Worth Fighting For: Daughters Improve their Mothers’ Autonomy in South Asia

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Abstract

In South Asia, parents prize sons for both economic and cultural reasons, and having a son is often thought to improve his mother’s status within the household. However, using data from Bangladesh and India, we show that such high regard does not necessarily translate into improved autonomy. In fact, a daughter raises her mother’s participation in household decisions and her freedom of mobility relative to a son. A daughter also prompts her mother to work more but not necessarily to consume more. These effects are strongest among mothers of older girls. We argue that these results suggest a model in which mothers have greater relative preferences for spending on their daughters than fathers do, and so seek more autonomy to direct resources to their daughters.

1 Introduction

Many mothers and fathers in South Asia report a preference for sons over daughters. Sons do not require dowries, are thought to be more likely to provide support to their aging parents, and are important in certain religious and cultural ceremonies. Accordingly, there is qualitative evidence that a woman’s status within the household increases when she has a son. For instance, Das Gupta et al. (2003) argue that “a woman’s main source of standing in her husband’s family is as the mother of the future men of the family” (p.

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172) and Puri et al. (2011) quote a woman who observes that “everyone in the family is very nice to a woman with a son because she has done her job” (p. 1171).

While it might be natural to expect to see this standing translating into greater autonomy for mothers, we document that a woman’s say in household decision-making and freedom of mobility actually increase after having a daughter, relative to a son. A woman’s labor supply also increases, but her consumption (as proxied by her body mass index and the occurrence of anemia) does not. These patterns persist when we look at a sample of only first-born children – where we find no evidence of sex-selective abortion in either country – so our results do not seem to be driven by the fact that conservative households are less likely to have daughters.

These results are consistent with a model in which a mother cares more about her daughter’s consumption than her husband does. So to direct more resources to her daughter, a mother increases her autonomy (even when doing so is costly) and her labor supply. We discuss other models that predict that daughters increase a mother’s labor supply or affect her health directly – for instance, daughters decrease a household’s permanent income or prompt higher fertility – but argue that these models make no direct prediction on a mother’s autonomy. While working itself could increase a mother’s autonomy through improving her negotiation skills or her future earning ability (Atkin 2009; Anderson and Eswaran 2009), but we show that labor supply and autonomy increases when the child is roughly the same age, whereas one might expect for working itself to improve bargaining power with a lag.

A well-known body of research has documented that resources allocated to mothers (or grandmothers) in developing countries differentially improve children’s, especially girls’, health and education (Thomas 1990; Duflo 2003; Rangel 2006; Doepke and Tertilt 2014). We make a complementary point: women do not only dedicate a greater share of an exogenous income transfer to their daughters in particular. Instead, we argue that they also attempt to exert a greater control over household-wide division of resources if they have stronger preferences for spending on their daughters than their husbands do.

This is a different determinant of women’s autonomy than has been highlighted in the economics literature. Previous literature has highlighted either the characteristics of a woman entering marriage, such as her age (Jensen and Thornton 2003; Field and Ambrus 2005), caste (Field, Jayachandran and Pande, 2010), or education (Mocan and Cannonier, 1

By contrast, Li and Wu (2011) focus on women’s participation in purchases of consumer durables for the household and find that sons increase their mother’s participation in these decisions. Since these purchases are not necessarily purchases targeted towards children – the most common include fans, television, and radio – we view this measure of bargaining power as capturing a different dimension from autonomy as we model and examine it empirically.
2012), or other determinants of her outside option such as her legal rights to property (Field, 2003) and inheritance (Roy 2008; Harari 2013), job availability (Majlesi, 2014), or her own labor market experience (Atkin 2009; Anderson and Eswaran 2009). We argue additionally that even holding constant a woman’s characteristics and her institutional environment, she can choose to seek greater autonomy if her gains from doing so are sufficiently high. By extension, the fact that not all women choose to do shows that seeking additional autonomy is not without cost. Our model can then help explain the findings of recent randomized control trials that give women inputs or cash transfers but find little effect (Blattman et al. 2014; Haushofer and Shapiro 2013) – or even reductions (Das et al., 2013) – on their autonomy. We argue that even if the treatments increase a woman’s outside option and could theoretically increase her autonomy, if exercising this autonomy is costly, then women will only do so if they perceive ways in which they would like to change household behavior.

This decision to seek autonomy has been described in qualitative research. Kabeer (1999) describes a women’s empowerment as “the process by which those who have been denied the ability to make strategic life choices acquire such an ability” (p. 435). We argue that a desire to direct household spending towards a daughter is one factor that motivates women to undertake this process. Indeed, Kabeer (1997) argues that “women who manage to retain control over their earnings” tend to focus on “altruistic sorts of expenditures” like children’s school expenses or private tuition (p. 297).

The desire to spend on a daughter also raises a mother’s gains from working, and thereby increases her labor supply. Heath and Tan (2014) also argue that the gains from working increase female labor supply, but focused on how inheritance rights improve a woman’s bargaining power and thus affect her ability to control the income that she does earn. In this paper we provide a different – although complementary – explanation: the woman’s endogenous desire to control income (not just her exogenous ability to do so) also affects her labor supply.

Finally, our results also help explain the origins of mothers’ reported son preference, which in some cases is even stronger than fathers’ reported preference (Jayachandran, 2014). We argue that this preference may not necessarily reflect mothers’ deeply rooted feelings against fellow females. Instead, in our model, mothers’ equilibrium utility is higher after a son than a daughter even if mothers get the same utility from the well-

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2Kabeer mentions this focus on altruistic spending as part of a broader argument that the fact that many women do not seek control over income – and that women who do tend to spend it on others – suggests that there are still “pre-existing hierarchies of claims and decision-making within the household.” Her thesis of uneven baseline levels of autonomy complements our paper; if women in our model had higher baseline autonomy, women not need to seek out greater autonomy after having a daughter.
being of daughters and sons, as long as fathers prefer spending on sons. The mechanism is that mothers know that their husbands are unlikely to spend on daughters, so mothers have to decrease their own consumption and increase their autonomy (which is costly) in order to ensure that resources are devoted to daughters.

The rest of the paper proceeds as follows. Section 2 models the decisions of mothers and fathers to invest in children in a noncooperative household. In section 3 we describe the data and empirical strategy we use to test the predictions of the model. Section 4 provides results, and section 5 discusses in detail potential alternative models that could explain the fact that daughters raise their mothers’ autonomy. Section 6 concludes.

2 A Model of Endogenous Female Autonomy and Investments in Children

In this section, we set up a simple model that identifies how a child’s gender affects the mother’s autonomy in a household setting. In accordance with recent literature that shows that bargaining outcomes between husbands and wives are not necessarily efficient (Duflo and Udry 2004; Robinson 2012; Heath and Tan 2014), we use a noncooperative model that does not impose Pareto efficiency, although the main mechanism would be similar in a collective model (Browning and Chiappori, 1998). In this context, we assume that autonomy is a choice variable that is costly for the wife to exercise. That is, in order to get more say in how money is spent – including on children’s human capital investments – the wife needs to either fight for the right (which is costly) or compensate the husband for his resulting loss of control. So the wife is willing to get more autonomy only when her preferences are sufficiently different from the husband’s.

We begin by laying out a baseline model of parental investments in their children and the wife’s decision to seek autonomy. In the baseline case, the only difference between sons and daughters is the utility their mother and father get from their well-being. Then in section 2.2 we build in various other differences between sons and daughters. Specifically, we consider three cases: daughters contribute time to help mothers with housework, daughters require dowry, and daughters provide lower returns to investment. In

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3 This is not to deny that the woman’s outside option also matters for autonomy. In particular, suppose there is baseline level of autonomy that is determined by each spouse’s outside option, and the wife gets this autonomy for free. For a given household, the outside options are exogenous, so the baseline autonomy is constant and is normalized to zero in the model.

4 Because the model takes the presence of a child as given, we use woman/wife/mother and man/husband/father interchangeably. The variables related to the female always have subscript f and those related to the male always have subscript m.
each extension, we show that how this additional difference between sons and daughters affects the prediction on increased autonomy.

2.1 Baseline Model

Suppose the wife’s utility has the following form:

\[ u_f(x_f, z_f, l_f, a_f) = \beta_f \ln x_f + \gamma_f \ln z_f + \delta_f \ln l_f + \alpha_f \ln (1 - a_f) \]

where her utility depends on her consumption \( x_f \), the well-being of her child \( z_f \), her leisure \( l_f \), and a cost \( \alpha_f \) to get a given level of autonomy \( a_f \). As will be seen in the budget constraints to each spouse’s maximization problem (equations 1 and 2), the more autonomy the wife has, the more of her income she controls. The wife spends a unit of time on working outside the home \( e_f \), working at home (taking care of the child) \( h_f \), and leisure \( l_f \), so \( e_f + h_f + l_f = 1 \). In this simple model, there is only one child in the household.

The husband’s utility has an analogous form:

\[ u_m(x_m, z_m, l_m) = \beta_m \ln x_m + \gamma_m \ln z_m + \delta_m \ln l_m \]

where his utility depends on his consumption \( x_m \), the well-being of his child \( z_m \), and his leisure \( l_m \). The husband spends a unit of time on working \( e_m \) and his leisure \( l_m \), so \( e_m + l_m = 1 \). An alternative conceptualization of autonomy could be the wife’s control of her time. In appendix B.3 we formalize this model and show that it also predicts that daughters prompt their mothers to seek more autonomy.

To study the effect of child’s gender, our baseline model assumes that the husband’s utility from a son’s well-being is higher than the utility from the daughter’s well-being, \( \gamma_m^s > \gamma_m^d \). Because the key to our model is the husband’s relative preference for spending on a son relative to a daughter (compared to the wife), we assume for simplicity that the wife’s preference for child’s well-being is independent of a child’s gender.\(^5\) Qualitative evidence from South Asia supports the assumption that women tend to have greater relative preference for spending on daughters than do their husbands (Kabeer 2001; Ahmad and Neman 2013). At the same time, we also acknowledge this assumption may not be true for all households, and in section 2.2 we show that other natural assumptions about daughters can also generate the prediction that women endogenously seek more autonomy.

\(^5\)As we mention in the introduction, the assumption that the wife gets equal utility from the well-being of a son and a daughter is not inconsistent with the fact that they tend to report preferences for sons over daughters if these reported preferences represent the equilibrium utility the wife would have in each case and not parameters of the utility function.
autonomy after having a daughter, compared to a son.

A possible extension to the model would allow the husband to pay a cost to reduce the wife’s autonomy. We show in another paper (Heath and Tan 2014) that giving women more autonomy can increase their labor supply and increase the household income, which then could increase the husbands’ utility. So it is not necessarily profitable for the husband to reduce the wife’s autonomy, and we omit this option in our model. Even aside from the case where more autonomy for the woman benefits the husband, allowing the husband to respond to the wife’s pursuit of greater autonomy would not change the main conclusions of the model unless the cost to the husband to do so is so small that he can completely counteract the wife’s desire to seek more autonomy after having a daughter.6

The well-being of the child depends on the wife’s labor contribution $h_f$ and the financial contribution from both spouses $y_f + y_m$. In other words, the child can be viewed as a household public good produced by both spouse. We assume it follows a Cobb-Douglas production function:

$$z = f(h_f, y_f + y_m) = (h_f)^{\lambda}(y_f + y_m)^{\rho}$$

in which $\lambda, \rho > 0$. If $\lambda + \rho = 1$, it has a constant return to scale.

The wife earns $w_f e_f$ from her labor force participation, but only controls a fraction of her income, determined by her autonomy $a_f$.7 The wife’s optimization problem can then be summarized as follows:

$$\max_{x_f,h_f,y_f,e_f,a_f} \beta_f \ln x_f + \gamma_f (\lambda \ln h_f + \rho \ln (y_f + y_m)) + \delta_f \ln (1 - e_f - h_f) + a_f \ln (1 - a_f)$$

s.t. $e_f, h_f, a_f \in [0, 1]$, $x_f, y_f > 0$

$$p_f x_f + y_f \leq a_f (w_f e_f)$$ (1)

where $p_f$ is the price of the wife’s private good and $w_f$ is the salary of the wife’s job. In this baseline case we assume the only income source for both spouses is their earned income. In section B.1 in the appendix we show that incorporating unearned income does not change the main conclusion of the model.

6For instance, Eswaran and Malhotra (2011) argue that violence is costly to men, but they still sometimes use violence to thwart women’s pursuit of higher autonomy. Then unless the cost of violence is very small, the man would respond to – but not completely cancel out – the wife’s pursuit of higher autonomy.

7We postulate the same set-up in Heath and Tan (2014). It can be viewed as the reduced form from a wide class of bargaining games. In Heath and Tan (2014), exogenous increases in inheritance rights increased $a_f$. Here we argue that if the wife wants to increase $a_f$, she can pay a cost to do so, but we do not take a stand on the exact structure of the bargaining process.
The husband’s optimization problem is similar:

$$
\max_{x_m, y_m, e_m} \beta_m \ln x_m + \gamma_s^d (\lambda \ln h_f + \rho \ln (y_f + y_m)) + \delta_m \ln (1 - e_m)
$$

s.t. $e_m \in [0, 1]$, $x_m, y_m > 0$,

$$
 p_m x_m + y_m \leq w_m e_m + (1 - a_f) (w_f e_f)
$$

where $p_m$ is the price of the husband’s private good, $w_m$ is the husband’s salary, and the husband controls the rest of the wife’s income, $(1 - a_f) w_f e_f$.

The key innovation of the model is letting the wife have some power to fight for higher autonomy if it is profitable. This endogenous autonomy has a complicated bi-directional relationship with labor supply. On one hand, a higher autonomy increases the gains from working and thereby incentivizes the wife to work more (Heath and Tan 2014). At the same time, a higher labor supply raises the gains from seeking more autonomy. This bidirectionality makes the model complicated and potentially non-monotonic. We thus introduce a critical value $a^*$, which is useful when making monotone predictions.

$$
 a^* = \frac{\sqrt{\gamma_f \lambda + \delta_f}}{\sqrt{\gamma_f \lambda + \delta_f + \sqrt{\lambda_f}}}
$$

We will explain where it comes from after presenting the results.

An equilibrium is interior if all variables don’t have corner solutions. We focus on interior solution since when both spouse contribute money to the household public good (the well-being of the child), there is a natural link between their utilities and they bargain through it. The corner solution with only one spouse contributing money is discussed in appendix B.2.

**Proposition 2.1.** Suppose the Nash equilibrium is interior. If the husband’s preference for the public good decreases when it is a girl ($\gamma_s^d > \gamma_m^d$),

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).
- The husband works less outside ($e_m$).
- The monetary investment to the household public good decreases ($y_f + y_m$), if $a_f \geq a^*$.

All proofs are in appendix A. When the child is a daughter, the husband has a lower preference for spending on the child, making the wife contribute more to the child’s financial expense. So she both works more to get more income and fights for a higher
autonomy to control more of her income. The increase in her labor supply leads to a decrease in both time working at home and her leisure. The husband, on the other hand, works less because he doesn’t need to pay as much for the child’s well-being. The overall monetary contribution to the child is likely to decrease. There are two effects moving the overall contribution in opposite directions: a direct effect is the husband’s decrease in his contribution, and an indirect effect is the wife’s increase in her contribution after working more and fighting for a higher autonomy. As long as $a_f \geq a^*_f$, the direct effect outweighs the indirect effect, since increasing the contribution is costly for the wife given that she had to pay a price for higher autonomy. In this case, the wife’s private consumption and her overall utility are also be lower (despite her higher autonomy), because she pays a cost for her autonomy and contributes more to the child’s well-being when $\gamma^s > \gamma^d$.

We now return to the discussion of $a^*$. Considering the first-order conditions (FOCs) for $e_f$, $y_f$ and $a_f$, we have

$$[e_f] : \frac{\beta_f a_f w_f}{a_f w_f e_f - y_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f}, \quad [y_f] : \frac{\beta_f}{a_f w_f e_f - y_f} = \frac{\gamma_f \rho}{y}, \quad [a_f] : \frac{\beta_f w_f e_f}{a_f w_f e_f - y_f} = \frac{\alpha_f}{1 - a_f}$$

The first FOC incorporates an optimal level of $h_f$. Combining them, we have

$$\frac{\gamma_f \lambda + \delta_f}{1 - e_f} = \frac{\gamma_f \rho a_f w_f}{y}, \quad \frac{\alpha_f}{1 - a_f} = \frac{\gamma_f \rho w_f e_f}{y}$$

Putting the solution of $e_f$ from the first equation into the second equation,

$$\frac{\gamma_f \rho w_f}{y} = \frac{\gamma_f \lambda + \delta_f}{a_f} + \frac{\alpha_f}{1 - a_f}$$

(3)

As $a_f$ increases, the RHS of (3) increases when $a_f > a^*$ and decreases otherwise. So when $a_f > a^*$, $y$ decreases as $a_f$ increases, i.e., with a decrease in the husband’s preference, the indirect effect – a increase in the wife’s investment – doesn’t outweigh the direct effect of a decrease of the husband’s investment.

While if $a_f < a^*$, it is possible that the indirect effect outweighs the direct effect, and total financial contribution is actually higher with a daughter. This is due to the non-monotone behavior of $e_f$ and $a_f$ we discussed, that is, the reinforcement of labor supply and autonomy: higher autonomy increases the marginal utility from working and higher

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8See details in the proof of Proposition 2.1. The predictions on women’s consumption and utility are in general ambiguous in the extensions we describe in section 2.2. The woman’s real income increases (due to both a higher autonomy and higher labor supply) would tend to increase consumption, but her the financial contribution to the daughters lowers her consumption (and this autonomy has a utility cost to her).
labor supply increases the marginal utility of autonomy. This reinforcement is stronger when $a_f$ and $e_f$ are not very high, such that it is not very costly to fight for autonomy and not very costly to work more and reduce leisure. With a sufficiently strong reinforcement, indirect effect, more investment from the wife, could outweigh the direct effect. While we point out this theoretical possibility, we do not think it is empirically relevant: while tests of whether spending on children differs by their gender do not always detect differences (Duflo, 2005), other studies do detect differences (Kingdon 2005; Zimmermann 2012b) in favor of boys, and we are unaware of any studies finding bias in expenditures towards girls. Thus our theoretical predictions consider the case where $a_f > a^*$, which both fits better with existing evidence and yields clearer predictions.

**Remark 1: High-paying jobs vs. low-paying jobs**

In addition to endogenizing autonomy, it is also possible that women can choose between different types of jobs. Say there are high-paying jobs $w^H_f$ as managers and supervisors, and low-paying jobs $w^L_f$ as those in agriculture. Assume $w^H_f > w^L_f$, but there is a sunk cost ($c$) to get a high-paying job. The cost could be a search cost, a training cost and/or a cost to get the husband’s consent.

We argue that more women would want to work on high-paying jobs when the child is a daughter. This is because the wife works more and gets a higher autonomy when the child is a daughter from Proposition 2.1, which makes the high salary more attractive. To be more precise, say $e^*_f$ and $a^*_f$ are the equilibrium strategies in a low-paying job, the wife would want to deviate to a high-paying job if $a^*_f w^H_f e^*_f - a^*_f w^L_f e^*_f > c$. It is easier for the inequality to hold when $e^*_f$ and $a^*_f$ are higher. So we consider an additional prediction that daughters increase female labor supply particularly into high-paying jobs.

**Remark 2: Alternative assumption – daughters lower the cost of autonomy.**

The husband’s preference of a son over a daughter may have additional effects on his behavior, beyond the effects on his labor supply and contribution to the household public good in the baseline model. For instance, he could pay more attention to supervising the wife when he has a son, in order to make sure the investments in the child more closely align with his preferences. One easy way to incorporate this story is to assume that with a daughter, it is easier for the wife to get autonomy, i.e. the cost of autonomy is lower when it is a daughter, $\alpha^*_f > \alpha^d_f$.\(^9\)

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\(^9\)The husband’s response could also be modeled in a principle-agent framework, as in Eswaran and Malhotra (2011). The result would be very similar; a husband would devote less costly monitoring effort to
Proposition 2.2. Suppose the Nash equilibrium is interior. If the cost of autonomy decreases when it is a girl ($a_s^f > a_d^f$),

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).
- The husband works less outside ($e_m$).
- The monetary investment to the public good increases ($y_f + y_m$).

When it is a girl, the husband doesn’t supervise the wife as much. She then seeks a higher autonomy, which makes working outside more profitable, and as a result she works more outside and less at home. As the wife brings more money back from working, the husband gets to work less, while the household’s total income still increases, so does the monetary investment to the public good. So allowing the husband to respond to a son by behaving in a way that makes it more costly for the wife to seek autonomy reinforces our main prediction that wives seek more autonomy after daughters.

2.2 Other Effects of Daughters on the Household

In this section, we extend the baseline model to include several other effects that daughters have on households. Specifically, they can contribute time to housework. We also consider two types of income effects that daughters present: they require a lump sum payment of a dowry and parents perceive lower returns on human capital investments in them due to lower anticipated future transfers.

We shut down the differential preferences channel in these extensions (i.e., we assume that $\gamma_m^s = \gamma_m^d$) in order to show that other natural assumptions about households in South Asia could also generate the prediction that women seek more autonomy after having a daughter. Thus, the empirical tests of our model should not be considered joint tests of differential parental preferences and a model of endogenous female autonomy. Instead, we argue that several realistic assumptions about households in South Asia generate the prediction that women seek more autonomy after having a daughter. Then, in section 5, we argue that these assumptions about households cannot naturally generate the prediction that women’s autonomy goes up in a standard model where female autonomy is a function only of a woman’s outside option.

Extension I: daughters help with housework.

One possible difference between daughters and sons is that daughters could help their mothers with some housework. In particular, suppose they contribute $H^d$ hours to pro-
duce the household public good. Alternatively, it can be interpreted as daughters can take care of themselves and need less time from the wife.

The wife’s optimization problem can be summarized as follows ($H^s = 0$ if it is a son),

$$\max_{x_f, h_f, e_f, a_f} \beta_f \ln x_f + \gamma_f (\lambda f (h_f + H^s) + \rho f (y_m)) + \delta_f \ln (1 - e_f - h_f) + \alpha_f \ln (1 - a_f)$$

s.t. $e_f, h_f, a_f \in [0, 1]$, $x_f > 0$, $p_f x_f \leq a_f (w f e_f)$

**Proposition 2.3.** Suppose the Nash equilibrium is interior. If daughter helps with housework, i.e. the total time on housework is $h_f + H^d$, when it is a girl,

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).
- The husband works less outside ($e_m$).
- The monetary investment to the public good increases ($y_f + y_m$).

Since the daughter frees the wife from housework, the wife can work more outside the home and less at home. While as she earns more, it is beneficial to get a higher autonomy. With the wife works more and contributes more to the household hold public good, the husband can work less and enjoy more leisure.

**Extension II: daughters cost more – dowry**

The second difference between sons and daughters is the need to provide daughters with dowry, which decreases a household’s permanent income and could prompt both parents to work more (Deolalikar and Rose, 1998). In the static model, we assume that the household needs to save an exogenous amount $D^d$ for the daughter’s dowry. So after taking out the dowry, the total contribution to the household public good is $y_f + y_m - D^d$, while we set $D^s = 0$.

**Proposition 2.4.** Suppose the Nash equilibrium is interior. If daughter requires dowry, i.e. the monetary investment is $y_m + y_f - D^d$, when it is a girl,

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).
- The husband works more outside ($e_m$), if $a_f \geq a^*$.
- The monetary investment to the public good decreases $(y_f + y_m - D^d)$, if $a_f \geq a^*$.

Since the daughter brings a negative income shock, both spouses have to work more to pay for the dowry. The wife fights for a higher autonomy because she values the extra payment for dowry more than her husband and her increased labor supply. The contribution to the household public good (excluding dowry) goes down.
Extension III: daughters give lower return to investment.

It is possible that the income effect of daughters is of a different form than the lump-sum dowry cost in extension II. Specifically, consider the possibility that there are lower returns to parents to investment in a daughter compared to a son (Rosenzweig and Schultz 1982; Rose 2000), either because the labor market returns to girls’ human capital are lower or parents value returns less (even if they are equal) if they anticipate lower transfers from daughters after marriage. Specifically, we assume the return to financial contribution ($\rho_s, \rho_d$) and/or to time contribution ($\lambda_s, \lambda_d$) depends on the child’s gender, and investments in daughters give a lower return: $\rho_s > \rho_d$ and/or $\lambda_s > \lambda_d$.

$$z = f(h_f, y_f + y_m) = (h_f)^{\lambda_s} (y_f + y_m)^{\rho_s}$$

**Proposition 2.5.** Suppose the Nash equilibrium is interior. If the return to monetary investment decreases when it is a girl ($\rho_s > \rho_d$),

- The wife works less outside ($e_f$), more at home ($h_f$), and gets a lower autonomy ($a_f$).
- The husband works less outside ($e_m$), if $a_f \geq a^*$.  
- The monetary investment to the public good decreases ($y_f + y_m$).

As the return to monetary investment is lower with a daughter, both spouses work less outside, and the wife works more at home. She needs a lower autonomy because she doesn’t need to spend much on the household public good and she works less. Thus, the total financial contribution goes down.

**Proposition 2.6.** Suppose the Nash equilibrium is interior. If the return to time investment in the public good decreases when it is a girl ($\lambda_s > \lambda_d$),

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).
- The husband works less outside ($e_m$).
- The monetary investment to the public good increases ($y_f + y_m$).

As the return to the time investment is lower with a daughter, the wife works less at home and more outside. She fights for a higher autonomy because she works more. Since the wife earns more, she contributes more to the household public good, which allows the husband to contributes less and thus works less. But the decrease in the husband’s contribution will not completely offset the increase from the wife’s contribution, so the monetary investment to the household public good increases.
To summarize the extensions to the baseline model presented in this subsection, most of these extensions reinforce the tendency for mothers to seek higher autonomy. In particular, while proposition 2.5 and proposition 2.6 give different predictions on the effect of lower returns to investment on girls in the wife’s autonomy, the aggregate effect of a decreased return to both time and financial investment depends on which effect dominates. If the decrease in the return of time investment is more severe, we still predict an increase in female autonomy, especially if the channel linking dowry to mother’s autonomy (proposition 2.4) or the effect of daughters’ help with housework on their mother’s autonomy (proposition 2.3) are also important.

2.3 Focusing on Women Who Do Not Work Outside the Home

In our model, a woman seeks a higher autonomy for two reasons: one is driven by preferences and the desire to spend on things she values more than her husband (such as a daughter), the other is that an increase in income raises the marginal returns to autonomy. This second channel implies that if a mother is compelled to work more for any reason, she will optimally seek higher autonomy. As a result, if a daughter prompts her mother to work more because of income effects (such as for a dowry, as modeled in extension II), the mother will seek more autonomy even if her preference for a daughter does not differ from her husband ($\gamma_f = \gamma_d$). While this is still a story in which daughters prompt the mothers to seek more autonomy, it suggests that any decrease in household’s permanent income that prompts increased female labor supply will have similar effects on autonomy.

To provide some suggestive evidence that it is the differential preferences for spending on daughters that are an important driver of the mother’s decision to seek autonomy after having a daughter, we consider a restricted scenario in which women do not have the option to work outside the home. If women still seek higher autonomy after having a daughter in this scenario, this autonomy would be used to change the spending of a fixed budget rather than assert control over a larger income prompted by the daughter. Focusing on women who cannot work also separates the endogenous decision to seek more autonomy from the possibility that working more increases baseline autonomy (Anderson and Eswaran 2009).

Of course, the women we observe empirically who do not work have endogenously chosen to do so. If the decision to work is related to their baseline autonomy (as in Heath and Tan (2014)), focusing on this group presents selection bias. So we first use our model to assess how this selection bias would affect an empirical assessment of the relationship between daughters and mothers who do not work. In order to do so, we add two new
components to the model: the wife’s baseline autonomy $a_0$ and unearned income $R_f$.\textsuperscript{10}

The wife’s maximization problem becomes:

$$
\max_{x_f,e_f,h_f,y_f,a_f} \beta_f lnx_f + \gamma_f (\lambda ln h_f + \rho ln (y_f + y_m)) + \delta_f ln (1 - e_f - h_f) + a_f ln (1 - a_f)
$$

s.t. $e_f, h_f, a_0 + a_f \in [0,1], x_f, y_f > 0, p_f x_f + y_f \leq (a_0 + a_f) (w e_f + R_f)$

where the wife gets her baseline autonomy for free, so the cost is only related to the additional autonomy $a_f$ and the overall autonomy is $a_0 + a_f$.

**Proposition 2.7.** Suppose the Nash equilibrium is interior. If the baseline autonomy increases, the wife works more outside ($e_f$).

As the wife gets a higher baseline autonomy, she gets a higher control over her earnings so it is optimal for her to work more. Suppose there are two thresholds $t^d$ and $t^s$, and if the wife’s baseline autonomy is higher than $t^d$ (or $t^s$) she goes out to work when it is a daughter (or a son). When we predict a daughter increases the wife’s incentive to work, $t^d < t^s$. When we focus on women who don’t work, we compare women with $a_0 < t^d$ with a daughter to women with $a_0 < t^s$ with a son. If anything, this selection bias itself makes women with a daughter show a lower autonomy. With this potential bias in mind, we focus on women who don’t work and re-examine the possible effects of a girl. (We omit the baseline autonomy.)

**Proposition 2.8.** Suppose the Nash equilibrium is interior. Suppose the wife gets an unearned income $R_f$ but cannot work outside the home. Then when a child is a girl, relative to a son,

- If $\gamma_m^s > \gamma_m^d$, the wife seeks a higher autonomy ($a_f$), works the same at home ($h_f$), the husband works less ($e_m$), and the investment to the public good decreases ($y_f + y_m$).

- If $\alpha_f^s > \alpha_f^d$, the wife seeks a higher autonomy ($a_f$), works the same at home ($h_f$), the husband works the same ($e_m$), and the investment to the public good remains the same ($y_f + y_m$).

- If $H^d > 0$, the wife seeks the same autonomy ($a_f$), works less at home ($h_f$), the husband works the same ($e_m$), and the investment to the public good remains the same ($y_f + y_m$).

- If $D^d > 0$, the wife seeks a higher autonomy ($a_f$), works the same at home ($h_f$), the husband works more ($e_m$), and the investment to the public good decreases ($y_f + y_m - D^d$).

\textsuperscript{10}Building in unearned income is necessary when we focus on the extensive margin of labor supply because otherwise she would have zero consumption – and infinitely negative utility – when she does not work.
• If $\rho^s > \rho^d$, the wife seeks a lower autonomy ($a_f$), works the same at home ($h_f$), the husband works less ($e_m$), and the investment to the public good decreases ($y_f + y_m$).

• If $\lambda^s > \lambda^d$, the wife seeks the same autonomy ($a_f$), works less at home ($h_f$), the husband works the same ($e_m$), and the investment to the public good remains the same ($y_f + y_m$).

When the channel of working outside is shut down, the predictions on female autonomy in point 2 and point 5 change from increased autonomy to constant autonomy. In these two channels, the direct effect of a daughter is on the time spent on household public good, i.e. the daughter helps with housework or she gives a lower return to it. When working outside is feasible, the wife responds by increasing her labor supply, which makes it is profitable to fight for a higher autonomy. While when working outside is not feasible, the effect of housework is no longer related to the wife’s autonomy. By contrast, the wife still seeks higher autonomy to spend more of her unearned income on her daughter if her husband prefers spending on a son $\gamma^s_m > \gamma^d_m$. We summarize the predictions on autonomy in scenarios both with and without female labor supply below:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Work Outside Possible</th>
<th>$\gamma^s_m &gt; \gamma^d_m$</th>
<th>$\alpha^s_f &gt; \alpha^d_f$</th>
<th>$H^d &gt; 0$</th>
<th>$D^d &gt; 0$</th>
<th>$\rho^s &gt; \rho^d$</th>
<th>$\lambda^s &gt; \lambda^d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wife can</td>
<td>higher $a_f$</td>
<td>higher $a_f$</td>
<td>higher $a_f$</td>
<td>higher $a_f$</td>
<td>lower $a_f$</td>
<td>higher $a_f$</td>
<td>higher $a_f$</td>
</tr>
<tr>
<td>work outside</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wife cannot</td>
<td>higher $a_f$</td>
<td>higher $a_f$</td>
<td>constant $a_f$</td>
<td>higher $a_f$</td>
<td>lower $a_f$</td>
<td>constant $a_f$</td>
<td></td>
</tr>
<tr>
<td>work outside</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: The effect of a daughter on women’s autonomy, when the husband has a lower preference for a girl ($\gamma^s_m > \gamma^d_m$), when daughter lowers the cost of autonomy ($\alpha^s_f > \alpha^d_f$), when the daughter helps with the housework ($H^d > 0$), when daughter costs dowry ($D^d > 0$), and when daughter gives a lower return to monetary and/or time investment ($\rho^s > \rho^d$ and/or $\lambda^s > \lambda^d$).

2.4 Summary of Testable Predictions of Theoretical Model

In the following empirical analysis, we concentrate on predictions on the wife, the key actor of interest in the model. The testable predictions on her behavior are: conditional on having a child, when it is a daughter, the mother’s labor supply increases, especially into high-paying jobs. The mother seeks more autonomy for two reasons – to direct more resources to her daughter given her greater relative preference for investment in her daughter, and because her increased labor supply increases marginal gains to additional autonomy. To focus on the preference channel, we look at the relationship between daughters
and mother’s autonomy in the endogenous subsample of women who do not work outside the home. Our model predicts that daughters increase their mother’s autonomy in this subsample, as long as the selection bias (that women who choose not work even with a daughter have particularly low baseline autonomy) does not overrule the causal effect of daughters on mother’s autonomy.

While the empirical component of this paper focuses on predictions on the mother’s behavior, it is also worth noting that the model’s other predictions are broadly consistent with empirical findings about gender in South Asia. In particular, the baseline model predicts that both money investment in girls will generally be lower than investment in boys, since the mother’s increased investment is unlikely to compensate for the father’s decreased investment. Time investment is also lower in girls as mothers devote more time to working outside the home. This prediction also holds in unitary household models if girls represent a negative income effect (as in extension III to our model) or if parents perceive lower returns on investment in girls (as in extension II to our model). There is indeed evidence that parents invest less money (Kingdon 2005; Zimmermann 2012b) and less time (Jayachandran and Kuziemko 2011; Bharadwaj and Lakdawala 2013; Barcellos, Carvalho and Lleras-Muney 2014) in girls than boys, especially after bad economic shocks (Rose, 1999).

The model’s prediction that male labor supply falls as the father invests less in the daughter (unless the income effects of a dowry, as in extension II, counteract this effect) are also supported by Rose (2000). In particular, she finds that while female labor supply increases after a daughter, male labor supply falls. Her theoretical model focuses on the role of mother’s time investments in sons, which prompt husbands in a unitary household to work more outside the home to counteract the wife’s decreased labor supply. Extension III to our model shows that a noncooperative bargaining model also predicts a similar increase in male labor supply after a boy if time investments in a boy are more valuable, causing the wife to work more. Empirically, we assess whether the relationship between daughters and male and female labor supply on the intensive margin (shown by Rose (2000) in three ICRISAT villages) holds in National Sample Survey data from India.11

The results are given in table A2 and explain the estimation in appendix C. While we highlight some caveats to those results – in particular, only children currently living in the household are observed – the results are nonetheless broadly consistent with Rose (2000) and the predictions of our theoretical model: male labor supply decreases after a daughter and female labor supply increases.

11The Bangladesh census does not collect labor supply data. While the nationally representative Housing Income and Expenditure Survey does, it only collects individual-level labor supply data on wage labor.
3 Empirical Strategy

3.1 Data and Measures of Autonomy

For India our main measures of women’s autonomy come from the National Family Health Survey of 2005-2006. For Bangladesh, we use the 2007 and 2011 rounds of the Demographic and Health Survey (DHS). Each survey includes a nationally representative sample of ever-married women between the ages of 15 and 49. Thus, we cannot estimate the effects of child gender on older women, or on the small sample of births that are to women who have never been married.\footnote{Fledderjohann et al. (2014) report that only 2 percent of births in India were to unmarried mothers.}

Because the National Family Health Survey is designed to be comparable to DHS surveys conducted worldwide, several of the questions we use to capture autonomy are asked in both surveys. In particular, both surveys ask women who makes decisions about the woman’s own health care, large household decisions, and purchases for daily life; possible options are the husband, wife, or both. The India survey additionally asks who makes decisions about spending the husband’s earnings and visiting relatives. It also contains measures of a woman’s freedom of mobility, in particular, whether she can go alone to the market, health facility, or places outside her village. Finally, it asks whether she has access to a bank account.

Table 2 provides summary statistics for sampled women with at least one child in both countries. In both countries this sample of women tends to have low education (5.1 years in India and 4.7 years in Bangladesh) and were married at a young age (17.9 years in India and 15.4 in Bangladesh). Women in India are more likely to work outside the home than women in Bangladesh (37 percent of women with at least one child in India, versus 20 percent of women in Bangladesh). Nonetheless, in the decision-making variables that were asked in both countries, women describe similar levels of autonomy; between sixty and seventy percent of women in both countries report some say in decisions about their own health care, large household purchases, and daily household purchases.

Because we have many outcomes that reflect autonomy, our main outcome of interest is an index of the individual autonomy measures. For the decision-making variables, we focus on whether a woman has some power over each decision.\footnote{The fact that a woman has sole control over a decision (relative to having some say in) may not capture additional bargaining power if this outcome reflects the fact that her husband leaves her on her own to control the household.} We construct this index by normalizing each variable so that it has mean zero and standard deviation one, and then summing the normalized variables. In appendix table A1 we provide the estimation
<table>
<thead>
<tr>
<th></th>
<th>India</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>32.86</td>
<td>31.76</td>
</tr>
<tr>
<td>years of education</td>
<td>5.11</td>
<td>4.65</td>
</tr>
<tr>
<td>age at first marriage</td>
<td>17.87</td>
<td>15.46</td>
</tr>
<tr>
<td>children</td>
<td>2.99</td>
<td>2.96</td>
</tr>
<tr>
<td>bmi</td>
<td>21.47</td>
<td>21.35</td>
</tr>
<tr>
<td>works outside home</td>
<td>0.368</td>
<td>0.198</td>
</tr>
<tr>
<td>say in own health care</td>
<td>0.683</td>
<td>0.628</td>
</tr>
<tr>
<td>say in large household purchases</td>
<td>0.605</td>
<td>0.601</td>
</tr>
<tr>
<td>say in visits to family</td>
<td>0.674</td>
<td></td>
</tr>
<tr>
<td>say in purchases for daily needs</td>
<td>0.684</td>
<td>0.632</td>
</tr>
<tr>
<td>say in spending husband’s earnings</td>
<td>0.732</td>
<td></td>
</tr>
<tr>
<td>can go to market alone</td>
<td>0.646</td>
<td></td>
</tr>
<tr>
<td>can go to health facility alone</td>
<td>0.603</td>
<td></td>
</tr>
<tr>
<td>can leave village alone</td>
<td>0.482</td>
<td></td>
</tr>
<tr>
<td>has access to a bank account</td>
<td>0.194</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>83,238</td>
<td>26,034</td>
</tr>
</tbody>
</table>

Table 2: Summary Statistics
results of child gender on each component of the index.

3.2 Estimating Equations and Identification Concerns

We estimate the effects of a child’s gender on her mother’s autonomy and labor supply (on the extensive margin) using two different specifications. The first uses the gender of the entire sample of a mother’s children. So for a woman $i$, we test whether the number of daughters affects an outcome $Y_i$ conditional on her total number of children:

$$Y_i = \beta_1 \text{Children}_i + \beta_2 \text{Daughters}_i + x_i' \delta + \epsilon_i \quad (4)$$

The mother-level control variables in $x_i' \delta$ are a set of variables that are very unlikely to change in response to overall fertility or the children’s gender: the mother’s years of education, state of residence, whether she lives in a rural area, and dummies for her year of birth and whether she is a member of a scheduled caste, scheduled tribe, or other backward caste (in India).

Importantly, $\text{Children}_i$ and $\text{Daughters}_i$ report total children ever born to the women, regardless of whether the children are still alive at the time of the survey, which avoids the reverse causality concern that would arise if only mothers who have high autonomy already can dedicate enough resources to daughters to ensure that they survive. This equation then estimates the causal effect of child gender on the mother’s outcomes under the assumption that conditional on the number of children and their order, the gender of a child at birth is random. While the spread of ultrasound technology that facilitates sex-selective abortion may cause this assumption to fail – a possibility we discuss in detail below – we nonetheless think that a useful point of departure is to use all of the variation in gender that we observe.

To address the possibility that unobserved household-level factors drive both women’s outcomes and the sex ratio at birth of their children in several ways, we consider the sample of first births, where previous research as found little evidence of sex selective abortion (Pörtner 2010; Bhalotra and Cochrane 2010; Rosenblum 2013). Indeed, figure 1 shows that 48.5 percent of first births in India are female, which is within the natural range (Chahnazarian, 1988). In Bangladesh, the confidence interval for all births lies within the natural range.

By contrast, subsequent births in India do fall outside of this range, suggesting sex-selective abortion at higher parities. To help understand the effects that this potential selection may have in equation 4, figure 2 examines the relationship between parental and household characteristics and the probability that a child is a girl. In India, the largest de-
terminant is wealth: a one standard-deviation increase in wealth decreases the probability that a child is a girl by 0.73 percentage points. This pattern likely reflects both their better access to ultrasounds and smaller desired family size, which increases son bias (Bhalotra and Cochrane, 2010) and also the possibility that poor nutrition during pregnancy may cause boys to be missing in poor families (Almond and Mazumder, 2011). Regardless of the cause, because wealth is associated with higher female autonomy – a one standard deviation increase in wealth corresponds to a 0.26 standard deviation increase in autonomy ($P < 0.001$) – it is likely that any bias would work against finding higher autonomy. Rural households, Muslim households, and households from scheduled castes and scheduled tribes are marginally more likely to have female children. Interestingly, neither mother’s nor father’s education increases the probability of a girl.

Since there is evidence of sex-selective abortion in India for births after the first, our second empirical strategy is to re-estimate equation 4 using only the gender of the first-born child:

$$Y_i = \beta_{FirstBirthFemale_i} + x_i'\delta + \epsilon_i$$

(5)

This gives the causal effect of having a first-born girl on the mother’s outcome, under the assumption (supported by figure 1) that there is no selection in the gender of the first child.

Even if child sex at birth is random, there is considerable theoretical justification and empirical evidence that South Asian families change subsequent behavior in response to the sex of a child. For instance, son-biased stopping rules for fertility predict that parents are more likely to have another child after the birth of a girl than a boy (Clark 2000; Jensen and Thornton 2003; Rosenblum 2013). The prevalence of dowries and lower anticipated lifetime transfers also dictate that the birth of a daughter (relative to son) decreases a family’s permanent income (Deolalikar and Rose, 1998). Thus, if we continue to include only predetermined controls in $x_i'\delta$, the effect of child gender on household outcomes reflects both direct responses to the child’s gender and indirect effects of actions a household takes to reoptimize after learning a child’s gender.

Some authors have argued that examining outcomes in a short time horizon after a child’s birth limits the opportunity that households have to reoptimize in response to a child’s gender and therefore isolates direct behavioral responses to the gender of the child (Barcellos, Carvalho and Lleras-Muney 2014; Zimmermann 2012a). However, we are interested in considering the overall effect of child gender, inclusive of these indirect effects. Therefore, we do not limit our sample to the mothers of very young children, but instead, in section 2.2 we build these behavioral responses into our model and show that in general the main prediction that mothers seek more autonomy after having daughters remains.
Relatedly, in section 5 we argue that behavioral responses to the birth of a daughter are unlikely to explain the entire increase in mother’s autonomy unless we also consider the endogenous autonomy response we model. Note, however, that because equation 4 estimates the effect of the number of daughters conditional on total fertility, this equation shuts down the effect of daughters on mothers’ subsequent fertility as a potential channel linking daughters to autonomy.

The ages of children indeed matter for the relationship between child gender and mother’s autonomy. Using the same India data as we do but focusing on only the mothers of young children, Zimmermann (2012a) finds small positive effects of a having a boy on a mother’s autonomy in the child’s first months of life, but these effects disappear after 6 months of life. Our overall finding that daughters increase their mother’s autonomy suggests that positive effects of an older daughter on the mother’s autonomy eventually dominate the short-term boost in status a mother enjoys after having a boy. In section 4 we explicitly consider how the effects of child gender vary by the child’s age.
Figure 2: Correlates of a female birth

(std) denotes variables whose units are expressed in standard deviations
4 Results

In table 3 we present results from equations 4 and 5 that estimate the effects of a daughter on her mother’s autonomy and labor supply in India and Bangladesh, first using all births and then just the first birth. In both countries and in both samples, having a daughter leads to positive and statistically significant increases in her mother’s autonomy. To contextualize the size of the effect, we compare it to the coefficient on an additional year of education. In India, with the full sample of children, the autonomy index increases by 0.066 units for each child that is a daughter (versus 0.147 for an additional year of education), and if her first child is a girl a mother’s autonomy index increases by 0.112 units compared to when her first child is a son. Note that the sum of the positive coefficient on the number of daughters and the negative coefficient on children overall is zero, implying that the negative association between the number of children she has and a mother’s autonomy is driven entirely by sons. In Bangladesh, the effect of a daughter, relative to a son, on the autonomy index is actually several times larger than the increase from an additional year of education: 0.058 in the sample of all children (versus 0.016 for each additional year of education), and 0.079 in the sample of the first child. While, unlike in India, the overall effect of a daughter on autonomy is negative and significant, it is still several orders of magnitude lower for a girl (0.022 units) than for a boy (0.080 units).

Turning to labor supply, in India each daughter is associated with a 0.58 percentage point increase in the probability that her mother works outside the home; a firstborn daughter is associated with a 0.83 percentage point increase. In Bangladesh the effects are again even larger. Each daughter there is associated with a 1.20 percentage point increase in the probability that her mother works, while a firstborn daughter increases the probability that her mother works by 1.6 percentage points. Note that for both autonomy and labor supply in both countries, the effects are if anything larger in the sample of only firstborn children, providing further evidence that sex-selective abortions are unlikely to be the cause of the effects we estimate.

In table 4 we break down the labor supply by the type of job that a woman enters. A consistent pattern emerges: daughters prompt women to work in jobs outside of the home throughout the year, for cash, and for another person (rather than for themselves or for a family member). Furthermore, these jobs are in professional, clerical, or manual sectors, but not agriculture.14 In Heath and Tan (2014) we find that an inheritance law

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14Our result stands in contrast to Rose (2000), who found that daughters increase their mother’s labor supply in agriculture. Note that her measure of labor supply is on the intensive margin, and one way of reconciling these two sets of results is a model in which the extensive margin of labor supply in agriculture is more responsive to factors that predate child gender such as the household’s landholdings.
<table>
<thead>
<tr>
<th></th>
<th>India</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Autonomy index</td>
<td>1(Work)</td>
</tr>
<tr>
<td>daughters</td>
<td>0.0655***</td>
<td>0.0070***</td>
</tr>
<tr>
<td></td>
<td>[0.0254]</td>
<td>[0.0024]</td>
</tr>
<tr>
<td>children</td>
<td>-0.0519**</td>
<td>-0.0053***</td>
</tr>
<tr>
<td></td>
<td>[0.0215]</td>
<td>[0.0020]</td>
</tr>
<tr>
<td>first birth female</td>
<td>0.1124**</td>
<td>0.0086**</td>
</tr>
<tr>
<td></td>
<td>[0.0437]</td>
<td>[0.0040]</td>
</tr>
<tr>
<td>mother's education</td>
<td>0.1477***</td>
<td>0.1496***</td>
</tr>
<tr>
<td></td>
<td>[0.0054]</td>
<td>[0.0052]</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Std Dev of Dep. Var.</td>
<td>5.233</td>
<td>5.233</td>
</tr>
<tr>
<td>Observations</td>
<td>85,134</td>
<td>85,134</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.197</td>
<td>0.197</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. The autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, her own health care, visits to family, spending her husband’s income. Additionally, it includes whether she has access to a bank account and whether she can go alone to the market, the health clinic, and locations out of town. In Bangladesh the autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, and her own health care. (See section 2 for details).

Table 3: Effects of Child’s Gender on Mother’s Autonomy and Labor Supply
reform increased women’s autonomy, which increased their labor supply into these jobs, which we argued were likely to be high-paying. Increased labor supply into high-paying jobs is consistent with remark 1 of our baseline model, in which there is a cost to obtaining higher wage jobs, which women are more likely to seek out after having a daughter.

We now assess whether the effects of child gender vary with the age of the child. Specifically, we allow the effects of child gender in equations 4 and 5 to vary based on five-year bins, from birth to age 25:

\[
Y_i = \sum_{a=0}^{5} \beta_{1,a}1(\text{Mother has child aged 5a to 5a+5}) + \sum_{a=0}^{5} \beta_{2,a}1(\text{Mother has daughter aged 5a to 5a+5}) + x_i\delta + \epsilon_i
\]

Specifically, we allow the effects of child gender in equations 4 and 5 to vary based on five-year bins, from birth to age 25:

\[
Y_i = \sum_{a=0}^{5} \beta_{1,a}1(\text{Firstborn child aged 5a to 5a+5}) + \sum_{a=0}^{5} \beta_{2,a}1(\text{Firstborn daughter aged 5a to 5a+5}) + x_i\delta + \epsilon_i
\]

Figures 3 and 4 graph the \(\beta_{2,a}\) coefficients for autonomy and labor supply, for India and Bangladesh, respectively. Figure 3 shows that the effects of a daughter in India are driven by older girls, roughly beginning at age 10 to 14 (although this pattern dissipates in the sample of first children) for autonomy and ages 15 to 19 for labor supply. In Bangladesh, shown in figure 4, a broadly similar pattern emerges, although the results are more consistent for autonomy than for labor supply, especially in the sample of just the oldest children.

In the context of the model, the fact that autonomy increases do not come immediately after birth could reflect the fact that parents’ differential preferences for spending on girls versus boys are stronger for older girls than younger girls. For instance, parents may agree that children of both genders could complete primary school, but differ in whether girls should go to secondary school. Then, if mothers either did not have full information about these divergent preferences or face constraints in saving up for future spending on a daughter, they would wait to exercise their autonomy until the differential preferences emerge.

Because the survey only sampled women up to age 50, the sample of older children does not capture women who had children relatively late. For instance, the sample of children aged 20 and above loses mothers older than age 30 when the child was born; this represents the 85th percentile of age at birth among surveyed women in India and the
<table>
<thead>
<tr>
<th></th>
<th>self</th>
<th>family</th>
<th>another</th>
<th>work away from home</th>
</tr>
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<tbody>
<tr>
<td><strong>daughters</strong></td>
<td>-0.0001</td>
<td>0.0014</td>
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<td>0.0067***</td>
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<td>[0.0013]</td>
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<td>[0.0023]</td>
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</tr>
<tr>
<td><strong>first birth female</strong></td>
<td>-0.0027</td>
<td>0.0033</td>
<td>0.0103***</td>
<td>0.0098**</td>
</tr>
<tr>
<td></td>
<td>[0.0021]</td>
<td>[0.0034]</td>
<td>[0.0032]</td>
<td>[0.0038]</td>
</tr>
</tbody>
</table>

| Mean Dep Var | 0.066 | 0.066 | 0.205 | 0.205 | 0.180 | 0.180 | 0.364 | 0.364 |
| Observations  | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 |
| R-squared     | 0.029 | 0.029 | 0.131 | 0.131 | 0.092 | 0.091 | 0.196 | 0.196 |

<table>
<thead>
<tr>
<th></th>
<th>unpaid</th>
<th>cash</th>
<th>in kind</th>
<th>pay scheme…</th>
<th>regularity</th>
<th>all year</th>
<th>occasionally</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>daughters</strong></td>
<td>-0.0008</td>
<td>0.0099***</td>
<td>-0.0006</td>
<td>0.0070***</td>
<td>0.0018</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0015]</td>
<td>[0.0023]</td>
<td>[0.0018]</td>
<td>[0.0022]</td>
<td>[0.0020]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>children</strong></td>
<td>0.0029**</td>
<td>-0.0113***</td>
<td>0.0067***</td>
<td>-0.0055***</td>
<td>0.0016</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0013]</td>
<td>[0.0019]</td>
<td>[0.0016]</td>
<td>[0.0019]</td>
<td>[0.0017]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>first birth female</strong></td>
<td>-0.0001</td>
<td>0.0120***</td>
<td>0.0014</td>
<td>0.0095**</td>
<td>0.0016</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
<td>[0.0038]</td>
<td>[0.0028]</td>
<td>[0.0038]</td>
<td>[0.0033]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Mean Dep Var | 0.101 | 0.101 | 0.299 | 0.299 | 0.112 | 0.112 | 0.271 | 0.271 |
| Observations  | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 | 85,134 |
| R-squared     | 0.098 | 0.098 | 0.103 | 0.103 | 0.112 | 0.111 | 0.08 | 0.08 | 0.115 | 0.115 |

Table 4: Effects of Child’s Gender on Mother’s Labor Supply, by Sector (India only)
### Effects of Child’s Gender on Mother’s Labor Supply, by Sector (India only – continued)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Mean Dep Var</th>
<th>Observations</th>
<th>R-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>daughters</td>
<td>0.022</td>
<td>85,134</td>
<td>0.091</td>
</tr>
<tr>
<td>children</td>
<td>-0.0025***</td>
<td>85,134</td>
<td>0.039</td>
</tr>
<tr>
<td>first birth female</td>
<td>0.006</td>
<td>85,134</td>
<td>0.039</td>
</tr>
<tr>
<td>Mean Dep Var</td>
<td>0.022</td>
<td>85,134</td>
<td>0.039</td>
</tr>
<tr>
<td>Observations</td>
<td>85,134</td>
<td>85,134</td>
<td>0.039</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.091</td>
<td>0.039</td>
<td>0.039</td>
</tr>
</tbody>
</table>

**Notes:** Robust standard errors in brackets.  ***, p<0.01, ** p<0.05, * p<0.1.
88th percentile in Bangladesh. Inasmuch as women who delay childbirth are somewhat more liberal, the effects of child gender at older ages should be interpreted as the effects on a relatively more conservative sample.

We conclude our empirical tests of the main model by assessing the relationship between child gender and mother’s autonomy among women who do not work outside the home. Table 5 gives these results. Note that they should no longer be interpreted as the causal effects of child gender, since this is a selective sample that is affected by child gender (recall that table 3 demonstrated that daughters increase the probability that their mother works outside the home). In the model, the mother’s baseline autonomy is positively correlated with her labor supply, which increases after a daughter in both our model and a unitary household model (Rose, 2000). By considering a subset of women who don’t work, we focus on women with low baseline autonomy (those whose desired hours of work, $e^*$, are negative in our model) which is even lower if she does not work.

Figure 3: Effects of a daughter on mother’s autonomy and labor supply in India, by daughter’s age.
Figure 4: Effects of a daughter on mother’s autonomy and labor supply in Bangladesh, by daughter’s age
with a daughter. If anything, this selection bias would tend to make women with a daughter show a lower autonomy than women without sons who do not work outside the home. Nevertheless, Table 5 shows a significant positive impact of daughters on mothers’ autonomy. As those women do not work outside the home even with a daughter, the increase in their autonomy is unlikely driven entirely by her increased labor supply. Instead, consistent with our baseline model, the increased autonomy suggests that at least some of the relationship between daughters and mother’s autonomy is driven by a stronger desire to control a fixed amount of income, in light of differential preferences between parents for spending on a daughter.

5 Alternative Explanations

As we explained in the extensions to the baseline model in section 2.2, previous research has found that daughters have many effects on their families in South Asia. In section 2.2 we incorporated several of these alternative explanations into our main model to show that the prediction that daughters increase their mothers’ autonomy persists. In this section, we make a related argument: models based on other effects of daughters – but without allowing the mother to choose to seek greater autonomy after having a daughter – do not naturally predict the results from section 4 on the nature and timing of increases in a woman’s autonomy after having a daughter. That is, while we do not seek to definitively rule out all other ways in which daughters affect their mother’s autonomy, we argue that our endogenous autonomy model is likely to be one of the factors.

A central question during this exercise is that if we shut down the endogenous autonomy channel in our model, what does determine autonomy? Standard household bargaining models say that a spouse’s outside option determines the payoff she or he gets in the marriage, so one class of alternate theories predict that – directly or indirectly – a daughter raises her mother’s outside option, which raises her autonomy. We argue that these explanations are unlikely: if anything, a daughter (versus a son) lowers her mother’s outside option. We also consider a third possibility, that autonomy is a function of a mothers beliefs about gender equality, which are affected by the presence of a daughter.
### Table 5: Relationship between Child’s Gender and Mother’s Autonomy among Women who do not Work

<table>
<thead>
<tr>
<th></th>
<th>India</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Autonomy index</td>
<td>Autonomy index</td>
</tr>
<tr>
<td>daughters</td>
<td>0.0821**</td>
<td>0.0463***</td>
</tr>
<tr>
<td></td>
<td>[0.0335]</td>
<td>[0.0159]</td>
</tr>
<tr>
<td>children</td>
<td>-0.0392</td>
<td>-0.0668***</td>
</tr>
<tr>
<td></td>
<td>[0.0282]</td>
<td>[0.0129]</td>
</tr>
<tr>
<td>first birth female</td>
<td>0.1246**</td>
<td>0.0876***</td>
</tr>
<tr>
<td></td>
<td>[0.0561]</td>
<td>[0.0287]</td>
</tr>
<tr>
<td>mother's education</td>
<td>0.1391***</td>
<td>0.1389***</td>
</tr>
<tr>
<td></td>
<td>[0.0070]</td>
<td>[0.0067]</td>
</tr>
<tr>
<td></td>
<td>0.0197***</td>
<td>0.0205***</td>
</tr>
<tr>
<td></td>
<td>[0.0037]</td>
<td>[0.0036]</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>-0.487</td>
<td>-0.487</td>
</tr>
<tr>
<td>Std Dev of Dep. Var.</td>
<td>5.452</td>
<td>5.452</td>
</tr>
<tr>
<td>Observations</td>
<td>53,667</td>
<td>53,667</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.195</td>
<td>0.195</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Controls not shown include a dummy for rural location, Hindu religion, region FE’s (Bangladesh), state FE’s (India), and dummies for scheduled caste, scheduled tribe, and other backward caste (India). The autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, her own health care, visits to family, spending her husband’s income. Additionally, it includes whether she has access to a bank account and whether she can go alone to the market, the health clinic, and locations out of town. In Bangladesh the autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, and her own health care. (See section 2 for details).
5.1 Daughters effects on mothers’ outside option

5.1.1 Daughters affect subsequent fertility and their mothers’ health

Many effects of a daughter would likely hurt her mothers outside option. For instance, daughters tend to prompt higher fertility as their families try again for a son (Clark 2000; Jensen and Thornton 2003; Rosenblum 2013). As a result, mothers tend to breastfeed daughters for shorter time than sons in order to be able to get pregnant again more quickly (Jayachandran and Kuziemko, 2011). Subsequent pregnancies at close intervals can also hurt a mother’s health (Milazzo, 2014). While there is some evidence that breastfeeding can temporarily lead to increased anemia (Sharman and Macro, 2000) – so that mothers of daughters might actually be better nourished in the short run – the ultimate findings of Milazzo (2014) suggest that eventually the subsequent pregnancies effect is even more harmful, so that eventually the net effect of daughters on mothers’ health is negative.

We estimate the effects of daughters on their mothers’ nutritional status using the same empirical strategy as equations 4 and 5, in light of these previously documented health effects and the ambiguous prediction of the theoretical model in section 2 on a mother’s consumption. On one hand, the mother sacrifices her own consumption to give more to her daughter. On the other hand, once she fights for autonomy (and begins working more) she has greater control over the income she does have. So the effects of daughters on a mother’s nutritional status we estimate are a combination of subsequent fertility and the net effect of the mother increasing her labor supply and seeking more autonomy but needing to divert resources to a girl in response to her husband’s possible withdrawal of support.

Note, however, that the fact that figures 3 and 4 suggest that autonomy doesn’t increase until a daughter is older, while the health effects would operate more when the daughter is younger and her mother is more likely to still be having children. Accordingly, we first provide the overall effects of daughters on their mother’s nutrition in table 6, but then we also break them down by age. We find, in accordance the results of Milazzo (2014) in India, that younger daughters tend to hurt their mother’s nutritional status in both India and Bangladesh. The effects go away in mothers of older girls, suggesting that the positive effects from the increased autonomy their daughters prompted improve their consumption have roughly counteracted any persistent health effects that began when their daughters were younger.

In any case, given the generally consistent evidence that daughters tend hurt their mother’s health, if seems unlikely that health effects could actually improve a mother’s autonomy. The higher subsequent fertility a daughter prompts could also affect a mother’s
autonomy, but if anything, more children would likely decrease a mother’s autonomy by making it harder for her to survive on her own, given biological reasons and social norms that children would remain with the mother upon dissolution of a marriage. Overall, we argue that the tendency for daughters to have more siblings cannot explain the increases in autonomy we see.

5.1.2 Daughters affect their mothers’ labor supply

There are several reasons why daughters would increase their mother’s labor supply, even absent intrahousehold bargaining. The need to provide daughters with dowry decreases a household’s permanent income, which could prompt the mother to increase her labor supply. Another way that daughters could increase their mothers’ labor supply is if daughters help with home production, allowing mothers to enter the labor force (as in extension I to the main model). Finally, if the high returns to investment in boy’s human capital also prompt mothers to invest more time in boys (Rose, 2000), mothers may drop out of the labor force to spend more time with their sons, which would again increase labor supply after daughters. In any case, working itself could increase a woman’s autonomy if it improves her outside option, either through returns to labor market experience or if the act of working itself decreases her psychic cost of working outside the home. Note that unlike the discussion of these issues in section 2.2, this type of labor supply channel would tend to link daughters to their mother’s autonomy even if was no longer a choice variable, as in the main model.

However, we might expect that in all of these cases, increases in labor supply would come before increases in autonomy, while figures 3 and 4 show that if anything, the increases in autonomy come before increases in labor supply. The fact that the strongest labor supply and autonomy effects are seen in mothers of older girls also argues against a story in which women drop out of the labor force to spend more time with boys, since the greatest returns to time inputs in children would likely come before they start school. Relatedly, if these cases above are the main channels to explain the increase in female autonomy with a daughter, we might expect the increase gets smaller and insignificant when we focus on women who don’t work. While Table 5 gives some suggestive evidence that it may not be true.

5.2 Daughters affect their mothers’ preferences or beliefs

A final potential alternative explanation is that a daughter directly affects her mother’s preferences or beliefs. For instance, a daughter may learn about gender equality in school
### Panel A: Consumption

<table>
<thead>
<tr>
<th>Outcome</th>
<th>BMI</th>
<th>Anemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>daughters</td>
<td>0.0227</td>
<td>0.0182*</td>
</tr>
<tr>
<td></td>
<td>[0.0184]</td>
<td>[0.0101]</td>
</tr>
<tr>
<td>children</td>
<td>-0.1544***</td>
<td>0.0049</td>
</tr>
<tr>
<td></td>
<td>[0.0157]</td>
<td>[0.0087]</td>
</tr>
<tr>
<td>first birth female</td>
<td>0.0076</td>
<td>0.0216</td>
</tr>
<tr>
<td></td>
<td>[0.0317]</td>
<td>[0.0173]</td>
</tr>
<tr>
<td>Observations</td>
<td>80,918</td>
<td>80,918</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.229</td>
<td>0.227</td>
</tr>
</tbody>
</table>

### Panel B: Perceptions of Domestic Violence

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1(Domestic Violence Ever Acceptable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>daughters</td>
<td>-0.0036</td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
</tr>
<tr>
<td>children</td>
<td>0.0123***</td>
</tr>
<tr>
<td></td>
<td>[0.0021]</td>
</tr>
<tr>
<td>first birth female</td>
<td>-0.0053</td>
</tr>
<tr>
<td></td>
<td>[0.0042]</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>0.471</td>
</tr>
<tr>
<td>Observations</td>
<td>85,134</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.106</td>
</tr>
</tbody>
</table>

### Panel C: Domestic Violence (India)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1(Moderate Domestic Violence)</th>
<th>1(Severe Domestic Violence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>daughters</td>
<td>-0.0089***</td>
<td>-0.0007</td>
</tr>
<tr>
<td></td>
<td>[0.0029]</td>
<td>[0.0022]</td>
</tr>
<tr>
<td>children</td>
<td>0.0234***</td>
<td>0.0066***</td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
<td>[0.0019]</td>
</tr>
<tr>
<td>first birth female</td>
<td>-0.0033</td>
<td>0.0011</td>
</tr>
<tr>
<td></td>
<td>[0.0048]</td>
<td>[0.0035]</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>0.319</td>
<td>0.104</td>
</tr>
<tr>
<td>Observations</td>
<td>63,075</td>
<td>63,074</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.103</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Notes: BMI and domestic violence equations are estimated using OLS and Anemia is estimated with an ordered logit (categories = none, mild, moderate, and severe). Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Figure 5: Effects of a daughter on mother’s nutrition, by daughter’s age
and could convince her mother to stand up for herself. There is indeed some evidence that daughters decrease the probability that their mothers report that domestic violence is ever acceptable. Panel A of table 6 shows that in Bangladesh, a daughter is associated with a 0.80 percentage point decrease in the probability her mother reports that domestic violence is ever acceptable in the sample of all births; a firstborn daughter is associated with a 1.4 percentage point decrease. In India the point estimates go in the same direction, but are not statistically significant.

A natural question is whether these suggestive changes in mother’s perceptions of domestic violence lead to actual changes in domestic violence. The India survey asked women about actual incidence of domestic violence, and we report the effects of daughters on domestic violence in Panel C. While there is evidence in the sample of all children that the number of daughters is associated with lower rates of (moderate) domestic violence, this effect disappears in the sample of only firstborn children, so we do not interpret it is as causal effect of daughters. One possible explanation for the zero effect in the sample of firstborn children is that there are countervailing effects. For instance, mothers’ increased perception that domestic violence is never justified could be translated into less risk of domestic violence, but this effect could be counteracted by the possibility that the mother seeking more autonomy leads to frictions that result in violence, as in Eswaran and Malhotra (2011) or Anderson and Genicot (2015).

The fact that the mother’s marginally significant decreased belief in the acceptability of domestic violence (in India) does not translate into lower domestic violence suggests that changes in preferences from daughters do not automatically translate into better treatment, suggesting that changes in preferences or beliefs cannot singlehandedly explain increases in autonomy. Additionally, increases in beliefs in gender equality cannot explain the marginal decreases in consumption without incorporating the differential preferences for spending on daughters predicted by our model. In sum, while we think it is plausible that daughters also affect their mothers’ perceptions of gender relations, we nonetheless think that it is unlikely that this model can explain the whole set of results we find.

6 Conclusion

While mothers in South Asia report preferences for sons, we show that mothers of daughters have higher participation in household decision-making and freedom of mobility than mothers of sons. These results are consistent with a model in which mothers have differentially stronger preferences for spending on daughters than do their husbands. So mothers exert greater autonomy, even when doing so it costly for them, and increase their
labor supply.

This model suggests new policies that could address son preference and its link to missing women. Women could prefer a son – and possibly be prompted to engage in sex selective abortion – even if they get the same fundamental utility from the well-being of a son and a daughter. Thus, policies to discourage mothers from participating in sex selective abortion do not necessarily need to address deep-seated social norms biasing women against female offspring. Rather, women need to be compensated for the sacrifice in their own consumption and cost of obtaining autonomy to divert resources to their daughters. And policies that either increase women’s baseline autonomy or lower the cost to women of seeking autonomy would also tend to decrease sex selective abortion.

This model also provides new insights into the ways to assess whether women’s preferences are taken into account in household decision-making. We argue that low reported levels of autonomy in the way it is typically measured (such as a woman’s say in household decision-making) do not necessarily imply that the household’s decisions to not take into account the woman’s preferences, if household members have similar preferences. Conversely, since fighting for autonomy can have a cost to the woman, high reported values of autonomy may not always imply that the woman’s utility is higher. Of course, we are not denying that autonomy is an important concept for policy. Rather, we argue that it is a means to an end – the woman’s preferences are reflected in household decisions – rather than a goal in and of itself.

References

Ahmad, Syed Munir, and Muhammad Neman. 2013. “Mothers, Daughters and Education: Exploring the Role and Relationship between Culture and Socio-Economic Factors.” *PUTAJ Humanities and Social Sciences*, 20.


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Blattman, Christopher, Julian Jamison, Eric Green, and Jeannie Annan. 2014. “The returns to cash and microenterprise support among the ultra-poor: A field experiment.” Available at SSRN 2439488.


<table>
<thead>
<tr>
<th>Panel A: India</th>
<th>Sample</th>
<th>Mean Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
<td>All</td>
</tr>
<tr>
<td>say in own health care</td>
<td>0.0037</td>
<td>0.0061</td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
<td>[0.0044]</td>
</tr>
<tr>
<td>say in large household purchases</td>
<td>0.0026</td>
<td>0.0054</td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
<td>[0.0046]</td>
</tr>
<tr>
<td>say in visits to family</td>
<td>0.0046*</td>
<td>0.0098**</td>
</tr>
<tr>
<td></td>
<td>[0.0024]</td>
<td>[0.0044]</td>
</tr>
<tr>
<td>say in purchases for daily needs</td>
<td>0.0047</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>[0.0025]</td>
<td>[0.0044]</td>
</tr>
<tr>
<td>say in spending husband’s earnings</td>
<td>-0.0003</td>
<td>0.0083*</td>
</tr>
<tr>
<td></td>
<td>[0.0024]</td>
<td>[0.0043]</td>
</tr>
<tr>
<td>can go to market alone</td>
<td>0.0056**</td>
<td>0.0087</td>
</tr>
<tr>
<td></td>
<td>[0.0024]</td>
<td>[0.0043]</td>
</tr>
<tr>
<td>can go to health facility alone</td>
<td>0.0071</td>
<td>0.0124***</td>
</tr>
<tr>
<td></td>
<td>[0.0024]</td>
<td>[0.0044]</td>
</tr>
<tr>
<td>can leave village alone</td>
<td>0.0070***</td>
<td>0.0128***</td>
</tr>
<tr>
<td></td>
<td>[0.0024]</td>
<td>[0.0044]</td>
</tr>
<tr>
<td>has access to a bank account</td>
<td>0.0027*</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>[0.0016]</td>
<td>[0.0031]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Bangladesh</th>
<th>Sample</th>
<th>Mean Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
<td>All</td>
</tr>
<tr>
<td>say in large household purchases</td>
<td>0.0139***</td>
<td>0.0207***</td>
</tr>
<tr>
<td></td>
<td>[0.0041]</td>
<td>[0.0071]</td>
</tr>
<tr>
<td>say in visits to family</td>
<td>0.0156***</td>
<td>0.0149***</td>
</tr>
<tr>
<td></td>
<td>[0.0041]</td>
<td>[0.0071]</td>
</tr>
<tr>
<td>say in purchases for daily needs</td>
<td>0.0122***</td>
<td>0.0134***</td>
</tr>
<tr>
<td></td>
<td>[0.0040]</td>
<td>[0.0067]</td>
</tr>
</tbody>
</table>

Notes: Standard errors in brackets, clustered at the mother level in the sample of all children and the primary sampling unit level in the sample of only oldest children. *** p<0.01, ** p<0.05, * p<0.1. The autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, her own health care, visits to family, spending her husband’s income. Additionally, it includes whether she has access to a bank account and whether she can go alone to the market, the health clinic, and locations out of town. In Bangladesh the autonomy index is an aggregate of whether the woman has say in large household decisions, purchases for daily life, and her own health care. (See section 2 for details).

Table A1: Effects of child gender on specific components of the autonomy index
### Table A2: Effects of Child’s Gender on Parents’ Labor Supply on the Intensive Margin

<table>
<thead>
<tr>
<th>Panel A: Men</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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Appendix: Proofs

Proof of Proposition 2.1: The maximization problem can be rewritten as:

\[
\max_{e_f, h_f, y_f} \beta_f \ln(a_f w_f e_f - y_f) + \gamma_f (\lambda h_f + \rho \ln(y_f + y_m)) + \delta_f \ln(1 - e_f - h_f) + a_f \ln(1 - a_f)
\]

\[
\max_{e_m, y_m} \beta_m \ln(w_m e_m + (1 - a_f) w_f e_f - y_m) + \gamma_m (\lambda h_f + \rho \ln(y_f + y_m)) + \delta_m \ln(1 - e_m)
\]

Take the first-order conditions \((y = y_m + y_f)\):

\[
[h_f]: \quad \frac{\gamma_f \lambda}{h_f} = \frac{\delta_f}{1 - e_f - h_f} \quad \Rightarrow \quad h_f = \frac{\gamma_f \lambda}{\gamma_f \lambda + \delta_f} (1 - e_f)
\]

\[
[e_f]: \quad \frac{\beta_f a_f w_f}{a_f w_f e_f - y_f} = \frac{\delta_f}{1 - e_f - h_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f}
\]

The last equation is obtained by inserting the value of \(h_f\).

\[
[e_f, y_f]: \quad \frac{\beta_f a_f w_f}{a_f w_f e_f - y_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f} = \frac{\gamma_f \rho a_f w_f}{y}
\]

\[
[e_m, y_m]: \quad \frac{\beta_m w_m}{w_m e_m + (1 - a_f) w_f e_f - y_m} = \frac{\delta_m}{1 - e_m} = \frac{\gamma_m \rho w_m}{y}
\]

Take the sum of two equations above:

\[
\rho(w_f e_f + w_m e_m - y) = \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m}\right)y \quad (8)
\]

in which

\[
e_f = 1 - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho a_f w_f} y, \quad e_m = 1 - \frac{\delta_m}{\gamma_m \rho w_m} y
\]

Put \(e_f\) and \(e_m\) into (8):

\[
(\rho w_f - \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} y + \rho w_m - \frac{\delta_m}{\gamma_m} y - \rho y) = \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m}\right)y
\]

\[
\left(\frac{\beta_f}{\gamma_f} + \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho\right)y = \rho(w_f + w_m) \quad (9)
\]
Lastly, consider $a_f$,

$$[a_f] : \frac{\beta_f w_f e_f}{a_f w_f e_f - y_f} = \frac{\alpha_f}{1 - a_f} \Rightarrow \frac{\gamma_f \rho_w e_f}{y} = \frac{\alpha_f}{1 - a_f}$$

Put $y$ and $e_f$ into $[a_f]$,

$$\frac{\gamma_f w_f (\beta_f + \beta_m + \delta_m + \rho)}{w_f + w_m (\gamma_f + \gamma_m + \gamma_m)} = \frac{(\gamma_f \lambda + \delta_f) w_m}{(w_f + w_m) a_f} + \frac{\alpha_f}{1 - a_f}$$

(10)

As $a_f \in (0, 1)$, RHS of (10) first decreases and then increases. If there is one interior solution, there must be two solutions of $a_f$ that satisfy (10). The FOC of $a_f$ equals LHS minus RHS of (10), which is first negative, then positive, and then negative. So the utility of the wife must first decreases, then increases and then decreases as $a_f \in (0, 1)$. The larger solution of $a_f$ is the utility maximizer. We will focus on this solution.

Now a decrease in $\gamma_m$ increases RHS of (10), and thus increases the solution of $a_f$. Since

$$\frac{\gamma_f \rho_w (1 - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho_w})}{y} = \frac{\alpha_f}{1 - a_f}$$

(11)

as $a_f$ increases, $y/a_f$ decreases, and then $e_f$ increases and $h_f$ decreases. By (9), $y/\gamma_m$ must increase, so $e_m$ decreases. Also by (11), as $a_f$ increases and $a_f \geq a^*$, $y$ decreases.

Proof of Proposition 2.2: A decrease in $\alpha_f$ decreases RHS of (10). Since we focus on the larger solution of $a_f$, the RHS increases in $a_f$, and thus a decrease in $\alpha_f$ increases the solution of $a_f$. By (11), as $a_f$ increases, $y/a_f$ decreases, so $e_f$ increases and $h_f$ decreases. By (10) and (11),

$$\gamma_f \rho w_f = (\frac{\gamma_f w_f}{w_f + w_m} (\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho) + \frac{(\gamma_f \lambda + \delta_f) w_f}{(w_f + w_m) a_f}) y$$

As $a_f$ increases, $y$ must increase, and then $e_m$ decreases.

Proof of Proposition 2.3: Rewrite the first-order conditions:

$$[h_f] : \frac{\gamma_f \lambda}{h_f + H} = \frac{\delta_f}{1 - e_f - h_f} \Rightarrow h_f + H = \frac{\gamma_f \lambda}{\gamma_f \lambda + \delta_f} (1 - e_f + H)$$
\[[e_f]: \quad \frac{\beta f a_f w_f}{a_f w_f e_f - y_f} = \frac{\delta_f}{1 - e_f - h_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f + H}\]

\[[e_f, y_f]: \quad \frac{\beta f a_f w_f}{a_f w_f e_f - y_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f + H} = \frac{\gamma_f \rho a_f w_f}{y}\]

\[e_f = 1 + H - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho a_f w_f} y\]

Then

\[
\left(\frac{\beta_f}{\gamma_f} + \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho\right) y = \rho (w_f (1 + H) + w_m)
\]

\[\frac{\gamma_f w_f (1 + H)}{w_f (1 + H) + w_m} \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho\right) = \frac{(\gamma_f \lambda + \delta_f) w_m}{(w_f (1 + H) + w_m) a_f} + \frac{\alpha_f}{1 - a_f}
\]

With a positive \(H\), LHS of (13) increases and RHS decreases, so \(a_f\) has to increase. Note that since RHS decreases and \(a_f\) is in the right half of the U shape without \(H\), \(a_f\) is also in the right half of the U shape with \(H\). By (12), as \(a_f\) and \(H\) increase, \(y\) must increase. Then \(e_m\) decreases. By (8), as \(y\) increases and \(e_m\) decreases, \(e_f\) must increase and then \(h_f\) decreases.

**Proof of Proposition 2.4:** Rewrite the first-order conditions \((y' = y_f + y_m - D)\):

\[[e_f, y_f]: \quad \frac{\beta f a_f w_f}{a_f w_f e_f - y_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f} = \frac{\gamma_f \rho a_f w_f}{y'}\]

\[[e_m, y_m]: \quad \frac{\beta_m w_m}{w_m e_m + (1 - a_f) w_f e_f - y_m} = \frac{\delta_m}{1 - e_m} = \frac{\gamma_m \rho w_m}{y'}\]

\[(w_f e_f + w_m e_m - y' - D) = \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m}\right) y'\]

\[
\left(\frac{\beta_f}{\gamma_f} + \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho\right) y' = \rho (w_f + w_m - D)
\]

\[\frac{\gamma_f w_f}{w_f + w_m - D} \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho\right) = \frac{(\gamma_f \lambda + \delta_f) (w_m - D)}{(w_f + w_m - D) a_f} + \frac{\alpha_f}{1 - a_f}
\]

\[\frac{\gamma_f \rho w_f (1 - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho a_f} y')}{y'} = \frac{\alpha_f}{1 - a_f}
\]

With a positive \(D\), LHS of (15) increases and RHS decreases, so \(a_f\) has to increase. Note that since RHS decreases and \(a_f\) is in the right half of the U shape without \(D\), \(a_f\) is also in the right half of the U shape with \(D\). By (16), \(y' / a_f\) decreases, and then \(e_f\) increases and
Proof of Proposition 2.5: A decrease in $\rho$ decreases LHS of (10), and thus decreases the solution of $a_f$. By (11), as $a_f$ decreases, $y/(\rho a_f)$ increases, and then $e_f$ decreases and $h_f$ increases. By (11), as $a_f$ decreases and $a_f \geq a^*$, $y/\rho$ increases and then $e_m$ decreases. By (9), $a_f$ and $\rho$ decreases, so $y$ decreases.

Proof of Proposition 2.6: A decrease in $\lambda$ decreases RHS of (10). Since we focus on the larger solution of $a_f$, the RHS increases in $a_f$, and thus a decrease in $\lambda$ increases the solution of $a_f$. By (10) and (11),

$$
\gamma_f \rho w_f = \left( \frac{\gamma_f w_f}{w_f + w_m} \right) \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho \right) + \frac{(\gamma_f \lambda + \delta_f) w_f}{(w_f + w_m) a_f} y
$$

As $\lambda$ decreases and $a_f$ increases, $y$ must increase. By $[a_f]$, $e_f$ increases, by $[h_f]$, $h_f$ decreases, and by $[e_m, y_m]$, $e_m$ decreases.

Proof of Proposition 2.7: The model with unearned income is discussed in appendix B.1, and we add baseline autonomy to the proof of Proposition B.1. (20) is modified as

$$
\gamma_f (w_f + R_f) = \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho = \frac{(\gamma_f \lambda + \delta_f) (w_m + R_m)}{(w_f + w_m + R_f + R_m) (a_0 + a_f)} + \frac{\alpha_f}{1 - a_f}
$$

(17)

As $a_0$ increases, the RHS decreases. Since we focus on the larger solution of $a_f$, the RHS increases in $a_f$, and thus a increase in $a_0$ increases the solution of $a_f$. By (21), $y/(a_0 + a_f)$ increases, so $e_f$ increases.

Proof of Proposition 2.8: Take the first-order conditions ($y = y_m + y_f$):

$$
[h_f]: \quad \frac{\gamma_f \lambda}{h_f} = \frac{\delta_f}{1 - h_f}
$$

$$
[a_f, y_f]: \quad \frac{\beta_f R_f}{a_f R_f - y_f} = \frac{\gamma_f \rho R_f}{y} = \frac{\alpha_f}{1 - a_f}
$$

$$
[e_m, y_m]: \quad \frac{\beta_m w_m}{w_m e_m + (1 - a_f) R_f - y_m} = \frac{\delta_m}{1 - e_m} = \frac{\gamma_m \rho w_m}{y}
$$

Notice that $h_f$ is independent of the rest of the outcomes. So everything remains the same except $h_f$ decreases in case 2 and 5.
Sum $[a_f, y_f]$ and $[e_m, y_m],

\[ \rho(R_f + w_m e_m - y) = \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} \right)y \]

in which $e_m = 1 - \frac{\delta_m}{\gamma_m \rho} w_m y$. So

\[ \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho \right)y = \rho(w_m + R_f) \]

In case 1, as $\gamma_m$ decreases, $y$ decreases and $y/\gamma_m$ increases, so $e_m$ decreases and $a_f$ increases. In case 4, as $\rho$ decreases, $y$ decreases and $y/\rho$ increases, so $e_m$ decreases and $a_f$ decreases.

In case 2, let $y = y_m + y_f - D$,

\[ \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho \right)y = \rho(w_m + R_f - D) \]

As $D$ increases, $y$ decreases, so $e_m$ increases and $a_f$ increases.

In case 6, a decrease in $a_f$ makes $a_f$ increases, while the rest is independent of them.

B Appendix: Robustness of the Model

B.1 Unearned Income

Let $R_f$ be the wife’s unearned income and $R_m$ be the husband’s unearned income.

The wife’s optimization problem can be summarized as follows,

\[
\begin{align*}
\max_{x_f, h_f, y_f, e_f, a_f} & \quad \beta_f \ln x_f + \gamma_f (\lambda h_f + \rho \ln (y_f + y_m)) + \delta_f \ln (1 - e_f - h_f) + a_f \ln (1 - a_f) \\
\text{s.t.} & \quad e_f, h_f, a_f \in [0, 1], \quad x_f, y_f > 0, \quad p_f x_f + y_f \leq a_f (w_f e_f + R_f) 
\end{align*}
\]

where $p_f$ is the price of the wife’s private good.

The husband’s optimization problem is similar,

\[
\begin{align*}
\max_{x_m, y_m, e_m} & \quad \beta_m \ln x_m + \gamma_m (\lambda h_f + \rho \ln (y_f + y_m)) + \delta_m \ln (1 - e_m) \\
\text{s.t.} & \quad e_m \in [0, 1], \quad x_m, y_m > 0, \quad p_m x_m + y_m \leq w_m e_m + R_m + (1 - a_f) (w_f e_f + R_f) 
\end{align*}
\]
Proposition B.1. The predictions of Proposition 2.1 remains the same: suppose the Nash equilibrium is interior and the husband’s preference for the public good decreases when it is a girl ($\gamma_m^s > \gamma_m^d$),

- The wife works more outside ($e_f$), less at home ($h_f$), and gets a higher autonomy ($a_f$).

- The husband works less outside ($e_m$).

- The monetary investment to the household public good decreases ($y_f + y_m$), if $a_f \geq a^*$. 

Proof of Proposition B.1: The proof is similar to the one without unearned income. Take the first-order conditions ($y = y_m + y_f$):

\[
[h_f]: \quad \frac{\gamma_f \lambda}{h_f} = \frac{\delta_f}{1 - e_f - h_f} \implies h_f = \frac{\gamma_f \lambda}{\gamma_f \lambda + \delta_f} (1 - e_f)
\]

\[
[e_f]: \quad \frac{\beta_f a_f w_f}{a_f (w_f e_f + R_f) - y_f} = \frac{\delta_f}{1 - e_f - h_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f}
\]

The last equation is obtained by inserting the value of $h_f$.

\[
[e_f, y_f]: \quad \frac{\beta_f a_f w_f}{a_f (w_f e_f + R_f) - y_f} = \frac{\gamma_f \lambda + \delta_f}{1 - e_f} = \frac{\gamma_f \lambda + \delta_f}{y_f}
\]

\[
[e_m, y_m]: \quad \frac{\beta_m w_m}{w_m e_m + R_m + (1 - a_f)(w_f e_f + R_f) - y_m} = \frac{\delta_m}{1 - e_m} = \frac{\gamma_m \rho w_m}{y}
\]

Take the sum of two equations above:

\[
\rho (w_f e_f + R_f + w_m e_m + R_m - y) = \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} \right) y \implies (18)
\]

in which

\[
e_f = 1 - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho a_f w_f} y, \quad e_m = 1 - \frac{\delta_m}{\gamma_m \rho w_m} y
\]

Put $e_f$ and $e_m$ into (18):

\[
(\rho w_f + \rho R_f - \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} y + \rho w_m + \rho R_m - \frac{\delta_m}{\gamma_m} y - \rho y) = \left( \frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} \right) y
\]

\[
\left( \frac{\beta_f}{\gamma_f} + \frac{\gamma_f \lambda + \delta_f}{\gamma_f a_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho \right) y = \rho (w_f + w_m + R_f + R_m) \implies (19)
\]
Lastly, consider \( a_f \),

\[
[a_f] : \frac{\beta_f (w_f e_f + R_f)}{a_f (w_f e_f + R_f) - y_f} = \frac{\alpha_f}{1 - a_f} \rightarrow \frac{\gamma_f \rho (w_f e_f + R_f)}{y} = \frac{\alpha_f}{1 - a_f}
\]

Put \( y \) and \( e_f \) into \([a_f]\),

\[
\frac{\gamma_f (w_f + R_f)}{w_f + w_m + R_f + R_m} (\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m} + \frac{\delta_m}{\gamma_m} + \rho) = \frac{(\gamma_f \lambda + \delta_f) (w_m + R_m)}{(w_f + w_m + R_f + R_m) a_f} + \frac{\alpha_f}{1 - a_f} \tag{20}
\]

As \( a_f \in (0, 1) \), RHS of (20) first decreases and then increases. As discussed in the proof of Proposition 2.1, the larger solution of \( a_f \) is the utility maximizer and we will focus on this solution.

Now a decrease in \( \gamma_m \) increases LHS of (20), and thus increases the solution of \( a_f \).
Since

\[
\frac{\gamma_f \rho w_f (1 - \frac{\gamma_f \lambda + \delta_f}{\gamma_f \rho a_f y}) + \gamma_f \rho R_f}{y} = \frac{\alpha_f}{1 - a_f} \tag{21}
\]

as \( a_f \) increases, \( y/a_f \) decreases, and then \( e_f \) increases and \( h_f \) decreases. By (19), \( y/\gamma_m \) must increase, so \( e_m \) decreases. Also by (21), as \( a_f \) increases and \( a_f \geq a^* \), \( y \) decreases.

### B.2 Corner solutions

Since the vast majority of men in South Asia work outside the home – 97% of men work in India, and 98% of in Bangladesh in our data – we maintain the assumption that the husband’s wage is high enough that he always works outside the home in equilibrium, i.e. \( e_m > 0 \). \(^{15}\)

We focus on the corner solution in which only one spouse is the financial contributor of the child’s expense. This is a generalization of models in which the wife contributes time and the husband makes a financial contribution (Anderson and Eswaran 2009). In our model this outcome will result when the husband has a high preference for the child, likely a son. However, when the child is a daughter and the husband cares very little about her well-being, the husband has little incentive to spend money on her and so the wife also takes care of her financial expenses, e.g. her education. Qualitative evidence

\(^{15}\) A corner solution \((e_m = 0)\) is not impossible because the husband gets some unearned income from the wife, but happens only if men’s salary is relatively low compared to women’s salary. While our data does not have earnings, in India women who report earnings earned on average 57% as much as men (2004 census) and in Bangladesh women who reported earnings earned on average 69% as men (2005 Housing Income and Expenditure Survey), so this case does not appear to be empirically relevant.
from Bangladesh suggests that many women do tend to invest money (not just time) resources on their children, and their daughters in particular (Kabeer 1997; Sultan Ahmed and Bould 2004).

Lemma B.2. There exist $\gamma_m$ and $\underline{\gamma}_m$, such that

- If the husband cares sufficiently high for the child’s well-being ($\gamma_m \geq \overline{\gamma}_m$), there is an equilibrium in which he pays for the child’s entire expense $y_m > 0$ and $y_f = 0$.

- If the husband cares sufficiently little for the child’s well-being ($\gamma_m \leq \underline{\gamma}_m$), there is an equilibrium in which the wife pays for the child’s entire expense $y_f > 0$ and $y_m = 0$.

Proof of Lemma B.2: When it is a son, the wife has no incentive to invest in the child only when the marginal utility is higher to invest to her own consumption (the equilibrium calculation is in the proof of Proposition B.3):

\[
\frac{\beta_f}{x_f^s} \geq \gamma_f \rho \frac{y_m^s}{y_m^s} \Rightarrow \frac{\gamma_m^s \rho}{\beta_m + \gamma_m \rho + \delta_m} \geq \frac{x_f^s \gamma_f \rho}{\beta_f (w_m + (1 - a_f^s) (w_f e_s^s))}
\]

So there exists an upper bound $\overline{\gamma}_m$, such that when $\gamma_m^s \geq \overline{\gamma}_m$, the husband pays high enough on the son and the wife doesn’t find it optimal to spend on the son.

When it is a daughter, the husband have no incentives to invest in the child only when the marginal utility if higher to invest in his own consumption:

\[
\frac{\beta_m}{x_m^d} \geq \gamma_m^d \rho \frac{y_f^d}{y_f^d} \Rightarrow \gamma_m^d \leq \frac{\beta_m y_f^d}{\rho x_m^d}
\]

So there exists a lower bound $\underline{\gamma}_m$, such that when $\gamma_m^d \leq \underline{\gamma}_m$, the husband cares so little about the child that he doesn’t want to contribute when the wife invest into the child.

We remark that $\overline{\gamma}_m$ and $\underline{\gamma}_m$ depends on all the parameters, including $\gamma_f$, and we omit this dependence for simplicity. We denote the equilibria above as single-financial-contributor equilibria, with the first type as men-contributing equilibria and the second one as women-contributing equilibria.

To study the effect of the child’s gender, we consider a husband with high preference for a son ($\gamma_m^s \geq \overline{\gamma}_m$) and low preference for a daughter ($\gamma_m^d \leq \underline{\gamma}_m$). In other words, the change is from a men-contributing equilibrium for a son to a women-contributing equilibrium for a daughter. While it is not entirely impossible to have multiple equilibria, especially when $\overline{\gamma}_m > \underline{\gamma}_m$, we further restrict our attention to the case with unique equilibrium, such that $\gamma_m^s \geq \max(\overline{\gamma}_m, \underline{\gamma}_m)$ and $\gamma_m^d \leq \min(\overline{\gamma}_m, \underline{\gamma}_m)$. 

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Proposition B.3. Suppose $\gamma^d_m \geq \max(\gamma^m, \gamma^s_m)$ and $\gamma^s_m \leq \min(\gamma^m, \gamma^s_m)$. When the child is a daughter (compared to a son):

- The wife works more outside the home ($e_f$), less at home ($h_f$), gets a higher autonomy ($a_f$), but a lower overall utility ($u_f$).

- The husband works less ($e_m$) and consumes more ($x_m$) as long as the loss of control of his wife’s income is not too high.

Proof of Proposition B.3: When it is a son, the husband pays the child’s entire expense. Then in equilibrium,

$$\frac{\beta_f}{a_f} = \frac{\alpha_f}{1 - a_f} \quad \Rightarrow \quad a_f = \frac{\beta_f}{\alpha_f + \beta_f}$$

$$\frac{\beta_f \omega_f}{\omega_f e_f} = \frac{\delta_f}{1 - e_f - h_f}, \quad \frac{\gamma_f \lambda}{h_f} = \frac{\delta_f}{1 - e_f - h_f}$$

So,

$$e^s_f = \frac{\beta_f}{\beta_f + \gamma_f \lambda + \delta_f}, \quad h^s_f = \frac{\gamma_f \lambda}{\beta_f + \gamma_f \lambda + \delta_f}$$

The husband:

$$y^s_m = \frac{\gamma_m \rho}{\beta_m + \gamma_m \rho} (w_m e_m + (1 - a_f)(w_f e_f))$$

$$e^s_m = \frac{(\beta_m + \gamma_m \rho) w_m - \delta_m((1 - a_f)(w_f e_f))}{(\beta_m + \gamma_m \rho + \delta_m) w_m}$$

$$p_m x^s_m = \frac{\beta_m}{\beta_m + \gamma_m \rho + \delta_m} (w_m + (1 - a_f^s)(w_f e^s_f))$$

When it is a daughter, the wife the child’s entire expense. Then in equilibrium,

$$y^d_f = \frac{\gamma_f \rho}{\beta_f + \gamma_f \rho} a_f(w_f e_f)$$

$$\frac{\beta_f + \gamma_f \rho}{a_f} = \frac{\alpha_f}{1 - a_f} \quad \Rightarrow \quad a^d_f = \frac{\beta_f + \gamma_f \rho}{\alpha_f + \beta_f + \gamma_f \rho}$$

Similarly,

$$e^d_f = \frac{\beta_f + \gamma_f \rho}{\beta_f + \gamma_f (\lambda + \rho) + \delta_f}, \quad h^d_f = \frac{\gamma_f \lambda}{\beta_f + \gamma_f (\lambda + \rho) + \delta_f}$$

The husband:

$$e^d_m = \frac{\beta_m w_m - \delta_m((1 - a_f)(w_f e_f))}{(\beta_m + \delta_m) w_m}$$
\[ p_m x_m^d = \frac{\beta_m}{\beta_m + \delta_m}(w_m + (1 - a_f^d)(w_f e_f^d)) \]

Her consumption change is unclear.

\[ p_f x_f^s = \frac{\beta_f}{\alpha_f + \beta_f \beta_f + \gamma_f \lambda + \delta_f} w_f \]

\[ p_f x_f^d = \frac{\beta_f}{\beta_f + \gamma_f \rho \alpha_f + \beta_f + \gamma_f \rho \beta_f + \gamma_f (\lambda + \rho)} w_f \]

Lastly, it is easy to check that the wife’s overall utility is lower when it is a girl. When it is a girl, the wife’s choices are \((x_f^d, e_f^d, h_f^d, y_f^d, a_f^d)\). When it is a son, using the same set of choices plus \(y_m^d > 0\) must give the wife is a strictly higher utility. □

### B.3 Autonomy as control of time

Alternatively, we can think of autonomy as the wife’s control of her time. In many traditional and conservative societies, the husband may dislike his wife working outside (Basu, 2006). In a simple model, we assume the husband controls \(h_f\), the time the wife has to spend on the household public good (i.e. taking care of the child). And the wife allocates her free time \(1 - h_f\) to working outside and leisure. Her autonomy is her free time \(a_f = 1 - h_f\).

In the husband’s utility,

\[
\max_{x_m, h_f, e_m, y_m} \beta_m \ln x_m + \gamma_s^d (\lambda h_f + \rho \ln (y_f + y_m)) + \delta_m \ln (1 - e_m) + \alpha_m \ln (1 - h_f)
\]

s.t. \(e_m, h_f \in [0, 1], x_m, y_m > 0, p_m x_m \leq w_m e_m - y_m\)

where \(\alpha_m \ln (1 - h_f)\) is the cost for the husband to supervise the wife.

In the wife’s utility,

\[
\max_{x_f, e_f, y_f} \beta_f \ln x_f + \gamma_f (\lambda h_f + \rho \ln (y_f + y_m)) + \delta_f \ln (1 - e_f - h_f)
\]

s.t. \(e_f \in [0, 1 - h_f], x_f, y_f > 0, p_f x_f \leq w_f e_f - y_f\)

**Proposition B.4.** Suppose the autonomy is control of time and Nash equilibrium is interior. If the husband’s preference for the public good decreases when it is a girl \(\gamma_s^d > \gamma_m^d\),

- The wife works more outside \((e_f)\), less at home \((h_f)\), and gets a higher autonomy \((a_f)\).
- The husband works less outside \((e_m)\).
The monetary investment to the household public good may increase or decrease \((y_f + y_m)\).

**Proof of Proposition B.4:** Take first-order conditions:

\[
[h_f]: \quad \frac{\lambda \gamma_m}{h_f} - \frac{\alpha_m}{1 - h_f} = 0 \rightarrow h_f = \frac{\lambda \gamma_m}{\lambda \gamma_m + \alpha_m}
\]

So as \(\gamma_m\) decreases when it is a girl, \(h_f\) decreases and \(a_f = 1 - h_f\) increases.

\[
[e_f, y_f]: \quad \beta_f w_f - \delta_f e_f - h_f = \frac{\gamma_f \rho w_f}{y}
\]

\[
[e_m, y_m]: \quad \beta_m w_m - \delta_m e_m = \frac{\gamma_m \rho w_m}{y}
\]

So we have,

\[
\rho (w_f e_f + w_m e_m - y) = \left(\frac{\beta_f}{\gamma_f} + \frac{\beta_m}{\gamma_m}\right) y \quad (22)
\]

\[
e_f = 1 - h_f - \frac{\delta_f}{\gamma_f \rho w_f} y, \quad e_m = 1 - \frac{\delta_m}{\gamma_m \rho w_m} y \quad (23)
\]

Putting \(e_f\) and \(e_m\) into the equation (22),

\[
\rho (w_f (1 - h_f) + w_m) = \left(\frac{\beta_f + \delta_f}{\gamma_f} + \frac{\beta_m + \delta_m}{\gamma_m} + \rho\right) y
\]

As \(h_f\) decreases, \(y / \gamma_m\) must increases, so \(e_m\) decreases. Lastly, if \(y\) decreases, by the expression of \(e_f\) in (23), it increases; otherwise if \(y\) increases, by equation (22), \(e_f\) must increases. So regardless, \(e_f\) increases.

As the husband cares less about a girl, he demands less control of the wife’s time, so she works less at home, works more outside and gets a higher autonomy. With both the less care of the household public good and the wife’s higher earning, the husband works less. The monetary contribution to the household public good is ambiguous, since on one hand the husband contributes less since he cares less, while on the other hand, the wife contributes more since she earns more.

**B.4 A cooperative model**

In a collective model, a social planner, representing the wife and the husband, maximizes the weighted total utility: \(U = a_f u_f + (1 - a_f) u_m\). Recall the wife and the husband’s
utilities are \( y = y_f + y_m \):

\[
\begin{align*}
    u_f &= \beta_f \ln x_f + \gamma_f (\lambda \ln h_f + \rho \ln y) + \delta_f \ln (1 - e_f - h_f) \\ 
    u_m &= \beta_m \ln x_m + \gamma_m^s (\lambda \ln h_f + \rho \ln y) + \delta_m \ln (1 - e_m)
\end{align*}
\]

In India, husbands are in dominant positions, so we maintain the assumption that \( u_m > u_f \) in equilibrium. Thus, the social planner has incentives to give the husband a higher weight once \( a_f \) is endogenous. In particular, suppose \( a_f^0 \) is the baseline autonomy determined by spouses’ outside options, and the social planner can costly move autonomy away from its baseline value. Let \( \Delta a_f \) be the distortion towards the husbands from baseline value, s.t. \( a_f = a_f^0 - \Delta a_f \). The cost to do so is \( \alpha \ln (1 - \Delta a_f) \), such that there is no cost if there is no distortion. Overall, the social planner’s utility is

\[
U = (a_f^0 - \Delta a_f) u_f + (1 - a_f^0 + \Delta a_f) u_m + \alpha \ln (1 - \Delta a_f)
\]

Suppose when it is a son, the social planner’s optimal choice is \( \Delta a_f^s, u_f^s \) and \( u_m^s \). Note that by assumption, \( u_f^s < u_m^s \), and thus the optimal \( \Delta a_f^s > 0 \). When it is a daughter, the husband cares less of the household public good (the well-being of the child), \( \gamma_m^d < \gamma_f^d \). The direct effect of a daughter is decreasing the husband’s utility while keeping the wife’s utility constant. To fix the idea, imagine the decrease of the husband’s preference \( \gamma_m \) is sufficiently high, such that the equilibrium adjustment doesn’t alter the direct effect. Then the gap of spouses’ utilities is smaller when it is a daughter, \( u_m^d - u_f^d < u_m^s - u_f^s \). The FOC suggests that

\[
u_m - u_f = \frac{\alpha}{1 - \Delta a_f}
\]

So \( \Delta a_f^d < \Delta a_f^s \). The wife gets a higher autonomy with a daughter, because of a lower distortion.

C Appendix: Estimating labor supply on the intensive margin

To estimate the effects of daughters on labor supply including both the extensive and the intensive margin, we use the 1993 National Sample Survey, which contains information on the number of days (between 0 and 7) a respondent worked in the previous week. We use tobits to estimate analogous equations to 4 and 5; results are qualitatively similar if
we use an ordered logit.

\[
DaysWorked_i = \beta_1 ChildrenPresent_i + \beta_2 FemaleChildrenPresent_i + x_i'\delta + \epsilon_i 
\] (24)

\[
DaysWorked_i = \beta_3 OldestChildPresent_i + x_i'\delta + \epsilon_i 
\] (25)

A caveat to interpreting these results is that rather than using all children ever born to estimate \(Children_i, Daughters_i,\) and \(FirstBornDaughter_i,\) which we argue in section 3.2 is important to avoid reversal causality concerns, we only see children present in the household. To create a sample of parents and children, we use adults who identify as the head of the household or spouse and consider children listed as children of the head. There are two levels of selection one may be concerned about in this sample: selection into remaining alive and selection into remaining in the household, conditional on being alive.

We try to minimize the latter by considering children who are less likely to be married. However, given that figures 3 and 4 indicate the daughters begin affecting their mothers autonomy and labor supply at approximately age 10, we also would not expect to see a sample of young children generating the results we see. We thus consider maximum age cutoffs ranging from age 10 to 16, the median age at marriage of women interviewed in the 1993 Demographic and Health Survey. The results in table A2 do indeed get stronger as the maximum age cutoff increases.

While the mechanism between these results could be a mixture of true causal effects of daughters and selection effects that increase with age (having a 16-year-old daughter still present in the household signifies a greater degree of liberalness than having a ten-year-old daughter still present in the house), note that the most clear selection story suggests that mothers with enough bargaining power to keep her daughter alive and present in the household may also be more likely to work. By contrast, it is less clear to us which way the selection of having a daughter present in the household would affect men’s labor supply. But since we cannot rule out that selection effects are driving the male labor supply results, we view them as suggestive evidence, in accordance with Rose (2000), that support our main model.