Chapter 11
Family Allocation Strategy in the Late Nineteenth Century

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Abstract I analyze the intrahousehold allocation of resources among nineteenth-century industrial families. The narrative record and economic theory suggest that we should find allocation differences by gender. Using a large survey of industrial households in the late nineteenth century, I find no evidence of gender bias in household allocations to children, nor can I reject the hypothesis that allocations were efficient. These findings cannot be explained by parental egalitarianism. I find that parents were strategic out of necessity—the future cooperation of children was unknown and highly uncertain, tempering any desire for gender bias in household allocations. Narrative and quantitative evidence supports this conclusion.

Keywords Parental egalitarianism · Intrahousehold allocation · Gender bias · Earnings potential · Adult consumption

11.1 Introduction

Economists and historians have noted for some time that industrialization changed intergenerational relationships in fundamental ways (see, e.g., Gary Becker 1991). Our knowledge of family strategies in the industrial world of the nineteenth century gives us some clues about how families behaved in this period. We know, for example, that the earnings of children were important to family survival as households made the transition from agricultural to industrial work and that household resources, savings, and labor force participation were intimately related to the household's age structure and the earnings of children—the dominant secondary workers at the time (Angus and Mirel 1985; Hoover 1985; Rotella and Alter 1993; Haines 1979, 1981; Manacorda 2006).

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P. Gray et al. (eds.), *Standard of Living*, Studies in Economic History,
https://doi.org/10.1007/978-3-031-06477-7_11

We also know that cultural and social norms changed much more slowly than the economic environment. Even though children of both genders worked, young men had greater labor force attachment than young women and earned, on average, higher wages. Indeed, the independence that young women could experience with participation in the labor force could cause conflict within the family (Goldin 1980, 1981; Moehling 2005). In many ways the independence of young women was thwarted by cultural norms that dictated that young women should live in their families of origin until marriage, although the cultural variations on this theme were many (Glenn 1990, Goldin 1981, Woods and Kennedy 1913, Ewen 1979). At the same time, young women in the USA were among the most educated in the world in the late nineteenth century, although the majority of women would leave the labor force upon marriage (Goldin 1980, Carter and Savoca 1991).

Given the contradictory indirect evidence, we should ask if the allocation of resources in industrial households favored one gender over another. This gender differential in allocations could take place for several reasons. If parents desired to smooth consumption over the lifecycle, they could devote more resources to children who would earn more for the household in the future. Similarly, if young women contributed more in nonmarket work or old age support, this could play a factor in how parents chose to allocate resources in the household. Alternatively, altruistic parents could devote more resources to children with higher marginal utilities of consumption, and this would appear to favor children who had lower potential earnings in the labor market. Both lifecycle and altruistic arguments imply gender differences in household allocation strategies.

Beyond this question of the direction of any potential allocation bias, there is a more fundamental economic question: Was the allocation strategy efficient? Would it have been possible to make one group (parents, sons, daughters) better off without any change in the welfare of others? While we do know about how households made decisions, we know little about the welfare implications of those decisions. Furthermore, should we expect efficiency? In theoretical work, economists have concentrated on efficiency as the shared condition for a large range of household decision-making models, from those with a single dictator to those where household members bargain over resources. Households, then as now, have long-lived relationships with one another, one of the requirements for efficiency to hold (one-shot games need not be efficient). Narrative evidence suggests the same social and cultural forces that tied young women closer to the home than young men could be used to the parents' advantage, and it is easy to imagine such situations being suboptimal. As with the question of allocation differences by gender, conjectures point in both directions.

To answer these questions, I test whether the pattern of intrahousehold allocation differed by gender among late nineteenth-century industrial households in the USA and also test for the efficiency of the allocation strategy. In every test, I cannot reject the hypothesis that the allocation of resources was equal by gender. Furthermore, I

cannot reject the hypothesis that the allocation of resources in these households was efficient. The failure to reject efficiency comes despite the fact that the earnings profiles of boys show that they earn roughly 40% more than their sisters during their teenage years.

Parents did not favor one gender over another and household allocations were efficient, yet we know that boys earned more than girls when they entered the labor market, and Rotella and Alter (1993) found that parents were forward-looking consumption smoothers. If parental allocations were efficient and parents were forward looking, then it must hold that parents perceived the expected income flows from sons and daughters to be equal or the marginal utilities of consumption for boys and girls to be equal. The perceived equal flows from sons and daughters could be due to either longer streams of wage income from daughters or greater nonwage contributions by daughters. Concentrating on labor market earnings only, I use the income profiles to estimate the probability that boys would not cooperate relative to girls. I find that boys age 12–24 in these industrial households were anywhere from 30% to 50% more likely than girls the same age to leave home. Narrative evidence is also consistent with this explanation—young men were allowed more freedoms, did fewer household chores, and retained more of their earnings than their sisters when they earned more in the labor market.

I conclude that parents were strategic out of necessity—because the future cooperation of children was unknown, parents allocated equally because the expected higher earnings of sons came with higher probability of noncooperation and/or greater bargaining concessions. This conclusion is supported by recent theoretical work that shows that intertemporal efficiency within households is unlikely because members cannot fully commit to future cooperation (Mazzocco 2007). Gender-neutral allocations were the best option for parents at this time.

11.2 Intrahousehold Allocation in the Historical Record

Before turning to the theory and empirical results, we should see what insights and hypotheses about gender differentials in household allocations can be found in the historical record. While there is a great deal of information in the historical narrative, those contemporaneous accounts of the phenomena are sometimes problematic. Many contemporary observers were known to be biased against the working class, industrial families, immigrants, and non-whites, and many of the sources were used as propaganda for policy agendas.

Therefore, we should look at the narrative record carefully and see what observations by contemporary observers are also supported by recent scholarship on the topic. Below, I analyze both contemporaneous and recent scholarship in an attempt to establish what is known about differentials in household well-being by gender in industrial households.

The changes brought about by industrialization changed traditional familial relationships. Not only did the wage economy change the location and tasks of

household members, but also the types of contributions they could be expected to make to the household. Children of both genders worked outside of the household to supplement their father's income. Glenn (1990) points out:

> This pattern was a shift from the traditional way that… [Europeans] had defined the economic role of women…redistribution of economic responsibility was a behavioral shift more than a shift in values, but it represented the first in a series of changes that would redefine the nature of …womanhood. (p. 89)

In short, this change was momentous and changed the way the family functioned and was structured.

Poverty was common among these households, and Chapin (1909) notes that households with more than one wage earner were more likely to be impoverished. Streightoff (1911) summarizes many of the general findings of contemporaneous reports of living standards in the late nineteenth century. He further supports Chapin's claims about the poverty of multiple- earner households when he looked at the other surveys of industrial families from the late nineteenth century onward. Since children were the primary secondary workers at the time, Chapin and Streightoff's findings imply that families in which children worked were most in need of their incomes for survival.[1] Streightoff additionally noted that young working women seem to be particularly affected by fatigue brought about by undernourishment.[2] Such observations point to mistreatment in the household and perhaps unequal allocations at the dinner table.[3] Glenn (1990) notes that until 1903 New York law required only 4 years of schooling before a child could work, and "working papers" were easy to forge, further enabling children at very young ages to participate in the labor market. Additionally, families could exert greater social control over their daughters than sons.

Haines (1981) concludes that the highest-earning members of the household could be expected to receive better treatment than others, and this was usually the father or older son. Goldin (1981) claims that this could be the result of implicit investment choices by parents, where boys would receive a larger share of parental resources. In an analysis of Philadelphia households in the late nineteenth century, she concludes that "sons and daughters had differing relative productivities in the

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[1] This is not a causal claim—there is an obvious endogeneity between the labor supply of household members and total household income.

[2] He reported that "The reason for this pitifully insufficient diet is well expressed by Mrs. Van Vorst in describing

her own experience as a working woman: 'I am beginning to understand why the meager lunches of preserves, sandwiches, and pickles more than satisfy the girls whom I was prepared to accuse of spending their money on gewgaws rather than on nourishment. It is a fatigue that steals the appetite. I can hardly taste what I put in my mouth; the food sticks in my throat. I do not want wholesome food…'" (Streightoff 1911, p. 91).

[3] There is further narrative evidence to support such claims. Glenn (1990) notes that "So important were a daughter's wages to the family that in some instances her marriage would be postponed until another child could earn enough to replace her…The economic needs and priorities of immigrant families frequently required daughters to drop out of school in order to become wage earners" (Glenn 1990, pp. 84–86).

household and in the market and required differing training for their future occupations inside or outside the home" (p. 293). To the extent that parents weighed market production more heavily than household production (or vice versa), we would expect differential allocations by gender.

Some social observers turned their attention to young women in the household. Unlike the investments that parents made in sons, observers claimed daughters were seen solely as a source of income. Some parents, it seems, were disinterested in the particulars of a daughter's work life:

> The family sense of responsibility for the girl who goes to work is universally admitted to be greatly underdeveloped …The vital question is that of putting the girl at work; her safety is merely incidental. "I do not know where she works, but I know what she gets a week," fairly represents the attitude of the average parent. (Woods and Kennedy 1913, pp. 59–60)

This lack of concern could spill over to other areas as well. Young women could be made to do a large portion of the household chores in addition to working, and parents were often likely to deny young women free time for recreation or large amounts of spending money.[4] This created conflict in the household, and Goldin (1980) claims that this conflict drove some young women to leave home and live in boarding houses, which were controversial as young women living alone could be exposed to "moral corruption."

Young women also faced dangerous work environments. Metzker (1971) details several accounts of young women in precarious situations with morally questionable or abusive supervisors, consistent with Woods and Kennedy's (1913) claim that many young women routinely worked near "red light" districts and were sometimes solicited for prostitution. Even without these (literal) moral hazards, the working conditions of young women were nearly as demanding as those of young men.[5]

The treatment of young women in the household interacted strongly with social norms. Since there was a strong taboo against young women living on their own and against married women working, the only range of escape from the household would be through marriage. Furthermore, once the daughter married, she was no longer a "member" of the household, as she would now belong to the husband's family. This echoes Glenn's (1990) observations about parents placing the interest of the household before the daughter. This view is supported by contemporary scholarship that views this changing landscape as one that put new demands on mothers who had to navigate the transition and enforce codes of conduct on the family:

> While middle class women lost control over their family economy, immigrant women and working class women created the machinery of the family economy… The divorce between

[4] See Salmon (1906, 1911) for more on domestic service at this time. The subject of retained earnings will be discussed later.

[5] One woman described her working conditions as a weaver in the following way: "When I came in 1900, we worked from six in the morning till six at night. I worked solid…Even on the weekends I worked… It wasn't long till I did see where I was wrong. It was drudgery there; of course, it paid well, but it's regular drudgery" (Hareven and Langenbach 1978, pp. 44–48).

> production and consumption and the reliance upon wages as the sole means to survival made money and its control a dominate imperative. (Ewen 1979, pp. 119–122)

This review of the narrative literature establishes a number of facts that clarify the questions asked of the empirical analysis. The record indicates that parents exploited their children to a certain extent—taking advantage of their income to secure goods for the household and potentially more for themselves as well. Children of different genders had different economic values in the labor market (favoring boys) and different degrees of attachment to the home (favoring girls). Parents took advantage of existing taboos regarding gender and independent living. Parents also appeared to treat daughters differently than sons in a number of ways. This narrative review leads to the question: Is the empirical evidence consistent with the notion of differential treatment by gender?

11.3 Conceptualizing Intrahousehold Allocation

11.3.1 Theory

There are now several different models of household decision-making. The oldest class of models treat the household as a single individual who maximized utility subject to a budget constraint of total household resources (Becker 1991). Recent models treat the household as a collection of individuals who make group decisions and where the decision process takes into account the fact that household members may have different opportunity costs of household membership. This bargaining structure has different theoretical and empirical predictions about household behavior, and there is now a large literature that looks at the distinctions between these two classes of models (Thomas 1990, Udry 1996, Mazzocco 2007).

Recently, theorists have derived a methodology that is consistent with a large number of these models and that allows empirical test of their predictions (Browning, et al. 1994). The main contribution of this new development is that it allows us to sidestep, at first, the issue of how the allocation decision is made as long as we assume that the outcome of that decision-making process is efficient.[6] What this means is that, whatever each member of the household receives as a result of the allocation process, each member's individual utility function is maximized subject to their effective budget constraint. In other words, the maximization of an individual household member's utility function takes place *after* the household has decided how much to allocate to public goods and how much to allocate to each household member for their own private consumption. That is, each household member i maximizes a utility function

[6] The discussion that follows borrows from Deaton (1997).

$$\max v^i\left(q,\bar{\omega}\right) s.t. p^i q = \theta^i\left(p,p_{\bar{\omega}},y\right) \tag{11.1}$$

where q is the good, $\bar{\omega}$ is the optimal choice of public goods (goods that are shared by household members), p is the prices of all goods, $p_{\bar{\omega}}$ is the price of all goods, p^i is the price of goods consumed by household member i, y is total household resources, and $\theta^i\left(p,p_{\bar{\omega}},y\right)$ is the sharing rule, the function that determines how much person i will get for their own private consumption conditional on prices and total household resources. Maximization of the utility function will lead to a set of demand functions for each household member

$$q^i = g^i\left[\theta^i\left(p,p_{\varpi},y\right),p^i,\varpi\right] \tag{11.2}$$

That depends on the sharing rule, prices of the private goods, and the public goods allocation decided earlier. For ease of exposition, suppose that a household contained two members, i and j. The efficiency assumption allows us to write the household's budget constraint as

$$y = p_{\varpi}\varpi + \theta^i\left(p,p_{\varpi},y\right) + \theta^j\left(p,p_{\varpi},y\right) \tag{11.3}$$

because $p^iq^i = \theta^i(p, p_\sigma, y)$. This is entirely intuitive; total household resources are devoted to either public goods, $\bar{\omega}$, or to the private consumption of each household member, q. We have limited information about who actually receives what in the household, and many items in the household are shared among household members. If there are goods that are only consumed privately (exclusively by one or only some members of the household), we could say that the demand for that good would be the sum of the *individual* demands as there would be no public component to it (a crude but vivid example would be undergarments). For such goods, the demand function would be

$$q_k = g_k^i\left[\theta^i\left(p,p_{\varpi},y\right),p^i,\varpi\right] + g_k^j\left[\left(y-\theta^i\left(p,p_{\mathrm{w}},y\right)-p_{\mathrm{w}}\varpi\right),p^j,\varpi\right] \tag{11.4}$$

If each household member (or, more generally, more than one household member) earned income, this could change the amount of resources available to each member under the sharing rule depending on how the household behaved. Different kinds of household behavior yield different kinds of sharing rules, and this is where the allocation process that was sidestepped earlier comes into play. If households pooled their income, individual earnings would not matter for individual demands, only total household income as given above, but if earnings reflected the opportunity costs of household membership or if household members bargained with one another over resources, then individual consumption (and the sharing rule) would depend on individual earnings. The earnings of each member of the household would affect the sharing rule because individual earnings act as an (outside) option of leaving the household if their demands are not met.

Leaving aside the prices and public goods to increase the exposition, this would give a demand function with

$$q_k = g_k^i\left[\theta^i\left(p,p_\pi,y,y^i,y^j\right)\right]+g_k^j\left[y-\theta^i\left(p,p_\varpi,y,y^i,y^j\right)\right] \tag{11.5}$$

(where $y = y^i + y^j$).[7] If we differentiate the function with respect to the individual earnings of each household member and derive one derivate by the other, we obtain

$$\frac{\partial q_k / \partial y^i}{\partial q_k / \partial y^j} = \frac{\partial \theta^i / \partial y^i}{\partial \theta^i / \partial y^j} \tag{11.6}$$

This expression tells us that the earnings of each member of the household (relative to the other member) make a difference with respect to demand in the same way that they matter for the sharing rule itself. Changes in individual earnings affect demand for private goods through the sharing rule, which in turn changes the budget constraint that each household member faces for their private consumption. Note that if the household pooled income, the left-hand side of (11.6) would equal 1 for all goods because the source of income would not matter for demand, and this is the basis for the tests of "pooled" income in the household.[8] Furthermore, we can test for efficiency by estimating the left-hand side of (11.6) and testing to see if these effects of income are equal to one another for the private goods.[9]

How can we incorporate children into this framework? The presence of children does yield some complications, particularly to the assumption of efficiency. McElroy (1985, 1990) notes that children may simultaneously determine household membership and labor force status. The future (expected) opportunity costs of family membership matter to the extent that opportunity costs increase the threat point (the maximum utility of not belonging to the household). The greater the opportunity costs, the more likely these household members can see their needs better reflected in the household's demand. This is analogous to asserting that these differences in the opportunity costs of membership in the household translate into different allocations within the household, so we would expect the characteristics of children to have some influence on the sharing rule. Becker (1991) has argued that household outcomes may be inefficient due to the inability of children to enter into contracts (bargain) with their parents and that children of different genders may receive different levels of investment from their parents because of the sexual division of labor.

[7] With prices and public goods, the demand function would be

$$q_k = g_k^i\left[\theta^i\left(p,p_\varpi,y,y^i,y^j\right),p^i,\varpi\right]+g_k^j\left[\left(y-\theta^i\left(p,p_\pi,y,y^i,y^j\right)-p_\pi\varpi\right),p^j,\varpi\right].$$

[8] See Thomas (1990) and Udry (1996) for classic examples.

[9] Equation 11.6 is a direct result of the efficiency assumption. See Browning et al. (1994) for the proof of the existence of the sharing rule. Some researchers have used public goods when performing the test, but Blundell et al. (2005) note that such tests fail to take account of the fact that the model only yields predictions for the allocations to private goods, whose allocation is decided conditional on the public goods allocation.

The theory on household decision-making usually argues that efficiency can be guaranteed because family members are involved in long-term relationships with one another, but Mazzocco (2007) has shown that long and enduring relationships are not sufficient to guarantee commitment to future allocations, even without the complications of adding children to the model.

Rather than having two members in the household, we can think of there being two groups in the household—parents and children. In the case of parents and children, the assumption about assignability of some goods in the household reduces to goods that are consumed by parents only. In the terminology of the theory, these goods would not only be assignable to adults, but they would also be exclusive—only consumed by adults.[10] Rather than subutility being separable for private goods as it was above, the model now requires utility to be separable for *adult* goods. Since all other (non-adult) goods are public, this is analogous to the assumption in the two-adult case. This aids in being able to identify the sharing rule itself because now the sharing rule would be the amount of expenditure on adult goods, which would be a function of household income, prices, and characteristics of parents and children. Put another way, we now assume that parents consume both the public goods and the adult goods.

The number (n) and characteristics (z) of children (C) will influence adult (A) consumption through the share of income devoted to children, which will be a function of the characteristics of children and adults. We can therefore modify the demand function in (11.5) to be

$$q_k = g_k\left[\theta^A\left(y,p,z^C,z^A\right),z^C,z^A,p,p_w\right] \tag{11.7}$$

where now the characteristics of children have the same effect as income from the other partner in the two-adult case. The sharing rule result now applies to the characteristics of children such that the result given in Eq. (11.6) is now

$$\frac{\partial q_k / \partial z^C}{\partial q_k / \partial y} = \frac{\partial \theta^A / \partial z^C}{\partial \theta^A / \partial y} \tag{11.8}$$

where once again the result is the same for all adult goods k. The test for efficiency is the same as in the two-adult case—namely, that the left-hand side of Eq. (11.8) is the same for all adult goods, which are the private goods in this setup.

We can further test, for two different demographic characteristics, C and C', whether

$$\partial q_k / \partial z^C = \partial q_k / \partial z^{C'} \tag{11.9}$$

[10] In practice, it is usually easier to argue that some goods are consumed only by parents than only by one adult in the household. Since the grouping here is between parents and children, I leave aside the issue of which of the parents consumes which adult items more than the other.

that is, whether children with different characteristics have different effects on demand for adult goods. If allocations were biased, there would be larger changes in demand for a child of type C than a child of type C'. This would reflect the (possibly) greater threat point for boys than girls and the fact that boys could secure greater resources based on their greater threat point. This is intuitive—if one child had different opportunity costs of household membership, this would affect the household's allocation decision in a distinguishable way. The theory, then, gives us two tests, one for the efficiency of household allocation and another for the same allocations across different child characteristics.

11.3.2 Empirical Strategy

To capture gender differentials, I use a variant of the Almost Ideal Demand System, which attributes changes in demand to the distribution of members in the household by age and gender. For each adult good in the data, w, I estimate

$$w_i = \alpha_i + \beta_i \ln\left(\frac{x}{n}\right) + \eta_i \ln(n) + \sum_{k=1}^{K-1} \gamma_{ik}\left(\frac{n_k}{n}\right) + \varepsilon_i \tag{11.10}$$

where w is the share of the total budget (expenditure) devoted to a particular good, n is the size of the family, x is total expenditure, and k is 5-year age sex categories (e.g., males 5–9, females 15–19, etc.).[11] I estimate the model above using ordinary least squares (OLS). If w is an "adult good" (e.g., a good consumed only by the mother and/or father), the size and sign of the γ coefficients gives the substitution away from (if negative) or toward (if positive) the consumption of that adult good if a given share of the household lies in that age-sex category.

If the γ coefficients are significantly different across genders for the same adult good and age grouping, then the adults can be said to sacrifice more of their consumption for one gender than for another. The basis of the type of gender differential is not child consumption, but parental *willingness to forgo consumption*. It can be thought of as a "top-down" measure of gender allocation, which follows directly from the theoretical discussion above since it relates to private (adult) goods. As such, it does have limitations—since this is a test based upon parental consumption, it will not capture different access by gender to services such as education and healthcare, for example. Even with these limitations, the allocation rules captured here are useful for thinking about and analyzing the allocation of goods within the

[11] As Deaton (1997) notes, the "transformation of expenditures to budget shares and of total outlay to its logarithm induces an approximate normality in the joint density of the transformed variables, so that the regression function is approximately normal" (p. 231). This joint normality justifies the use of OLS. Horrell and Oxley (1999) use a similar econometric strategy to test for gender discrimination among the British households in the 1888CEX. Since one potential control variable would be skill level, the results are disaggregated for metalworks and textile families.

household, particularly in light of the narrative evidence and the model described above.[12]

11.3.3 Data

The primary data analyzed in this paper comes from the "Cost of Living of Industrial Workers in the United States and Europe 1888-1890" (1888CEX) survey published by the US Department of Labor (2006).[13] The 1888CEX contains a sample of 6809 American families working in iron, steel, coal, textile, and glass industries in the USA. Homes from 24 states in the Northeast, Midwest, Mid-Atlantic, and South were surveyed. For the households surveyed, enumerators from the Department of Labor were sent to firms in the nine selected industries and collected information on the costs of production and the standard of living of the workers in the firms surveyed for costs of production. As Haines (1979) notes, how the household sample was chosen remains unclear, but the sample is broadly representative of industrial households in the USA at the time in the selected industries.

The data set contains detailed annual expenditure information for both food and nonfood items and annual income information for all members of the household (father, mother, and children). In addition, the data also contains demographic information on the household's age and sex composition, as well as a detailed enumeration of the husband's occupation. The occupations of children and wives are not included in this study, although their labor force status is recorded in the data.

There are several limitations to the data that may influence the empirical results. First, remittances from children not living at home are not recorded, although they could be listed under the "other income" category.[14] Second, the labor force and/or school enrollment for each child, individually, is not given. As such, we are unable to assign child income to particular children in the household, although we can

[12] Another important use of this approach is that it fits quite well with the historical era under consideration. In contemporary populations, it is unwise to think of household composition as exogenous. As Behrman (1997) has correctly noted, these types of regressions may fail to reject the hypothesis of gender equality even when there is substantial evidence that women are mistreated in the home. If parents are taking part in activity which eliminates young women from the household (e.g., sex-selective abortion, infanticide, etc.), the failure to find gender differentials in household allocation is not on a firm footing. Historically, there is no evidence of excess infant female mortality in the late nineteenth century—while household size was determined by the family, composition was not similarly constructed through sex-selective practice. Lifetables from the time suggest that the probabilities of dying in the first year of life were equal, and if anything were higher for boys than girls. For more see the Human Mortality Database (http://www.mortality.org)

[13] For more on the historical forces shaping the 1888CEX, see US Department of Labor *How American Buying Habits Change* (1959).

[14] The "other income" category provides very little income, on average less than 2.5% of household income.

assign income to children as a group and derive earnings profiles through a parametric method.

More importantly, these families come from a number of different industries that may have different patterns of household allocation. In many instances, children in textile families earned nearly as much as the household head, and the differences in earnings by gender were relatively small. In contrast, daughters whose fathers worked in iron or steel often had to secure employment in low-paying service jobs like domestic service. Although the focus in this paper is the general pattern of household allocation among these industrial households, I also present results for the families employed in metalworks (iron and steel) and textiles (wool and cotton) separately as a test of the robustness of the general pattern for households with highly unequal (metalworks) and equal (textiles) earnings for young workers. Since families in metalworks tended to concentrate in the Northeast and Midwest, while textile families were located in the Northeast and South, separation by industry also acts as a quasi-geographic control.[15] Table 11.1 lists the means and standard errors of the variables used in this analysis. As the table shows, the household shares were similar between textile and metalworks families overall. Expenditure shares on adult goods were largely similar as well, but families in metalworks had greater expenditure for alcohol and religious donations.

11.4 Intrahousehold Allocation in the Late Nineteenth Century

11.4.1 Gender and Intrahousehold Allocation

In the 1888CEX I identified six expenditure items that can be thought of as adult goods. Tobacco, alcohol, husband's clothing, wife's clothing, charity, and religious expenditures were most likely made by and for adults. I further aggregate these goods to create a seventh adult good to test for differential gender allocation. Of the six adult goods, tobacco, alcohol, husband's clothing, and wife's clothing expenditures were surely not made for children, particularly young children, and as such these four items were the most likely adult goods, and I aggregate these four "most likely" adult goods into an eighth adult good.[16] To test for differences in gender allocation, I test the null hypothesis that the age category coefficients are equal to one another across gender. The regression results are listed in Table 11.2.

[15] See Smith (1994) for more on the geographic differences by occupation.

[16] I also used savings, savings as a share of total income and expenditure, the share of protein in the diet, and the share of protein from animal sources as potential adult goods. As the results for these goods were the same as the most likely adult goods from the data, these results are not reported.

Table 11.1 Means and standard errors of variables, American sample of 1988 Cost of Living Survey

	Whole sample		Metalworks		Textiles	
Variable[a]	Mean	Std. error.	Mean	Std. error	Mean	Std. error
Log Per Cap. Exp.	9.491	0.461	9.517	0.454	9.453	0.419
Log Family Size	1.464	0.454	1.421	0.452	1.491	0.458
Tobacco	0.016	0.014	0.018	0.015	0.014	0.014
Liquor	0.019	0.121	0.025	0.244	0.008	0.020
Husb Cloth	0.054	0.031	0.064	0.031	0.041	0.024
Wife Cloth	0.040	0.026	0.044	0.028	0.033	0.024
Religion	0.013	0.264	0.024	0.550	0.012	0.014
Charity	0.004	0.007	0.005	0.005	0.002	0.005
Male 0–4	0.073	0.125	0.080	0.134	0.068	0.123
Male 5–9	0.065	0.107	0.065	0.107	0.059	0.102
Male 10–14	0.056	0.100	0.053	0.099	0.057	0.100
Male 15–19	0.037	0.087	0.027	0.077	0.045	0.095
Male 20–24	0.025	0.088	0.026	0.094	0.025	0.085
Male 25+	0.234	0.132	0.248	0.133	0.220	0.132
Female 0–4	0.073	0.125	0.077	0.128	0.065	0.120
Female 5–9	0.063	0.107	0.062	0.107	0.060	0.104
Female 10–14	0.051	0.096	0.047	0.093	0.056	0.099
Female 15–19	0.050	0.107	0.048	0.108	0.059	0.112
Female 20–24	0.057	0.126	0.057	0.130	0.058	0.124
Female 25+	0.211	0.147	0.208	0.147	0.218	0.152
N	6809		1568		3043	

Notes: [a]Unless otherwise noted, non-logged variables are the share of either total household expenditures (for consumption goods) or total number of persons in the household (for age-sex categories). Author's calculations using 1888CEX

Parents appeared to substitute away from the consumption of adult goods in the presence of young children, as can be seen by the negative regression coefficients. Similarly, it appears that the substitution lessened with age, although this certainly does not hold in a strict sense. We should expect such a result—as children aged, parents were less likely to decrease their consumption of adult goods, possibly because the earnings of children in the labor market could be devoted to securing more adult goods or because as children aged they provide services to the household which have an income effect, or a substitution effect away from public good consumption. When looking at the aggregate of the four most likely adult goods, it does appear that there was statistically significant variation with the age and sex composition of the household with respect to adult consumption.

The primary focus, however, is the comparison between genders in the same age category. Table 11.3 lists the Wald test statistics for the hypothesis of gender equality by age group for each of the regressions presented in Table 11.2 as well as the Wald test statistics for the test by industry for the metalworks and textile

Table 11.2 Gender allocation regression results for the American sample, 1988 Cost of Living Survey

	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	All Adult	4 Adult
Intercept	0.117	−0.250	0.193	0.044	−0.049	−0.031	0.023	0.103
	(0.00602)	(0.04670)	(0.01165)	(0.00997)	(0.01609)	(0.00415)	(0.05444)	(0.05161)
ln (x/n)	−0.009	0.027	−0.006	0.004	0.004	0.004	0.026	0.018
	(0.00056)	(0.00411)	(0.00107)	(0.00094)	(0.00091)	(0.00039)	(0.00471)	(0.00459)
ln (n)	−0.010	0.017	−0.029	−0.027	−0.003	0.001	−0.052	−0.050
	(0.00076)	(0.01358)	(0.00161)	(0.00134)	(0.01034)	(0.00032)	(0.01729)	(0.01385)
Male 0–4	−0.009	−0.010	−0.024	0.006	0.003	0.001	−0.032	−0.037
	(0.00235)	(0.02184)	(0.00527)	(0.00412)	(0.01364)	(0.00108)	(0.02751)	(0.02368)
Male 5–9	−0.006	0.008	−0.031	0.010	0.032	0.000	0.013	−0.018
	(0.00247)	(0.00984)	(0.00563)	(0.00432)	(0.04452)	(0.00116)	(0.04686)	(0.01389)
Male 10–14	−0.006	−0.029	−0.042	−0.002	0.032	−0.001	−0.049	−0.079
	(0.00262)	(0.03338)	(0.00559)	(0.00448)	(0.04047)	(0.00106)	(0.05344)	(0.03469)
Male 15–19	−0.002	−0.043	−0.059	−0.020	0.016	0.000	−0.109	−0.124
	(0.00298)	(0.03019)	(0.00612)	(0.00468)	(0.02197)	(0.00117)	(0.03890)	(0.03192)
Male 20–24	0.001	0.014	−0.009	0.002	0.184	−0.003	0.189	0.007
	(0.00227)	(0.01942)	(0.00562)	(0.00477)	(0.18584)	(0.00094)	(0.18762)	(0.02168)
Female 0–4	−0.009	0.004	−0.025	0.006	0.000	0.001	−0.023	−0.024
	(0.00236)	(0.01032)	(0.00532)	(0.00409)	(0.01124)	(0.00111)	(0.01812)	(0.01378)
Female 5–9	−0.005	−0.009	−0.026	0.015	0.032	0.000	0.007	−0.024
	(0.00249)	(0.02574)	(0.00560)	(0.00434)	(0.13812)	(0.00097)	(0.05179)	(0.02754)
Female 10–14	−0.005	−0.035	−0.042	0.002	0.028	0.000	−0.054	−0.081
	(0.00259)	(0.03433)	(0.00568)	(0.00448)	(0.03706)	(0.00120)	(0.05156)	(0.03564)
Female 15–19	−0.006	−0.006	−0.064	−0.016	−0.002	−0.002	−0.096	−0.092
	(0.00251)	(0.01155)	(0.00556)	(0.00433)	(0.00572)	(0.00104)	(0.01622)	(0.01507)
Female 20–24	−0.010	−0.039	−0.073	−0.015	0.086	−0.003	−0.055	−0.137
	(0.00282)	(0.01853)	(0.00598)	(0.00489)	(0.08456)	(0.00110)	(0.08752)	(0.02138)
Female 25+	−0.010	−0.035	−0.100	−0.029	0.038	−0.002	−0.139	−0.175
	(0.00282)	(0.00981)	(0.00612)	(0.00512)	(0.03031)	(0.00105)	(0.03394)	(0.01471)
R Square	0.071	0.008	0.203	0.203	0.005	0.038	0.018	0.050

Notes: N = 6809 for all regressions. Robust standard errors listed in parentheses. The column in a regression in which the dependent variable is the share of the budget devoted to teach good in the column heading

households.[17] The most striking feature of Table 11.3 is that the hypothesis of gender equality is only rejected for children above the age of 20. When looking at Wald

[17] The Wald test statistics for metalworks and textile families are based on regressions on the form listed in Table 11.3. Since I use a robust variance-covariance matrix, the F-test for a set of linear restrictions for the regression is not appropriate. Fortunately, the Wald test (which must be used when employing the Eicker-White variance-covariance matrix) reduces to a standard F-test for my hypotheses. Under the null of gender equality, the Wald statistic has a chi-squared distribution with degrees of freedom equal to the number of linear restrictions imposed by the null hypothesis. Since I test each age category separately, each test has one degree of freedom.

Table 11.3 Wald statistics for the hypothesis of gender equality in household allocation, 1888 Cost of Living Survey

Age group	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	4 Adult
American sample (N = 6809)							
0–4	0.035	0.305	0.027	0.004	0.029	0.008	0.204
5–9	0.053	0.388	0.409	0.738	0.000	0.002	0.038
10–14	0.069	0.020	0.000	0.397	0.005	0.104	0.002
15–19	1.455	1.317	0.246	0.424	0.608	1.647	0.845
20–24	8.365	3.927	60.215	5.941	0.234	0.184	22.366
Metalworks (N = 1568)							
0–4	0.0216	0.0879	0.0312	0.2309	0.0026	0.0382	0.0529
5–9	0.0001	0.2470	0.4695	0.5579	0.0010	0.0901	0.1112
10–14	0.2605	0.0055	0.2153	0.0322	0.0000	0.1775	0.0181
15–19	0.2716	1.2283	0.1647	0.2301	0.0350	0.0044	1.1235
20–24	0.4243	1.6485	3.8407	2.3557	0.6090	0.1893	2.7952
Textiles (N = 3043)							
0–4	0.045	0.812	0.665	0.001	0.987	0.403	0.000
5–9	0.040	0.438	0.033	0.119	0.009	0.002	0.412
10–14	0.029	0.488	0.270	0.080	0.464	0.048	0.000
15–19	1.013	3.921	0.921	0.184	0.003	0.029	3.810
20–24	4.659	0.919	52.033	1.210	0.879	0.006	27.374

Notes: The Wald test statistics are based on regression results presented in Table 11.2 (not reported for metalworks and textiles). The results test the hypothesis that the male and female coefficients in a given group are equal to one another for the specified adult good listed above. The critical value for the Wald test ($\alpha = 0.01$) is 6.64

test statistics for metalworks and textile families, the pattern is the same. The hypothesis of gender equality is never rejected for metalworks families, and for textile families only above the age of 20.

There are two problems with the results of Table 11.3. The first is that few of the demographic coefficients themselves are statistically significant, so the finding of gender equity could be a problem of a poorly specified regression. The second problem is that these results are not specified in a manner consistent with the theory outlined earlier. Demand for the adult goods should depend on the sharing rule, which is a function of household income and the characteristics of parents and children. In order to match the theory as closely as possible, I estimated the sharing rule and then test for gender equity. First, I estimated the sharing rule as

$$\theta_i = \alpha_i + \beta_i \ln\left(\frac{x}{n}\right) + \eta_i \ln(n) + \sum_{k=1}^{K-1} \gamma_{ik} \left(\frac{n_k}{n}\right) + \varepsilon_i \tag{11.11}$$

where θ is the total expenditure on all six adult goods, and as noted earlier is a function of household income, and the characteristics of parents and children. I then estimated the demand for each adult good as a function of the sharing rule and household income and demographics

$$w_i = \alpha_i + \lambda\hat{\theta}_i + \beta_i \ln\left(\frac{x}{n}\right) + \eta_i \ln(n) + \sum_{k=1}^{K-1}\gamma_{ik}\left(\frac{n_k}{n}\right) + \varepsilon_i \tag{11.12}$$

This is appropriate since the model assumes that the sharing rule is decided before the expenditure on individual adult goods. From this specification we can test for gender equity as before, where now we have accounted for the sharing rule itself.[18] Table 11.4 shows the results. Unlike the results of Table 11.2, the regressions in Table 11.4 show that the demographic characteristics have a statistically significant effect on the demand for the adult goods—and the sharing rule itself does have an effect on the demand for the adult goods. Even with this improved fit, the results for gender equity remain the same, and these are presented in Table 11.5. Also in Table 11.5 are the gender equity results when the sharing rule was estimated with child income and only for households where children earned income.[19] In no specification of the demand equation do I reject the hypothesis of gender equality in household allocations.

11.4.2 The Efficiency of Intrahousehold Allocation

Tests for efficiency in household allocation hinge on the hypothesis that changes in demand for adult goods due to household composition are the same as changes in the sharing rule due to changes in household composition, $\frac{\partial q_k / \partial z^C}{\partial q_k / \partial y} = \frac{\partial \theta / \partial z^C}{\partial \theta / \partial y}$ where z is the demographic category.[20] To test for efficiency I bootstrapped the sharing rule regression to obtain an estimate of the standard error for $\frac{\partial \theta / \partial z^c}{\partial \theta / \partial y}$ for each demographic category C that can then be compared to the estimate of $\frac{\partial q_j / \partial z^c}{\partial q_j / \partial y}$

[18] One would like to include nonlinear forms of the sharing rule such as those exploited by Browning et al. (1994). The issue for the paper is that there are several demographic categories, and one assumes that they have a linear effect on demand. While one would like to use nonlinear forms, I cannot because symmetry of the Slutsky matrix and the additive structure of the specification require a linear model (see Blundell et al. 2003 for a proof).

Chiappori and Browning, since they restrict their sample to two-adult households, do not have the number of demographic categories I use here, and this allows them to try several alternative specifications without regard to this consideration. I am not able to use nonlinear specifications of the sharing rule without the results being suspect and inconsistent with the theoretical model that they are supposed to correspond to.

[19] For child income the sharing rule is $\theta_i = \alpha_i + \phi \ln\left(y_{\text{child}}\right)_i + \beta_i \ln\left(\frac{x}{n}\right) + \eta_i \ln(n) + \sum_{k=1}^{K-1}\gamma_{ik}\left(\frac{n_k}{n}\right) + \varepsilon_i$. Also, Wald test results for households where no children worked (N = 4826) are qualitatively similar to those where only children worked. See Appendix B.

[20] Since prices are fixed in the cross section, we can ignore them here.

Table 11.4 Gender allocation regressions with the sharing rule results for the American sample, 1888 Cost of Living Survey

	Sharing rule	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	4 Adult
Intercept	0.023	0.113	−0.247	0.178	0.034	−0.048	−0.030	0.079
	(0.115)	(0.005)	(0.046)	(0.011)	(0.009)	(0.101)	(0.003)	(0.050)
Sharing rule		0.145	−0.103	0.624	0.404	−0.069	−0.001	1.070
		(0.011)	(0.097)	(0.022)	(0.019)	(0.212)	(0.006)	(0.105)
ln (x/n)	0.026	−0.012	0.028	−0.022	−0.005	0.007	0.004	−0.011
	(0.026)	(0.001)	(0.006)	(0.001)	(0.001)	(0.012)	(0.000)	(0.006)
ln (n)	−0.052							
	(0.016)							
Male 0–4	−0.032	−0.012	0.027	0.007	−0.002	−0.021	0.003	0.018
	(0.050)	(0.002)	(0.027)	(0.003)	(0.003)	(0.030)	(0.001)	(0.015)
Male 5–9	0.013	−0.016	0.051	−0.027	−0.019	0.009	0.002	−0.011
	(0.054)	(0.002)	(0.016)	(0.004)	(0.003)	(0.034)	(0.001)	(0.017)
Male 10–14	−0.049	−0.008	0.008	−0.001	−0.006	0.004	0.001	−0.006
	(0.056)	(0.002)	(0.017)	(0.004)	(0.003)	(0.038)	(0.001)	(0.019)
Male 15–19	−0.109	0.006	−0.011	0.020	0.000	−0.016	0.002	0.015
	(0.059)	(0.002)	(0.022)	(0.005)	(0.004)	(0.048)	(0.001)	(0.024)
Male 20–24	0.189	−0.029	0.046	−0.123	−0.082	0.190	−0.002	−0.188
	(0.045)	(0.003)	(0.028)	(0.006)	(0.005)	(0.061)	(0.002)	(0.030)
Female 0–4	−0.023	−0.013	0.041	−0.001	−0.007	−0.024	0.003	0.020
	(0.049)	(0.001)	(0.013)	(0.003)	(0.003)	(0.029)	(0.001)	(0.015)
Female 5–9	0.007	−0.014	0.033	−0.019	−0.011	0.009	0.002	−0.011
	(0.054)	(0.002)	(0.015)	(0.004)	(0.003)	(0.034)	(0.001)	(0.017)
Female 10–14	−0.054	−0.006	0.002	0.003	0.000	0.000	0.002	−0.001
	(0.058)	(0.002)	(0.018)	(0.042)	(0.004)	(0.040)	(0.001)	(0.020)
Female 15–19	−0.096	−0.001	0.025	0.008	0.000	−0.032	−0.001	0.033
	(0.053)	(0.002)	(0.017)	(0.004)	(0.003)	(0.037)	(0.001)	(0.018)
Female 20–24	−0.055	−0.010	−0.003	−0.027	−0.016	0.058	−0.001	−0.056
	(0.056)	(0.002)	(0.014)	(0.003)	(0.003)	(0.030)	(0.001)	(0.015)
R Square	0.018	0.068	0.007	0.202	0.197	0.005	0.038	0.050

Notes: N = 6809 for all regressions. Robust standard errors listed in parentheses. The column is a regression in which the dependent variable is the share of the budget devoted to each good in the column heading. The sharing rule is the share of total expenditure devoted to all six adult goods. The variable Sharing Rule is the unique predicted sharing rule for each household based upon the coefficients in the sharing rule regression and the household's income and composition

from the demand equation for each adult good.[21] Since I do not bootstrap the demand-equation estimates, the test here is conservative (e.g., if I fail to reject the

[21] Note that these demand equations include the sharing rule as a variable. Also, that identification of the sharing rule itself is actually not a requirement for the test—we could similarly test whether the demand-equation parameters were equal to one another (since they all must equal the ratio from the sharing rule, they therefore must be equal to some constant).

Table 11.5 Wald test statistics for the hypothesis of gender equality in household allocation, 1888 Cost of Living Survey

Age group	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	4 Adult
Sharing rule included in demand equations							
0–4	0.145	0.235	2.650	1.299	0.003	0.021	0.012
5–9	0.451	0.652	2.983	3.074	0.000	0.003	0.000
10–14	0.297	0.061	0.007	1.233	0.007	0.146	0.024
15–19	4.143	1.741	3.968	0.000	0.068	1.684	0.358
20–24	30.906	2.432	183.258	114.677	3.788	0.077	15.363
Sharing rule that includes child income							
0–4	0.0081	0.5107	2.2143	0.9736	0.0069	0.0007	0.0286
5–9	0.2645	0.6186	2.7822	2.8070	0.0002	0.0016	0.0009
10–14	0.1865	0.0563	0.3060	1.1680	0.0061	0.2216	0.0178
15–19	1.1813	1.5922	2.3180	0.3733	0.1359	4.0447	0.7329
20–24	7.8760	1.6859	283.6953	103.3548	3.5678	5.3800	13.7260
Households with nonzero child earnings (N = 1982)							
0–4	0.189	2.037	0.937	0.148	0.477	0.011	2.219
5–9	0.003	0.560	0.381	0.416	0.009	0.219	0.411
10–14	0.020	0.000	0.132	0.197	0.022	0.008	0.004
15–19	1.937	0.345	8.403	5.006	0.461	4.081	0.007
20–24	4.099	1.255	1.448	0.622	2.557	0.001	1.920

Notes: The Wald test statistics are based on the regressions as described in the text. For all estimates the demand system included an estimate of the sharing rule. The bottom panel is based on regressions similar to those in Table 11.4 that only included households where children earned income. The critical value for the Wald test ($\alpha = 0.01$) is 6.64

hypothesis of equality here, I would surely fail to reject it in a test where the demand-equation estimate was allowed to vary).

Table 11.6 shows the results of the efficiency tests. For all of the adult goods, the hypothesis that household allocations are efficient cannot be rejected.[22] While there is some variation in the individual t-statistics for each test, the overall conclusion from Table 11.6 is that the allocations were efficient—it would certainly be difficult to support an argument that the allocations were inefficient. Even when expanding the number of potential adult goods to include savings and savings as a share of total income and expenditure, as well as the amount of protein in the diet, the hypothesis is not rejected. The robustness of the result to an expanded definition of adult goods, and even a different version of the sharing rule, adds further strength to the claim that household allocations were efficient.

[22] In only one instance is the hypothesis of efficiency rejected at the $\alpha = 0.001$ level. There are alternatives to estimating the variance of the quotient for the demand equation. If $\partial q_j/\partial z^C = \beta$ and $\partial q_j/\partial y = \lambda$, then by the delta method the variance of β/λ is $V(\beta/\lambda) = \frac{\sigma_\beta^2}{\lambda^2} - 2\left[\frac{\beta\sigma_{\beta\lambda}}{\lambda^3}\right] + \frac{\beta^2\sigma_\lambda^2}{\lambda^4}$. Hypothesis tests with estimates of the standard errors from the demand equations based on the delta method led to failure to reject the hypothesis in all instances.

Table 11.6 Efficiency test of household allocation, 1888 Cost of Living Survey

$\frac{\partial\theta / \partial z^C}{\partial\theta / \partial y}$		$\frac{\partial q_j^A / \partial z^C}{\partial q_j^A / \partial y}$						
		Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	4 Adult
Male 0–4	−1.251	1.046	0.941	−0.296	0.488	−2.996	0.875	−1.700
	(0.969)							
Male 5–9	0.504	1.341	1.810	1.238	3.706	1.259	0.474	0.995
	(1.797)							
Male 10–14	−1.893	0.656	0.295	0.023	1.140	0.613	0.362	0.529
	(1.872)							
Male 15–19	−4.252	−0.465	−0.396	−0.915	−0.050	−2.293	0.432	−1.380
	(2.264)							
Female 0–4	−0.879	1.114	1.452	0.026	1.344	−3.337	0.919	−1.911
	(0.869)							
Female 5–9	0.284	1.205	1.184	0.848	2.206	1.264	0.454	0.992
	(1.969)							
Female 10–14	−2.098	0.529	0.074	−0.133	0.041	−0.056	0.518	0.137
	(1.839)							
Female 15–19	−3.756	0.054	0.896	−0.346	−0.059	−4.499	−0.149	−3.044
	(1.773)							

Notes: Bootstrapped estimates of standard errors (B = 500) are listed in parentheses. The estimates from the demand equations come from a regression similar to those in Table 11.2, where an estimate of the sharing rule (a theta hat unique to each household) has been added as a covariate. N = 6809 for all regressions

There are some caveats to this result, however. Firstly, we have employed a linear form here, and although there are theoretical justifications for its use, more complex demand systems may give different results. Secondly, the choice of adult goods will influence the estimation of the sharing rule that forms the basis of the test. Even with these caveats, these results tell us that there were very little, if any, gender differentials in household allocations in the late nineteenth century, especially for young children. Additionally, the allocation of resources in these households appears to have been efficient. Lastly, both of these results are robust to a number of adult goods and alternative specifications of the sharing rule.

11.5 Explaining the Finding

Given the lack of gender bias in allocations and the efficiency of household allocations, we should seek to explain such a finding. If children of different genders had different earnings potential, why do efficient allocations coincide with gender equality in allocations to children? Differences in earnings would imply different

allocations by gender if parents were allocating based in future contributions or if parents allocate more to children with higher marginal utility of consumption.

The first explanation for the efficiency of gender neutrality of allocations would be that parents desired to have gender equity in the household, and as such the substitution away from adult consumption is the same for both genders.[23] This explanation, however, is inconsistent with the theoretical model and the econometric test, and therefore parental egalitarianism cannot explain this finding. The method employed here looks at parental substitution away from adult consumption—not allocations to children directly. Since the test is indirect, parents could make themselves better off by increasing the consumption of adult goods when children who earn more are present or, similarly, consuming more when children with low marginal utilities of consumption were present.

To see the inconsistency of the parental egalitarianism explanation, consider the following example. Suppose that parents were egalitarian, but also that they valued their own consumption. Further assume that parents were forward looking and desire to smooth consumption over the lifecycle. If parents knew that children of one gender had greater earnings potential than another, parents could increase their own consumption while still ensuring gender equity in actual allocations to children, and if they were smoothing consumption over the lifecycle, this is what we would expect. But this would imply that parents could be made better off (through additional consumption) while leaving the utility of children unchanged, and this does not agree with the efficiency finding. While the finding of gender equality seems to be consistent with parental egalitarianism, the efficiency finding contradicts this explanation as increased parental consumption would be Pareto improving.

Since parental egalitarianism cannot explain this result, we must return to the theory outlined earlier to see what these results implied for parents and their decision-making process. If this result cannot be explained by egalitarianism, then it must be explained by another feature. If parents are forward looking and there was no differential allocation by gender, it must hold that parents viewed the stream of future benefits coming from sons and daughters as equal—the same would be true of the marginal utilities of consumption for both sons and daughters. If not, they could substitute more (less) away from their own consumption for the child who would earn less (more) in the future.[24]

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[23] We must be mindful, however, to distinguish between altruism and egalitarianism in this context. In models of parental altruism, altruistic parents seek to ensure that children are equally well off, and this is achieved by allocating more resources to the child with the greater marginal utility of consumption. This supposes, then, that parents would allocate resources differentially to children by type insofar as that type signifies differing marginal utilities of consumption. The empirical test, however, does not look at allocations to children directly, only substitution away from adult consumption. While it could certainly be the case that substitution differentials would be highly correlated with allocation differentials, it need not be the case per se.

[24] It is important to note that discounting would matter, but the main point hinges on differences between young men and women. As it is unlikely that parents had different discount factor for the earnings of children of different genders, these are suppressed here.

Is the evidence consistent with this explanation? Below, I detail the ways in which this "strategic" explanation is consistent with both the quantitative evidence and the narrative record. First, I concentrate on the income from children and use wage profiles to calculate a "back of the envelope" relative probability of sons leaving home as opposed to their sisters. Second, we return to the narrative record to see what evidence exists about household chores and responsibilities for boys versus girls and how this nonwage activity could lead to equal streams of benefits from both genders.

11.5.1 Future Cooperation in the Household

If parents view equalized future income from children in a probabilistic setting, we can use wage profiles to uncover the underlying probabilities of leaving home, which we can take as relative probabilities of noncooperation. There are two things that parents must consider: (1) the possibility that a child of type k will leave in the home, r_k, and (2) the earnings of the child of type k, w_k. So parents must take into account $r_k\, w_k$ where $r_{boy} > r_{girl}$ and $w_{boy} > w_{girl}$. In fact, Moehling (2005), Woods and Kennedy (1913), Ewen (1979), and others tell us that parents would negotiate with children to keep them in the home once they began to work, so parents did not view the income of working children as an extra boon to the household coffers with absolute certainty. Parents negotiating with their children can be taken as evidence that parents were unsure about the future earnings stream coming from children. Similarly, social taboos against married women working and young women living alone outside of their parents' household insured that $r_{boy} > r_{girl}$. Combining these two facts with the absence of any gender differentials, it must hold that parents assumed that $r_{boy}\, w_{boy} = r_{girl}\, w_{girl}$. If not, parents could increase their current consumption more dependent on the gender of the child, and this would mean a differential in substitution away from (or toward) adult goods dependent on gender, which has been rejected.

Since the probability-weighted earnings are equal, we can use this conclusion to derive an estimate of $r_{boy}/r_{girl,}$ which would tell us the relative probability that a daughter would stay in the home (cooperate) relative to a son. We can estimate this over a number of ages since we have estimates of the wages of children by gender, but to be the most concrete, we should estimate it for younger ages when children are more likely to stay in the home and a time horizon that is short enough to represent the time horizon that parents can be said to be reasonable about.

If one had information on individual child earnings (and the age and sex of the child), a simple age profile based on each child's age and earnings could be constructed from an equation such as

$$y_i = \sum_{n=0}^{4}\left[\alpha_n age_i^n\right] + \varepsilon_i \tag{11.13}$$

where income would be a polynomial function of age. One could add a term that would designate the gender of the child in the household to capture potential gender differentials as well. Since the income from children is pooled and it is impossible to assign income from the data itself, I aggregate the right-hand side of Eq. (11.13) since child income is aggregated in the data. Further, I adopt a method that allows us to estimate earnings profiles for each gender in one procedure. I gauge the income of young men and women in the following specification:

$$\text{ChildIncome}_i = \sum_s \left[\sum_{n=0}^{4} \alpha_{n_s} age_{s_i}^n \right] + \varepsilon_i \tag{11.13}$$

where child income is regressed on a polynomial aggregated for the ages of all children in the household above the age of 12, with separate coefficients for each sex.[25] The estimated α's are then used to generate an income profile for young men and young women.

Table 11.7 lists the earnings of boys and girls at selected ages. From the table two facts are clear. Firstly, the earnings of young boys and young girls were similar, but the earnings of young men grew faster with age than the earnings of young women. For example, 15-year-old young women earned 80% of what 15-year-old young men earned, but by the age of 20, young women earned only 70% of what young men earned. In a broad sense, this result agrees with Goldin's (1980) observation that the earnings of young women peaked faster than the earnings of men. Secondly, the earnings of young men in the household were substantially lower than the earnings of men of the same age who are heads of their household. This implies that the earnings of men were also a function of the head of household status at the time.

By industry, the results show marked differences. As expected, families in textiles had very similar earnings, but in metalworks the earnings gap by gender was quite large, with boys earning several times what girls earned. This is entirely consistent with the notion that young women in iron and steel households could only secure employment in very low-paying jobs. Also note, however, that the earnings at very young ages were low for both boys and girls in metalworks but that by age 20 young men earned significantly more than the average 20-year-old man living at home, but less than the average 20-year-old man who was the head of his household.

We can turn to other sources to confirm a portion of these wage results. I used data from the "Report on Women and Child Wage Earners" report collected by Goldin (1980). The data comes from the *Report on Condition of Woman and Child Wage-Earners in the U.S. in 19 Volumes*, Vols. 86–104 (1910, 1911). Goldin's sample of women and child wage earners contains information on the individual wages,

[25] Note that both males and females have different intercepts and coefficients on the age terms, so that the two profiles are allowed to be as independent as possible in this specification. Specifications with age minimums of 9, 10, and 11 were also specified, and the income profiles were robust to the age cutoff. There is little narrative evidence that children below the age of 10 worked outside of the household in the USA at the time, and the vast majority who entered the workforce did so around the age of 12 or shortly thereafter.

Table 11.7 Estimated annual earning of children by gender, 1888 Cost of Living Survey

Age	Whole sample (N = 6809)		Metalworks (N = 1568)		Textiles (N = 3043)	
	Male	Female	Male	Female	Male	Female
13	36.17	30.95	8.33	1.09	54.91	54.38
14	80.09	59.04	29.73	9.30	100.35	89.88
15	117.43	82.82	70.29	16.54	136.38	119.23
16	148.68	102.67	120.34	22.82	164.27	143.03
17	174.35	118.99	171.71	28.13	185.24	161.87
18	194.89	132.13	217.76	32.49	200.39	176.30
19	210.77	142.45	253.40	35.92	210.75	186.83
20	222.45	150.27	275.06	38.45	217.25	193.97
21	230.36	155.91	280.67	40.12	220.73	198.20
22	234.94	159.66	269.74	40.98	221.94	199.95
23	236.60	161.82	243.25	41.08	221.56	199.64
Estimated annual earnings of male household head, 1888 Cost of Living Survey						
Age	Whole sample		Metalworks		Textiles	
18	409.24		481.18		349.71	
19	425.62		485.60		361.98	
20	441.35		491.27		373.64	
21	456.37		498.01		384.65	
22	470.65		505.64		395.01	
23	484.16		513.99		404.68	

Notes: Author's calculation based on 1888CEX. See the text for an explanation of the income estimation procedure for children

schooling, household structure (although not by age and sex), and retained earnings for over 3000 women and children employed in the cotton textile and clothing industries in New York, Massachusetts, Illinois, and North Carolina collected in 1907.[26] As the sample pertains to women generally but to males only for children, I restricted the sample to those below the age of 17 (the age of the oldest males in the sample; this resulted in a sample size of 1485) and estimated the log wages of the children as a function of age, sex, literacy, and household structure (the number and earnings of other household members). These wage regressions show that the coefficient on sex was statistically indistinguishable from zero, which would be consistent with the wage profiles generated here from the aggregate child earnings data for textile workers.[27]

Using the wage profiles of the 1888CEX, I calculate the wage ratio (boy/girl) for ages 13–14 and 13–17. Table 11.8 lists the results. The relative probabilities suggest that boys were around 30% more likely on average, according to their parents, to

[26] For a full description of the data, see Goldin (1980).

[27] The regression coefficient on sex was −0.003 and the standard error was 0.004. This would imply a small (but statistically insignificant) penalty for females in textiles, which is consistent with the wage profiles from the 1888CEX.

Table 11.8 Relative male/female wages by age, 1888 Cost of Living Survey

Age	Whole sample (N = 6809)	Metalworks (N = 1568)	Textiles (N = 3043)
13	1.17	7.61	1.01
14	1.36	3.20	1.12
15	1.42	4.25	1.14
16	1.45	5.27	1.15
17	1.47	6.10	1.14
18	1.47	6.70	1.14
19	1.48	7.05	1.13
20	1.48	7.15	1.12
21	1.48	7.00	1.11
Average	1.42	6.04	1.12
13–14 Average	1.26	5.40	1.06
13–17 Average	1.37	5.29	1.11
Ratio of males to females by age group, 1888 Cost of Living Survey			
0–4	1.000	1.034	1.045
5–9	1.030	1.045	0.994
10–14	1.098	1.133	1.026
15–19	0.740	0.557	0.764
20–24	0.439	0.457	0.432

Notes: Estimates of relative male/female wages by age from top portion of the table are derived from the income estimates presented in Table 11.7. The ratio of males to females by age group is based on author's calculations based on 1888CEX

leave (not cooperate) as their daughters if parents viewed the probability-weighted wages as equal.[28] In metalworks the probability is more than five times greater, while in textile families it is lower, only around 10%.

It is important to note that forward-looking hedging was a very real feature of industrial households at the time. In fact, it explains the degree to which the household political economy would change when children began to work outside of the home. Parents were willing to make concessions, in part, because they needed the income of the children, but also because they understood that the threat of their children leaving the home was very real. Even in the comments of the 1888CEX, there are notes that older sons had abandoned the family or no longer contributed to the home. Parents had to take this into account the distinct possibility of noncooperation when planning on the future income to the household that would be provided by children. Table 11.8 also shows the ratio of boys to girls in age groups. As the table shows, boys began disappearing from the household in the mid-teens. By these calculations, boys 15–19 were 25% more likely to leave the household than girls and more than 50% more likely to leave the household by the age of 24. Young

[28] An important caveat here is that once the wages were realized and the child chose to stay in the home, consumption could increase, and total household welfare could improve. Parents could not guarantee this, however, because of the inability to form contracts and agreements with children (Becker 1991).

men in metalworks families were much more likely to leave home than young women, entirely consistent with their higher earnings. Young men in textiles were less likely to leave home, consistent with their lower earnings.

How reliable are these estimates for leaving home? These estimates suggest that young men in industrial households left home at relatively early ages, certainly earlier than the ages produced by other scholars. In general the age at leaving home declined from the mid-20s in the mid-nineteenth century to the early 20s in the early twentieth century, but it is not clear how the age of leaving home varied by other factors.[29]

There are three confounding factors that should temper our desire to label this estimate an "age" of leaving home. The first is that the 1888CEX is not broadly representative of American households at the time. Indeed, we can only say that it is representative of households whose head was employed in the nine industries targeted in the original survey. Haines (1979) compared the age of household heads in the 1888CEX to the age of household head from the Census and found broad, general agreement. Modell (1978) also confirms the representativeness of the 1888CEX in this regard. It does appear, then, that the 1888CEX is representative of families employed in the selected sectors. The second factor is that this estimate is not one for an age at leaving home—it calculates the sex ratio as a function of age. Certainly some of the estimate could be due to mortality differentials by gender and sampling error, where working sons may be underrepresented. Third, absence from the home cannot (and should not) be taken, on its own, as noncooperation. For example, children who leave home earlier may have contributed more to the household's coffers while in residence. While this relative probability estimate is consistent with the arguments made here, it is not the only possible explanation. As a partial confirmation, however, the rates for leaving home reported here are also consistent with Horrell and Oxley's (1999) estimates for England in the late nineteenth century, which is based upon a British sample of the same industries. As such, as a relative probability, there is some independent support for these estimates.

11.5.2 Retained Earnings and Nonwage Benefits

Parents may treat children equally despite their unequal earnings, if the wages retained by parents were equal. If sons kept a larger portion of their income than their sisters, the additional income into the household's coffers could be equal (or nearly so). In fact, parents may be forced to let the higher-earning child retain more of their earnings if that would keep the child in the household. Parents may have been forced to provide incentives to work or make concessions in the way that Moehling (2005) and Tuttle (1999) describe to keep children contributing

[29] Steckel's (1996) estimates for the mid-nineteenth century (age 25 for males) are much higher than Gutmann and Pullman-Pinon's (2002) estimates (age 22 for males).

(cooperating) in some way. The percentages reported in Table 11.6 would also refer to the percentage of income that boys were able to retain.[30] There is narrative evidence that suggests that boys were allowed to keep a larger share of their earned income than girls. Ewen notes that:

> Boy children, in general, were allowed greater access to social life outside of the domain of family life than girl children…In a study of Italian working class life, the social workers observed that "it was assumed as a matter of course that the girl's pay envelope should be turned over to the mother intact," because "it wouldn't look nice to pay board to the mother who raised you…while the question as to whether the brothers also contributed everything to the home received the answer, 'Oh no, he's a boy.'" (Ewen 1979, p. 131)

Woods and Kennedy (1913) note the same phenomenon. This speaks to the fact that parents did treat their children differently once they began working, but perhaps out of necessity. Allowing the son more freedom may have been the only way to keep sons, and their earnings, in the household, while parents had the additional aid of social norms and taboos to coerce daughters to cooperate. More (1907) finds that treatment differentials by gender were quite common.[31] Chapin (1909) also documents how daughters were expected to contribute all of their earnings to the household coffers, while sons after adulthood would pay only board. In some households, the income of daughters was blindly turned over to the female head.[32]

There is historical data that allows us to look at this issue in finer detail. Returning to the Goldin data that was used to estimate the gender wage differential for children in textiles, we can see if children in textiles would retain different amounts of their earnings as we see that their wages were similar. In regressions for the log of retained earnings on age, sex, family size, and household earnings (once again restricting the sample to those below the age of 17), the coefficient on sex was not statistically distinguishable from zero, so young women in textiles did not retain less than their brothers, who were earning similar wages.[33] This would be entirely consistent with children retaining the same portion of their wages conditional on the wages themselves. The wage earnings received by parents were the same.

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[30] That is, on average, boys could retain 30% more of their earnings than their sisters, assuming daughters gave all of their income to their parents.

[31] "It is the general custom for all boys and girls between 14 and 18 to bring pay envelopes to the mother unopened, and she has the entire disbursement of their wages, giving them from $0.25 to $1. a week spending-money, according to the prosperity of the family. After they are 18, the boys usually pay board of $4.−$8. a week, according to their wages…The girls are not usually boarders until they are over 21, and then they pay from $3. to $6 a week to their mothers. In some cases they continue to give all their wages to their mother, who supports them until they are married" (More 1907, p. 87).

[32] "Few Jewish daughters considered their wages their own; rather they understood them to be part of the family fund…And Nettie Licht, who began working as a milliner in 1910, faithfully gave her pay envelope to her parents without even bothering to open it…Many other Jewish daughters did the same: as one 1916 report noted, the majority of women in the New York shirtwaist factories gave their "untouched and unopened" pay envelopes to their parents" (Glenn 1990, p. 84).

[33] The coefficient on sex in the retained earning regression is −0.029, with a standard error of 0.114.

We can also address the issue of remittances, somewhat, from a different sample of the same Goldin data. The Goldin data also contains a sample of more than 1300 young women who were living at home in New York City and a sample of nearly 400 young women who lived apart from their families in New York City and Philadelphia.[34] In both instances the young women were employed in either stores or factories. Regressions of contributions to family members on the characteristics of these women show that, even controlling for rent and for transportation costs for young women who lived apart from their families, women apart their families contributed less than half of what women who lived with their families did.[35] This would be consistent with the narrative evidence that parents took pains to keep their daughters in the home because it resulted in more resources for them.

11.6 Conclusion

Rather than allocating more resources to the children who would earn more in the labor market or more resources to children who would earn less in the labor market, parents chose to allocate resources equally to both genders in the late nineteenth century. Theoretical models of the household allow us to discern the motivations behind this allocation strategy. Namely, the gender equity in resource allocation was not altruistic or egalitarian. Pure economic altruism would predict that parents would allocate more resources to the child who would earn less, and egalitarianism would predict that parents would allocate resources equally, but even when doing so they could increase their own consumption more when young boys were present in the household, and that has been rejected as well. The elimination of altruistic or egalitarian motives implies that parents were strategic. Parents treated children of different genders equally because, in the probabilistic setting, the future higher earnings of boys were offset by their higher probability of leaving the household. This explanation is also consistent with parents letting boys keep a larger share of their earnings and letting boys have more freedom and/or fewer responsibilities in the household. Each of these possibilities is supported by the narrative record. Parents were forced to treat children of different genders equally as young children because of an uncertain future. Parents knew boys would earn more than girls, but

[34] These women are noted as being "adrift."

[35] This was estimated in two ways. First, I regressed the log of the wage on the contributions to family members, age, and experience. For women at home, the coefficient on contributions was 0.47 (0.03), while for women adrift it was 0.147 (0.03). I also regressed the log of contributions to family members on the log of earnings, age, and experience. These can be interpreted as elasticities, which would estimate for every percent increase in income what portion was contributed to the family. For women at home, the coefficient for the log of earnings was 0.924 (0.033), while for women adrift it was 0.492 (0.117). For women away from home, regressions also included education, board payments, and transportation costs—exclusion of these variables results in lower coefficient estimates for women away from home.

they also knew that boys could leave the household behind—the net result was gender equality in household allocations.

An important caveat is that the theory used here is static, yet many of the conclusions depend on dynamic parental decision-making. While it would appear to cause a problem, the results here agree with work by Mazzocco (2007) who finds that household members cannot commit to future allocation decisions, which is what parents and children could not do here.[36] These cooperation-related explanations agree not only with the gender equity result but also with the efficiency result. Ex ante, if parents and children were able to enter into an agreement before children entered the labor market, where parents agreed to give children a larger share of their income in exchange for children agreeing to stay in the household for a given time, both parties could have been better off. The reality is that parents had to make allocation decisions before the children made the cooperation decision, a decision made with uncertainty about future cooperation. Gender-neutral allocations were not efficient ex post, but were efficient ex ante.

Appendixes

Appendix A: Reflection on Murray

I first met John at meetings of the Economic History Association as an assistant professor. I had heard about him before then because my colleague Rick Steckel had referred to him often as the best student he had ever had. When I met John, I was struck by his intellect and his kindness, and I always looked forward to seeing him at the EHA or Social Science History Association meetings. When I was visiting at the University of Michigan, John invited me down to Toledo to give a seminar. It was at dinner where we discussed the paper in this volume, and John shared insights from his work that were quite important to how I came to think about this project. To this day, it is the longest dinner I have had after a seminar, and it was because of John's humor and the amazing conversation we had. John's recollection of data, conceptual frameworks, and models around the issues of household allocation, children as breadwinners, and the role of social norms and gender in parental decisions was powerful. When John moved to Rhodes, I remember filling him in on the great BBQ places that he could enjoy now that he was in the capital of the industry!

[36] Duflo and Udry (2004) and Ligon (2002) are recent attempts to analyze the intertemporal implications of the collective model. Formally testing the implications of the dynamic collective model (as in Mazzocco) requires the use of panel expenditure data that is unavailable in the historical record.

Appendix B: Expenditure Equivalent Ratios

The choice of adult goods and the test of efficiency are subject to numerous criticisms. For example, it is unclear if husband's and wife's clothing precludes the clothing expenditures of adult children, who could (presumably) fit and wear their parents' clothing. Similarly, the efficiency test was not particularly powerful, even in its conservative form, because of the large standard errors of the sharing rule derivative quotient. We would like additional information to strengthen the selection of adult goods and the efficiency results. Fortunately, such information exists. We can estimate expenditure equivalent ratios, which measure the percent change in per capita expenditure that would induce the same increase or decrease in expenditure on a particular adult good as an additional child of a certain age and gender. For example, an expenditure equivalent ratio for alcohol for a female aged 0–4 of −0.32 would tell us that per capita expenditure would have to decrease by 32% to induce the same change in alcohol demand as the presence of a girl aged 0–4 does. More precisely, the expenditure equivalent ratio for good j and demographic category c is[37]

$$\pi_{jc} = \frac{\partial q_j / \partial n_c}{\partial q_j / \partial x} / \frac{x}{n}. \tag{A1}$$

The expenditure equivalent ratio serves two purposes. If good j is an adult good consistent with the definition given earlier, then the expenditure equivalent ratio should be the same for all goods since it measures the derivative of the sharing rule (by Eq. 11.8). If gender equality holds, then the ratios will be equal by gender at particular ages. Variation of expenditure equivalent ratios between different goods would tell us if the variances of the sharing rule were spurious or reflected the true variances in the adult expenditure categories. As such, the ratios not only tell us which goods should be considered adult goods, but they serve as a robustness check on the gender neutrality and efficiency results.[38]

Table A1.1 shows the expenditure equivalent ratios for all households and households in metalworks and textiles separately. While the presence of children generally would result in lower per capita expenditures to achieve the same effect as the presence of a child, this is not always the case. Tobacco and alcohol consumption expenditure equivalent ratios suggest that children have the effect of increasing

[37] Calculation of the expenditure equivalent ratios is done by $\pi_{jc} = \frac{\left(\eta_j - \beta_j\right) + \gamma_{jc} - \sum_k \gamma_{jk}\left(n_k / n\right)}{\beta_j + w_j}$, where the means of the budget shares and demographic variables are used. See Deaton (1997) for calculation of the standard errors of expenditure equivalent ratios.

[38] One could argue that the efficiency result is due to the sharing rule being "unidentified." There is nothing in the theory, however, which allows us to distinguish "spurious" estimates of the sharing rule with "minimum variance" estimates. The use of the expenditure equivalent ratios here is a partial solution—if the variances of the sharing rule in Table 5 actually reflect variance in the underlying demand with respect to household composition, then the expenditure equivalent ratios will vary as well.

Table A1.1 Expenditure equivalent ratios, 1988 Cost of Living Survey

Whole sample (N = 6809)								
	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	All Adult	4 Adult
Male 0–4	1.856	0.302	0.896	−0.730	−2.023	−0.442	−0.005	0.265
Female 0–4	1.771	0.015	0.921	−0.722	−1.855	−0.460	−0.061	0.180
Male 5–9	1.385	−0.086	1.028	−0.802	−3.608	−0.235	−0.268	0.140
Female 5–9	1.275	0.284	0.922	−0.922	−3.634	−0.227	−0.235	0.181
Male 10–14	1.481	0.711	1.269	−0.535	−3.604	−0.192	0.091	0.558
Female 10–14	1.348	0.858	1.272	−0.626	−3.393	−0.259	0.121	0.572
Male 15–19	0.838	1.016	1.627	−0.125	−2.706	−0.230	0.443	0.865
Female 15–19	1.481	0.217	1.712	−0.219	−1.715	0.029	0.369	0.643
Male 20–24	0.495	−0.200	0.578	−0.619	−12.153	0.060	−1.293	−0.034
Female 20–24	1.927	0.946	1.900	−0.240	−6.628	0.140	0.126	0.953
Metalworks (N = 1568)								
	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	All Adult	4 Adult
Male 0–4	2.087	0.495	−0.457	−0.569	−1.233	0.373	−0.218	1.596
Female 0–4	1.917	0.423	−0.397	−0.419	−1.166	0.297	−0.310	1.389
Male 5–9	0.798	0.404	−0.524	−0.499	−1.621	0.610	−1.027	1.207
Female 5–9	0.789	0.534	−0.777	−0.752	−1.578	0.483	−0.705	1.533
Male 10–14	1.451	0.627	−0.180	−0.197	−1.603	0.706	−0.135	2.243
Female 10–14	2.118	0.647	−0.002	−0.260	−1.599	0.521	−0.024	2.380
Male 15–19	0.147	0.591	−0.178	−0.119	−1.395	0.800	−0.008	2.076
Female 15–19	0.855	0.277	−0.016	−0.295	−1.110	0.769	−0.580	0.958
Male 20–24	0.778	0.133	−0.667	−0.550	−3.577	0.639	−4.383	0.159
Female 20–24	1.545	0.448	0.012	−0.063	−2.545	0.811	−1.789	1.689
Textiles (N = 3043)								
	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	All Adult	4 Adult
Male 0–4	1.406	−0.107	1.524	−0.661	0.715	0.489	0.643	0.634
Female 0–4	1.472	−0.467	1.665	−0.669	0.488	0.749	0.615	0.637
Male 5–9	1.336	0.080	1.935	−0.752	0.794	0.456	0.792	0.807
Female 5–9	1.267	−0.210	1.901	−0.835	0.817	0.435	0.709	0.698
Male 10–14	0.953	−0.075	2.119	−0.532	0.670	0.631	0.833	0.878
Female 10–14	1.012	0.234	2.019	−0.600	0.843	0.532	0.858	0.877
Male 15–19	0.758	−0.156	2.406	−0.062	0.581	0.140	0.996	1.127

(continued)

Table A1.1 (continued)

Whole sample (N = 6809)								
	Tobacco	Liquor	Husb Cloth	Wife Cloth	Religion	Charity	All Adult	4 Adult
Female 15–19	1.088	0.673	2.580	0.035	0.594	0.068	1.245	1.445
Male 20–24	0.504	0.233	1.388	−0.644	0.117	0.588	0.439	0.504
Female 20–24	1.182	0.618	2.639	−0.403	0.333	0.621	1.121	1.319

Notes: The calculation of expenditure equivalent ratios is given in the text of Appendix 2. Expenditure equivalent ratios for metalworks and textiles are based on separate regression for those samples

expenditure on these items, some by significant percentages.[39] As the table shows, there is marked variation of the expenditure equivalent ratios by goods and even for the same good by different samples. We should expect some variation between individual households and also between households employed in different industries, but it is not clear whether this is "too much" variation. This type of variation by adult good is consistent with other estimates of expenditure equivalent ratios, both contemporary and historical (Deaton 1997; Horrell and Oxley 1999).[40] Given such marked variation, we should expect the standard error to be large for the sharing rule derivative quotient, as it was in the bootstrapping procedure. Consistent with the gender neutrality finding, the expenditure equivalent ratios are very similar for males and females of the same age group.[41] Overall, the expenditure equivalent ratios confirm the gender neutrality of allocations and the underlying variability of the sharing rule for specific goods.

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[39] Note that these adult good expenditures are (on average) a small percent of the budget—tripling expenditures on tobacco would still imply that tobacco was less than 5% of the household budget.

[40] Horrell and Oxley (1999) use age categories of 0–4, 5–14, 15–54, and 55+. Given the focus on the allocations to young children here, the 5-year categories to the age of 25 are used.

[41] It is important to note that the regressions used to estimate the expenditure equivalent ratios are done so with an estimate of $\hat{\theta}$, so the ratio acts as an additional robustness check of gender neutrality with the inclusion of the sharing rule in the demand equation.

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