

**Carleton College Department of Economics  
Working Paper Series**

*Do Credit Constraints Explain Family Size Effects?  
Tests Based on Bequest Receipt and Family Earnings*

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**No. 2005-07**

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**November 2005**

Thanks to Lars Lefgren, Mark Kanazawa, Jenny Wahl, members of the University of Minnesota Applied Economics department, and members of the Iowa State economics department for helpful comments on this paper. Portions of this research were completed with funding assistance from Carleton College. The author is responsible for any remaining errors. This paper represents the views of the author and does not necessarily reflect the opinion of Carleton College.

## Abstract

The dominant economic model of fertility predicts a negative relationship between family size and child achievement. In the model, scarce parental resources create this “quality-quantity trade-off”. Many understand the resource constraint in financial terms, interpreting family size effects evidence of credit constraints. This paper tests this hypothesis using two signals of credit market access: bequest receipt and parental earnings. Contrary to the credit constraints hypothesis, those receiving large bequests exhibit large family size effects while those not receiving bequests show no effect at all. Also contrary to the credit constraint hypothesis, the quality-quantity trade-off is independent of parental earnings.

## I. Introduction

Economic models of intergenerational human capital investment demonstrate the potential importance of credit market failure in determining child achievement (for example, Becker and Lewis 1973, Willis 1973, Becker and Tomes 1986, and Becker and Barro 1988). In models of fertility, credit constraints may explain the negative effect of family size on child achievement or the “quality-quantity trade-off”. Without the ability to borrow against future child earnings, additional children raise the cost of providing a given level of child quality; alternatively, the greater the level of child quality, the higher the cost of having an additional child.<sup>1</sup>

While the theory makes a compelling case for the potential importance of credit market failure, the practical importance of credit access in modern economies remains an empirical question. Free government provision of primary and secondary education and significant loan subsidies for post-secondary study may mitigate credit limitations on educational attainment.<sup>2</sup> On the other hand, some contend that the structure of these programs is regressive, undermining their potential to ease credit market failure. (Hansen and Weisbrod 1969 represents the seminal contribution to this argument.)

Early empirical studies of family size effects found large negative effects, consistent with significant credit market failure. (Kessler 1991 includes a brief survey of

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<sup>1</sup> The economic models of Becker and Lewis (1973) and Willis (1973) emphasize the way in which rational choice theory magnifies the effects of the tighter budget. (The interaction between number and quality of children in the budget constraint means that the opportunity cost of quality is positively related to fertility and vice versa.) However, Zajonc’s (1976) paper shows that the interaction of quality and quantity can produce negative family size effects even under non-rational choice.

<sup>2</sup> The credit constraints studied in this paper are intergenerational in nature and limit parents’ ability to borrow against the child’s future earnings in order to make human capital investments. It is possible to envision an environment in which policy has effectively addressed this form of credit market failure and yet other credit constraints limit borrowing (inter- or intra-generationally) for consumption or other purposes. Lochner and Monge-Naranjo (2004) provide evidence that this distinction may be of practical importance.

this literature.) However, Kessler points out that this early literature often ignored the possible effects of birth order. Because birth order is inherently correlated with family size, this omitted variable might account for observed family size effects if first- or early-born children are advantaged due to preferential parental investments or innate advantages. (See Behrman and Taubman 1986 for a discussion of biological, psychological, and economic reasons for such birth order effects.)

Studies which include both family size and birth order controls offer conflicting results.<sup>3</sup> Using data from the National Longitudinal Survey of Youth, Kessler (1991) finds that neither birth order nor family size affect the level or growth rate of wages. He does find a family size effect in the hours worked by women, though the direction of the effect depends on age. Black et al. (2005) and Grawe (2005a) find significant family size effects with ordinary least squares even with birth order controls. However, both studies report that these results disappear when family size is instrumented with twinning and religious denomination respectively. Taken at face value, the absence of family size effects in these studies suggests either that family size is not correlated with credit market access or that expansions of public education funding have eliminated credit constraints. But clearly these results are only suggestive at best.

This paper approaches the role of credit constraints in the effects of family size more directly than existing works. The following section briefly reviews the standard economic model of the quality-quantity trade-off, highlighting the role of credit access.

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<sup>3</sup> Kessler (1991) distinguishes between birth order and relative birth order. The former captures the number of siblings born before an individual while the latter notes the position of the child within the family. For instance, the third of three children and the third of five children both have a birth order of three. However, the third of three children is a last child while the third of five is a middle child. The studies cited below all control for birth order, but only some control for relative birth order. Blake (1989) finds no significant effects of being first- or last-born, suggesting that the omission of relative birth order does not significantly bias results.

The model suggests two signals of credit market access: bequest receipt and high parental earnings. Section III describes how this observation is applied to data from the Panel Study of Income Dynamics to evaluate the role of credit constraints in producing family size effects in the United States. The results presented in section IV do not support the credit constraint hypothesis. While a family size effect is present in US earnings data, the effect is only present among those receiving sizable bequests and is unrelated to parent earnings. The final section concludes.

## II. Brief Theory Synopsis

The model of child investment proposed by Becker and Lewis (1973) and Willis (1973) emphasizes the role of the credit constraint in creating a quality-quantity trade-off. In the simplest version of the model parents seek to maximize utility which is a function of their own consumption  $C_p$ , per capita consumption of their children  $C_c$ , and fertility  $n$ :  $U(C_p, C_c, n)$ . The parent indirectly chooses child's consumption through allocations to either financial or human capital investments, represented by  $x$  and  $h$  respectively. For each dollar the parent bequests to a child, the child's adult consumption is increased by  $(1+r)$  where  $r$  is the intergenerational interest rate. And for each dollar invested in human capital, the child's consumption rises by  $\delta w/\delta h$  where  $w$  is the wage income of the child which is a function of both human capital  $h$  and market ability. The (privately) efficient level of human capital equates the returns to these alternative investments:  $1+r = \delta w/\delta h$ .

Whether this efficient level of investment is realized depends on the functioning of credit markets. The parent maximizes utility subject to available resources which include parent wealth  $X_p$ , parent earned income  $W_p$ , and (possibly) the future earned

income of children. In the case of identically able children, the budget constraint can be written

$$C_p + nh + nx \leq X_p + W_p. \quad (1)$$

The completeness of credit markets can be seen by examining limitations on child bequests. When credit markets are perfect parents are able to leave negative bequests, borrowing against their children's future earnings.<sup>4</sup> In this case, the human capital purchased for each child will be a function of that child's market ability alone regardless of family size because the costs of educating an additional sibling can be paid for out of that sibling's future earnings.

If creditors have a difficult time recovering loans made against human collateral, credit markets may not permit parents to borrow against their children's future earnings. In this case financial bequests must be non-negative  $x \geq 0$ . In families for whom this constraint binds, additional investments in human capital require parents to forgo own consumption which has a cost greater than  $1+r$ . Facing a higher opportunity cost of human capital, these families reduce the level of human capital investment relative to families whose parental resources are large enough to self-finance these investments. Becker and Lewis (1973) and Willis (1973) implicitly assume binding credit constraints, arguing that increases in the number of children produce higher prices for child quality.

While the absence or presence of a quality-quantity trade-off in the population as a whole may provide suggestive evidence of the role of credit constraints in creating that trade-off, the model suggests two much more direct approaches to the question. The first is based on inheritance receipt and follows the test used in Mulligan's (1997 and 1999)

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<sup>4</sup> Of course, even under perfect credit market access such negative bequests can be no greater than the present value of the children's future earnings.

study of intergenerational earnings mobility. Families facing a binding credit constraint experience returns to educational investment in excess of those to financial investment. As a result, theory predicts that constrained families will not leave financial bequests to their children. Of course, the uncertainties of life expectancy may lead some families to unintentionally leave small bequests, but large bequests would generally indicate ability to self-finance educational investments.<sup>5</sup> We can evaluate the importance of credit constraints in determining family size effects by testing for equality of the effect across children who do and do not receive bequests. If credit constraints are their cause, family size effects should only appear in the sample not receiving significant bequests.

The second test stems from Becker and Tomes' (1986) suggestion that families with high parental earnings are less likely to be constrained. It has been noted that the positive intergenerational correlation in market ability means that the likelihood of being credit constrained does not decrease monotonically in parent income. (See Corak and Heisz 1999, Grawe 2004, and Han and Mulligan 2001 for a more detailed discussion of this point.) However, it seems safe to assume that families at the very top of the parent earnings distribution do indeed have access to capital markets. If credit constraints produce the family size effect, then the quality-quantity trade-off should be weaker (or non-existent) among families with very high parent earnings.

### **III. Data**

The data for this study are drawn from the Panel Study of Income Dynamics (PSID). Children are matched to male household heads using the 1968-1973 waves of

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<sup>5</sup> When the market ability of children is not identical, credit constrained families may nevertheless leave bequests to some of their children—particularly those with low market ability—in an effort to mitigate consumption inequalities across children. However, given the significant correlation in abilities across siblings, it would seem unlikely that within family variation in ability is so large as to produce large intergenerational bequests.

the survey. Children must be born between 1951 and 1965 and no older than 18 years of age in the year they are matched to their father; the father must be no younger than 15 years old in the same year. Child achievement is measured by earnings reported in the 1997, 1999, and 2001 surveys.<sup>6</sup> For male children achievement is defined as average log earnings in years in which the subject is household head and reports earnings greater than \$200. (The reported results include only those who report positive earnings in all three years of observation, though the results are qualitatively similar when this sample selection rule is relaxed.) Because female labor force participation decisions likely create significant selection bias, achievement of female children is not based on own earnings. Rather, female child achievement is measured by the earnings of her male spouse.<sup>7</sup> In some cases, more than one child is matched to a given father. To account for the likely resulting earnings correlation across siblings as well as heteroskedasticity, robust standard errors are calculated assuming clustering by family.

Family size is measured by the number of children born to the subject's mother. (This may or may not reflect the number of children in the subject's household due to the blending of families and divorce. The PSID does not provide information on the total number of children associated with a particular household.) Birth order is defined as the order of birth within the mother's birth history. To mitigate the endogeneity of family size resulting from the response of fertility choices to market value of mother's time, all regressions control for mother's years of schooling. The age of the child at earnings observation and its square are included as controls.

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<sup>6</sup> All dollar figures are year 2000 dollars.

<sup>7</sup> The positive assortative marriage matching predicted by Becker (1973) suggests a strong similarity between the earnings of a daughter's husband and her brothers. Assortative matching is empirically confirmed in Atkinson et al. (1983) and Lam and Schoeni (1993) and (1994.)

As noted in the previous section, theory points to two useful indicators of credit access: receipt of a large inheritance and high parent earnings. Following Mulligan (1997 and 1999), a large bequest is defined as any gift greater than \$25,000. The PSID data do not report the source of an inheritance though it seems unlikely that many inheritances came from givers who would not have considered making an *intervivos* gift toward education. The PSID contains five observations of inheritance receipt: 1984, 1989, 1994, 1999, and 2001. Mulligan argues that a bequest early in life is an especially clear signal that an individual was not constrained at the time of post-secondary human capital investment. Given this, I use the 1984 and 1989 responses for those born between 1951 and 1955, the 1989 and 1994 responses for those born between 1956 and 1960, and the 1994 and 1999 responses for those born between 1961 and 1965. The top panel of Table 1 reports summary statistics for the samples using inheritance receipt to signal credit access.

[Table 1 goes here]

When father's earnings indicates credit access, one data restriction is added while another is relaxed. Father's earnings data are drawn from the 1968 PSID survey. To mitigate noise generated by extreme earnings variation in cases like unemployment, only observations of earnings greater than \$200 are included. (This restriction follows standard practice in the intergenerational mobility literature. See Solon 1992.) Earnings are coded as "high" if they lie in the top 20 percent of the father earnings distribution (more than \$59444 in year 2000 dollars). The added restriction on father's earnings is offset by the ability to relax the restriction on son's birth year. Because there is no need to match age with responses to inheritance questions the required birth year of sons can

be extended to include all years between 1950 and 1970. The bottom panel of Table 1 presents summary statistics for the samples using father's earnings to signal credit access.

Regressions are performed separately for men and women to allow for difference by sex. (Sex differences in family size effects are found throughout the literature. See Kessler 1991 and Butcher and Case 1994 for two examples from studies of the US.) In the base regression child average log earnings are regressed on family size, birth order and its square, mother's years of education, and the age of the child at earnings observation and its square. The test of credit market failure based on bequest receipt augments this base regression with two variables: a dummy for inheritance receipt and an interaction between this dummy and family size. Similarly, the test based on parental earnings includes a dummy for high father-earnings along an interaction between this dummy and family size.

#### **IV. Results**

Table 2 examines the family size effect and its connection to inheritance receipt. The first four columns report results for sons while the last four report findings for daughters. Column 1 of table 2 shows that in the absence of controls for birth order, mother's education, or bequest status, the addition of a sibling results in a five percent earnings loss among men. Inclusion of the mother's education control reduces the family size effect by more than half (column 2). And when birth order controls are additionally included (column 3) the effect of siblings is further reduced to a statistically insignificant one percent loss. (This point estimate is very similar to that found by Black et al. 2005 in Norway.)

[Table 2 goes here]

The failure to find a quality-quantity trade-off in the population as a whole does not necessarily mean that no trade-off exists. If the data in fact contain two groups—a credit constrained group with a negative family size effect and a second, unconstrained group with no effect—then the regression results in column 3 may be concealing an effect limited to a portion of the population. Column 4 explores this hypothesis, dividing the observations between those who have and have not received large inheritances. Contrary to the credit constraint hypothesis, men receiving large bequests experience substantial earnings losses with the addition of siblings while those reporting no or small inheritances show no negative family size effect.

The results for women are very similar except for the impact of birth order controls. In the absence of mother's education and birth order controls, each additional sibling results in a five percent (husband) earnings loss (column 5)—just as column 1 reports for men. When the control for mother's education is added (column 6) the family size effect is again significantly reduced to around three percent per sibling. However, when birth order controls are subsequently added (column 7), the family size effect for women actually increases; each additional sibling reduces earnings by seven percent.

When the sample is broken down based on inheritance receipt (column 8), the family size effect is evident among those who did not receive inheritances. But again the credit constraint hypothesis fails to find support; those who received bequests experienced an even larger family size effect (though the difference is not statistically significant). In total, the evidence from inheritance receipt does not support the credit constraint hypothesis.

The theory presented in Section II suggests that an alternative indicator for credit constraint susceptibility is parent earnings. Table 3 reports results from regressions analogous to those in Table 2 except that father's earnings now serve as the potential indicator for credit access. Again, the first four columns report results for sons while the last four columns present findings for daughters. For both sons and daughters, the first three specifications yield coefficients almost identical to those in Table 2. This similarity demonstrates that the slight differences in sample selection required for the two tests do not meaningfully alter the findings. Column 4 forms the basis of the test for the importance of credit constraints in creating the family size effect among sons. The evidence is not consistent with a meaningful role for credit constraints. When the data are divided into groups based on whether the father earns more than the 80<sup>th</sup> percentile father in the sample, the family size effect is actually more negative among high earning families (though the difference is statistically insignificant).

[Table 3 goes here]

Column 8 considers the same test using the sample of daughters. Once again the (husband) earnings loss associated with additional siblings is statistically no different in the sample of high earning families. As in the case of sons, to the extent the statistically insignificant point estimate is to be trusted, the sign contradicts the hypothesis that credit constraints produce the family size effect. These results are consistent with Grawe (2005b) which report no relationship between father income and family size effects in Britain.

To test the robustness of these results, the definition of "high" earnings was altered with the cutoff set at the top 15%, 10%, 5%, and 2.5% of father earnings. (The

earnings levels associated with these cutoffs are \$62126, \$71186, \$82835, and \$103544 respectively.) Among men, the results are unchanged in the first three specifications. In the 2.5% specification, the family size effect among high earning families is statistically larger—exactly opposite the pattern predicted if credit constraints explain the quality-quantity trade-off. Among women no change is found in the 15% and 10% specifications, but families with fathers in the top 2.5% and 5% of the earnings distribution do show a family size effect which is significantly smaller than lower earning families. While this conforms with the pattern predicted by the credit constraint interpretation of the family size effect, it requires that we assume that a) credit access is relevant to women, but not to men (which might be the case if parents devote greater resources to male children) and b) the level of earnings required to acquire access to capital is very high.

## **V. Conclusions**

This paper studies the connection between credit market access and the quality-quantity trade-off in fertility. Theory suggests that those who are credit constrained will experience a stronger loss when additional siblings are born into a family. Following other existing works, the paper uses inheritance receipt and high father earnings to proxy for credit market access. Neither approach produces results consistent with the hypothesis that credit constraints cause family size effects. Using PSID data, the paper finds the family size effect to be stronger among males who received a bequest. Among women, the impact of family size was also stronger among those receiving bequests, but the difference was not statistically significant. Similarly, among sons, no statistical differences were found by father's earnings class. Daughters in families with extremely

high earnings (top 5%) do show smaller family size effects, but no difference is found under more modest definitions of “high” father earnings (top 10 or 20%). These results do not broadly reject the economic model of fertility, however. It may simply be the case that non-financial resource constraints are relevant. For instance, Grawe (2005b) shows that family size effects which are uncorrelated with parent earnings can be explained by a parent time constraint.

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**Table 1: Summary Statistics**

	Bequest sample		Father earnings sample	
	Mean	Standard deviation	Mean	Standard deviation
<i>Sons</i>				
Log earnings	10.628	0.645	10.604	0.632
Family size	4.903	3.061	4.705	2.924
Birth order	3.103	2.450	3.012	2.341
Years of education, mother	11.350	2.477	11.455	2.402
Age	39.755	4.140	38.828	5.059
Bequest receipt (yes=1, no=0)	0.039	0.194	-	-
High father earnings (yes=1, no=0)	-	-	0.189	0.392
Sample size		565		660
<i>Daughters</i>				
Husband log earnings	10.697	0.583	10.674	0.571
Family size	4.760	2.766	4.705	2.789
Birth order	2.912	2.122	2.950	2.203
Years of education, mother	11.477	2.392	11.472	2.416
Age	39.813	4.166	39.008	5.060
Bequest receipt (yes=1, no=0)	0.029	0.169	-	-
High father earnings (yes=1, no=0)	-	-	0.212	0.409
Sample size		409		481

**Table 2: Estimated Family Size Effect Using Bequest Receipt as Indicator of Credit Access**

Dependent Variable: Child's log earnings	Sons				Daughters			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Family size	-0.052*** (0.008)	-0.021*** (0.008)	-0.010 (0.013)	-0.008 (0.013)	-0.049*** (0.013)	-0.031** (0.013)	-0.067*** (0.022)	-0.067*** (0.022)
Age	0.196 (0.149)	0.194 (0.137)	0.214 (0.137)	0.222 (0.137)	0.102 (0.139)	0.067 (0.135)	0.101 (0.131)	0.108 (0.130)
Age <sup>2</sup>	-0.002 (0.002)	-0.002 (0.002)	-0.003 (0.002)	-0.002 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Mother's years of education		0.091*** (0.010)	0.090*** (0.010)	0.090*** (0.010)		0.067*** (0.013)	0.071*** (0.013)	0.071*** (0.013)
Birth order			-0.036 (0.030)	-0.031 (0.031)			0.050 (0.037)	0.046 (0.038)
Birth order <sup>2</sup>			0.002 (0.002)	0.001 (0.002)			0.002 (0.004)	0.002 (0.004)
Bequest indicator				0.603** (0.293)				-0.066 (0.471)
Bequest * family size				-0.137** (0.061)				-0.034 (0.096)
R-squared	0.068	0.166	0.168	0.174	0.055	0.123	0.146	0.150
Sample size	565	565	565	565	409	409	409	409

*Note: Standard errors (in parentheses) are robust standard errors and assume clustering by family. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels respectively.*

**Table 3: Estimated Family Size Effect Using High Father Earnings as Indicator of Credit Access**

Dependent Variable: Child's log earnings	Sons				Daughters			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Family size	-0.054*** (0.008)	-0.022*** (0.008)	-0.013 (0.012)	-0.007 (0.012)	-0.049*** (0.011)	-0.032*** (0.011)	-0.069*** (0.019)	-0.061*** (0.019)
Age	0.167** (0.076)	0.170** (0.072)	0.177** (0.072)	0.141* (0.072)	0.148* (0.077)	0.118 (0.075)	0.136* (0.075)	0.137* (0.072)
Age <sup>2</sup>	-0.002* (0.001)	-0.002** (0.001)	-0.002** (0.001)	-0.002* (0.001)	-0.002* (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.002* (0.001)
Mother's years of education		0.090*** (0.010)	0.090*** (0.010)	0.073*** (0.009)		0.059*** (0.012)	0.065*** (0.012)	0.048*** (0.001)
Birth order			-0.023 (0.027)	-0.027 (0.027)			0.040 (0.030)	0.028 (0.030)
Birth order <sup>2</sup>			0.001 (0.002)	0.001 (0.002)			0.002 (0.002)	0.003 (0.002)
High father earnings indicator				0.339* (0.202)				0.336* (0.183)
High father earnings * family size				-0.004 (0.057)				-0.016 (0.048)
R-squared	0.080	0.175	0.176	0.211	0.066	0.121	0.146	0.179
Sample size	660	660	660	660	481	481	481	481

*Note: Standard errors (in parentheses) are robust standard errors and assume clustering by family. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels respectively.*