The Schubert Effect: When Flourishing Businesses Crowd Out Human Capital

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Summary. — We show that in family or household firms, credit constraints can make business investment a direct competitor to educational investment. We test this theory on data collected in Cameroon. Households that are not restricted by credit constraints invest more in education when demand for the product they produce and sell increases. However, credit-constrained households react in the opposite way: when demand increases, they invest less in education, as predicted by our theory. We obtain these results controlling for endogeneity of family size, of demand conditions, and credit constraints.
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1. INTRODUCTION

Human capital investments are good for economic development, and so are conditions that encourage the growth of family businesses; these are two hypotheses that command near-universal assent in the scientific literature. Yet what happens if these two sets of conditions conflict? We show in this paper that this is not an abstract possibility: we suggest a simple theory showing that the growth of family businesses can reduce investment in human capital, and with data from Cameroon, we find that it does so in practice – not for everyone, but for households facing significant credit constraints.

In particular, we find that for households who do not report facing credit constraints, higher demand for the products sold by family businesses can increase investment in education by up to 6 years. However, for households facing the greatest credit constraints, such an increase in demand reduces investment in education by around 2 years. The reason is simple: family businesses are household activities, and households with limited access to investible resources may have to choose between investing those resources in business ventures or in the education of their children. Two extensive bodies of literature, the one on human capital and the one on business development, seem to have overlooked these interactions, perhaps because in neo-classical theory, households and firms are treated as two distinct and non-overlapping institutions. However, and particularly in the non-industrialized world, many businesses *are* households, and any business choice is a household choice, too.

Educating children involves both present and future externalities. Hence, the importance of human capital in the economic growth of a country is one of the fundamental preoccupations of economists and development policy makers. Human capital has been considered a necessary condition (Becker, 1975; Lucas, 1990; Mincer, 1974), and the primary engine of growth (Glomm & Ravikumar, 1992). It has also been argued that flexibility in the production process and the ability to absorb new technologies are related to the stock of human capital (Evenson & Westphal, 1995; Nelson & Phelps, 1966; Tybout, 2000).

However, resource constraints oblige every household to prioritize and choose the mix of human and physical capital that maximizes its welfare. The most important influence on this decision is likely to be the expected returns from each form of capital. In the context of the African manufacturing sector, production function estimates indicate the rate of return on physical capital to greatly exceed the average return on human capital (Bigsten *et al.*, 2000). [1]

Besides expected returns, a set of complex institutions govern both the process of generating human capital and that of allocating it to its best use. The political system is often important for the provision of finance, teachers, and real estate. Religious organizations play an important role in supplying education by building schools in villages and towns. The school system may fail or succeed in producing the right human capital, and it may do so at varying levels of efficiency. Media may be instrumental to assure that the funds earmarked for education do not get embezzled. Markets may differ in their ability to provide signals reflecting social costs and benefits, and so may firms' incentives to hire employees on the basis of their productivity rather than on grounds of racial preferences or nepotism.

The complex interactions between these institutions have attracted important attention in the literature. We argue that there is a simple, and largely overlooked constraint to generating and using human capital – the family firm. Microeconomic theory assumes that firms and households are two separate entities and that the credit constraints on firms are essentially unrelated to the constraints families face. Similarly, the constraints faced by households are essentially unrelated to the credit constraints of the firms in which they may happen to work. In reality, however, and especially in the world's poorer regions, many firms are owned by single individuals

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or households (Burkart, Panunzi, & Shleifer, 2003; Van Reenen & Bloom, 2007). The credit constraints that these households face affect both their household and their business investments. Decisions about whether to invest in human capital will therefore depend not just on the absolute returns to those investments but on their returns relative to business investments. A rise in the demand for the products of a business may therefore lead to a fall in human capital investment, even if investment in human capital may raise the income from the family firm as found by Vijverberg (1995). This is what we observe in our data.

However, this does not by itself imply that rising product demand leads to a fall in household welfare. Rather household welfare will increase, even if more product demand lowers investment in education. However, education is not like other investments: it is subject to externalities, conflicts of interest between children and parents, and sometimes failures of foresight and commitment that might make the effective impact of a fall in educational investment significantly greater than the immediate impact. For this reason the fact that improved business conditions may hurt investment in education deserves to be considered very carefully as a potential hidden cost of policies to encourage business development. Priority needs to be given to complementary policies, such as those to improve the functioning of credit markets, which might prevent such perverse outcomes from occurring.

Many explanations of low levels of investment in education in developing countries appeal to credit market imperfections (Jacoby, 1994; Ljungqvist, 1993). This may not be the whole story, of course: even when funds are available for education, households may use them for purposes with higher expected earnings (Behrman, Pollak, & Taubman, 1989). Nevertheless, the results of this research have given impetus to credit market intervention policies such as the numerous lending programs all over the developing world (Besley, 1995). While some of these lending programs have been targeting education, others have targeted the promotion of entrepreneurship. But family firms differ from ordinary firms: they supply and demand the same inputs: labor and capital inputs [2]; they produce human capital and demand it also at the same time. Each family firm chooses how much human capital to produce depending on (i) its own demand for it, (ii) the market demand for its output, and (iii) the demand of the labor market for its human capital. So, environmental or policy changes that enhance the business opportunities of a family firm may have complex consequences for its human capital investment decision.

The closest work in the literature to our own is a series of papers on "the wealth paradox". A number of papers have shown that when families' endowment of land increases, there is a reduction in the demand for education of their children, rather than an increase as standard theory would lead one to expect if education is a normal good. The first paper to our knowledge to explore this phenomenon is by Heady and Bhalotra (2003). We see these papers as complementary to our own, with the main distinguishing features of the current paper being twofold. First, we explore the impact not of land ownership but of business conditions in general, and, second, we explore the specific interplay of business prospects and credit constraints which is responsible for the paradoxical impact on demand for education.

Our paper is also related to a large literature on child labor. It is often considered that the low investment in schooling is caused by poverty. Children may be withdrawn from school and are either set to performing household labor or are working in the market and bringing income into the family to reduce poverty. Child labor may thus conflict with school attendance (Boozer & Suri, 2001), and it may reduce the time children invest in studying and consequently reduce school performance and attainment (Heady, 2003a, 2003b). It should be noted, however, that the empirical evidence does not find child labor to be necessarily negatively related to education (see the survey of Edmonds, 2007). We here, hence, abstract from child labor and focus on the decisions of a family firm to invest in human capital or in the family business.

Our theoretical argument is presented in Section 2. Section 3 provides the context of our study and an overview of the data collected by one of us (Leinyuy) in Cameroon. Section 4 sets out the main econometric model, presents the main dependent and independent variables, and discusses an endogeneity concern and the instrumental variable strategy designed to deal with it. Section 5 reports results. Section 6 discusses some implications.

2. THEORY

Our theory is one in which a household or family firm decides on the investment in the education of one or more children who will subsequently work either in the family firm or in the outside labor market. Our focus is on the interaction between the effect of demand conditions and credit constraints on the investment strategies of family firms. Specifically, we argue that credit-constrained family firms may increase investments in physical capital, but decrease investments in their children's education, when their demand conditions improve.

To illustrate this point, we consider a simple model, in which the household's objective function is the undiscounted sum of income over two periods – we ignore risk aversion, discounting, and bounded rationality, not because we would argue that they are unimportant in the context of Cameroon, but because they are distinct from the core issues of this paper. We relegate the analytical steps necessary for solving the model to the Appendix, but in order to sharpen and illustrate our main argument that credit-constrained firms may reduce investments in their children's education when their businesses get better, we here briefly present the formal setting and the main result. In the next section, we will provide the context for this theory by providing information on the economic activity in the region we surveyed and the institutional setting of family businesses. In particular, that section will motivate why we assume unitary decision-making (by the household head) in our theory.

The household produces its first-period income using borrowed funds B, and a family endowment A, so that we write the production function as $g(B, A)$. Some of the resulting revenue is shared between investment in education, e, and investment in business capital, k, and then the rest of the profit is Y_1, used for the functioning and consumption of the family.

The second-period business outcome is subject to uncertainty. With probability θ, the business is good and the family firm uses the educated child to run the business whose capital is now k and produces $f(e, k)$ which is sold at a price p. However, if the business outcome is bad, which occurs with probability $(1 - \theta)$, then the educated child works in the outside market and earns a revenue equal to $R(e)$. [3] In this period, the family firm repays its loan with interest r. Therefore $\theta p f(e, k) + (1 - \theta)R(e) - (1 + r)B$ is the expected second-period family firm revenue.

In our theory, the household or family firm's behavior may be restricted by two constraints; the first, a credit constraint, reflects the fact that access to credit is imperfect and implies

a limit to its total borrowing, so that $B \leqslant \overline{B}$. The second is a consumption constraint that implies that the household must have a strictly positive minimum level c of consumption in the first period; we write this as $g(B, A) - C(e) - k \geqslant c \geqslant 0$.[4]

The family firm model is then given by:

$$\max_{e,k,B} W(e,k,B) = Y_1 + Y_2$$

st:

$$Y_1 = g(B,A) - C(e) - k \tag{1}$$

$$Y_2 = \theta p f(e,k) + (1-\theta)R(e) - (1+r)B \tag{2}$$

$$g(B,A) - C(e) - k \geqslant c \geqslant 0 \tag{3}$$

$$B \leqslant \overline{B} \tag{4}$$

In the Appendix, we investigate changes in the sign of $\partial e / \partial p$ as we move from a business household with *no constraints* on its borrowing and consumption levels (case 1) to a business household for which borrowing and consumption are constrained (case 2).

We find that family firms that are not constrained expand both investments in capital and their children's education when p increases. However, this is not the case when constraints are binding. The results suggest that:

$$\frac{\partial e}{\partial p} \begin{cases} < 0 & \text{when } f_k > \frac{f_e}{C_e} \\ \geqslant 0 & \text{if otherwise} \end{cases}$$

$$\frac{\partial k}{\partial p} \begin{cases} > 0 & \text{when } f_k > \frac{f_e}{C_e} \\ \leqslant 0 & \text{if otherwise} \end{cases}$$

Therefore, provided that $f_k > f_e/C_e$, family firms that are credit-constrained will increase their business capital investment and decrease their human capital investment when demand conditions improve. Following the empirical evidence that rates of return on physical capital exceed the average rate of return on human capital in the manufacturing sector of five African countries including Cameroon (Bigsten *et al.*, 2000), it is likely that under credit constraints, improving business conditions may crowd out education investments. This may, however, depend on the type of the family business, a question we will also briefly explore.

In the empirical attempt to test this simple theory, we shall look at the interaction between demand conditions and credit constraints of business households, and specifically study the effect of improvements in demand conditions on years of a child's formal education across business households with different levels of credit constraints. Because our data are from an environment subject to many institutional failures, we expect to see that increasing access to credit will change the way business demand affects household education investment.

3. EMPIRICAL BACKGROUND AND DATA

To test our theory, we use data from a survey of 362 family firms in Bui Division, a region of Northwest Cameroon. We here discuss its economic structure, the role of the family and family businesses, education, and access to credit to make a link to the setting of our model outlined in Section 2, and to describe the context of the data on which the empirical analysis is based. The section builds on our own survey and the one by Goheen (1996).

(a) Economic activities in Bui division

Bui division (over 400,000 inhabitants) is one of Cameroon's (19.4 million inhabitants) most important food-supplying regions. Most, if not all of business in Bui is owned and operated by families. Farming and livestock are the predominant economic activities with major crops including maize, beans, tubers, vegetables, tree crops, and fruits. Coffee is one of the major cash crops, and most of it is exported. Households tend to diversify their investments in agriculture: the households in our survey have on average three pieces of farm land, nine cows, and seventeen sheep. Family businesses tend to expand their activities by investing in storage, transportation, and distribution networks across the country. Formal education is demanded in tourism, restaurants, medical services, woodwork and metalwork, tailoring, mechanics, and electronics.

(b) Role and internal structure of family businesses

Banso culture significantly determines the structure of businesses and the roles of men and women in the economy. Goheen (1996) found that the male–female roles and the division of labor have been stable over generations, with men owning the fields and women owning the crops. Women's productive and reproductive labor forms the basis of male wealth accumulation. Men control most productive resources, long distance trading networks and use their incomes and time to invest in entrepreneurial enterprises and in networks of kin and clients, which allow them to accumulate wealth. In our data, see Table 1, men have an average of 1.6 wives with a range from 0 to 5, and many children (on average eight – with a range from 0 to 33).

Firms in Bui tend to hire very little labor for their farming activities outside of their own family. Goheen (1996) found that only 2% of households' expenditures went into hired labor. Poor formal institutions are considered in the literature to be the reason for hiring family members (Bellow, 2003; Burkart *et al.*, 2003; Caselli & Gennaioli, 2013), but introducing formal institutions may not be sufficient to change the outcome because of the important role of family employment. The family firm is not only a source of income; it provides scarce employment and practical training to family members, raising their chances of future employment and total family welfare. Family labor tends to be more flexible, and the

Table 1. *Head of household characteristics*

Variable	Observations	Mean	Std. Dev.	Min	Max
Education	279	6.796	4.891	0	22
Age	321	56.664	10.567	33	80
Wives	321	1.583	1.003	0	5
Children	322	8.075	4.817	1	33
Wealth (log)	322	6.610	1.663	2.3	13.6
Farms (plots)	322	3.166	2.626	0	18
Muslim	322	0.354	0.479	0	1
Catholic	322	0.568	0.496	0	1
Protestant	322	0.078	0.268	0	1

The average number of children per household (8.075) relates to father's children as the business households are headed by male individuals who often have more than one wife as shown in the table, the average number of wives is 1.583.

rewards of family labor may not involve direct monetary payment making hired labor less competitive.

(c) Education

A survey published by the World Bank in 2010 indicates that in Cameroon, the high cost of primary education prevents many families from sending their children to school and lack of funds is ranked as the main reason for children dropping out of school. The survey found that less than half of the school-age population completed primary education in 2009 and school life expectancy only increased by 2 years over the past 20 years. [5] However, during the fiscal year 2009, the Cameroon government allocated nearly 15.5% of its total budget to the education sector, an increase of almost 1.4% compared to the previous fiscal year (2008). [6] While government investment in education is important in terms of building schools, training teachers and ensuring the system runs smoothly, households are responsible for the choice of type of education and the level of education their children may attend. We hence focus more on the demand side context of the region surveyed.

(d) Access to credit

Goheen (1996) describes that in the Bui region, some credit was obtained through saving groups or loan associations, but only men were able to participate. When conducting our survey, we occasionally asked households about sources of credit and found that the situation had not changed much since Goheen (1996) carried out her survey. Little credit is available through formal institutions including credit unions and banks, and these institutions impose a minimum scale to provide finance. Once a business establishes good relationships with suppliers or wholesalers, however, they may buy through credit arrangements. Most importantly for our empirical strategy, land ownership by men provides collateral needed for credit, while women, because they own no land, cannot access credit.

(e) The data

In 2005–06 one of us collected data on family business history and evolution in the Bui region, which provide detailed information on the business prospects and credit conditions of 362 family firms, and on schooling and individual characteristics of 2,601 children and their parents in fourteen villages. Each of the villages is considered as a local market in which many of the family businesses sell their products and services. But some of the village businesses also travel across to other villages or towns to access more market opportunities. Through these encounters with wider markets, they enhance demand for their goods and overcome credit constraints.

In addition to the data about individual and household characteristics we also asked heads of households a set of questions designed to measure the extent to which their family businesses had been affected by business prospects and credit constraints. Ideally, historical data of the demand and credit conditions of the businesses would be considered to determine the extent to which they have been constrained by these factors. However, business households in the Bui region, as in most parts of Cameroon, do not keep such data. This is partly because of human capital constraints, the lack of formal business management skills to keep accounting data. However, during the survey we also noticed that even households with formal management skills did not keep much business data, and that available data were neither registered consistently nor in a format that could be reasonably analyzed.

4. ECONOMETRIC SPECIFICATION

As our focus is to investigate the impact of an improvement in market conditions (business demand) on incentives to invest in children's education, we focus on the interaction effect between the family business demand and the family credit constraints on the years of formal education completed by children in the family. We estimate a model in which the dependent variable is years of child's education (e_i) with the following specification:

$$e_i = \beta_0 + \beta_1(Demand) + \beta_2(Credit) + \beta_3(Demand * Credit)$$
$$+ \delta F + aC + \varepsilon_i$$

Here, δ is the coefficient estimate of the fertility variable (F), measured by the number of children of the head of the household and C is a vector of controls which include the child's age and gender, enrollment, mother's and father's education, and household wealth measured by peak wealth ever achieved by the household.

(a) The dependent variable

Completed years of a child's education is the dependent variable we focus on. We measure it by counting the years of formal education completed by each child in each business household. It takes values from zero up to 21 when a child completes a master's degree. For example, it takes a value of 9 when a child completes primary school (i.e., 2 years nursery plus 7 years primary), 14 when the child completes secondary school (5 additional years), and 16 when the child completes high school (two additional years of schooling). Table 1 summarizes the years of education for all the children, by gender and by current enrollment. We consider all children in the household including adult children. For children currently not enrolled, the observations record their final level of education, while for those still enrolled we are unable to observe what this final level will be, which creates a truncation problem for our data (See Table 2).

To ensure that this truncation problem does not bias our estimates, we have considered several sample restrictions and compared regression results with the full sample. More precisely, we restrict the sample to: (1) results from a subset of children who are not enrolled anymore; and (2) results from a subset of children above the upper-bound age of school attendance (determined to be 20 years of age).

Concerning (1): Children who were out of school at the time of the survey are very unlikely to be re-enrolled. This view is based on the comparison of enrollment information collected

Table 2. *Average years of children's schooling*

	Average years of schooling	Obs.	Std. Dev.	Min	Max
All children	9.659	2601	4.323	0	24
Boys	9.621	1315	4.353	0	24
Girls	9.699	1286	4.293	0	22
Enrolled children	9.089	1021	4.722	0	21
Not enrolled children	10.028	1580	4.003	0	24
Muslim	8.073	1251	3.803	0	20
Christian	11.130	1350	4.257	0	24

Years of child's schooling has a maximum value of 24 years, as reported by a few households that reported 24 years of schooling. This is the sum of 2 years in nursery school, 7 years in primary school, 5 years in secondary school, 2 years in high school, 3 years to get a First Degree, 2 years in a Masters Degree and 3 years to complete a Doctorate.

during a pilot survey carried out a year before the main study; children who were not enrolled in the pilot study were still not enrolled a year later. Concerning (2): Defining 20 years as the upper bound of school attendance is supported by our data which showed that 37% of the children go beyond primary education (which is normally completed at the age of 13), 13% go beyond secondary school (which is mostly completed at the age of 18), and only 6% complete high school (which is mostly completed at the age of 20). The data suggest that completing primary, secondary, or high school are important milestones for these households. An insignificant proportion of the children go to university and a much smaller proportion ever get a university degree.

(b) Key independent variables

The measures of demand conditions and the credit constraint are the most important right-hand-side variables. The measures use business households' self-assessment. We have relied on a self-assessment strategy for a number of reasons: First, we are interested in understanding the extent to which these constraints have been effective during the period when children's education decisions were made; second, households are best placed to report the extent to which their business growth had been constrained in the past by limited demand conditions to sell their products or services, and the extent to which limited access to credit had constrained their ability to finance their investment opportunities. Third, in the finance literature, self-assessment is the standard means of measuring the severity of constraints,[7] in particular because Kaplan and Zingales (1997) demonstrated the shortcomings of the previously used measures based on the sensitivity of investment to cash flow (reliable data on which are unavailable in most developing countries).

We asked each household the following questions:

- *Credit constraint:* Has difficulty in obtaining credit been an obstacle to the expansion of your business? If so, by how much would you have been able to expand your business if you were able to borrow as much money as you needed?
- *Demand conditions:* Has difficulty in obtaining demand for your products been an obstacle to the expansion of your business? If so, by how much would you have been able to expand your business if you were able to sell as much as you could produce?

These questions were meant to elicit long-term conditions of the family businesses, rather than current or short-term volatility. We ensured that the heads of households understood the questions accordingly. On the second part of the questions, the households were allowed to report their answers using a range from "not expand at all" to "would expand greatly", as shown in Table 3. In our data, a household is highly credit

Table 4. Summary of the business observations

	Obs.	Mean	Std. Dev.	Min	Max
Demand	314	2.503	1.028	0	4
Credit access	314	1.586	1.189	0	4

constrained if it reported that, if it had been able to borrow as much as needed, it then would have expanded its business greatly. At the other end of the spectrum, a business household is considered to be not credit-constrained at all if it reported that, it would not have expanded its business at all even if it could have borrowed more. We considered the self-assessment about demand conditions in similar ways, and then allocated values to the constraints ranging from 0 (not constrained) to 4 (highly constrained).

The data show that about 25% of the business households have been highly credit constrained compared to just 2.3% that have been highly constrained by access to demand for their products and services. At the other end of the scale, only about 5% have been unconstrained by access to credit, while 16.9% have been unconstrained by demand. These data are presented in Table 3, the average value for demand conditions is greater than the average value of the credit constraint (2.5 against 1.6), see Table 4.

Tables 5 and 6, respectively summarize data for the heads of household characteristics, children's characteristics and village characteristics considered in the survey and analysis.

Table 7 shows that demand conditions and access to credit (the inverse of credit constraints) are negatively correlated to each other. However, they are both positively correlated to the level of children's education.

Raw correlation coefficients are not sufficient to investigate the real impact of demand conditions and credit constraints on years of children's education. Our regressions control for unobserved effects such as: (i) the interaction effect between demand and access to credit; (ii) possible endogeneity of these business constraints and other explaining variables; and (iii) group effects by clustering by household level, considering village-level variables and also industry-level variables.

(c) Endogeneity concerns

OLS produces biased and inconsistent estimates if independent variables, in our case, demand conditions and credit constraints, were endogenous. Similarly, fertility measured by the number of children in the household, might be endogenous. We here briefly explain potential sources of endogeneity.

With respect to demand conditions and credit constraints, education decisions may affect household's decisions about the type of business to engage in, which affects the demand conditions and credit constraints they will face. For example, a household that decides to educate its children may engage in a business that requires more formal skills, for instance, accounting, which may also be useful in relaxing credit

Table 3. Measurement of constraints on business expansion

Household's assessment of expansion if constraint removed	Implication	Allocating values to demand and credit access (inverse of constraint)	Credit access %	Demand access %
Would expand greatly	Highly constrained	0 (low access)	24.59	2.25
Expand quite a lot	Constrained	1	23.36	14.7
Expand somewhat	Somewhat constrained	2	31.37	25.46
Expand slightly	Slightly constrained	3	15.98	40.72
Not expand at all	Not constrained at all	4 (high access)	4.7	16.87
			100	100

Table 5. *Childrens' characteristics*

Variable	Observations	Mean	Std. Dev.	Min	Max
Age of child	2590	21.221	10.137	1	53
Gender of child	2601	0.506	0.500	0	1
Moslem	2601	0.481	0.500	0	1
Catholic	2601	0.457	0.498	0	1
Protestant	2601	0.062	0.241	0	1
Mother's education	2553	6.442	4.581	0	24
Protestant children by village	2639	7.051	12.167	0	42
Father is farmer	1736	0.339	0.473	0	1
Father is trader	1736	0.392	0.488	0	1
Father has professional skills	1736	0.143	0.350	0	1

Note that all children ever born in the household are included in the data, as such, the average age of a child is high (21.2 years) and the maximum age is high (53 years). This allows us to consider investment in children's education through the entire life of the business household.

Table 6. *Village-level characteristics*

Variable	Mean	Std. Dev.	Min	Max
Average village fertility	10.433	2.739	6.628	15.837
Average village plots of land (farms)	3.525	1.507	1.292	6.715
Moslem children by village	76.297	76.799	0	199
Catholic children by village	58.258	59.041	0	157
Protestant children by village	7.051	12.167	0	42

Note that the average village fertility is that of male and is high because the business households are headed by male individuals who on average have more than one wife (average number of wives is 1.583, see Table 1).

Table 7. *Correlation between years of child's education and business conditions*

	Years of child's education	Demand for family business products	Access to credit
Years of child's education	1		
Demand for family business products	0.0088	1	
Access to credit	0.0839	-0.2541	1

constraints, or marketing skills, which may be useful for improving demand conditions. Similarly, a household that anticipates business conditions or demand constraints may decide to educate its children as a strategy to overcome these constraints. Thus, demand conditions and credit constraints may be endogenous to education decisions. We expect that households with high education levels may engage in businesses that face less restrictive credit or demand conditions than those in the rest of the village. Importantly, the *average reported level of credit constraints and demand conditions at the village level* will be among the instruments we use.

Regarding fertility, the number of children in the household is likely to affect educational investments in each child via its effect on the per capita resources available to the household, the trade-off between quality and quantity of children famously investigated by Becker and Lewis (1973). Thus fertility may very well be correlated with unobserved factors that also affect the demand for education.

(d) *Instrumental variables*

The distribution of demand conditions and credit constraints according to religion and skills is presented in Figure 1. On average, Catholic households appear to have better demand conditions than Muslim households, followed by

Protestants. Regarding access to credit (the inverse of credit constraints), Protestant and Catholic households appear to have the same levels and both groups seem to have greater access to credit than Muslim households. In terms of professions, we observe that farmers report worse demand conditions than traders and professional households report the best demand conditions. Access to credit is more of a problem for traders than it is for farmers and for professional households.

The instruments we use to predict *fertility* are the amount of land owned by the child's parents, proxied by the number of farms owned by the household. Land owned matters because farming is a labor-intensive activity for which hired labor and household labor are imperfect substitutes. We also use variables on the religion of people in the surveyed villages as instruments. Different religions lay different emphasis on the value of fertility and are tolerant of birth control to different degrees; however, there is no evidence (at least in the region we investigated) that religion affects families' beliefs about the appropriate amount of education for their children. This is borne out in our estimations which find that religion is completely insignificant if included in the main equation, under all specifications. We consider that land ownership may affect both fertility decisions and market conditions of business households. This is more likely in the region where farming is a labor-intensive activity and where hired labor and household labor are imperfect substitutes.[8] One could also expect land to be used as collateral to borrow money. In addition, land is also a capacity constraint which can restrict the ability of some business households to respond swiftly to demand shocks. This is likely the case for business households whose business activities significantly depend on land. We therefore consider that land owned can indirectly affect the level of education of children through its potential effect on fertility, credit, and demand conditions. As such, in the estimation strategy we have used the amount of land (number of plots or farms owned by the business household) as an instrument to control for potential endogeneity of fertility, credit constraints, and demand conditions.

We test for the validity of our instruments using the Hansen *J* test (overidentification test of all instruments). Our results pass the tests.

5. RESULTS

We begin by reporting an Ordinary Least Squares (OLS) specification. We then control separately for endogeneity of fertility, and finally control for both the endogeneity of fertility and the endogeneity of demand conditions, the credit
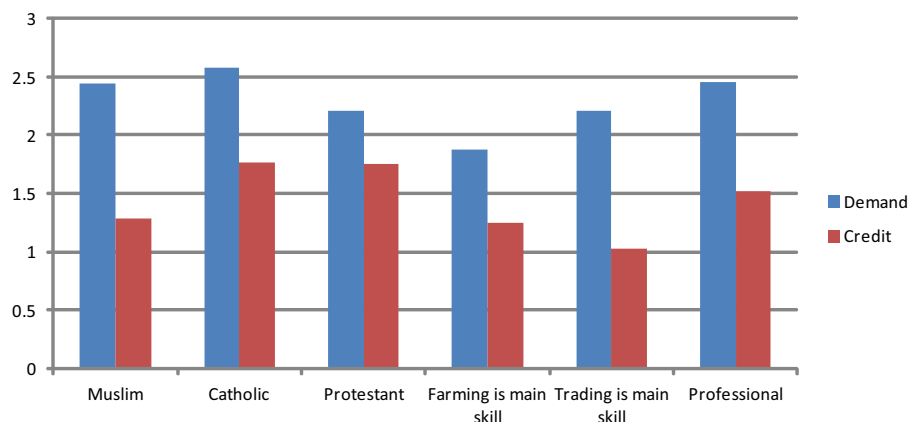
Figure 1. *Demand and credit access by religion and by professional skills (industry).*

Table 8. *The benchmark model: OLS estimations*

Dependent variable is years of child's schooling	Subsample 1: highly credit constrained	Subsample 2: credit constrained	Subsample 3: somewhat credit constrained	Subsample 4: slightly or not credit constrained
Demand	−0.321***	0.082	0.239***	0.872***
	(0.134)	(0.067)	(0.079)	(0.150)
Mother's education	0.037	0.020	−0.015	0.076**
	(0.029)	(0.017)	(0.020)	(0.034)
Father's education	0.036	0.111***	0.082***	0.063**
	(0.026)	(0.014)	(0.017)	(0.030)
Wealth (log)	0.091	0.234***	0.225***	0.209***
	(0.069)	(0.043)	(0.053)	(0.080)
Child's age	0.959***	1.062***	1.028***	1.002***
	(0.037)	(0.025)	(0.030)	(0.051)
Child's age square	−0.015***	−0.017***	−0.016***	−0.016***
	(0.001)	(0.001)	(0.001)	(0.001)
Child's gender	−0.154	−0.212	−0.085	−0.201
	(0.189)	(0.132)	(0.163)	(0.269)
Enrollment dummy	2.147***	2.392***	2.520***	2.413***
	(0.258)	(0.167)	(0.209)	(0.362)
Father's children	−0.015	−0.107***	−0.101***	−0.193***
	(0.019)	(0.011)	(0.014)	(0.023)
Constant	−3665***	−5.973***	−5.47***	−6.731***
	(0.840)	(0.445)	(0.549)	(0.871)
N	592	1643	1109	447
R-sq	0.625	0.627	0.605	0.613

Robust standard errors in parentheses. Statistical significance: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.025$. Data clustered by mother, as polygamy is frequent in the data with average number of wives per household equal 1.58. The results show that the impact of demand on education increases as you move from the group with high credit constraint or low access to credit (i.e., from −0.321 in Subsample 1) to the group with higher access to accredit (i.e., to +0.872 in Subsample 4).

constraint, and the interaction term simultaneously. We specify our models such that the first stage regressions of the endogenous variables are run on all of the exogenous variables.

The results in Table 8 are estimates of the impact of demand conditions on education for different subsamples differentiated according to the degree to which the business is credit constrained. The credit constraint relaxes as we move from subsample 1 to subsample 4. The coefficient estimates of demand conditions are negative and significant for the more credit-constrained households (subsample 1), nil for subsample 2, and positive and significant at 1% for the less credit-constrained households (subsample 3). The parameter estimate is even considerably greater if we consider estimates for the smaller subsample in subsample 4, consisting only of households that have very little or no credit constraints. Thus, as

predicted by our theoretical model, the effect of demand on years of child's education differs depending on the level of the credit constraint of the business household.

In Table 9 we present OLS regressions for the full sample, the sample restricted to children older than 20, and the sample with children who completed their education. We also introduce an interaction effect between credit constraints and demand conditions. Whereas the coefficients on each constraint type are negative in all specifications, the interaction term is positive and significant in all of them. This means that while the most credit-constrained households (those for whom the constraint takes the value 0) have a negative response of education to increases in demand) the least credit-constrained households (those for whom the constraint takes the value 4) have a strongly positive response of education to increases in

Table 9. *OLS results for the whole sample, and the sample restricted to children who have completed school*

Dependent variable: years of child's schooling	OLS estimates		
	All children	Children age 20 and above	Children with completed school
Demand	−0.344*	−0.883***	−0.766***
	(0.181)	(0.328)	(0.283)
Credit access	−0.584**	−1.421***	−1.262***
	(0.266)	(0.509)	(0.429)
Interaction term (demand*credit)	0.216***	0.488***	0.422***
	(0.094)	(0.170)	(0.146)
Number of children in household	−0.083***	−0.120***	−0.096***
	(0.014)	(0.02)	(0.019)
Mother's education	0.018	0.029	0.011
	(0.026)	(0.041)	(0.035)
Father's education	0.103***	0.170***	0.128***
	(0.022)	(0.037)	(0.031)
Wealth (log)	0.193***	0.391***	0.214***
	(0.059)	(0.086)	(0.079)
Child's age	1.033***	0.436***	0.790***
	(0.026)	(0.113)	(0.024)
Child's age square	−0.016***	−0.007***	−0.012***
	(0.001)	(0.002)	(0.001)
Child's gender	−0.192*	−0.042	−0.063
	(0.104)	(0.171)	(0.143)
Enrollment dummy	2.319***	4.494***	
	(0.161)	(0.333)	
Constant	−4.477***	0.073	−0.164
	(0.774)	(1.849)	(1.073)
N	2226	1204	1347
R-sq	0.628	0.344	0.482

Robust standard errors in parentheses. Statistical significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.025$. Data clustered by mother, as polygamy is frequent in the data. Average number of wives per household is 1.6.

Table 10. *IV estimates, Controlling for endogeneity of demand, credit access, and fertility*

Dependent variable: years of child's schooling	All children	Children age 20 and above	Children no more enrolled
Demand (predicted)	−0.508	−2.444	−1.231
	(0.612)	(1.64)	(1.032)
Credit access (predicted)	−2.125***	−5.766*	−3.073
	(1.176)	(3.442)	(2.116)
Interaction term (Demand*Credit, predicted)	0.931***	2.076*	1.232*
	(0.415)	(1.111)	(0.674)
Children in household (predicted)	−0.165***	−0.244***	−0.162***
	(0.046)	(0.069)	(0.047)
Mother's education	0.061	0.057	0.042
	(0.038)	(0.065)	(0.048)
Father's education	0.080*	0.138**	0.110**
	(0.041)	(0.068)	(0.049)
Wealth (log)	0.385***	0.486***	0.347***
	(0.105)	(0.148)	(0.109)
Child's age	0.936***	0.157	0.756***
	(0.037)	(0.158)	(0.043)
Child's age square	−0.016***	−0.002	−0.011***
	(0.001)	(0.003)	(0.001)
Child's gender	−0.102	0.145	0.051
	(0.144)	(0.238)	(0.188)
Constant	−1.898	13.931***	1.273
	(2.021)	(5.923)	(3.525)
N	1,546	791	920
R-sq	0.569	0.023	0.477
Hansen J statistic	0.555	4.317	3.358
Chi-sq(2) P-val	0.968	0.365	0.500

Robust standard errors in parentheses. Statistical significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.025$. Data clustered by mother, as polygamy is frequent in the data. Average number of wives per household is 1.6.

demand exactly as predicted by our model. It is noteworthy that the magnitude of the point estimates for the constraints and the interaction of the constraints is larger when we restrict the sample to the children with completed education. It thus seems that truncation problem we have discussed before does not affect the quality of the results. The impact is greatest for the sample including only children aged 20 and above, which is considered to deal with the truncation problem.

In the regressions in Table 10, we controlled for endogeneity of the constraints. All parameter estimates are qualitatively similar to the ones in the preceding tables. Some of the point estimates lose statistical significance as the standard errors go up, but the one we are most interested in, the interaction between demand and credit constraints remains both statistically and economically significant. The signs and magnitudes of the coefficients of the demand and credit access variables and their interaction term are consistent with the expected results. Their magnitudes are consistently higher for children of age 20 and above. Importantly, we observe that Hansen's J statistic is 4.317 with a P-value of 0.365 suggesting that our model is valid and matches the data well, giving us confidence that our instrument set is appropriate. Our interpretation of the Hansen test is consistent with the interpretation by Baum, Schaffer, and Stillman (2007).

To see the real effect of demand on years of school and to see what our estimates imply for households with different degrees of credit constraint, we use the following model to calculate the value of the coefficient on demand at the values 0, 1, 2, 3 and 4 of the credit constraint: $\frac{\partial e_i}{\partial demand} = \hat{\beta}_1 + \hat{\beta}_3 credit$. According to the model, the impact of a change in demand on years of child's education is a linear function of credit with the coefficient estimate of demand as the intercept term and the coefficient estimate of the interaction term as the gradient. We can see that $\hat{\beta}_1$ is the effect of demand on education when the value of credit = 0. So, for a business household with a credit value of zero, a 1-unit increase in demand will lead to a $\hat{\beta}_1$ variation in education. However, for a business household with a credit value of 4, a 1-unit increase in demand will lead to a $(\beta_1 + 4\hat{\beta}_3)$ variation in education. Using this function and the estimates in Table 10, we then compute the interaction terms for each value of the credit variable from 0 to 4. We do so for each of the six models. The calculated values of the interaction term are presented in Table 11 and plotted in Figure 2.

Figure 2 shows that, whatever the estimation models we use, we find that as the credit constraint is relaxed (credit access increases), the effect of demand on education becomes greater and greater. This effect is weakest for the OLS on the full sample, and strongest for the model which simultaneously controls for the endogeneity of fertility and the endogeneity of demand conditions, the credit constraint, and their interaction term, and uses only the subsample of children aged 20 or more.

Table 11. *Real interaction effect of increase in family business demand and credit access on years of child's schooling*

| | Real effect of an increase in family business demand on years of child's schooling | | | | | | | | |
| Access to credit | All children | | | Children age 20 and above | | | Children with completed education | | |
	OLS	IV for fertility	IV for fertility and constraints	OLS	IV for fertility	IV for fertility and constraints	OLS	IV for fertility	IV for fertility and constraints
0 (Low)	−0.34	−0.22	−0.51	−0.79	−0.52	−2.44	−0.77	−0.44	−1.23
1	−0.13	0.00	0.42	−0.37	−0.10	−0.37	−0.34	−0.06	0.001
2	0.09	0.22	1.35	0.05	0.32	1.71	0.08	0.31	1.23
3	0.30	0.43	2.29	0.47	0.74	3.78	0.50	0.68	2.47
4 (High)	0.52	0.65	3.22	0.88	1.15	5.86	0.92	1.06	3.70

Overall, the results are qualitatively consistent across the subsamples and the different estimation models. The highest impact of demand on years of schools is observed in the sample involving children age 20 and above (20 years considered to be the upper-bound age of school attendance) and specifically with the model that controls for the possibility of endogeneity of the demand and credit constraints and fertility. These results are better explained graphically as presented in Figure 2.
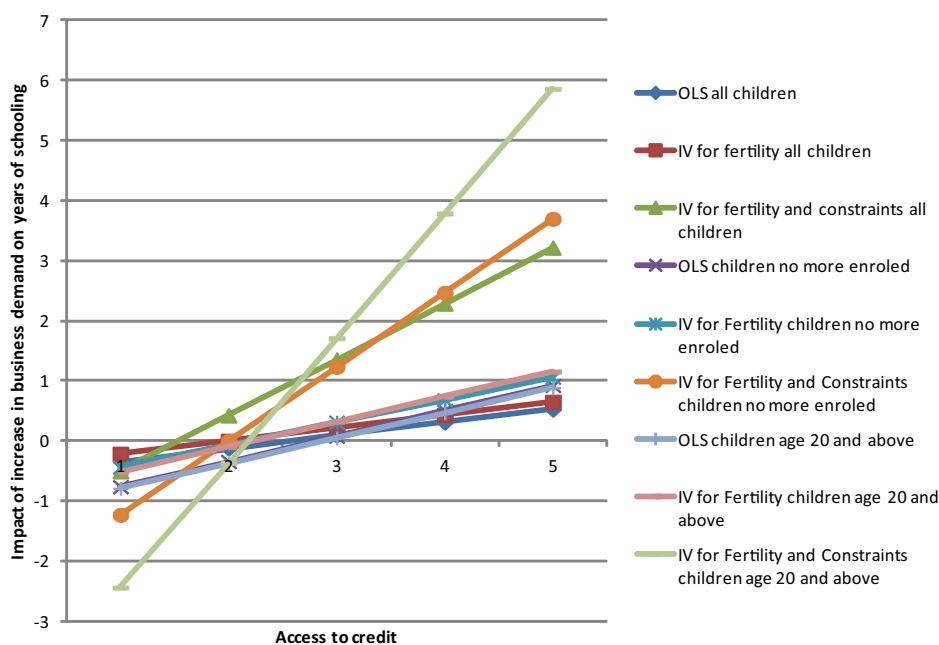
Figure 2. *Graphical illustration of the interaction effect of increase in family business demand and credit access on years of child's schooling.*

6. CONCLUDING DISCUSSION

We have shown in this paper, both in theory and in data from a developing economy, that the presence of credit constraints may have an important impact on the response of business households to improvements in the conditions of their business. Improving business conditions may divert investment away from the education of children. Not all business households do this; only those that are significantly credit constrained. We have subjected our estimations to a range of robustness tests, controlling for selection bias and the possible endogeneity of both fertility and the constraints faced by households. However, controlling for these factors substantially strengthens rather than weakens our findings that credit constraints make a large difference to whether households facing higher demand raise or lower their demand for education.

The main practical implication of these findings is that policies to improve the business environment, which are widely agreed to be necessary to enable poor countries to outgrow their dependence on subsistence farming, need to be

complemented with financial market policies in order to avoid such perverse effects. Likewise, an expansion of the supply of education, as has been the case for Cameroon, does not suffice because business households may contract rather than expand their demand when their businesses get more profitable.

It will be important for further research to investigate these complementarities and interactions in greater depth in order for policy interventions to have the most beneficial impact. Part of this deepening of understanding would consist of investigating heterogeneous effects of business expansion on different types of households.

In our theory, and in the empirical analysis building on it, we have largely considered that all family businesses want to grow and therefore their growth is only limited by credit and demand constraints. This may not be the case for all families or for every region and might require more targeted policy design. For example, we split our small dataset into three subgroups by the professional areas of the family firms: farmers, traders and professional. Simple analysis suggested that households that are entirely focused on business activities

seem to react in different ways from households that are led by a professional parent who might be running a family business as a secondary activity. Farmers and traders behaved in a way consistent with the theory. However, family businesses run by a professional parent (for instance, teacher, doctor, and engineer) appear to react to changes in demand conditions in the opposite way with highly credit-constrained family businesses appearing to increase investment in education when the demand for their family business products increases.

Our data are not sufficient to robustly establish these results, but we believe it to be fruitful to explore further the heterogeneity in reaction to changing demand conditions. Understanding the possible differences in motivation for growth would not only be important in improving the quality of policies designed to promote human capital investment but also for designing more refined policies to promote entrepreneurship.

NOTES

1. This research uses panel data from the manufacturing sector of five African countries. It investigates how high are the returns to human relative to physical capital and what is the relative importance of endowments of human and physical capital in determining differences in earnings and productivity across the countries. Beside findings that the rate of return on physical capital exceeds the average return on human capital, the evidence also shows that productivity and earning differentials are large between Cameroon and Ghana and that these differences are due almost entirely to differences in physical, not human, capital endowments.

2. The family firm literature points out that businesses and families are invariably and inextricably interlocking and overlapping elements, which can best be viewed, studied, and understood in relationship to the way they interact to create and sustain one another. The family has been considered as the source of oxygen for the combustion of entrepreneurship (Heck & Rogoff, 2003). But in this literature, the questions asked are usually firm-specific and entail issues of governance, financing, management, and succession. The family and its internal problems occupy a secondary position and are only treated as an input in the development of the firm. As a consequence, the consideration of the firm as an input into the wellbeing and functioning of the family is neglected: education investment in children is one of these important family decisions.

3. For simplicity, we here abstract from the interesting question of correlated shocks affecting the different activities of the family (Rijkers & Söderbom, 2013), and how uncertainty in itself affects education (Kazianga, 2012).

4. In the absence of the consumption constraint, the linearity of utility in consumption (imposed to simplify the analysis) would imply that a household wishing to borrow could simply escape its credit constraints by consuming negatively in the first period. The consumption constraint rules this out and therefore implies that the credit constraint is genuinely binding for at least some households.

5. Cameroon Economic Update, Revisiting the Sources of Growth, The Quality of Basic Education, January 2014. http://www.worldbank.org/content/dam/Worldbank/document/Africa/Cameroon/Report/cameroon-economic-update-vol7.pdf.

6. http://www.statistics-cameroon.org/downloads/pets/2/Rapport_principal_Education_anglais.pdf.

7. Note that under the conditions famously modeled by Modigliani and Miller (1958), the way business is financed does not matter for real economic outcomes because internal and external financing are perfect substitutes. However, many empirical studies have shown that financial constraints are an important determinant of firm investment behavior, firm growth, and firm survival (Aghion, Fally, & Scarpetta, 2007; Beck, Demirgüç-Kunt, & Maksimovic, 2005; Carlin, Schaffer, & Seabright, 2007).

8. The relation between land holding and fertility can be strengthened by evidence in the literature on the relation between land holding and child labor. For example, Basu, Sanghamitra, and Bhaskar (2010) found an inverted-U relationship between land holding and child labor in data from India.

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APPENDIX

Solving the model

Case 1: The unconstrained family firm

Here, constraints (3) and (4) are not binding and the maximization problem is:

$$\max_{e,k,B} L(e,k,B) = g(A,B) - C(e) - k - (1+r)B + \theta p f(e,k)$$
$$+ (1-\theta)R(e)$$

with first-order conditions given in (5)–(7):

$$L_e = -C(e) + \theta p f_e + (1-\theta)R_e = 0 \qquad (5)$$

$$L_k = -1 + \theta p f_k = 0 \qquad (6)$$

$$L_B = g_B - (1+r) = 0 \qquad (7)$$

We assume that $0 \leqslant \theta \leqslant 1$, $1 \leqslant p$, that there exists a minimum positive level of education for each child that is exogenously determined, by for example government policy such that each child always receives at least a year of schooling ($e > 0$). The

parameter a, is the cost of the minimum level of education. We also assume that $g(A, 0) > 0$ implying that even a family that has no access to borrowing may still run its business project on internal financing A. We also assume $g_B > 0$ and $g_{BB} < 0$ $g_B > 0$ and $g_{BB} < 0$, i.e., first-period production is increasing and concave in B, and $C_e > 0$ and $C_{ee} > 0$, i.e., the cost of education is increasing and convex. We also assume that education makes business capital more productive and that there are diminishing returns to each input; implying that the second-period production function is increasing, twice differentiable, and concave in both e and B. Specifically: $f_e > 0$, $f_k < 0$, $f_{ee} < 0$, $f_{kk} < 0$ and $f_{ek} = f_{ke} > 0$.

The first-order conditions indicate that the unconstrained family firm is able to satisfy its efficient borrowing and its efficient investment conditions. While Eqn. (7) implicitly permits us to determine the efficient borrowing B^*, we must notice that e^* and k^* are jointly determined by Eqns. (5) and (6). To solve for them, we totally differentiate Eqns. (5) and (6) and use Cramer's rule which gives:

$$\frac{\partial e}{\partial p} = \frac{-\theta(f_e f_{kk} - f_{ek}f_k)}{[-C_{ee} + \theta f_{ee} + (1-\theta)R_{ee}]\theta f_{kk} - p[\theta f_{ek}]^2} > 0 \qquad (8)$$

Eqn. (8) shows that improvement in business prospects increase its incentive to invest in children's education. Eqn. (9) also shows that the improvement in business prospects leads to greater investment in business capital:

$$\frac{\partial k}{\partial p} = -\left(\frac{1}{p}\right) \frac{[-C_{ee} + \theta p f_{ee} + (1-\theta)R_{ee}]f_k - \theta p f_e f_{ke}}{[-C_{ee} + \theta p f_{ee} + (1-\theta)R_{ee}]f_{kk} - \theta[f_{ek}]^2} > 0 \qquad (9)$$

Case 2: The credit-constrained family firm

When both the family credit constraint $B \leqslant \overline{B}$ and the consumption constraint $Y_1 \geqslant S \geqslant 0$ are binding, the firm solves the following maximization program:

$$\max_{e,k,B} W = g(A,B) - C(e) - k + \theta p f(e,k) + (1-\theta)R(e)$$
$$- (1+r)B$$

s.t:

$$g(A,B) - C(e) - k \geqslant S$$

$$B \leqslant \overline{B}$$

The Lagrangian is given by:

$$\max_{e,k,B,u,\lambda} L = g(A,B) - C(e) - k - (1+r)B + \theta p f(e,k)$$
$$+ (1-\theta)R(e)$$

with the following first-order conditions:

$$L_e = -(1+\lambda)C_e + \theta p f_e + (1-\theta)R_e = 0 \qquad (10)$$

$$L_k = -(1+\lambda) + \theta p f_k = 0 \qquad (11)$$

$$L_B = (1+\lambda)g_B - (1+r) - u = 0 \qquad (12)$$

$$L_\lambda = g(A,B) - C(e) - k - S = 0 \qquad (13)$$

$$L_u = \overline{B} + B = 0 \qquad (14)$$

Solving this system of first-order conditions yields the following expressions:

$$\frac{\partial e}{\partial p} = \frac{\theta(f_e - f_k C_e)}{\theta p[f_{ek} - C_e f_{kk}]C_e - [\theta p f_{ee} + (1-\theta)R_{ee} - (1+\lambda)C_{ee}] + \theta C_e p f_{ke}}$$

$$\frac{\partial e}{\partial p} \begin{cases} < 0 & \text{when} f_k > \frac{f_e}{C_e} \\ \geqslant 0 & \text{if otherwise} \end{cases} \tag{15}$$

$$\frac{\partial k}{\partial p} = \frac{-\theta(f_e - f_k C_e)C_e}{\theta p[f_{ek} - C_e f_{kk}]C_e - [\theta p f_{ee} + (1-\theta)R_{ee} - (1+\lambda)C_{ee}] + \theta C_e p f_{ke}}$$

The denominators are positive, so the signs of $\partial e/\partial p$ and $\partial k/\partial p$ will depend on the signs of the respective numerators. This implies that:

$$\frac{\partial k}{\partial p} \begin{cases} > 0 & \text{when} f_k > \frac{f_e}{C_e} \\ \leqslant 0 & \text{if otherwise} \end{cases} \tag{16}$$

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