\_Supplies$ is the weekly hours an individual spends on either market work or housework. $Same\_sex$ is a binary variable reflecting whether a person is in a same-sex relationship. $Earning$ is measured with hourly earnings, which reflects the individual's earning potential. The definition is the same for $Partner\_Earning$. Additionally, I incorporate individuals' weekly non-labor income. All time and monetary values are transformed using the Inverse Hyperbolic Sine (IHS) function ($\sinh^{-1}(x)$).

Based on the data description, it's evident that women, particularly those in opposite-sex relationships, exhibit a lower percentage of labor force participation, resulting in a prevalence of zero-value dependent variables. To investigate the distinction between lesbian and heterosexual women, I initially examine the impact of shifting preferences towards degenderization on their labor force participation. I employ both Probit and Logit regressions to explore this relationship.

A similar inquiry arises concerning men's involvement in housework. While this is less of a concern for gay men due to their notably high participation rates, it remains essential to address this issue among heterosexual men. Likewise, I utilize both Probit and Logit regressions to investigate the influence of shifting preferences towards degenderization on housework participation among gay and heterosexual men.

In addition to the basic specification regarding the role of degenderization, I delve deeper into testing the impact of comparable comparative advantage between same-sex partners on labor supply patterns. This involves integrating an interaction term comprising the type of relationship and the corresponding earnings of either themselves or their partner.

$$Labor\_Supplies_i = \beta_0 + \beta_1 \cdot Same\_Sex + \beta_2 \cdot Earning + \beta_3 \cdot Partner\_Earning$$
$$+ \beta_4 \cdot Same\_Sex \cdot Earning + \beta_5 \cdot Same\_Sex \cdot Partner\_Earning + \beta_6 \cdot Nonlabor\_income + \varepsilon_i \tag{45}$$

The estimation results are presented in the two tables below:

[Insert Table 3 here]

[Insert Table 4 here]

The study's findings on paid work consistently reveal significant results for men, aligning with theoretical predictions. Gay men, on average, work around 20% fewer hours compared to their heterosexual counterparts. Consistent with previous literature, a higher hourly wage motivates men to work more, irrespective of sexual orientation, with a 1% increase in wage leading to approximately a 1% increase in market work hours. Conversely, a higher partner hourly wage acts as a deterrent for men to work more, regardless of sexual orientation, with a 1% increase in their partner's wage resulting in around a 0.4% decrease in market work hours.

Upon introducing the interaction term, we can analyze the effects of comparative advantage. As a gay man's partner shares a similar comparative advantage in both types of work, a higher hourly wage has a lesser impact on his market work hours, with a 1% increase in wage leading to a 0.04% lesser percentage increase compared with heterosexual men. Additionally, a higher partner hourly wage further discourages men from working more, with a 1% increase in their partner's wage resulting in a 0.01% more decrease in their market work hours.

Regarding women, being in a same-sex relationship increases the likelihood of participating in market work, as evidenced by both Probit and Logit models. Among market participants, lesbian women participate significantly more on average. When considering degenderized preferences alone, lesbian women spend approximately 12.5% more hours on market work than straight women. Comparative advantage plays a less

significant role for women, with a higher hourly wage having marginal effects regardless of sexual orientation. However, the effect is even weaker (0.01% lower) among lesbian women.

On the contrary, housework labor supply exhibits markedly different patterns. Regarding participation rates, being in a same-sex relationship significantly increases a man's likelihood of participating in housework, as evidenced by both Probit and Logit models. When it comes to housework hours, both degenderized preferences and comparative advantage play crucial roles in distinguishing between gay and straight men, as well as between lesbian and straight women.

On average, gay men spend 30 to 40% more hours on housework than straight men, while lesbian women spend considerably less than straight women ($50 - 60\%$). A higher hourly wage reduces hours spent on housework for women, regardless of sexual orientation, with a 1% increase in wage resulting in approximately a 1.7% decrease in housework hours. The difference in this regard is not significant between lesbian and straight women.

Furthermore, a 1% increase in their partner's wage leads to a 0.07% increase in housework hours, albeit less significantly among lesbian women, with a magnitude standing at only 0.02 percentage points.

3.2.2 Distinguished Comparative Advantage and Labor Supply

To further prove that earning ability gaps cannot fully explain the labor supply difference between individuals in same-sex and opposite-sex relationships, I compare the higher earner in a gay couple with a heterosexual man who earns more than his wife and the lower earner in a lesbian couple with a heterosexual woman who earns less than her husband. Given the earning potential, the specification is the same one as Equation 45.

Table 5 presents the estimation results.

[Insert Table 5 here]

The table illustrates how the interplay between shift of preference and comparative advantage varies among individuals in same-sex relationships with differing earning capacities. Naturally, one would expect that a higher earning ability diminishes the significance of personal preference in decision-making. For men with

lower wages, the de-gendered aspect of preference becomes pivotal, often resulting in reduced market participation among gay men. Conversely, earning potential holds less sway over the labor hours of men, particularly among gay individuals, underscoring the nuanced dynamics at play.

Among men with higher wages, preference parameters alone cannot adequately explain market labor decisions among gay men. Interestingly, a 10% decrease in the impact of higher hourly wages is observed on the market labor hours of gay men. A parallel trend emerges among women. For women with lower wages, de-gendered preference exerts considerable influence, leading to heightened labor participation among lesbian individuals. Similarly, a comparable advantage shared with their same-sex partner curtails the increase in market labor hours among high-wage lesbian women.

Conclusion

This study serves as a valuable addition to Gronau and Becker's theory of labor supply by examining how diverse preference patterns among same-sex couples, along with the role of comparative advantage relative to opposite-sex couples, shape collective labor supply decisions. To explore this, I introduce a gender-neutralized collective model that incorporates the concept of degenderization, recognizing that individuals in same-sex relationships may have unique preferences and inclinations toward various forms of labor participation. This approach highlights the impact of these evolving preferences and facilitates a discussion on their effects on intra-household bargaining dynamics within same-sex couples.

I propose a revised Chiappori-style collective model that diverges from conventional gender norms. This model challenges the typical framework where heterosexual men often express greater aversion to housework compared to heterosexual women, while women tend to exhibit more reluctance towards market work, all else being equal. The concept of degenderization, central to this model, posits that individuals in same-sex relationships depart from these traditional patterns. Specifically, the model posits that gay men experience less marginal aversion to housework and more to market work, while lesbian women experience less marginal aversion to market work and more to housework compared to their heterosexual counterparts. Furthermore, the

model accounts for the fact that same-sex couples tend to possess more similar comparative advantages due to their shared gender.

The findings of this model reveal a notable convergence in labor supply among same-sex partners, reflected in both the allocation of time and the similarities between partners. This convergence highlights a more equitable distribution of paid work and housework within same-sex relationships and underscores the alignment of collective labor supply decisions between the two partners, in contrast to opposite-sex couples. These results challenge traditional gender roles and provide strong evidence supporting the concept of degenderization in same-sex relationships.

Leveraging comprehensive data from the British Household Panel Survey (BHPS) spanning from 1992 to 2009, I employ both structural and reduced-form analyses of labor supplies. The results strongly corroborate the proposed theory. According to estimations derived from the collective model, being in a same-sex relationship reduces inequality by 11% for gay men and 17% for lesbian women. In the reduced-form analysis, which considers hourly earnings as a proxy for earning potential and accounts for the earning potential of both partners, gay men tend to engage less in market work, whereas lesbian women tend to participate more. These trends become more pronounced and consistent when focusing on the higher earner within gay couples and the lower earner within lesbian couples. Additionally, I uncover a general tendency towards increased participation in household chores among gay men and decreased participation among lesbian women.

Moreover, my research findings present compelling contradictions to the Becker-Gronau model's conclusions regarding the roles of spouses' comparative advantages. Specifically, it is evident that both gay men respond more negatively to their own earning potential in market work, whereas lesbian women respond more positively. Additionally, a noteworthy discrepancy emerges as gay men respond more negatively to their partners' earning potential in market work. These discrepancies challenge the conventional assumptions put forth by the Becker-Gronau model.

These findings enhance our understanding of the distinct economic behaviors and preferences within same-sex relationships, offering valuable insights into the convergence of labor supply among same-sex couples.

The research underscores the significance of considering degenderization and the impact of shifting preferences when examining household dynamics in same-sex relationships. Further exploration of intra-household bargaining dynamics among same-sex partners is warranted, as it represents an area that requires further investigation in the existing literature. beamer

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Table 1: Summary Statistics

	Individual					
	Straight man	Gay	Diff 1	Straight woman	Lesbian	Diff 2
Age (average)	40.14	40.91	-	37.86	35.94	-
Market work hours (weekly)	36.10	32.15	-3.95***	22.14	29.09	6.95***
Market work participation	87.28%	87.01%	-0.0027	75.14%	83.71%	0.086***
Full-time market work participation	84.61%	74.68%	-0.099***	43.25%	66.85%	0.23***
Housework hours (weekly)	5.76	8.27	2.51***	17.15	8.49	-8.66***
Housework participation	89.79%	99.68%	0.099***	99.18%	98.31%	-0.0086
Hourly wage	10.41	11.52	1.11*	6.58	11.26	4.68***
Full-time hourly wage	11.63	13.15	1.52**	8.76	12.96	4.20***
Labor income (weekly)	409.37	411.41	2.04	188.36	376.66	188.29***
Nonlabor income (weekly)	33.77	34.68	0.91	39.76	38.33	-1.43
Partner wage	6.58	11.52	4.94***	10.41	11.26	0.85
Partner labor income (weekly)	188.36	411.41	223.05***	409.37	376.66	-32.71
Number of observations	2430 (matched)	308		2430 (matched)	178	
	Household					
	Opposite-sex	Gay	Diff3	Lesbian	Diff4	
Household labor income	604.96	792.03	187.01***	685.72	80.76	
Household nonlabor income	82.3	65.54	-16.76	81.12	-1.18	
Household expenditure (weekly)						
Food and grocery	76.05	72.61	-3.43	68.22	-7.83**	
Housing	85.89	144.08	58.18***	130.44	44.54***	
Nondurable	13.36	13.78	0.43	12.38	-0.97	
Number of children	1.09	0.058	-1.03***	0.49	-0.60***	
Number of observations	2430 (matched)	154		89		

Notes: The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. All the consumption are at the household level at the sample averages. All values are in the pound sterling.

Table 2: Structural Estimation

	Estimation
Intra-household bargaining power gap	
Opposite-sex	0.2018
Same-sex: gay	0.0035
Same-sex: lesbian	0.0014
Parameter estimation	
Pareto weight (bargaining power)	
Gender (male)	0.4094***
	(0.0337)
Education	0.0300***
	(0.0005)
Home production parameter	
Gender (male)	-1.2794***
	(0.3612)
Same-sex relationship	0.4750**
	(0.2114)
Consumption preference	
Food and grocery: Gender (male)	0.0012***
	(0.0004)
Housing: Gender (male)	0.0007*
	(0.0004)
Nondurable: Gender (male)	-0.0001
	(0.0003)
Home production: Gender (male)	1.1584***
	(0.0701)
Observations	2,043

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. All the consumption are at the household level at the sample averages. All values are in the pound sterling.

Table 3: Regression on Market Work Labor Supply

	Market work labor supply							
Gender	Men			Women				
Dependent variable:	Market work hours (weekly)			Market work participation		Market work hours (weekly)		
				Probit	Logit			
Same sex	-0.194***	0.213***	0.332***	0.942**	0.064*	0.214***	0.161**	0.227***
	(0.053)	(0.078)	(0.094)	(0.429)	(0.876)	(0.037)	(0.070)	(0.074)
Hourly wage	0.934***	0.967***	0.965***	68.154	183.356	0.087***	0.098***	0.101***
	(0.015)	(0.016)	(0.016)	(965.647)	(6106.008)	(0.017)	(0.017)	(0.017)
Partner hourly wage	-0.042***	-0.046***	-0.038***	0.436***	0.908***	-0.004***	-0.004**	-0.005***
	(0.013)	(0.013)	(0.014)	(0.138)	(0.279)	(0.001)	(0.001)	(0.002)
Hourly wage*Same sex		-0.035***	-0.035***				-0.012**	-0.018***
		(0.005)	(0.005)				(0.005)	(0.005)
Partner hourly wage*Same sex			-0.011**					0.011**
			(0.005)					(0.005)
Nonlabor income (weekly)	-0.129***	-0.124***	-0.124***	-0.161**	-0.338**	-0.061***	-0.062***	-0.061***
	(0.008)	(0.008)	(0.008)	(0.063)	(0.133)	(0.006)	(0.006)	(0.006)
Observations	2,738	2,738	2,738	2608	2608	2,066	2,066	2,066
R2	0.66	0.667	0.667			0.035	0.038	0.040
Log Likelihood				-55.879	-56.256			

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. All the consumption are at the household level at the sample averages. The implemented method calculates Heteroskedasticity-robust standard errors. All values are in the pound sterling.

Table 4: Regression on Housework Labor Supply

	Housework labor supply							
Gender	Men					Women		
Dependent variable:	Housework participation		Housework hours (weekly)			Housework hours (weekly)		
	Probit	Logit						
Same sex	1.160***	2.977***	0.415***	0.368***	0.512***	-0.475***	-0.450***	-0.347***
	(0.326)	(1.006)	(0.047)	(0.070)	(0.115)	(0.058)	(0.081)	(0.090)
Hourly wage	0.068**	0.133**	-0.138***	-0.142***	-0.143***	-0.173***	-0.173***	-0.174***
	(0.031)	(0.058)	(0.014)	(0.015)	(0.015)	(0.012)	(0.012)	(0.012)
Partner hourly wage	0.134***	0.259***	0.058***	0.058***	0.064***	0.061***	0.061***	0.068***
	(0.027)	(0.052)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Hourly wage*Same sex				0.004	0.004		0.001	0.007
				(0.004)	(0.004)		(0.005)	(0.006)
Partner hourly wage*Same sex					-0.043			-0.016***
					(0.037)			(0.006)
Nonlabor income (weekly)	-0.016	-0.025	0.002	0.001	0.001	0.051***	0.051***	0.051***
	(0.017)	(0.032)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
Observations	2,738	2,738	2,489	2,489	2,489	2,608	2,608	2,608
R2			0.069	0.069	0.07	0.164	0.164	0.167
Log Likelihood	-786.271	-786.17						

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. All the consumption are at the household level at the sample averages. The implemented method calculates Heteroskedasticity-robust standard errors. All values are in the pound sterling.

Table 5: Regressions on Collective Market and Housework Labor Supply

Dependent variable:	Collective market labor supply		Collective housework labor supply	
	Male	Female	Male	Female
Same-sex	0.040***	-0.059***	0.054***	-0.063***
	(0.008)	(0.009)	(0.006)	(0.007)
Hourly wage	-0.052***	-0.058***	-0.009***	-0.029***
	(0.002)	(0.002)	(0.002)	(0.002)
Partner hourly wage	0.009***	0.005***	0.005***	0.002***
	(0.0004)	(0.0004)	(0.0003)	(0.0003)
Observations	2,738	2,608	2,738	2,608
R2	0.253	0.264	0.134	0.153

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. All the consumption are at the household level at the sample averages. The implemented method calculates Heteroskedasticity-robust standard errors. All values are in the pound sterling.

Appendix

A1 Theoretical Appendix

A1.1 Labor Supply Convegence

The FOCs w.r.t. h_P^1, h_H^1, h_P^2 and h_H^2 are:

$$\mu \cdot \frac{\partial U^1}{\partial h_P^1} - \lambda^0 w^1 = 0 \tag{A1}$$

$$\mu \cdot \left(\frac{\partial U^1}{\partial h_H^1} + \frac{\partial U^1}{\partial c_H} \frac{\partial c_H}{\partial h_H^1} \right) + (1-\mu) \cdot \frac{\partial U^2}{\partial c_H} \frac{\partial c_H}{\partial h_H^1} = 0 \tag{A2}$$

$$(1-\mu) \cdot \frac{\partial U^2}{\partial h_P^2} - \lambda^0 w^2 = 0 \tag{A3}$$

$$(1-\mu) \cdot \left(\frac{\partial U^2}{\partial h_H^2} + \frac{\partial U^2}{\partial c_H} \frac{\partial c_H}{\partial h_H^2} \right) + \mu \cdot \frac{\partial U^1}{\partial c_H} \frac{\partial c_H}{\partial h_H^2} = 0 \tag{A4}$$

Equations (A1) and (A3) lead to:

$$\frac{U^1_{h_P^1}}{U^2_{h_P^2}} = \frac{1-\mu}{\mu} \cdot \frac{w^1}{w^2} \tag{A5}$$

Equations (A2) and (A4) lead to:

$$\frac{U^1_{h_H^1}}{U^2_{h_H^2}} = \frac{1-\mu}{\mu} \cdot \frac{\frac{\partial c_H}{\partial h_H^1}}{\frac{\partial c_H}{\partial h_H^2}} \tag{A6}$$

The two results above also lead to the substuition between the two types of work:

$$\frac{U^1_{h_H^1}}{U^2_{h_H^2}} = \frac{U^1_{h_P^1}}{U^2_{h_P^2}} \cdot \frac{w^2}{w^1} \cdot \frac{\frac{\partial c_H}{\partial h_H^1}}{\frac{\partial c_H}{\partial h_H^2}} \tag{A7}$$

For any set of wages:

$$\frac{\partial LHS}{\partial s^1} < 0, \quad \text{and} \quad \frac{\partial RHS}{\partial s^1} > 0 \tag{A8}$$

This means an increase in h_H^1 and a decrease of h_P^1.

Similarly,

$$\frac{\partial LHS}{\partial s^2} < 0, \quad \text{and} \quad \frac{\partial RHS}{\partial s^2} > 0 \tag{A9}$$

This means a decrease in h_H^2 and an increase of h_P^2.

$$\frac{\partial (h_P^1/h_P^2)}{\partial s^i} < 0, \quad \text{and} \quad \frac{\partial (h_H^1/h_H^2)}{\partial s^i} > 0 \tag{A10}$$

A1.2 Egoistic Preference

Let h_X^i is the derivative of h^i with respect to X. Let us denote

$$A = \frac{h_{w^2}^1}{h_y^1} = \frac{\phi_{w^2}}{\phi_y} \tag{A11}$$

$$B = \frac{h_{w^1}^2}{h_y^2} = -\frac{\phi_{w^1}}{1-\phi_y} \tag{A12}$$

When we have just a single factor shifting the bargaing power:

$$C = \frac{h_d^1}{h_y^1} = \frac{\phi_d}{\phi_y} \tag{A13}$$

$$D = \frac{h_d^2}{h_y^2} = -\frac{\phi_d}{1-\phi_y} \tag{A14}$$

For the single variables of degenderization:

$$E = \frac{h_{s^2}^1}{h_y^1} = \frac{\phi_{s^2}}{\phi_y} \tag{A15}$$

$$F = \frac{h_{s^1}^2}{h_y^2} = -\frac{\phi_{s^1}}{1-\phi_y} \tag{A16}$$

This delivers the function form of the sharing rule as:

$$\phi_y = \frac{D}{D-C} \tag{A17}$$

$$\phi_d = \frac{CD}{D-C} \tag{A18}$$

$$\phi_{w^1} = \frac{BC}{D-C} \tag{A19}$$

$$\phi_{w^2} = \frac{AD}{D-C} \tag{A20}$$

The effect of degenderization on the transfer of non-labor income:

$$\phi_{s^1} = \frac{CF}{D-C} \tag{A21}$$

$$\phi_{s^2} = \frac{DE}{D-C} \tag{A22}$$

For individual 1's utility maximization problem:

$$U^1(\mathbf{c^1}, \mathbf{h^1}, \mathbf{s^1}) + \lambda^1(c_G^1 + g_H^1 - w^1 h_P^1 - \phi^1) \tag{A23}$$

The FOCs w.r.t. c_G^1, g_H^1 and h_P^1 are:

$$\frac{\partial U^1}{\partial c_G^1} + \lambda^1 = 0 \tag{A24}$$

$$\frac{\partial U^1}{\partial c_H}\frac{\partial c_H}{\partial g_H^1} + \lambda^1 = 0 \tag{A25}$$

$$\frac{\partial U^1}{\partial h_P^1} - \lambda^1 w^1 = 0 \tag{A26}$$

A2 Empirical Appendix

A2.1 Estimation of Housing and Durable Goods Spendings

This section details the estimation and prediction of expenditure variables for housing and durable goods. As shown in the descriptive data, there is a significant difference in the magnitudes of these two categories. Households typically spend more on housing, so it is reasonable to expect positive predicted values for housing expenditure. Therefore, a linear model is appropriate for housing expenditure predictions.

However, since spending on durable goods is relatively smaller, even on an annual scale, using a linear model might lead to negative predictions. Given that these expenditures are countable, Poisson regression is more efficient. For housing expenditure, I consider the following specification:

$$Housing_{i,t} = \beta_0 + \mathbf{beta}_1 \mathbf{X}_{i,t} + \mathbf{beta}_2 \mathbf{Y}_{i,t} \tag{A27}$$

where $Housing_{i,t}$ represent the weekly housing expenditure for individuals with positive values at time t. I focus on the sample with positive housing spending to estimate its correlations with other monetary variables. The vector $\mathbf{X}i, t$ includes spending on food, groceries, and nondurable goods (weekly) at time t. The vector $\mathbf{Y}i, t$ encompasses the household's labor and non-labor income at time t. Additionally, I include dummy variables for house features to capture the types of home ownership and floor plans.

For durable goods spending, I incorporate housing expenditure information from the previous estimation as an independent variable in the spending vector $\mathbf{X}_{i,t}$. The Poisson regression model is specified as follows:

$$log(Durable_{i,t}) = \beta_0 + \mathbf{beta}_1 \mathbf{X}_{i,t} + \mathbf{beta}_2 \mathbf{Y}_{i,t} \tag{A28}$$

Table A1 presents the estimation results used to predict missing or zero values for housing and durable goods spending in the sample. To improve the efficiency of the estimation, I use the original sample before matching. In total, $54,497$ and $46,492$ households are available for analysis. They represent 86.08% and 57.88% of the total samples, respectively. It is important to note the differences in the covariates across the two regression models, as there is a gap in the sample sizes of these groups.

[Insert Table A1 here]

Both spending and income categories are highly correlated with the two spending variables I am estimating. The only exception is the correlation between durable and nondurable goods, which is not significant. This makes logical sense given the substantial differences in their purposes. Aside from that, the regression results indicate a great fit. I use these results to predict and replace the missing or zero observations for the rest of the sample that were not used in the previous regressions. However, these predictions do not fill in all the missing or zero values due to the limitations of the covariate vectors. Any sample with missing values in any consumption

category is marked as a missing value.

Table A1: Estimation of Housing and Durable Goods Spending for Prediction

Variable:	Housing Expenditure	Durable Goods Expenditure
Food and grocery	0.091***	0.003***
	(0.009)	(0.00002)
Nondurable	0.676***	0.00005
	(0.041)	(0.00006)
Labor income	0.049***	0.0003***
	(0.001)	(0.0000)
Nonlabor income	-0.010***	0.0001***
	(0.002)	(0.0000)
Housing		0.0004***
		(0.0014)
Home ownership	×	×
Home features	×	
Year fixed effects	×	×
Observations	54,497	46,492
R2	0.231	
Log likelihood		-1,708,743

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The results use the sample from the British Household Panel Survey (BHPS). The summary covers the wave 2 to 18, which were conducted from 1992 until 2009. The regressions utilize the original full sample with positive spending in the two categories. The standard errors of the parameter estimates are calculated using the robust (or sandwich) estimator of variance. All the consumption are at the household level. All values are in the pound sterling. The home feature is a vector of dummy variables, which include the types of kitchen, bathroom, terrace, and garden.

A2.2 Moments Consruction

The maximization problem and the budget constraint allow me to construct a Lagrange function, where λ will be served as the Lagrange coefficient.

$$\begin{aligned} logU^H = {} & \mu^1 \cdot \{\alpha_1^1 log(c_1^1) + \cdots + \alpha_n^1 log(c_n^1) + \frac{\alpha_H^1}{1-\rho} log\big[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\big] + \varphi_P^1 \frac{(1-h_P^1)^{1-\eta_P^1} - 1}{1-\eta_P^1} - \varphi_H^1 h_H^1\} \\ & + \mu^2 \cdot \{\alpha_1^2 log(c_1^2) + \cdots + \alpha_n^2 log(c_n^2) + \frac{\alpha_H^2}{1-\rho} log\big[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\big] + \varphi_P^2 \frac{(1-h_P^2)^{1-\eta_P^2} - 1}{1-\eta_P^2} - \varphi_H^2 h_H^2\} \\ & + \lambda(c_1^1 + \cdots + c_n^1 + c_1^2 + \cdots + c_n^2 - w^1 h_P^1 - w^2 h_P^2 - y) \end{aligned} \tag{A29}$$

The first order conditions with respect to every choice variable are:

For c_j^1, where $j = 1, 2, \cdots$, or n:

$$\mu^1 \alpha_j^1 \frac{1}{c_j^1} = -\lambda \tag{A30}$$

For c_j^2, where $j = 1, 2, \cdots$, or n:

$$\mu^2 \alpha_j^2 \frac{1}{c_j^2} = -\lambda \tag{A31}$$

For h_P^1:

$$-\mu^1 \varphi_P^1 (1 - h_P^1)^{-\eta_P^1} = \lambda w^1 \tag{A32}$$

For h_P^2:

$$-\mu^2 \varphi_P^2 (1 - h_P^2)^{-\eta_P^2} = \lambda w^2 \tag{A33}$$

For h_H^1

$$\frac{(\mu^1 \alpha_H^1 + \mu^2 \alpha_H^2) e^1 (h_H^1)^{-\rho}}{e^1 (h_H^1)^{1-\rho} + e^2 (h_H^2)^{1-\rho}} = \mu^1 \varphi_H^1 \tag{A34}$$

For h_H^2

$$\frac{(\mu^1 \alpha_H^1 + \mu^2 \alpha_H^2) e^2 (h_H^2)^{-\rho}}{e^1 (h_H^1)^{1-\rho} + e^2 (h_H^2)^{1-\rho}} = \mu^2 \varphi_H^2 \tag{A35}$$

This gives the consumption other than home production of each catagory as:

$$c_j^1 = -\frac{\mu^1 \alpha_j^1}{\lambda}, \qquad c_j^2 = -\frac{\mu^2 \alpha_j^2}{\lambda} \tag{A36}$$

That leads to

$$c_j = -\frac{\mu^1\alpha_j^1 + \mu^2\alpha_j^2}{\lambda} \tag{A37}$$

$$c_j^1 = \frac{\mu^1\alpha_j^1}{\mu^1\alpha_j^1 + \mu^2\alpha_j^2}c_j, \qquad c_j^2 = \frac{\mu^2\alpha_j^2}{\mu^1\alpha_j^1 + \mu^2\alpha_j^2}c_j \tag{A38}$$

These two expressions allude that the individuals' consumption or intrahousehold allocation would be deided once the household level consumption and bargainin power are determined.

Thus, based on the utility maximization problem, I can construct a Lagrange function, where λ will be served as the Lagrange coefficient:

$$\begin{aligned} logU^H = {} & \mu^1 \cdot \{\alpha_1^1 log(c_1^1) + \cdots + \alpha_n^1 log(c_n^1) + \frac{\alpha_H^1}{1-\rho} log\left[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\right] + \varphi_P^1 \frac{(1-h_P^1)^{1-\eta_P^1} - 1}{1-\eta_P^1} - \varphi_H^1 h_H^1\} \\ & + \mu^2 \cdot \{\alpha_1^2 log(c_1^2) + \cdots + \alpha_n^2 log(c_n^2) + \frac{\alpha_H^2}{1-\rho} log\left[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\right] + \varphi_P^2 \frac{(1-h_P^2)^{1-\eta_P^2} - 1}{1-\eta_P^2} - \varphi_H^2 h_H^2\} \\ & + \sum_{j=1}^{n} \frac{(\mu^1\alpha_j^1)^2}{\mu^1\alpha_j^1 + \mu^2\alpha_j^2} + \sum_{j=1}^{n} \frac{(\mu^2\alpha_j^2)^2}{\mu^1\alpha_j^1 + \mu^2\alpha_j^2} \\ & + \lambda(c^1 + \cdots + c^1 - w^1 h_P^1 - w^2 h_P^2 - y) \end{aligned} \tag{A39}$$

The F.O.C. with respect to all choice variables in this maximization problem will remain unchanged after the distribution terms are eliminated:

$$\begin{aligned} logU^H = {} & \mu^1 \cdot \{\alpha_1^1 log(c_1^1) + \cdots + \alpha_n^1 log(c_n^1) + \frac{\alpha_H^1}{1-\rho} log\left[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\right] + \varphi_P^1 \frac{(1-h_P^1)^{1-\eta_P^1} - 1}{1-\eta_P^1} - \varphi_H^1 h_H^1\} \\ & + \mu^2 \cdot \{\alpha_1^2 log(c_1^2) + \cdots + \alpha_n^2 log(c_n^2) + \frac{\alpha_H^2}{1-\rho} log\left[e^1(h_H^1)^{1-\rho} + e^2(h_H^2)^{1-\rho}\right] + \varphi_P^2 \frac{(1-h_P^2)^{1-\eta_P^2} - 1}{1-\eta_P^2} - \varphi_H^2 h_H^2\} \\ & + \lambda(c^1 + \cdots + c^1 - w^1 h_P^1 - w^2 h_P^2 - y) \end{aligned} \tag{A40}$$

In other words, the F.O.C. s with respect to labor choices are the same with the utility maximzation problem with individual consumptions. The F.O.C. with respect to the aggrgated consumption is:

For c_j, where $j = 1, 2, \cdots$, or n:

$$\mu^1\alpha_{1,j}\frac{1}{c_j} + \mu^2\alpha_{1,j}\frac{1}{c_j} = -\lambda \tag{A41}$$

Combining Equation A32, A34, A33 and A35 and A41, I am able to construct enough moments for estimation.