Sibling Sex Composition and Cost of Children

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Abstract

This paper contributes to the debate over the usage of same-sex sibship as an identifying instrument. Angrist and Evans (1998) use the gender of the first two births, specifically same-sex sibship, as a natural instrument to estimate fertility effects on married women's labor supply decision. However, the usage of same-sex sibship as an identifying instrument implicitly assumes that child cost do no depend on the sibling sex composition. To test whether the saving potential from hand-me-downs is larger for families with children of the same gender and, therefore, enlarges economies of scale for these families, I estimate consumption-based equivalence scales for different household types. Using data from Switzerland and Mexico, I find no significant differences between the estimated equivalence scales of families with different sibling sex composition.

JEL Codes: D12, J12, J13, C14
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1 Introduction

The association between fertility and female labor supply has long been of interest to labor economists. However, the effect of family size on employment is hard to interpret: women with low earning potentials are more likely to have children than women with high earning potentials and a strong attachment to the labor market. On the other hand, women with many children are probably less likely to be in labor force. Angrist and Evans (1998) solve this endogeneity problem using the sibling sex composition of the first two children as a natural instrument for the effect of the birth of a third child on women's labor supply.[1] The instrument is motivated by the widely observed phenomenon of parental preferences for balance in the sex composition of children.[2] Since the gender of a new-born is virtually randomly assigned, a variable indicating whether the two first born children have the same sex provides a plausible instrument for a further child for mothers of two children. However, the usage of same-sex sibship as an identifying instrument implicitly assumes that child cost do no depend on the sibling sex composition. Rosenzweig and Wolpin (2000) argue that using same-sex sibship as a natural experiment imposes too strong restrictions on preferences and household technologies, i.e. having children of the same sex in the first two births does not affect the subsequent labor supply decision directly. It is therefore required that the sibling sex composition and leisure are strongly separable in the utility function and that child cost are not affected by sibling sex composition. However, if hand-me-downs differ by sibling sex composition and, therefore, affect the child cost, same-sex sibship might not be a valid identifying instrument. Rosenzweig and Wolpin examine this relationship and present empirical evidence using Indian data on household expenditures. They show that a family's expenses for clothing for the third child in the birth order are significantly lower for children which have same-sex older siblings. India, however, is well-known for strong parental preferences for boys while 'one of each' is the top choice of most parents in Western societies. Furthermore, Indian families have significantly more children and, therefore, the birth of the third child is not as important an event compared to families in Western societies. Hence, further analysis could be beneficial to answer the question whether sibling sex composition is a valid instrument.

If Rosenzweig and Wolpin's critique is valid, the saving potential due to room- and

[1] The same instrument is also used by Angrist, Lavy, and Schlosser (2009) as a natural instrument for the effect of the birth of a third child on the child-quantity/child-quality trade-off.

[2] Ben-Porath and Welch (1976) report that in the 1970 Census, 56 percent of families with either two girls or two boys had a third child. However, only 51 percent of families with one girl and one boy had a third child. Also more recent Census data suggest that mothers of two children of the same sex are more likely to have a third child than women with two children of each sex.

cloth-sharing should be greater for families with children of the same sex. This saving potential should also be reflected in enlarged economies of scale for families with same sex siblings compared to families with mixed sex siblings. I therefore estimate consumption-based equivalence scales to measure these economies of scale. To my knowledge, it is the first application of equivalence scales to study effects of sibling sex composition on family expenditures.

My contribution, in this paper, is to carefully document the differences in equivalence scales by sibling sex composition and thereby test whether the sibling sex composition has an effect on household economies of scale. Using data from Swiss and Mexican household surveys, I find that the size of the estimated equivalence scales do not vary between families with different sibling sex composition.

The remainder of the paper is organized as follows. The next section introduces the theoretical framework, presents the assumptions necessary to identify equivalence scales and gives a brief overview of the estimation strategy. The main characteristics of the data sources and the selected samples are reported in Section 3. Section 4 discusses the empirical results. The last section concludes.

2 Estimation of Shape-Invariant Equivalence Scales

Equivalence scales are an instrument for comparing the well-being between households of different sizes. They measure the expenditures of a family of a given size and demographic composition, relative to the expenditures of a reference family, when both families attain the same level of utility. Shared public goods such as living space or household heating expand the production and consumption opportunities of a multi-person household. Due to these economies of scale, a couple household, e.g., does not need twice the expenditure level of a single person to be equally well off, and therefore, a couple household has an equivalence scale between one and two. The more goods a couple can share, the closer the equivalence scale will be to one.

In general, equivalence scales are used for social evaluation as inequality and poverty analysis, to compute social benefit payments, life insurance, or alimony. Furthermore, equivalence scales are used to measure how much a child costs (see, e.g., Muellbauer, 1974; Browning, 1992; Pashardes, 1991; Lyssiotou, 1997). This approach is used here to test whether the sex composition of children has an effect on cost of children.

2.1 Consumer Demand

Consumption-based equivalence scales are built on a theoretical framework and date back to Engel (1895). Engel observed that richer households tend to spend a smaller share of their total budget on food than poorer households. He proposed therefore to use a household's share of food expenditure as a measure of a household's standard of living. The resulting Engel equivalence scale is defined as the ratio of incomes of two different sized households that have the same budget share for food. Similar to Engel scales, Rothbarth (1943) equivalence scales compare two households that differ only in their number of children. These equivalence scales are defined as the ratio of incomes of the two households when each household purchases the same quantity of so-called adult goods (alcohol, tobacco, or adult clothing). Barten (1964) constructed a different Engel type scale for every good people purchase. These Barten scales correspond to a different economies of scale measure for each good. Modern consumption-based equivalence scales are based on consumer theory and households' consumption behavior. Well-being is measured in terms of utility, using cost functions estimated from consumer demand.

Consider a household with a finite dimensional vector of observable characteristics $\mathbf{z}$ and total expenditures x that faces a $(1 \times m)$-vector $\mathbf{p}$ of prices of m different goods. Given a linear budget constraint, the household chooses the bundle of goods that maximizes its utility. The expenditure function is given by $x = C(\mathbf{p}, u, \mathbf{z})$ and defines the minimum expenditure required for a household with demographic characteristics $\mathbf{z}$ facing prices $\mathbf{p}$ to attain utility level u. The equivalence scale

$$D(\mathbf{p}, u, \mathbf{z}) = C(\mathbf{p}, u, \mathbf{z})/C(\mathbf{p}, u, \overline{\mathbf{z}}), \tag{1}$$

relates the expenditures of a household with characteristics $\mathbf{z}$ to a reference household with characteristics $\overline{\mathbf{z}}$. The functional form of $C(\cdot)$ is left unspecified.

Since the utility of a family cannot be observed directly, equivalence scales are difficult to estimate. Consumer demand data are often used to estimate expenditure functions via revealed preference theory. The revealed preference theory implies that demand data identify the shape and ranking of consumers' indifference curves over bundles of goods. Thus, one set of indifference curves for the reference household and another set for the non-reference household can be identified due to revealed preferences over goods. However, the actual level of well-being for each indifference curve cannot be identified. There is no way of observing which indifference curve of the non-reference household yields the same level of well-being as any given indifference curve of the reference household. Thus, the equivalence scale $D(\mathbf{p}, u, \mathbf{z})$ cannot be identified because it varies with the unobserved utility level u at which the comparison is made. Additional information or untestable restrictions on preferences over the two household types are therefore needed to identify equivalence scales. To solve this identification problem, Lewbel (1989) proposes 'base independence', i.e., the assumption that the equivalence scale function is independent from utility.[3] He shows that the expenditure functions must be related by

$$C(\mathbf{p}, u, \mathbf{z}) = C(\mathbf{p}, u, \overline{\mathbf{z}})\Delta(\mathbf{p}, \mathbf{z}), \tag{2}$$

if there exists a base independent equivalence scale function $\Delta(\mathbf{p}, \mathbf{z})$ which varies with price $\mathbf{p}$ and household characteristics $\mathbf{z}$, but is independent of u. That is, the equivalence scale is the same for all households with equal characteristics across all utility levels. In other words, the equivalence scale is independent of expenditures or, equivalently, utility. Furthermore, the special case where the equivalence scale is also independent of $\mathbf{p}$ yields Engel scales. Assuming that equivalence scales are base independent, Shephard's Lemma implies that $\omega(\mathbf{p}, u, \mathbf{z}) = \omega(\mathbf{p}, u, \overline{\mathbf{z}}) + n(\mathbf{p}, \mathbf{z})$, where is ω^j the fraction of total expenditures a household spends on the jth good and $n(\mathbf{p}, \mathbf{z}) = \nabla_{ln\mathbf{p}} ln\Delta(\mathbf{p}, \mathbf{z})$. Defining $x/\Delta(\mathbf{p}, \mathbf{z})$ as the equivalent expenditure, that is, the expenditure level needed to bring the utility of a reference household to the level of utility of a household with characteristics $\mathbf{z}$, this relation can be written as

$$\mathbf{w}(\mathbf{p}, x, \mathbf{z}) = \mathbf{w}(\mathbf{p}, x/\Delta(\mathbf{p}, \mathbf{z}), \overline{\mathbf{z}}) + n(\mathbf{p}, \mathbf{z}), \tag{3}$$

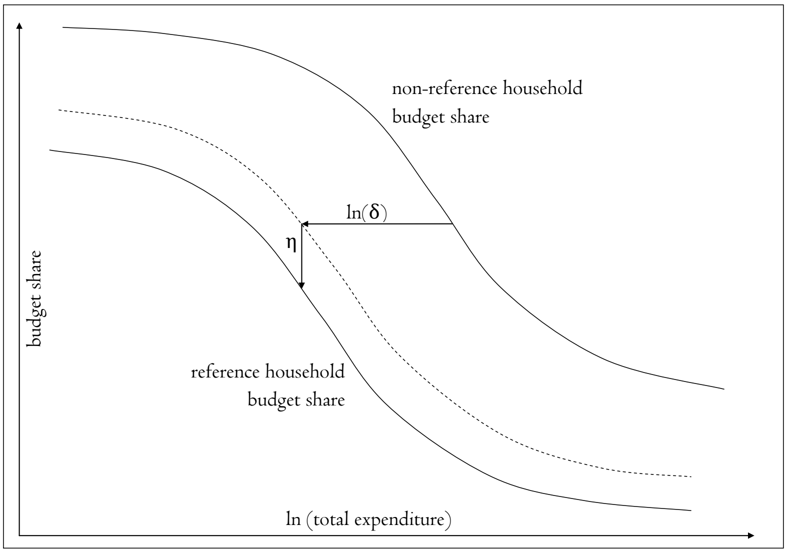
where $\mathbf{w}(\cdot)$ is the Marshallian budget share vector. Consequently, under base independence the Marshallian shares of a non-reference household are equal to the Marshallian shares of the reference household at the same equivalent expenditure plus the elasticity of the equivalence scale with respect to $\mathbf{p}$ (see also Lewbel and Pendakur, 2008). Consequently, the equivalent expenditure is proportional to household expenditure if base independence is satisfied.

Furthermore, equation (3) shows that under base independence the shape of the budget share function is the same for particular goods across household types. The relationship is visualized in Figure 1. Budget share functions of the reference and non-reference households must be related by a horizontal and a vertical shift. The basic idea of the estimation approach is, therefore, to derive the log of the equivalence scale δ by estimating the horizontal shift between the budget share functions for the reference and non-reference households. An estimate for the scale elasticity η is given by the vertical shift. Hence, this estimation approach is consistent with consumer theory, accounts for demographic decomposition and is nonlinear in log of total expenditure.[4]

[3]Blackorby and Donaldson's 1993 'equivalence-scale exactness' also considers the case where the equivalence scale function is independent of utility.

[4]To estimate unique equivalence scales under base independence using demand data, expenditure share equations must be nonlinear. Pendakur (1999) therefore proposes to estimate expenditure share equations using either log-quadratic or nonparametric regression.

Figure 1: Log of the equivalence scale and scale elasticity



2.2 Equivalence Scales

In empirical applications the base independence assumption was mostly rejected in fully parametric models (see, e.g., Blundell and Lewbel, 1991). The rejection of base independence in parametric models might either reflect the true dependence of the equivalence scale equation on expenditures, or is an artifact of restrictive parametric assumptions about the functional form of the demand system. To parametrically estimate Engel curves, a functional form of the estimation equations must be specified in advance, directly or indirectly, through the specification of the analytical formula of the utility or cost functions. Thus, an erroneous specification of the underlying microeconomic model could have serious consequences for the results. To avoid specifying functional forms, Gozalo (1997) introduces a nonparametric model of equivalence scales. He describes a system of Engel curves where both the equivalence share equations and the equivalence scale function are treated as completely nonparametric. Pendakur (1999) uses a semi-parametric method: First, he estimates household Engel curves nonparametrically. The equivalence scale is then estimated as a parameter in each expenditure share equation. The resulting equivalence scale is comparable to parametric estimates and allows to test whether household preferences satisfy shape invariance.[5]

However, when estimating equivalence scales under base independence in single equa-

[5]Shape invariance is a necessary but not sufficient condition for base independence (see Pendakur, 1999).

tions, one important implication of base independence is not considered. Base independence implies that the horizontal shift parameter must be the same for all commodities. Therefore, Blundell, Duncan, and Pendakur (1998) extend the approach to a system of expenditure share equations - the so-called extended partially linear model. This framework is a preference-consistent method and a flexible semiparametic approach for pooling nonparametric Engel curves for different commodities.

This paper applies a modified version of the extended partially linear model. The following section provides a short overview of the estimation strategy. For notational simplicity, I restrict the focus on expenditure share equations for a single good without price variation. I consider two types of households, the reference household a and non-reference household b. The share of a single good purchased by the household $y = f(x)$ is specified as a function of the log of total expenditure x. Under base independence, the Engel curves of household type a and b are linked by

$$f_b(x_b) - \eta = f_a(x_b - \delta), \tag{4}$$

where $f_z(x_z)$ is the share of a single good purchased by household type $z = a, b$, δ is the log of the equivalence scale and η is the elasticity of the equivalence scale with respect to the price of the single good. The system satisfies base independence if δ and η do not depend on x. Considering a base independent system of Engel curves with given prices, both δ and η are constants. While the shape of the function f_z for $z = a, b$ may differ for each good, the horizontal shift parameter δ is constant for all goods. The exponential transformation of the horizontal shift, i.e. $\exp(\delta)$, is the equivalence scale. The model imposes rather weak restrictions on the Engel curves and it allows for a brought class of functional forms in the empirical analysis.

The basic idea of the estimation approach is to find the log of the equivalence scale δ that is able to most nearly fit the estimated nonparametric expenditure share equations of two different types of households. The loss function proposed by Sun, Stengos, and Wang (2006) serves as a measurement of the distance between the nonparametric reference and non-reference Engel curves.[6] The equivalence scale δ is then parametrically estimated by minimizing the parameter value of this loss function. The search algorithm is a simple gridsearch across a wide span of values for δ.

[6]The loss function applied by Pendakur (1999) has some weaknesses: it only uses information from the non-reference type of households and leaves half of the information unexploited. On the other hand, problems might arise because nonparametric kernel methods cannot produce sensible estimates for the sample tails. The loss function proposed by Sun, Stengos, and Wang (2006) relies on all observations from both household types and includes a penalty term that accounts for the degree the two sample sets overlap. The larger the range the two sets overlap, the smaller the penalty value.

3 Data

To estimate expenditure share equations for different commodity groups and different household types, I work with data from two countries: Switzerland and Mexico. Where the specific choice of countries is conditioned by data availability, I want to look at countries with different development status. Since incomes, prices, and preferences might differ across countries, there is no reason to expect identical results. Therefore, it is important to test whether families' saving potential depends on sibling sex composition in richer and poorer economies. While Switzerland is among the richest economies worldwide in terms of GDP per capita, Mexico is considered an emerging market economy.

First, I use the Swiss Household Budget Survey[7] 2000-2005. The Household Budget Survey is a nation-wide survey that contains information on household earnings and consumption patterns. About 3000 households take part each year. Second, I use the Mexican Family Life Survey 2002 and 2005. The survey is a multi-thematic database which collects a wide range of information on socioeconomic indicators. The survey has a national representation and the approximate sampling size is 8,440 households in 150 communities throughout the Mexican Republic.

Since the analysis focuses on families with children, all households with a household head younger than 20 or older than 60 years are excluded. Furthermore, the sample is limited to households with two adults and either one, two or three children younger than 16 years. Spacing of children is an important factor for hand-me-downs and shared rooms. The analysis therefore focuses only on families with children that are born no more than five years apart. The Swiss data sample also abstracts from families with a household head that is still in education, already retired or unemployed. Moreover, trimming 5% from each tail of the expenditure distribution[8] reduces the data sample to 4115 observation for Switzerland and to 2499 observation for Mexico, respectively. There is no price variation.[9]

The observations are segmented into five different demographic groups. The household types are (i) couples with one child, (ii) couples with either two boys or two girls,

[7]The Swiss Household Budget Survey was previously called Household Expenditure Survey.

[8]There are two reasons why the extreme parts of the sample are omitted. Firstly, there is evidence that individuals at upper and lower end of the distribution behave quite differently from the rest (see Donaldson and Pendakur, 2004). Secondly, at the extremes, individuals tend to misrepresent their incomes and expenditures, something that introduces measurement error problems. Hence, it is customary to trim these parts out of the sample (see Yatchew, Sun, and Deri, 2003).

[9]Prices do not uniquely determine the form of the equivalence scales. Since the elasticity of the equivalence scale will be estimated directly, the elasticity will be calculated at a single point. Therefore, the dependence of equivalence scales and elasticities on prices is henceforward neglected.

(iii) couples with one boy and one girl, (iv) couples with either three boys or three girls, and (v) couples with either two boys and one girl or two girls and one boy.

Since the collected expenditure categories vary across countries, the application includes eight broad commodity groups that contain similar expenses for Switzerland and Mexico: food purchased in stores, food in restaurants, entertainment, transport and communication, housing, household operations, adult's clothing, and children's clothing.[10] The total expenditures, however, are based on total expenses on regular means of subsistence. The analysis in this paper is restricted to non-durables because purchases of major durable goods are infrequent. For example, households do not usually buy a car each month, but many households enjoy the services of a car. That is, consumption of durable goods occurs over a long period of time, while the expenditure on the item generally does not. This divergence between enjoyment of the good and expenditure on the good complicate the analysis of durables. All payments for durables, e.g. expenses for car or furniture purchases, are therefore subtracted from the expenditures in the corresponding commodity group.

Table 1 and Table 2 report summary statistics for the five household types considered in this paper. The average and the median household expenditures increase with the number of children in both countries. Swiss families spend approximately one third of the total expenditures on housing and a fifth on food purchased form stores. The largest budget shares for Mexican families are the commodities food purchased from stores as well as transport and communication.

4 Empirical Results

Equivalence scales are known as the ratio of total expenditures needed to equate budget shares across households at given prices. That is, a large household with a high income is as well off as a smaller household with lower income if both households demand equal budget shares for different commodities. If household economies of scale of families with different sibling sex composition are identical, the demanded share of different commodities, e.g. children's clothing, should be the same. However, if hand-me-downs increase a family's saving potential, this equality is no longer true.

To measure the extent to which household expenditures can be shared depending on sibling sex composition, I estimate semiparametric equivalence scales across household

[10]Approximately two thirds of the households in Mexico do not report housing cost because the household owns the house and the property is fully paid. Consequently, a further child does not cause any further housing cost and equivalence scales for housing cannot be identified. Therefore, the estimated equivalence scales for Mexico do not include housing expenditures.

Table 1: Descriptive Statistics, Switzerland

	Couple with one child	Couple with two children (same sex)	Couple with two children (mixed sex)	Couple with three children (same sex)	Couple with three children (mixed sex)
Number of observations	1305	1071	1087	190	462
Average consumption (CHF)	4865.9	5076.5	5041.5	5445.7	5349.6
	(1439.4)	(1476.9)	(1420.7)	(1947.4)	(1576.0)
Median consumption (CHF)	4471.5	4608.8	4626.0	5007.1	5001.4
Average shares:					
Food purchased from stores	0.167	0.188	0.188	0.213	0.209
	(0.062)	(0.061)	(0.064)	(0.066)	(0.068)
Food in restaurants	0.075	0.071	0.075	0.066	0.067
	(0.049)	(0.047)	(0.050)	(0.042)	(0.046)
Entertainment	0.109	0.124	0.119	0.126	0.134
	(0.079)	(0.086)	(0.078)	(0.072)	(0.088)
Transport and Communication	0.137	0.121	0.130	0.122	0.120
	(0.081)	(0.069)	(0.076)	(0.075)	(0.067)
Housing	0.337	0.334	0.331	0.330	0.315
	(0.106)	(0.106)	(0.102)	(0.102)	(0.104)
Household operations	0.052	0.051	0.051	0.051	0.057
	(0.063)	(0.061)	(0.063)	(0.038)	(0.062)
Adult's clothing	0.037	0.035	0.034	0.027	0.030
	(0.046)	(0.038)	(0.038)	(0.028)	(0.035)
Children's clothing	0.015	0.024	0.023	0.024	0.028
	(0.019)	(0.026)	(0.024)	(0.028)	(0.031)

Notes: Standard errors are reported in parentheses.

Table 2: Descriptive Statistics, Mexico

	Couple with one child	Couple with two children (same sex)	Couple with two children (mixed sex)	Couple with three children (same sex)	Couple with three children (mixed sex)
Number of observations	725	433	493	205	643
Average consumption (MXN)	4170.1	5312.2	5174.7	6405.5	5932.8
	(1992.1)	(2496.6)	(2581.0)	(3115.2)	(2982.0)
Median consumption (MXN)	3746.2	4709.1	4491.2	5281.1	4963.3
Average shares:					
Food purchased from stores	0.397	0.367	0.369	0.352	0.379
	(0.182)	(0.159)	(0.162)	(0.155)	(0.164)
Food in restaurants	0.041	0.034	0.037	0.030	0.039
	(0.079)	(0.063)	(0.068)	(0.055)	(0.079)
Entertainment	0.011	0.007	0.010	0.010	0.007
	(0.041)	(0.021)	(0.040)	(0.029)	(0.029)
Transport and Communication	0.143	0.164	0.151	0.154	0.162
	(0.133)	(0.130)	(0.135)	(0.128)	(0.134)
Household operations	0.077	0.078	0.069	0.084	0.080
	(0.069)	(0.074)	(0.065)	(0.109)	(0.069)
Adult's clothing	0.039	0.039	0.038	0.035	0.035
	(0.048)	(0.048)	(0.047)	(0.044)	(0.046)
Children's clothing	0.020	0.028	0.030	0.023	0.029
	(0.028)	(0.030)	(0.032)	(0.028)	(0.035)

Notes: Standard errors are reported in parentheses.

types. The estimation is structured in two steps: first, I estimate unrestricted nonparametric Engel curves using Kernel regressions for the Gaussian kernel and the least square cross-validation method to compute the bandwidth.[11] In a second step, I use a simple gridsearch to minimize the value of a common loss function for all commodity groups and search for a common shift parameter δ. The common loss function is a weighted sum of the integrated loss of all commodity groups which measures the distance between the nonparametric reference and non-reference Engel curve. The scale elasticity η differs for each commodity group. If base independence is satisfied and the size of the equivalence scale is the same across all equations, this method yields a consistent estimator of the true parameters (see Pinkse and Robinson, 1995).

So far, the possibility of exogenous differences in cost by children's sex was neglected. However, the identification of the effects of the sibling sex composition from sex effects on child cost might be a key issue here. Therefore, I first look at the relationship between a child's sex and expenditures on children's clothing for first born children to separate general sex-specific cost effects from effects of the sibling sex composition. The potential savings due to hand-me-downs are irrelevant for first births. The effect of the sex of the first born child on child cost reflects either differences in preferences or income effects. Table 3 reports estimates of the equivalence scale for the comparison between childless couples and couples with either a boy or a girl. There are no significant differences in the estimated equivalence scales between families who have a girl first compared to families whose first child is a boy. Hence, there is no evidence that child cost differ exogenously by gender. Based on these results, possible differences in expenditures between families with boys and families with girls are henceforward neglected.

Estimates for the equivalence scale for each pairwise comparison between the before specified household types are presented in Table 4. Equivalence scales are estimated using couples with one child as the reference household.[12] In Switzerland, the estimated equivalence scale is 1.09 for families with either two boys or two girls and 1.12 for families with one child of each sex.[13] Hence, the total expenditures of a couple household with one child have to be multiplied by 1.09 that a couple household with two children of the

[11]All nonparametric regressions are computed using the np package for nonparametric econometrics for the software R developed by Hayfield and Racine (2008).

[12]The confidence intervals are computed using a bootstrap that draws 1000 random samples with replacement and estimating the Engel curves and equivalence scales for each sample drawn.

[13]Browning and Meghir (1991) emphasize that estimates of the effect of young children on household demand might be biased if labor supply is not taken into account. To consider for the effect of female labor supply, I also estimate equivalence scales that distinguish between households with one and with two working adults. The estimated values differ slightly, but the estimates are not significantly different. Therefore, the distinction between families with one or two working adults is henceforward neglected.

Table 3: Equivalence Scale Estimates - Reference Household: Couple without Children

Switzerland			
Non-reference household	Log equivalence scale	Confidence interval	Equivalence scale
Couple with a boy	0.21	[0.16; 0.26]	1.23
Couple with a girl	0.19	[0.15; 0.23]	1.21

Mexico			
Non-reference household	Log equivalence scale	Confidence interval	Equivalence scale
Couple with a boy	0.16	[0.11 ; 0.21]	1.17
Couple with a girl	0.17	[0.10; 0.24]	1.19

same sex can attain the same level of utility. If the non-reference household is a couple with one child of each sex, the factor is 1.12. This suggests that the marginal cost of a second child of the same gender are 9 percent of the cost of family with one child, the marginal cost of a second child of a different gender are 12 percent. Although the estimated equivalence scales for families with a mixed sibling sex composition are slightly higher, the difference between the estimated equivalence scales for families with mixed and same-sex sibship are not significant. Comparing families with one child and families with three children, the estimated equivalence is 1.15 for families with either three boys or three girls and 1.20 for three-children-families with a mixed sibling sex composition. Again, the difference between the estimated equivalence scales for the different family types is not significant. Adding a second child to the family is more expensive than adding a third child. The parameters reflect the economies of scale within families and outline the extent to which the marginal cost of children declines with the number of children.

The estimates for Mexico are a little higher. Relative to a couple with one child, a couple with two children of the same sex has an estimated equivalence scale of 1.12. That is, a couple with two children of the same sex must spend 1.12 times more than couple with one child to be as well-off. This suggests that the marginal cost of the second child with the same sex is 12 percent of the cost of a couple with one child. The estimated equivalence scales for the comparison of couples with one child and couples with two children of different sex is 1.15. That is, the marginal cost of the second child with a different sex is 15 percent of the cost of the couple with one child. The equivalence scales for the comparison of families with one child and families with three children are 1.16 for families with children of the same sex and 1.17 for families with a mixed

Table 4: Equivalence Scale Estimates - Reference Household: Couple with one Child

Switzerland

Non-reference household	Log equivalence scale	Confidence interval	Equivalence scale
Couple with two children (same sex)	0.09	[0.01; 0.17]	1.09
Couple with two children (mixed sex)	0.11	[0.04; 0.18]	1.12
Couple with three children (same sex)	0.14	[0.03; 0.25]	1.15
Couple with three children (mixed sex)	0.18	[0.11; 0.25]	1.20

Mexico

Non-reference household	Log equivalence scale	Confidence interval	Equivalence scale
Couple with two children (same sex)	0.11	[0.04; 0.18]	1.12
Couple with two children (mixed sex)	0.14	[0.05; 0.23]	1.15
Couple with three children (same sex)	0.15	[0.02; 0.28]	1.16
Couple with three children (mixed sex)	0.16	[0.07; 0.25]	1.17

sibling sex composition. However, all estimated equivalence scales for families with a mixed sibling sex composition and families with same-sex sibship are not significantly different.[14] Hence, gender specific hand-me-downs increase a family's saving potential, but this increase is not significant. Therefore, there is only little evidence that household economies of scale crucially differs with sibling sex composition.

5 Conclusion

The objective of this paper is to test whether families save money when they have children of the same gender opposed to only boys or girls. If room-sharing and hand-me-downs enlarge the extent to which household expenditures can be shared in families

[14]To analyze whether equivalence scales for single commodity groups differ crucially with sibling sex composition, I also use Pendakur's 1999 semiparametric estimation approach to compute equivalence for child-specific goods. Comparing the equivalence scales for families with a mixed sibling sex composition and families with same-sex sibship, I find significant differences for the commodity children's clothing. There is some saving potential due to handed-down clothing for families with either only boys or only girls. Since children's clothing has a very small expenditure share, these differences are not reflected in the estimation of the extended partially linear model.

with children of the same sex, household scale economies for this type of families should be grater. To measure this effect, I compute consumption-based equivalence scales using the extended partially linear model.

I find rather small differences between equivalence scales for families with a mixed sibling sex composition and families with children of the same sex. The saving potential due to cloth- and room-sharing does not cause crucial differences in the household economies of scale of families with different sibling sex composition. Therefore, this paper does not provide evidence that the instrumental variable estimates of the effect of fertility on labor supply based on the measures of same-sex sibship, as used in Angrist and Evans (1998), are altered through hand-me-downs in the Swiss or Mexican context. Since Angrist and Evans base their empirical work on data from the United States, it is not possible to apply the evidence presented in this paper directly to their context. Another limitation of the analysis is that restrictions on preferences that have to be imposed using same-sex sibship as a natural experiment cannot be tested in this framework. Furthermore, the estimation method applied in this study ignores intra-household bargaining and within-family distribution of resources. Lise and Seitz (2010) show that there is non-negligible inequality within households and that ignoring consumption inequality within families yields biased estimates for equivalence scales. Therefore, it is left for future research to investigate how families' saving potential depending on sibling sex composition is affected by intra-household bargaining.

References

Angrist, J., V. Lavy, and A. Schlosser (2009): "Multiple Experiments for the Causal Link between the Quantity and Quality of Children," Discussion paper.

Angrist, J. D., and W. N. Evans (1998): "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size," *American Economic Review*, 88(3), 450–77.

Barten, A. P. (1964): "Family Composition, Prices, and Expenditure Patterns," in *Econometric Analysis for National Economic Planning: 16th Symposium of the Colston Society*, ed. by P. Hart, L. Mills, and J. K. Whitaker. Butterworth, London.

Ben-Porath, Y., and F. Welch (1976): "Do Sex Preferences Really Matter?," *The Quarterly Journal of Economics*, 90(2), 285–307.

Blackorby, C., and D. Donaldson (1993): "Adult-Equivalence Scales and the Economic Implementation of Interpersonal Comparisons of Well-Being," *Social Choice and Welfare*, 10(4).

Blundell, R., A. Duncan, and K. Pendakur (1998): "Semiparametric estimation and consumer demand," *Journal of Applied Econometrics*, 13(5), 435–461.

Blundell, R., and A. Lewbel (1991): "The Information Content of Equivalence Scales," *Journal of Econometrics*, 50, 49–68.

Browning, M. (1992): "Children and Household Economic Behavior," *Journal of Economic Literature*, 30(3), 1434–75.

Browning, M., and C. Meghir (1991): "The Effects of Male and Female Labor Supply on Commodity Demands," *Econometrica*, 59(4), 925–51.

Donaldson, D., and K. Pendakur (2004): "Equivalent-expenditure functions and expenditure-dependent equivalence scales," *Journal of Public Economics*, 88(1-2), 175–208.

Engel, E. (1895): "Die Lebenskosten Belgischer Arbeiter-Familien Früher und Jetzt," *International Statistical Institute Bulletin*, 9, pp. 1–74.

Gozalo, P. L. (1997): "Nonparametric bootstrap analysis with applications to demographic effects in demand functions," *Journal of Econometrics*, 81(2), 357–393.

Hayfield, T., and J. S. Racine (2008): "Nonparametric Econometrics: The np Package," *Journal of Statistical Software*, 27(5).

Lewbel, A. (1989): "Household equivalence scales and welfare comparisons," *Journal of Public Economics*, 39(3), 377–391.

Lewbel, A., and K. Pendakur (2008): "Equivalence Scales," in *The New Palgrave Dictionary of Economics*, ed. by S. N. Durlauf, and L. E. Blume. Palgrave Macmillan, Basingstoke.

Lise, J., and S. Seitz (2010): "Consumption Inequality and Intra-Household Allocations," *The Review of Economic Studies*.

Lyssiotou, P. (1997): "Comparison of Alternative Tax and Transfer Treatment of Children Using Adult Equivalence Scales," *Review of Income and Wealth*, 43(1), 105–17.

Muellbauer, J. (1974): "Household composition, Engel curves and welfare comparisons between households : A duality approach," *European Economic Review*, 5(2), 103–122.

Pashardes, P. (1991): "Contemporaneous and intertemporal child costs : Equivalent expenditure vs. equivalent income scales," *Journal of Public Economics*, 45(2), 191–213.

Pendakur, K. (1999): "Semiparametric estimates and tests of base-independent equivalence scales," *Journal of Econometrics*, 88(1), 1–40.

Pinkse, C., and P. Robinson (1995): "Pooling Nonparametirc Estimates of Regression Functions with Similar Data," in *Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C.R. Rao*, ed. by G. S. Maddala, T. N., and P. Phillips, pp. 172–195. Wiley-Blackwell.

Rosenzweig, M. R., and K. I. Wolpin (2000): "Natural "Natural Experiments" in Economics," *Journal of Economic Literature*, 38(4), 827–874.

Rothbarth, E. (1943): "Note on a Method of Determining Equivalent Income for Families of Different Composition," in *War-time Pattern of Saving and Spending*, ed. by C. Madge, vol. Appendix 4, pp. 123–130. Cambridge University press, Cambridge.

Sun, Y., T. Stengos, and D. Wang (2006): "Estimates of semiparametric equivalence scales," *Journal of Applied Econometrics*, 21(5), 629–639.

Yatchew, A., Y. Sun, and C. Deri (2003): "Efficient Estimation of Semiparametric Equivalence Scales with Evidence from South Africa," *Journal of Business & Economic Statistics*, 21(2), 247–57.