Economic Inquiry

HOUSEHOLD PRODUCTION AND SEXUAL ORIENTATION

DOUGLAS W. ALLEN*

The 2006 Canada census is used, along with a well-known model of household production, to estimate the value of household commodities produced by gay, lesbian, and heterosexual couples. The results show some intriguing differences and similarities. Unlike heterosexuals, gay and lesbian couples respond differently to changes in the cost of time. However, all couples are characterized by the importance of market goods over time and the importance of human capital in the market over the home, with respect to household production. Hence, although there are differences in the sexual division of labor between households of different sexual orientations, the value of household commodities is mostly driven by differences in the amount of market goods used in the home. Market goods are determined by income, and differences in income within a couple-type swamp differences in income across couple-types, and as a result there is no statistical difference in the value of household commodities produced across the three sexual orientations. (*JEL* D13)

> Homosexual unions do not result in children, and generally they have a less extensive division of labor and less marital-specific capital than heterosexual marriages.
>
> (Becker 1981, p. 225)

I. INTRODUCTION

It is conventional economic wisdom that the gains from household production are lower for same-sex couples compared to opposite-sex couples because the former obviously lack the benefits that come from a sexual division of labor within the home. Even with the presence of children, these specialization gains would seem lacking because differences across sexes are absent, and therefore, opposite-sexed couples should receive larger household benefits. Indeed, the lower benefits within same-sex households have long been a cornerstone in the explanation of duration instability among these couples.[1] Yet, none of these long-held beliefs are based on any large sample empirical estimates.

The challenges in estimating the value of household commodities among same-sex couples are large, and until very recently, were impossible to overcome. Gays and lesbians make up a very small fraction of any population. Among this small fraction, few are in common law or married relationships, and still fewer have children. Furthermore, within the United States same-sex marriage is legal only within a handful of states, and though the number of states continues to grow, no census or other large probability sample directly identifies same-sex couples. In smaller samples that might identify same-sex couples, seldom is data collected on time devoted to household activities, or the labor market variables necessary to estimate home production. So on the one hand, estimation requires a specific set of economic data on time use, market activity, and expenditures that are lacking in any sociological data that includes same-sex couples. While on the other hand, large probability sample datasets with market and household information often fail to identify sexual orientation.

ABBREVIATIONS

CRS: Constant Returns to Scale
OLS: Ordinary Least Squares

*Thanks to Krishna Pendakur and two anonymous referees for their productive comments.

Allen: Burnaby Mountain Professor of Economics, Department of Economics, Simon Fraser University, Burnaby, BC, Canada. Phone 778 7823445, Fax 778 7824955, E-mail allen@sfu.ca

1. See Nock and Brinig (2002) for a nice summary of the role that sexual division of labor has played in divorce. Becker (1981), and Badgett (1995) discuss the effect sexual orientation can have on the sexual division of labor and the subsequent marriage benefits.

Economic Inquiry
(ISSN 0095-2583)
Vol. 53, No. 1, January 2015, 406–418

doi:10.1111/ecin.12095
Online Early publication April 30, 2014

The 2006 Canada census solves almost all of these problems.[2] First, same-sex marriage became legal across all of Canada in 2005.[3] As a result, the 2006 census self-identifies same-sex couples: both married and common law.[4] The census also measures time use within the household, income (based on tax records), and other demographic characteristics for both spouses. Most importantly, the census is large enough to contain a random sample of same-sex couples to allow for estimation. Thus, although not perfect, the census contains the minimum amount of information necessary to estimate differences in the household production functions across different couple-types.

Given that the household commodity output is unobservable, it is necessary to do this estimation within the context of a specific household model. Here the Graham and Green (1984) model is used.[5] This model exploits a simple Cobb-Douglas production function, in which household output depends on the amount of time each household member devotes to the household and the amount of market goods that are utilized. The empirical findings are rather interesting, and robust. First, same-sex couples respond differently than opposite-sex couples to time cost changes with respect to their allocation of household time. This finding is consistent with other social science findings that show same-sex couples are less likely to specialize within the household. However, by far the most important element in determining the value of total household production is the value of market goods employed. As a result, differences in the value of household production that arise over differences in the sexual division of labor between same- and opposite-sex homes are swamped by the role that market goods play in producing household commodities. Thus, based on the findings here, one would conclude that the loss of a sexual division of labor is *not* an important factor in the determination of the value of household production for gays and lesbians.

Differences in household production across different couple-types may be caused by many different factors. However, here the objective is to test the long-held conjecture of Becker, quoted above, by investigating time use patterns within the household and providing the first estimates of the value of household commodities for gay and lesbian households. That is, the goal is simply to see if such a difference actually exists.

II. MATCHING, SOCIAL NORMS, AND HOUSEHOLD PRODUCTION

Individuals do not randomly match with others to form couples. Rather, selection takes place within the context of a matching market, and individuals choose the best match possible given the competition of others. These matches depend on the size of the matching market, the social norms of the subculture the individuals live in, as well as observable and unobservable (to third parties) individual characteristics. In the end, we only observe those matches that result from this process.

Given the nonrandom assignment of individuals into couples, the actual amount of household goods produced depends on the matching process. For example, there is a gender studies literature that suggests lesbians allocate household labor based in part on strong subculture social norms of equality and a rejection of traditional gender differences.[6] Hence, despite the lack of biological difference, inability to jointly bear children, and matching on similar income

2. The 2011 census rules were changed to allow voluntary responses. Hence the 2011 census may not be a true probability sample, and to-date is still not available.

3. Same-sex couples in Canada have had all taxation and government benefits since 1997. The first Canadian same-sex marriage took place on January 14, 2001 at the Toronto Metropolitan Community Church. These early marriages became the basis of a successful legal challenge which ended at the court of appeal on June 10, 2003. On July 20, 2005, the Federal government passed the Civil Marriage Act that made Canada the fourth country in the world to legalize same-sex marriage. Thus, different people date the arrival of same-sex marriage in Canada as 2001, 2003, or 2005. Biblarz and Savci (2010, p. 490) note that legalization has reduced the stress and stigma of homosexuality in Canada, which makes it more likely that respondents would be unintimidated to respond correctly to Statistics Canada surveys.

4. Here, for the purpose of estimating the household production function, I make no distinction between married and cohabitating couples. First, the census groups them together for same-sex couples. Second, in Canada the distinction has had no legal implication since 1997 when cohabitating couples were granted all legal rights and responsibilities as married couples.

5. Suen and Lui (1999) provide another model for estimating household production.

6. See Giddings (2003), Kurdek (2007), or Patterson, Stufin, and Fulcher (2004) for small sample studies of equal allocation of household labor for lesbian couples. Oerton (1998) points out that lesbian couples may still have a "housewife," but this identification is not based on traditional gender roles. Two other book-length treatments that discuss the relationship between the market and home for same-sex couples are Carrington (1999) and Badgett (2001).

levels, further reductions in specialization may result from these social norm differences.

In addition to the role of social norms, same-sex couples may match differently than opposite-sex couples, and gay couples may match differently from lesbian couples. For example, differences in the expectation of marriage, future children, or life expectancy might lead to systematic differences in couple-specific human capital investment decisions, which influence the quantity of household production that takes place.[7] In addition, higher search costs for same-sex couples could lead to fewer couplings and lower quality matches on average. This may lead to different parts of the distribution of men and women forming couples for the different couple-types, and differences in the value of household production could result from this different composition of the sample.

Hence, actual differences found in the value of household production, without the context of a specific model being tested, cannot be directly attributed to the "same-sexness" of the couple. The differences may reflect differences in social norms, differences in sorting, or some other systematic difference between same and opposite-sex couples. However, the objective here is not to sort through these different factors, but rather to first establish whether any difference in household output actually exists between opposite- and same-sex couples and if it does exist, how large is it?

III. THE GRAHAM AND GREEN MODEL

Directly estimating a household production function, in general, is difficult because there are almost no instances where household outputs are reported in surveys.[8] Without measures of the dependent variable, various indirect procedures have been used, many of which exploit detailed information on time and market goods used in home production.[9] When the data are more aggregated and less detailed, usually various restrictions are in order to separate the role of household preferences from production.[10]

Here the parsimonious nature of the census expenditure data forces the use of the indirect method developed by Graham and Green (1984), which (1) has the critical (and unappealing) assumption that market goods and home production are perfect substitutes, and (2) allows for time spent at home to be a combination of leisure and production. Within this model the household maximizes a household utility function defined over consumption and leisure subject to a series of standard time and budget constraints, and a Cobb-Douglas household production function.[11] Appendix A describes the basic equations of the model, but here it is only necessary to address the household production function:

$$(1) \qquad Z = A\left(M_1^a H_1\right)^{\gamma_1}\left(M_2^b H_2\right)^{\gamma_2} X_z^{\beta},$$

where H_1 and H_2 are the quantities of time each devotes to the household, M_1 and M_2 are respective human capital measures of the "effective" home production time that takes into account jointness in production, X_z is the composite market good used within the home, and A is a scale parameter (see Appendix A).[12] The key parameters that need to be estimated are a, b, γ_1, γ_2, and β.

The parameters a and b measure an individual's relative productivity in the home versus the market. Values $a = b = 1$ imply that both persons 1 and 2 are equally productive across the two sectors and have no specialized human capital for the home or market. A comparative advantage in the home for person 1 would imply $a > 1$. The parameters γ_1, γ_2, and β are the returns to scale parameters of the household production function,

7. See Jespen and Jespen (2002), who show some differences in the matching of different types of couples.

8. There are a few exceptions. For example, Fitzgerald, Swenson, and Wicks (1996) are able to directly estimate a household production function given the unique design and extremely small dataset they collected. Rosenzweig and Schultz (1983) use birth weight as a measure of output. In both cases, the special features of the data collected allowed for a direct estimation. As Fitzgerald, Swenson, and Wicks point out, however, "With data only on time use in household production, indirect estimation of household production functions and the use of these production functions to estimate the value of production is the best that can be done" (p. 166).

9. For example, see Kooreman and Kapteyn (1987), Gronau (1980), and Graham and Green (1984).

10. See Pollak and Wachter (1975).

11. The presence of same-sex and cohabitating unions means that the use of nouns like "husband" and "wife" or "male" and "female" are not appropriate. Here I simply refer to person "1" and "2" where person 1 is self-identified in the census as the "main provider." Later, household production values are reported when person 2 is switched to be the main provider.

12. The variables on the right-hand side are observable (although M_1, M_2, and A are the linear combinations of various observable variables), while Z is not observable. A household commodity (Z) could be something like clean teeth or a meal. Keeping teeth clean requires time (H) and a tooth brush (X_z).

and measure the relative importance of person 1's and 2's time and market goods. Hence, $\gamma_1 + \gamma_2 + \beta = 1$ would imply constant returns to scale in the household. The Graham and Green model would suggest that a strong division of labor would exist when there is a large difference between a and b, and the γ of one spouse is relatively large. According to conventional wisdom, this division of labor is enhanced by sexual differences between the couple. Thus, across the different sexual orientations there should be significant differences in these parameter values if sex differences in couples matter for household production.

A twist in the Graham and Green model is that it allows for "jointness" in leisure and household production. That is, time spent in the home can be both productive and enjoyable (e.g., gardening or cooking). This relationship is defined by Equations (A6) and (A7) in Appendix A, but here it is only necessary to understand the parameter δ_i, which measures the degree of jointness for each person. Thus, $\delta_1 = 0$ means no jointness for person 1—housework is only a chore. On the other hand, $\delta_2 = \infty$ means perfect jointness for person 2—housework is like a vacation.

The Graham and Green set-up is purely neoclassical: the household maximizes utility subject to all of the various time, goods, and production constraints listed in Appendix A. Solving from the system of first-order conditions, Graham and Green derive a simple log-linear demand equation based on observable variables, which includes the following demand for H_2:

$$\begin{aligned}(2)\quad \ln H_2 = {} & c' + (1/q)\ln A \\ & + (((\gamma_1/1+\delta_1) + \beta - 1)/q)\ln W_2 \\ & - (((\gamma_1/1+\delta_1))/q)\ln W_1 \\ & + (b\gamma_2/q)\ln M_2 + (\alpha\gamma_1/q)\ln M_1,\end{aligned}$$

where W_1 and W_2 are the respective wages, c' is a constant, and

$$\begin{aligned}q = {} & (1-\beta)\left(1+\delta_2\right) - \gamma_2 \\ & - \left(\gamma_1\left(1+\delta_2\right)\right) / \left(1+\delta_1\right).\end{aligned}$$

Equation (2) can be estimated with census data as

$$\begin{aligned}(3)\quad \ln H_2 = {} & c_0 + c_1 \ln A + c_2 \ln W_2 + c_3 \ln W_1 \\ & + c_4 \ln M_2 + c_5 \ln M_1.\end{aligned}$$

Here, the c_i coefficients are the compound functions of the model parameters found in Equation (2). Graham and Green provide formulas for backing all of the relevant household production function parameters (a, b, γ_1, γ_2, and β) from the c_i coefficients.[13]

The Graham and Green system is underidentified by two.[14] To solve this identification problem Graham and Green must impose two additional restrictions on the model, and this results in nine different cases. These are Case 1, no jointness in household production ($\delta_1 = \delta_2 = 0$); Case 2, equal productivity in home and market ($a = b = 1$); Case 3A, constant returns to scale (CRS) and no jointness for person 1 ($\gamma_1 + \gamma_2 + \beta = 1$, $\delta_1 = 0$); Case 3B, CRS and no jointness for person 2 ($\gamma_1 + \gamma_2 + \beta = 1$, $\delta_2 = 0$); Case 3C, CRS and neutrality of person 1's time ($\gamma_1 + \gamma_2 + \beta = 1$, $a = 1$); Case 3D, CRS and neutrality of person 2's time ($\gamma_1 + \gamma_2 + \beta = 1$, $b = 1$); Case 3E, CRS and equality of relative productivities at home and in the market ($\gamma_1 + \gamma_2 + \beta = 1$, $a = b$); Case 3F, CRS and equal jointness of time ($\gamma_1 + \gamma_2 + \beta = 1$, $\delta_1 = \delta_2$); and finally, Case 4, equal jointness and relative marginal productivity ($a = b$, $\delta_1 = \delta_2$). Following Graham and Green, the household production function is estimated for each one of these cases. No argument is made in favor of one restriction over another given that the objective is to compare the value of household production across different couple-types.

Once Equation (3) is estimated, the household production *parameters* are calculated under the various case restrictions, and combined with the average values of the *variables* in Equation (1) to estimate the value of household production for a given home. When these values are averaged over all the individuals within a group, a measure of the average value of household production within that group is arrived. The procedure is not perfect and makes some heroic assumptions, but it works with the level of data available, and provides for a comparison across different types of couples.

IV. DATA

The 2006 Canada census is a 20% random sample of the noninstitutionalized Canadian

13. See Graham and Green (1984, p. 279). The actual formulas depend on the various identification assumptions. For example, if there is no jointness ($\delta_1 = \delta_2 = 0$), then $\gamma_1 = -c_4/c_1$, but if there is neutrality in human capital ($a = b = 1$), then $\gamma_1 = c_5/c_1$.

14. Examination of Equation (2) shows that there are only five variables to estimate seven parameters.

TABLE 1
Estimated Population Averages (Weighted Observations)

	Heterosexuals		Gays		Lesbians	
	With Children	Without Children	With Children	Without Children	With Children	Without Children
Family size	3.87	2	3.48	2	3.54	2
Value home	249,283	202,017	237,432	227,791	223,016	182,296
Number of rooms	7.62	6.58	7.28	6.03	7.30	6.12
Age youngest child	11.83		14.59		9.41	
Age person 2	42.6	53.88	44.25	42.25	40.17	43.03
Age person 1[a]	45.31	56.50	46.07	44.64	40.81	44.07
Education person 2	4.95	4.20	5.63	6.04	6.11	6.19
Education person 1	5.27	4.58	5.88	6.76	6.64	6.66
After-tax income 1	42,960	36,073	47,257	42,320	40,413	36,280
After-tax income 2	29,333	24,696	33,490	32,660	32,749	31,641
Age difference	2.69	2.58	2.11	2.22	0.56	0.91
Income difference	28,681	23,017	33,294	25,320	20,786	19,244
HH hours 1	1782.86	928.68	1756.66	680.11	2397.30	813.70
HH hours 2	2514.61	1208.77	1892.60	680.33	2452.43	816.94
Hours difference	731.75	280.09	135.94	0.22	55.13	3.24
N	3,953,255	3,242,765	760	22,305	3,330	16,255

[a]For gay and lesbian couples "Person 1" refers to the person who is identified as the "head" of the household.

population. It contains 6,470,472 individual records and represents 1,813,576 census families. From all records the married or cohabitating couples (with or without children) were selected, leading to a total sample of 1,463,895 couples. Table 1 provides some descriptive statistics for the six groups under consideration, and variable definitions are found in Table A1 of Appendix B.[15]

The census contains measures of time at home spent on housework, child care, and senior care. Following the theory of household production, the time spent on these three activities was combined to create a total household time variable for each spouse. The census contains annual income and wage information, as well as market place hours information for the week prior to the census.[16] The variable for weekly hours worked in the workforce often contained too many missing observations to be useful. As a result, wages were calculated using the annual after-tax income and total annual hours of work.[17] Because many couples are made up of one spouse who does not work outside the home, the Heckman two-step procedure is used to estimate a selection equation and then adjust the wage equation to come up with estimated wages for all individuals.[18]

Table 1 reports the estimated population averages among the different family types for the variables of interest. Several interesting features stand out. First, heterosexual households with children are larger on average than gay or lesbian households with children.[19] Second, the differences in family income across the different couple-types are typical: gay households with the highest, followed by lesbian and heterosexual households. Third, the income differences between the spouses are high and similar for gays and heterosexuals (with and without children), but lower for lesbian couples. Correspondingly, the average amount of time spent on household activities varies considerably across the different couple-types. There is a considerable difference in spouse time spent in the household for

15. The census file used is not a public dataset. To use the data, a proposal is screened by the Social Sciences Research Council of Canada, a Royal Canadian Mounted Police criminal check is conducted, and the researcher becomes a deemed employee of Statistics Canada subject to the penalties of the Statistics Act. Empirical work was conducted at the SFU Research Data Center, and all results were screened by Statistics Canada before release. Statistics Canada does not allow the release of the sample means, nor maximums or minimums of any variables. Furthermore, population sizes are rounded off to the nearest 5. Hence the averages reported in Table 1 are the averages of the estimated population variables.

16. For most respondents the income information comes from their tax return. Otherwise it is self-reported.

17. In Canada individuals are taxed, not households.

18. This procedure is used by Kooreman and Kapteyn (1987).

19. All of the heterosexual means, for both those with and without children, are statistically different from the means for gays and lesbians. However, most of the gay and lesbian means are not statistically different from each other. For example, the 95% confidence intervals for family size for couples with children are 3.869–3.873 for heterosexuals, 3.32–3.64 for gays, and 3.48–3.60 for lesbians.

TABLE 2
Estimated Hours Equation (Weighted Observations, Variables Logged; Dependent Variable: Logarithm of Person 2's Household Time)

	Heterosexuals		Gays		Lesbians	
	With Children	Without Children	With Children	Without Children	With Children	Without Children
Wage variables						
After-tax income 1	0.627	0.183	−0.243	0.031	−0.288	−0.215
	(0.007)*	(0.009)*	(0.973)	(0.212)	(0.338)	(0.152)
After-tax income 2	−0.544	−0.870*	3.90	−0.239	0.217	0.130
	(0.007)*	(0.010)*	(2.015)*	(0.310)	(0.517)	(0.230)
Human capital variables						
M Person 1	−0.577	0.214	0.778	0.211	0.214	0.663
	(0.013)*	(0.016)*	(1.090)	(0.191)	(0.505)	(0.215)*
M Person 2	0.304	1.142	−3.11	0.541	0.370	0.095
	(0.015)*	(0.016)*	(1.66)**	(0.242)*	(0.651)	(0.266)
Scale variable						
A	0.166	0.174	1.60	0.410	−.0001	0.201
	(0.007)*	(0.004)*	(0.712)*	(0.054)*	(0.285)	(0.061)*
Constant	7.55	9.04	−29.37	5.05	9.03	4.06
	(0.106)*	(0.133)*	(15.02)*	(3.19)	(3.18)*	(1.73)*
N[a]						
F	13,641	6,769	7.85	19.08	9.84	9.72
R^2	0.212	0.118	0.340	0.064	0.234	0.040

Note: Standard errors in parentheses.
[a]Statistics Canada does not allow the release of the sample sizes for each regression.
*Significant at the 5% level.

heterosexual couples, with very little difference for gays and lesbians. Finally, there is a larger age gap for heterosexual and gay couples, compared to the small age gap for lesbian couples. Just looking at these averages suggests that gay and lesbian couples are less likely to be specializing in household production and market work—Becker's prediction seems confirmed.

One of the most significant facts comes from the last row of Table 1: the estimated population sample sizes are low for gay and lesbian households. Whereas there are millions of heterosexual households, there are very few gay and lesbian households with children, and even the total population estimates of 23,065 gay and 19,585 lesbian couples is relatively small.[20]

V. ESTIMATION

Estimation of a household production function begins with estimating the demand for household time in Equation (3) for the six different household types in the sample. Equation (3) regresses household time of person 2 on wages for both spouses, a general scale parameter, and each spouse's human capital. Following Graham and Green, the scale parameter is a vector combination of household characteristics. To the extent possible, I used variables similar to Graham and Green: the value and size of the home, family size, and the age of the youngest child. Likewise, the human capital variables follow Graham and Green, and are combinations of age and education levels. The estimates for Equation (3) are found in Table 2.

Table 2 shows that in terms of responses to the cost of time, heterosexual households behave as general household theory would predict: increases in the cost of time to person 2 leads to reductions in his/her time spent at home (coefficients for after-tax income are −.54 and −.87), and increases in the cost of time to person 1 leads to an increase in person 2's time spent at home (coefficients are .63 and .18). Both heterosexual regressions (with and without children) show that as the human capital levels of person 2 increase, the hours at home increase (coefficients for M_2 are 0.30 and 1.14). Similarly, as the scale parameter increases, person 2 spends more time

20. Allen and Lu (2013), using the Canadian Community Health Survey that directly identifies sexual orientation, find a population estimate of 80,209 lesbians and 143,038 gay men in Canada. This amounts to .83% of the population and does not include bisexuals. Hence the estimates here for the number of same-sex couples is consistent with the data from the health survey.

at home (coefficients for *A* are .16 and .17). All of the heterosexual results make sense in terms of traditional household models and are very similar in size and sign with those found by Graham and Green.[21]

The regression coefficients for the other four household types show some considerable differences. Most notable is the reduced precision and lack of statistical significance even though the sample size is substantial. In addition, same-sex couples do not systematically behave the way heterosexual couples do with respect to the cost of time. Indeed, with respect to the reaction of person 2's household hours to the cost of time, with the exception of gay households without children, the other household types behave in the *opposite* way of heterosexual households; that is, the coefficients for after-tax income have the opposite signs compared to those for heterosexuals. This may be caused by different household behavior and bargaining, but it reflects a reduced sexual division of labor.

The difference in coefficients between opposite- and same-sex households is not quite as striking for the human capital variables (*M*) and the household scale parameter (*A*). In general, with respect to changes in these variables the same-sex households respond in a similar fashion to opposite-sex households. Thus, when human capital improves, family members from all types of families increase the amount of time in household production. When the scale of household production increases, all types of households again increase the amount of time in producing household commodities. If gay and lesbian families respond to human capital and scale changes in ways similar to heterosexual households, then their different response to changes in the costs of time may be due to a lack of sexual division of labor since the other alternative explanations are likely to affect human capital and scale variables as well.[22]

As mentioned, Graham and Green provide closed form solutions of all the parameters of the production function based on the coefficient estimates of Table 2.[23] Here I produce the final calculated parameter values based on each special case in Table 3, only for the couples with children.[24] Although a complicated and daunting table, Table 3 provides the essential parameter estimates of Equation (1) necessary to arrive at a value of household production (*Z*). Consider the top panel of Table 3 for heterosexuals with children. The γ_1 and γ_2 parameters measure the importance of time in home production. Looking across all of the cases, the values are all small and generally positive. On the other hand, β measures the importance of market goods in household production. In all the cases β is slightly bigger than 1. Together these mean that heterosexual households effectively experience constant returns to scale, and scale is driven almost entirely by β.

Looking at the same rows for the gay and lesbian households shows that lesbian households are almost identical to heterosexual homes in terms of scale and the magnitudes of the parameters, and that gay households are slightly different. Although gay households generally experience constant returns to scale (i.e., $\gamma_1 + \gamma_2 + \beta \approx 1$), β is 10% higher and γ_2 tends to be more negative. This means that market goods play an even more important role in gay

21. The core Graham and Green results to the same regression (1984, Table 3, p. 280), compared to the base results of Table 2 for heterosexual couples with children are shown below (standard errors in parentheses). With one exception, the signs are all the same for each variable.

Variable	Graham and Green	Table 2
Husband's wage	0.047 (0.07)	0.627 (0.007)
Wife's wage	−0.169 (0.05)	−0.544 (0.007)
Wife's age	0.129 (0.07)	0.246 (0.01)
Husband's education	−0.091 (0.11)	−0.124 (0.002)
Wife's education	−0.191 (0.14)	0.057 (0.002)
Family size	0.577 (0.13)	0.452 (0.005)
Number of rooms	0.207 (0.08)	0.080 (0.004)
Age of youngest child		−0.343 (0.002)

Owing to a collinearity problem, Graham and Green do not include the Husband's age as a regressor—this was not a problem with the 2006 Canada census. They also use four dummy variables to mark the ages of children, whereas Table 2 uses the age of the youngest child. Graham and Green find that as more older children are present, the wife's home production time falls, which is consistent with the result above that when the age of the youngest child increases, the wife's household time falls.

22. An alternative approach to estimating Equation (3) pooled all of the data across the different household types, using the same-sex indicators interacted with the variables in the equation. This was estimated multiple times, starting with just the wage variables, adding the human capital variables, and then finally adding the scale variables. When all variables are included, the results are essentially the same, and the general conclusion of the article follows. There is no getting around the problem that same-sex households are rare, and this results in a lack of estimation precision. When just the wage variables are included, all of the coefficients are statistically significant, but also they are all negative.

23. See Graham and Green (1984, p. 279).

24. With the exception of one parameter for one household type (brought up below), the parameters for households without children are similar.

TABLE 3
Estimated Production Function Parameters (for Couples with Children)

	Case 1	Case 2	Case 3A	Case 3B	Case 3C	Case 3D	Case 3E	Case 3F	Case 4
Heterosexuals with children									
γ_1	−.05	−.04	.05	.03	.04	−.03	.01	.58	−.05
	(0.002)*	(0.001)*	(0.002)*	(0.001)*	(0.001)*	(0.001)*	(0.001)*	(0.099)*	(0.002)*
γ_2	.03	.02	.04	−.03	.04	.02	.007	−.58	.12
	(0.001)*	(0.001)*	(0.001)*	(0.001)*	(0.002)*	(0.001)*	(0.0008)*	(0.097)*	(0.012)*
β	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
	(0.055)*	(0.055)*	(0.055)*	(0.055)*	(0.055)*	(0.055)*	(0.055)*	(0.055)*	(0.055)*
a	.92	1	.92	−1.54	1	.04	3.30	−.08	.197
	(0.019)*		(0.019)*	(0.056)*		(0.002)*	(0.386)*	(0.013)*	(0.009)*
b	.66	1	.55	−.66	.61	1	3.30	−.04	.197
	(0.043)*		(0.031)*	(0.042)*	(0.019)*		(0.386)*	(0.005)*	(0.009)*
Gays with children									
γ_1	.006	.02	.006	.03	.02	−.01	.03	.005	−.001
	(0.06)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)*	(0.02)*
γ_2	−.14	.08	−.11	−.14	−.12	.08	−.13	−.10	.009
	(0.046)**	(0.46)*	(0.67)**	(0.75)**	(0.07)**	(0.46)**	(0.08)**	(0.06)	(0.04)
β	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
	(0.44)*	(0.44)*	(0.44)*	(0.44)*	(0.44)*	(0.44)*	(0.44)*	(0.44)*	(0.44)*
a	3.19	1	3.19	.62	1	−.02	.64	4.39	−9.35
	(9.74)		(9.74)	(0.58)		(0.02)	(0.17)*	(14.63)	(35.90)
b	.63	1	.79	.63	.70	1	.64	.81	−9.35
	(0.13)*		(14.95)	(0.13)*	(0.13)*		(0.17)*	(0.16)*	(35.90)
Lesbians with children									
γ_1	.02	.02	.02	.10	.02	.03	−.008	.36	−.03
	(0.014)	(0.008)*	(0.014)	(0.031)*	(0.008)*	(0.602)	(0.050)	(0.85)	(0.85)
γ_2	−.10	.03	.01	−.10	−.01	−.03	.01	−.35	.14
	(0.034)*	(0.08)	(0.028)	(0.034)*	(0.005)**	(0.081)	(0.047)	(0.875)	(0.35)
β	.99	.99	.99	.99	.99	.99	.99	.99	.99
	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)	(0.86)
a	.74	1	.74	.16	1	−.01	−2.19	.05	.20
	(0.38)		(0.38)**	(0.039)*		(0.021)	(5.21)	(0.20)	(0.18)
b	.08	1	1.69	.30	2.56	1	−2.19	.08	.20
	(0.23)		(5.12)	(0.881)	(8.258)		(5.21)	(0.40)	(0.18)

household production and for person 2 there is a greater amount of jointness between leisure and housework.[25]

Consider now the values of *a* and *b* across the different cases and household types in Table 3. These parameters measure the relative productivity of each spouse in the home versus the market. In almost all of the cases, except for gay person 1, these values are less than 1. Almost everyone is more productive in the market rather than the home.

These three general findings—that all households experience constant returns to scale; that the home production elasticity with respect to market goods (β) is always greater than the elasticity with respect to time (γ_1 and γ_2); and that when *a* and *b* are not constrained to be 1, they are almost always less than 1—were also found by Graham and Green. They also play a significant role in the household production estimates because they mean that (1) market goods play a much larger role in the production of household commodities than time, and (2) time devoted to market activity to generate income is more productive than time used in the home producing household commodities directly. No doubt this reflects the ease with which goods and technology can easily substitute for time—especially in the modern home.

The importance of β in determining the value of household production means that X_z is the critical input. However, market goods within the home are a function of income, and so income differences across different household types will mostly drive differences in the value of household production. For example, gay households, on average, tend to have higher joint incomes and higher levels of education. This means these households generate lots of market goods, and given the higher value of β

25. A value of $\gamma < 0$ means that the home can have more by reducing the amount of time in home production. Hence, the time spent must be generating utility directly through the enjoyment of the housework.

for gay households, they use these market goods effectively in the home. Similarly for lesbian households, their high joint household income contributes to large values of household production. Thus, even though gay and lesbian households are "same-sex" and likely have reduced sexual division of labor gains (based on Table 2), the general elasticity differences in the key parameters will more than compensate for the inability to exploit sexual differences in spouses.

A. *The Value of Household Production*

The final step to estimate the value of household production requires a return to Equation (1). This equation provides the relationship between household production (Z), the parameters, and choice variables. Table 3 provides the parameter estimates for a, b, γ_1, γ_2, and β that can now be plugged into Equation (1). The value for hours H_1 and H_2 comes directly from the data, and Graham and Green provide a procedure to indirectly estimate the values of A, M_1, and M_2. This procedure involves taking a weighted average (the weights are based on the estimated coefficients) of the mean values of the variables that make up A, M_1, and M_2.[26] More problematic is X_z, the value of market goods used to produce household commodities. Since the census contains no variable comparable to X_z, I use a procedure similar to that used by Graham and Green and approximate X_z using the after-tax income levels of both spouses multiplied by the average fraction of after-tax income that is spent on household consumption by income quintiles. These fractions come from other Statistics Canada documents, and moving from the lowest to the highest quintiles, these fractions are 1.17, .907, .790, .694, and .538.[27] Thus, to calculate X_z, the total after-tax income of the household is multiplied by the relevant fraction.

Once all parameter and choice variable values are calculated, they are plugged back into Equation (1) to calculate the value of household production for a given couple. Following this procedure for every couple gives a distribution of household production values for each household class. The averages and standard errors of each class are reported in Table 4. Each value in the table is the average of the estimated value of household production (with its standard error in parentheses below) for a given household type and for a given set of restrictions on the production function. Considering only the heterosexual couples, the values in Table 4 (adjusting for inflation) are comparable to the values found by Graham and Green almost 30 years earlier.[28]

What can be said about the value of household production across the different sexual orientations? First, given the large standard errors, there is no statistical difference across the different household types, and perhaps this is the most important lesson. Given the role and wide dispersion of income across couples, and given the relative unimportance of time in household production, the gender combination of the couple is not important. Other factors dominate this effect. In particular, given the relative size of the β parameter to the γ's, the value of household production is driven mostly by the amount of X_z used, and this is determined by income. Since the income distribution *within* any class is enormous compared to the differences *across* a class, there is no statistical difference in Z across heterosexual, gay, or lesbian homes.

On the other hand, if we just consider the average of the estimated values of household production, some interesting features appear that may be worthy of speculation and further study. First, heterosexual households produce about the same

26. The human capital variables M_1 and M_2 are linear combinations of the Age and Education variables. If c_a and c_e are the coefficients from estimating Equation (3), then M_1 is $c_a/(c_a + c_e) \times \text{Age} + c_e/(c_a + c_e) \times \text{Education}$.

A similar procedure is followed for M_2. Similarly, the scale variable A is a linear combination of Family Size, the Value of Home, the Number of Rooms, and the Age of Youngest Child. The weights for this combination are again the coefficient of each variable from the estimation of Equation (2) divided by the sum of the coefficients on these four variables. This follows the procedure of Graham and Green (1984, p. 282).

27. See Statistics Canada, *Survey of Household Spending*, Table RY2007 C2FPY0032 IncomeQuintiles. To date there is no evidence to suggest different propensities to consume for the different couple-types. Although there may be a difference across the couple-types, a recent consumer report finds essentially no difference in average household consumption expenditures across heterosexual, gay, and lesbian homes. According to the consumer report, the higher household incomes for gays and lesbians is offset by "the fact that both lesbian and gay adults tend to reside in larger cities where the cost of living can be considerably higher" (Experian Information Solutions 2012, p. 8). Although slight, this may justify using the same income shares for the different household types to estimate X_z.

28. Dropping the two estimates by Graham and Green that make no sense (i.e., the household production value estimates equal to \$178 and \$1,636), and using the Canadian consumer price index for adjustment, the average Graham and Green estimate of household production value is \$41,917. This is well within the range of values found in Table 4 for heterosexual couples.

TABLE 4
Estimates of Household Production

Case 1	Case 2	Case 3A	Case 3B	Case 3C	Case 3D	Case 3E	Case 3F	Case 4
Heterosexuals with children								
Average over all cases: $48,080								
24,795	40,569	45,817	43,684	45,730	53,076	45,061	41,769	92,226
(22,234)	(36,897)	(41,814)	(39,323)	(41,657)	(48,025)	(40,503)	(52,751)	(85,570)
Heterosexuals without children								
Average over all cases: $48,064								
31,773	72,933	54,285	51,973	49,863	50,739	49,993	54,689	16,332
(21,803)	(57,103)	(38,789)	(36,764)	(38,847)	(36,826)	(39,110)	(39,680)	(11,352)
Gays with children								
Average over all cases: $79,256								
56,951	91,194	69,723	69,785	69,751	66,490	69,783	69,720	149,908
(69,644)	(110,972)	(84,674)	(86,551)	(85,669)	(78,080)	(86,500)	(84,551)	(177,774)
Gays without children								
Average over all cases: $24,712								
21,679	26,711	25,290	25,378	25,459	24,692	24,243	25,308	23,654
(18,287)	(24,444)	(22,039)	(21,817)	(21,958)	(21,554)	(22,138)	(22,073)	(19,977)
Lesbians with children								
Average over all cases: $36,997								
23,426	37,970	43,755	43,857	43,755	41,490	43,379	45,472	10,055
(8,703)	(13,630)	(15,668)	(16,248)	(15,649)	(14,901)	(16,073)	(22,651)	(3,996)
Lesbians without children								
Average over all cases: $53,033								
34,823	81,357	59,029	59,199	59,071	48,126	56,812	60,020	18,860
(13,762)	(35,443)	(22,599)	(22,833)	(22,580)	(19,085)	(24,889)	(25,185)	(8,156)

value of household production, with or without children, at around $48,000. Given this similarity, and the similarity between both types of heterosexual households in Table 2, it can be concluded that these two types of households are specializing in similar ways. This no doubt reflects the expectation of *future* children within all opposite-sex households, leading to similar levels of specialization, total income, spouse income differences, and spouse age differences. For example, from Table 1 there is a strong similarity in the age gap between opposite-sex couples with and without children: 2.69 versus 2.58 years—again, suggesting similar behavior regardless of children.

For both gay and lesbian households the presence of children makes a large difference, but in opposite ways. The average value of household production for gay couples with children is $79,256, but only $24,712 for couples without children. Indeed, gay households with children produce the largest value of household production.[29] Referring back to Table 1, this type of couple has the higher level of total income, and the largest spouse income difference. Hence gay couples with children have a large elasticity of home production with respect to market goods (income), and they have large levels of income. On the other hand, gay households without children produce the lowest values of household production, almost 1/3 of their "with child" counterparts. The difference in household production levels is driven mostly by the value of β for gays without children, which equals .99—identical to both types of lesbian couples. The large difference between the two types of gay households suggests that most gay households without children are not on the path to becoming parents.[30]

Finally, for lesbians with children the average value of household production is $36,997, but it is $53,033 when children are not present. Lesbian couples would appear similar to heterosexuals when there are no children, but have lower values of household production when children are present. Of all couple-types, lesbians are the most similar to each other. Their age and income differences are small, they are younger on

29. Allen and Lu (2013) investigate several behaviors (drug use, smoking, sexual behavior, and sorting) across different sexual orientations using the Canadian Community Health Survey, and they also find the presence of children in same-sex households makes an enormous difference in behavior, but not for opposite-sex households.

30. Allen and Lu (2013) find large differences in the way gay couples with children behave compared to gay couples without children, with respect to drug use, smoking, and sexual behavior. This difference is much smaller for heterosexual couples, with or without children.

average, and their incomes are similar to heterosexuals.[31]

VI. CONCLUSION

Estimating household production functions involves a number of (heroic) assumptions, and the specific levels estimated cannot be taken too literally. This caution has to be heeded even more so when the data limitations and conceptual difficulties of different sexual orientations are added to the mix. However, these problems are less of a concern when examining differences between different household types. Thus, conditional on the procedure, this article has made the first estimates of household production values for gay and lesbian households in comparison to heterosexual ones.[32] In terms of fundamentals, gays and lesbians would appear to behave differently than heterosexual couples. They are more similar in age and income, their hours of work in the household generally do not respond in similar ways to changes in the cost of time, and there would appear to be large differences between gay and lesbian households, with and without children.[33]

However, for all couple-types the input of market goods (driven by income) plays a much more important role in the household production function than the role of time, and human capital skills are much more valuable in the market than in the home. These effects swamp any differences that arise from a loss of sexual division of labor. Perhaps most important, given the wide dispersion of income within each type of sexual orientation, the variance in the estimates of the value of household production are so large that there is no statistical difference between the different types of sexual orientations. Thus, although the point estimates found here confirm other findings that orientations, these differences are swamped by variation within a household type.

31. As noted, within the census an individual self identifies as the "main provider," and for heterosexual couples this is almost always the male. Such a distinction may be irrelevant in a same-sex household, and the person self identified as the main provider may be arbitrary. The Graham and Green exercise was repeated, switching person 1 and person 2, with some interesting results. The average values of estimated household production across all the different cases becomes:

	Heterosexuals		Gays		Lesbians	
	With Children	Without Children	With Children	Without Children	With Children	Without Children
Average HP	$30,303	$43,893	$57,447	$24,875	$39,661	$52,582

Three things are noteworthy. First, the values of household production are all lower, reflecting the on average lower incomes of person 2 in the household. Second, the only household estimate that changes in a large way is heterosexual households with children. This reflects the sexual division of labor in opposite-sex homes. However, all of the household production values remain statistically insignificant from each other, and so the main conclusion remains: although there is evidence of differences in specialization across sexual

32. It would have been more sophisticated to estimate the parameters directly using a nonlinear estimator. However, such a procedure rests on the assumption that the specified model is correct, and most canned programs are very sensitive to missing data. Here the ordinary least squares (OLS) estimates likely provide a more robust method.

33. There are enough differences between gay and lesbian households to justify treating them in separate regressions. When they are combined, the following estimates of household production values (and standard errors) are obtained:

Case 1	Case 2	Case 3A	Case 3B	Case 3C	Case 3D	Case 3E	Case 3F	Case 4
Gays and lesbians with children								
Average over all cases: $44,193								
39,489	47,165	48,867	48,862	47,652	47,462	48,864	48,863	20,517
(21,345)	(25,228)	(26,118)	(26,528)	(26,869)	(25,406)	(26,196)	(26,560)	(10,972)
Gays and lesbians without children								
Average over all cases: $23,149								
19,714	25,087	22,628	23,532	22,601	22,423	22,622	22,601	27,141
(16,417)	(22,058)	(19,881)	(19,568)	(19,831)	(18,912)	(19,870)	(19,832)	(23,954)

The results, as might be expected, lie between the values found in Table 4 for gays and lesbians.

these three couple-types are likely different in their behavior and that Becker was right in terms of the sexual specialization of same-sex households, as a practical matter, sexual specialization in household production is dominated by the ability to generate income.

In almost every U.S. legal case dealing with same-sex marriage the issue of household production arises. Those in favor claim that marriage would encourage more household production. Those opposed claim that same-sex couples amount to roommates and that any gains to household production would be small. The results of this article would suggest that both are right to some extent. The gains from a sexual division of labor are smaller for same-sex couples, but this does not matter much for household production. In other words, the question of same-sex marriage should not rest on household production.

APPENDIX A

The Graham and Green model consists of the six equations. First is a household utility function that depends on consumption, C, and "effective" leisure M_iL_i:

$$U = U\left(C, M_1L_1, M_2L_2\right) \tag{A1}$$

C is the sum of goods purchased in the market X_m, and household commodities Z.

$$C = X_m + Z \tag{A2}$$

Equation (A2) is the critical "perfect substitute" assumption in the model, which implies that choice is a matter of opportunity costs alone, and that time in household production is independent of nonlabor income. The household commodities are produced according to a Cobb-Douglas function:

$$Z = A\left(M_1^aH_1\right)^{\gamma_1}\left(M_2^bH_2\right)^{\gamma_2}X_z^{\beta} \tag{A3}$$

where H_1 and H_2 are the time inputs of person 1 and 2. X_z are those purchased market goods that are used in household production. The household faces several constraints. First, a budget constraint:

$$X_m + X_z = W_1N_1 + W_2N_2 + \nu \tag{A4}$$

where W_1, W_2, N_1, N_2 are the respective wages and hours worked, and v is the amount of unearned income. Next there is a time constraint, where total time T is divided between work at home H, the market N, and a residual l:

$$l_i + H_i + N_i = T, \qquad i = 1, 2. \tag{A5}$$

Finally, Equation (A6) reflects the possibility of joint production within the household:

$$L_i - l_i + g\left(H_i\right), \qquad i = 1, 2. \tag{A6}$$

and where

$$g\left(H_i\right) = H_i - \left(1/T_i^{\delta}\right)\left(H_i^{1+\delta_i}/1 + \delta_i\right), \qquad i = 1, 2. \tag{A7}$$

Leisure L_i is the sum of the residual time, plus a fraction of the time spent doing housework. In the Graham and Green model the household maximizes Equation (A1) subject to the constraints in Equations (A2)–(A7).

APPENDIX B

TABLE B1
Definitions of Variables

Variable Name		Definition
Wage variable		
After-tax income	=	After-tax income as reported on income tax or self-reported
Human capital variables		
Age	=	Age in years
Education	=	1 if no high school diploma
	=	2 if only high school diploma
	=	3 if trades certificate
	=	4 if registered apprentice
	=	5 if college credit less than 1 year
	=	6 if college credit 1–2 years
	=	7 if college credit greater than 2 years
	=	8 if college diploma
	=	9 if earned Bachelor's degree
	=	10 if Bachelor plus college diploma
	=	11 if professional degree
	=	12 if earned Master's degree
	=	13 if earned PhD
Scale variables		
Family size	=	The number of people in the household
Value of home	=	Dollar value of occupied residence
Number of rooms	=	Number of all rooms in residence
Age youngest child	=	Age in years of youngest child

REFERENCES

Allen, D.W., and S.E. Lu. "Marriage and Children: Differences Across Sexual Orientations." Working Paper, Simon Fraser University, 2013.

Badgett, M. V. L. "Gender, Sexuality, and Sexual Orientation: All in the Feminist Family?" *Feminist Economics*, 1(1), 1995, 121–39.

———. *Money, Myths, and Change: The Economic Lives of Lesbians and Gay Men*. Chicago: University of Chicago Press, 2001.

Becker, G. A. *Treatise on the Family*. Cambridge, MA: Harvard University Press, 1981.

Biblarz, T., and E. Savci. "Lesbian, Gay, Bisexual, and Transgender Families." *Journal of Marriage and Family*, 72(3), 2010, 480–97.

Carrington, C. *No Place Like Home: Relationships and Family Life Among Lesbians and Gay Men*. Chicago: University of Chicago Press, 1999.

Experian Information Solutions. *The 2012 LGBT Report: Demographic Spotlight*. New York: Experian Simmons, 2012.

Fitzgerald, J., M. Swenson, and J. Hicks. "Valuation of Household Production at Market Prices and Estimation of Production Functions." *Review of Income and Wealth*, 42(2), 1996, 165–80.

Giddings, L. "But Who Mows the Lawn? The Division of Labor within Same-Sex Households," in *Women, Family, and Work: Writings on the Economics of Gender*, edited by K. Moe. Malden, MA: Blackwell Publishing Ltd., 2003.

Graham, J., and C. Green. "Estimating the Parameters of a Household Production Function with Joint Products." *Review of Economics and Statistics*, 1984, 277–83.

Gronau, R. "Home Production—A Forgotten Industry." *Review of Economics and Statistics*, 62, 1980, 408–16.

Jespen, L., and C. Jespen. "An Empirical Analysis of the Matching Patterns of Same-Sex and Opposite-Sex Couples." *Demography*, 39(3), 2002, 435–53.

Kooreman, P., and A. Kapteyn. "A Disaggregated Analysis of the Allocation of Time within the Household." *Journal of Political Economy*, 97(2), 1987, 223–49.

Kurdek, L. "The Allocation of Household Labor by Partners in Gay and Lesbian Couples." *Journal of Family Issues*, 28(1), 2007, 132–48.

Nock, S., and M. Brinig "Weak Men and Disorderly Women: Divorce and the Division of Labor," in *The Law and Economics of Marriage and Divorce*, edited by A. W. Dnes and B. Rowthorn. Cambridge: Cambridge University Press, 2002.

Oerton, S. "Reclaiming the 'Housewife'? Lesbians and Household Work," in *Living "Difference": Lesbian Perspectives on Work and Family Life*, edited by G. Dunne. Stroud, UK: Haworth Press, 1998.

Patterson, C., E. Stufin, and M. Fulcher. "Division of Labor Among Lesbians and Heterosexual Parenting Couples: Correlates of Specialized Versus Shared Patterns." *Journal of Adult Development*, 11(3), 2004, 179–89.

Pollak, R., and M. Wachter. "The Relevance of the Household Production Function and Its Implications for the Allocation of Time." *Journal of Political Economy*, 83, 1975, 255–77.

Rosenzweig, M., and P. Schultz. "Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight." *Journal of Political Economy*, 91, 1983, 723–46.

Suen, W., and H. K. Lui. "A Direct Test of the Efficient Marriage Market Hypothesis." *Economic Inquiry*, 37(1), 1999, 29–46.