Essays in Trade and Labor Economics

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Dedication

To my parents and my sister.

Abstract

This dissertation is composed of three essays.

Chapter 1 studies the role of the composition of intermediate inputs in shaping the dynamics of skill premium in developing countries following trade liberalization. The sharp increase in the skill premium in developing countries following trade liberalization is an empirical regularity that is at odds with the predictions of standard Heckscher-Ohlin trade theory. In this paper, I argue that most of the rise in the skill premium is accounted for by complementarity between high skilled labor and foreign intermediate inputs. To quantitatively assess this effect, I build a model featuring two types of labor, high skilled and low skilled, which interact with foreign and domestic inputs at varying degrees of substitution. In this environment, increased access to foreign intermediate inputs raises the relative demand for skilled labor, and consequently, the skill premium. Using firm-level microdata from Ghana, I provide evidence for this mechanism and estimate the degree of skill-complementarity. I find that with differences in substitution elasticities, changes in the observed shares of foreign intermediate inputs account for 75% of the rise in the skill premium observed in the data.

Chapter 2 studies the determinants of the negative educational gradient in divorce. The data suggests that couples with higher levels of education face a lower risk of divorce. This observation is puzzling in the context of standard models of household formation, which are based on the trade-off between gains from joint-consumption and match quality. In these models, the gain from joint consumption is lower for college-educated people due to decreasing returns in consumption, but the gain from match quality is higher, leading to a higher divorce rate. To resolve this puzzling observation, I provide evidence that divorce reduces the chances of success for children. Moreover, this reduction is much more pronounced for children with college-educated parents than for those with non-college educated parents. This additional cost for college-educated

parents, in the form of a lower likelihood that their offspring complete their college degree, provides a stabilization effect. I build a model of household formation to quantitatively assess to what extent this larger reduction can account for the divorce gap observed in the data. I estimate that these higher costs impute to parents of higher levels of education account for almost two thirds of the divorce gap. This finding suggests that the benefit of marriage conferred on college-educated parents in rearing children is the primary factor in shaping the differences in divorce.

Chapter 3 explores the causes behind an increasing gap between college graduates and high school graduates in entrepreneurship entry. Up until the 1980s, both college graduates and high school graduates had the same propensity of becoming entrepreneurs. The fraction of these two groups who were entrepreneurs was 13%. However, after the 1980s, there was a substantial gap between the number of college and high school entrepreneurs. In 2010, the fraction of college graduates who were entrepreneurs increased to 20%, while the same fraction stayed at 14% for high school graduates. I build a model of educational choice and occupational choice to unravel the underlying economic forces in shaping this increasing gap. The findings of this paper suggest that an increasing complementarity between managerial ability and education is the main driver of the gap in entrepreneurship entry.

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Chapter 1

Imported Intermediate Inputs and the Skill Premium: Micro Evidence from Ghana

1.1 Introduction

Following trade liberalization, many developing countries have experienced a sharp increase in the skill premium, measured as the relative wage of skilled labor versus unskilled labor.[1] This observation is at odds with the results of the Stolper-Samuelson theorem, i.e., skill premium should decline – not increase – in low-skill abundant (developing) countries. Due to this discrepancy between the Heckscher-Olin model and data, many leading hypotheses for the increase in the skill premium in developing countries have relied on skilled-biased technological change as opposed to trade-based explanations.[2]

[1] Robbins [1996] finds a strong empirical association between trade liberalization and increases in the skill premium. Behrman et al. [2003] report that the skill premium has increases both in developed and developing countries. In all Latin American countries, the skill premium increased by almost 60 percent points from 1990-1998.

[2] Recent explanations include Parro [2013], Burstein et al. [2011]. The key ingredient in this model to generate a rise in the skill premium is the decline of the prices of equipment. The reduction

In this paper, I argue that international trade has a sizable effect on the skill premium through its impact on the trade in intermediate inputs. Trade liberalization generates a significant rise in the flow of goods, in particular, that of intermediate inputs, see e.g. Feenstra [1998]. In an environment where foreign intermediate inputs are more complementary to skilled labor than to unskilled labor, increased access to foreign intermediate inputs raises the demand for high-skilled workers, and lowers the demand for low-skilled workers, and consequently, increases the skill premium.

I provide direct evidence that supports this mechanism using firm-level micro-data from Ghana's manufacturing sector. This detailed micro-data allows me to study the changes in the composition of intermediate input used in production as well as the workforce composition at the plant level. In my empirical analysis, I show a substantial increase in both the skill premium and the expenditure share of foreign inputs across firms. Moreover, firms that utilize more foreign intermediate inputs tend to employ a higher share of skilled workers.

To quantify the effect of increasing trade in intermediate inputs on the rise of the skill premium observed in the data, I build a model with two types of labor, high skilled and low skilled, that interact with foreign and domestic intermediate inputs at varying degrees of substitution. The model features a higher complementarity between foreign intermediate inputs and skilled labor, than that between foreign intermediate inputs and unskilled labor. To be more precise, the elasticity of substitution between foreign intermediate inputs and skilled labor is lower than that between intermediate inputs and unskilled labor. A key implication of this complementarity is that cheaper intermediate inputs increase the marginal product of the skilled workers, but decrease the marginal product of unskilled labor.

I exploit the variations in the combination of intermediate inputs, and workforce

in equipment prices leads to an increase in the demand for skilled workers, who are complements for equipment, but it decreases the demand for unskilled workers, who were substitutes. However, this observation is inconsistent with the expenditure share on equipment across time and across country (see Bems [2008]).

composition to estimate the crucial parameters of my model. My estimates are consistent with the hypothesis that foreign intermediate inputs and skilled labor are complements. The elasticity of substitution between foreign intermediate inputs and skilled labor is less than one. In contrast, skilled labor and unskilled labor display a much higher elasticity of substitution (1.67), which is similar to the estimates of Krusell et al. [2000] using U.S. aggregate data, and within the range of estimates from the micro literature (see Johnson [1997] for a comprehensive survey on this elasticity).

The findings of this paper support the view that changes in the composition of foreign intermediate inputs is a key factor in understanding the rise in the skill premium in developing countries. The differences in the elasticity of substitutions imply that changes in the observed composition of intermediate inputs have a significant and sizeable effect on the rise of the skill premium. In my quantitative exercise, I find that greater access to foreign intermediate inputs generates an increase of almost 30% in the skill premium in Ghana, which in turn accounts for almost two-thirds of the observed rise.

The mechanism proposed in this paper is also supported by evidence from other developing countries. Saravia and Voigtländer [2012] find strong support for the complementarity between foreign intermediate inputs and skilled workers using firm data from Chile. They found that firms with higher intermediate imports tend to employ a significantly larger share of skilled workers. Using detailed firm-level data from India, Goldberg et al. [2010] argue that trade liberalization introduces new varieties of inputs to domestic firms that were not previously available, and the access to this broader variety allows domestic firms to introduce new products. If the introduction of new products requires high skilled labor, trade liberalization may induce increases in the skill premium.

The episode of trade liberalization in Ghana is particularly interesting because, like many Sub-Saharan African countries (SSA), Ghana has implemented a set of restrictive trade policies after its independence from British colonial rule in 1957 (Ackah and Aryeetey [2012]). After a long period of stagnation in the 1970s, Ghana abandoned its

"import-substituting" policies to become one of the first few SSA countries to enact trade liberalization reforms under the Economic Recovery Programme (ERP). These major trade policies include tariff adjustments and elimination of the import licensing system.[3] By the late 1980s, with virtual elimination of import quotas and substantial reduction in tariff levels, Ghana became one of the most liberal trade regimes in Africa (Baah-Nuakoh and Teal [1993]) These trade policies transformed a close to *autarkic* economy into an internationally engaged one within 5 years (see Cook [1999]). Most interestingly, after this period of major trade reforms, the skill premium increased by a factor of 1.5.

1.2 Related Literature

This paper is related to a growing literature that highlights the role of trade in the rise of the skill premium of developing countries.[4]

In terms of narrative, this paper is closely related to the work of Kurokawa [2011]. Motivated by evidence from Kehoe and Ruhl [2013] and Feenstra [1998], showing that trade liberalization increases the trade in the extensive margin of manufacturing goods, and that most of this increase has been in intermediate inputs, Kurokawa [2011] quantitatively evaluates the role of input *varieties* on the rise of the skill premium observed in Mexico with a model of trade that features variety-skill complementarity. In his framework, trade induces a higher demand for skilled labor by increasing the varieties of intermediate inputs available.[5] In his numerical exercise applied to the case of Mexico, the increases in varieties account for over 10 percent of the actual skill premium observed in the data. This numerical example shows that the potential of this channel in generating rises in the skill premium is promising. However, it has yet to provide a compelling empirical support for this mechanism.

[3] Import license system is one of the main sources of trade flow restriction, see Kehoe [1995].

[4] See Goldberg and Pavcnik [2007] for a comprehensive survey on this literature.

[5] An alternative interpretation of this mechanism is that more variety involves more task to be handled, that in turn corresponds to higher demand for skilled workers.

A related set of papers emphasizes the role of trade on skill premium through a distinct mechanism: the access to cheaper capital goods. The core of this argument is based on the hypothesis of capital-skill complementarity formalized by Griliches [1969]. Burstein et al. [2011] and Parro [2013] argue that increases in the trade flow of equipment, which are skill-complement, due to globalization may have contributed to the rise of the skilled premium observed in developing countries. However, this mechanism implies an increasing trend in the expenditure share on equipment in developing countries. This is inconsistent with observations documented by Bems [2008], that the aggregate expenditure shares on structure and equipment have remained close to constant over time, and they are very similar in both rich and poor countries.

In addition, several empirical studies suggest that the role of capital did not play a major role in the rise of skill premium observed in Ghana (see Bigsten et al. [1999]). Akay and Yuksel [2009] find little support of capital-skill complementary hypothesis. Their empirical estimates show little support for the capital-skill complementarity hypothesis. Moreover, Bigsten et al. [1999] argue that the median values of investment to value-added are less than 1 percent in the Ghana's manufacturing sector. These findings suggest that the accumulation of capital is too low to have played any significant role in the rise of the skilled premium. Finally, expenditure on R&D in the manufacturing sector in Ghana is not quantitatively relevant to have shift the skill premium (see Navaretti et al. [1994]).

The paper is organized as follows. I provide a brief description of the trade liberalization episode in Ghana in section (1.3). In section (1.4), I describe the key features of the data. In section (1.5), I present a model of skill premium with intermediate inputs. Section (1.6) describes the estimation procedure of the model, and reports the findings. Finally, section (1.7) holds the conclusion.

1.3 The Case of Trade Policy Reform in Ghana

1.3.1 Trade Liberalization Policies

Like many Sub-Saharan African (SSA) countries, Ghana has had restrictive trade policies since its independence from British colonial rule in 1957 (see Ackah and Aryeetey [2012]). After a long period of stagnation in the 1970s, Ghana abandoned its "import-substituting" policies to become one of the first few SSA countries to enact trade liberalization reforms under the Economic Recovery Program (ERP).

By late 1980s, with the virtual elimination of import quotas and a substantial reduction in tariff levels, Ghana had become one of the most open trade regimes in Africa (Baah-Nuakoh and Teal [1993]). Within a few years, these trade policies transformed a nearly closed Ghana economy into one that was internationally engaged (see Cook [1999]). In addition to the reductions of tariffs, the import license system was also abolished in 1989. It is worth to mention that the removal of import license is crucial in allowing the trade of goods. Using evidence from the trade liberalization episode from Mexico, Kehoe [1995] shows that the import license system is one of the main sources of trade flow restriction.

Table 1.1 shows the import tariffs in Ghana from 1983-2000. We can observe that most items experienced a significant tariff reduction. The import tax on capital goods and raw materials were decreased by almost 25 percent points. By 2000, Ghana tariff structure has become relatively simple. Consumer goods had a uniform tariff of 10%, and capital goods and raw materials, 5%, while tariffs on luxury goods were maintained at 20%. Concessionary items were completely tariff exempt. It is important to mention the complete elimination of tariff under concessionary items. There were a number of programs under which manufacturers could apply for permission to apply raw materials and intermediate inputs at concessionary duty rates (Bhasin [2012]).

Table 1.1: Import Tariffs 1983-2000

Import Duty Rates (%) 1983-2000				
Item	1983	1990	1995	2000
Concessionary	20	10	0	0
Consumer Goods	30	10	25	10
Capital Goods	30	10	10	5
Raw Materials	25-30	25	0	0-5
Luxury Goods	30	25	25	25

Source: Bhasin [2012]

Table 1.2: Effective Rates of Protection in Ghana, 1987-1990 (Percent)

Sector	1987	1990	Percent change
Food and Processing	81	46	-43.2
Garments	150	54	-64.0
Wood products	59	41	-30.5
Furniture	108	39	-63.9
Metal Processing	152	25	-83.6
Machinery	101	11	-89.1

Source: Berger and Consult [1991]

In addition to reduction of import tariffs, many industries in the manufacturing sector were also exposed to more foreign competition. The effective rates of protection, reported in table 1.2, fell significantly between 1987 and 1990.

To sum up, these major structural changes can be summarized as:

1. Elimination of import quotas and substantial reduction in tariff levels.

2. Abolishment of the import license system.

3. Substantial reduction in the import tax on raw materials and capital goods.

1.4 Facts on the Skill Premium

The data used in this paper is from the World Bank Regional Project on Enterprise Development.[6] The data set contains a panel survey of firms operating within Ghana's manufacturing sector. The survey was designed to represent the firm size distribution across the major sectors of Ghana's manufacturing sector. It covers firm level information over the period 1992-2002. The survey contains information on fixed assets, wage bill, composition of employees, and different measure of expenditure on inputs. It contains sectors from food processing, textiles and garments, wood products and manufacturing, metal products, and machinery.[7] In addition, it also contains a sub-sample of workers information in each firm. This feature allows me to match employees data with the corresponding firms in the panel.

For practical purposes, I follow a standard practice in the literature in using non-production and production classification for manufacturing in separating workers into skilled and unskilled groups (see Forbes [2001] for a detailed survey on skill classification in the literature). The *production workers* category is consisted of workers engaged in *maintenance, production, masters and apprentices*, while the *non-production workers* category is consisted of workers engaged in *management, administration, sales, and supervisors*. It is generally assumed that nonproduction workers are predominantly skilled workers. I use this separation throughout the paper in describing the skill composition for each firm.

1.4.1 Key Facts on Trade and Skill Premium from Firm-level Data

In this section, I describe the key facts from the data. These facts are crucial for my model's quantitative implications. The key empirical findings are summarized as follows:

[6] The data is available from the Centre for the Study of African Economies at Oxford University.
[7] For a more detailed description of the structure of this data set, see Teal [2002].

(i) The skilled premium increased by a factor of 1.5 from 1992-1998 (ii) During the same period, foreign intermediate inputs utilization increased threefold. (iii) There is a pronounced positive correlation between producers skill intensity and foreign intermediate inputs utilization.

Increasing Skill Premium And Increasing Expenditure Share On Foreign Intermediate Inputs

Figure 1.1 plots the evolution of the skill premium and expenditure share in the Ghana manufacturing sector from 1992-1998. From this figure, we can observe that a typical high skilled worker in 1992 used to earn 2.6 times more than that of a low skilled worker in 1992. By the end of 1998, the wage of a typical skilled worker is almost 4 times of the wage of a low skilled worker. The wage differential increased by a factor of 1.5 in less than 6 years. This implies an annual growth rate of the skill premium of 12 percent.

During the same period, the utilization of foreign intermediate inputs also displays an increasing trend. Foreign intermediate inputs utilization increased threefold. Back in 1992, the share of intermediate inputs that is foreign was 11 percent. The same measure increased to 27 percent in 1998.

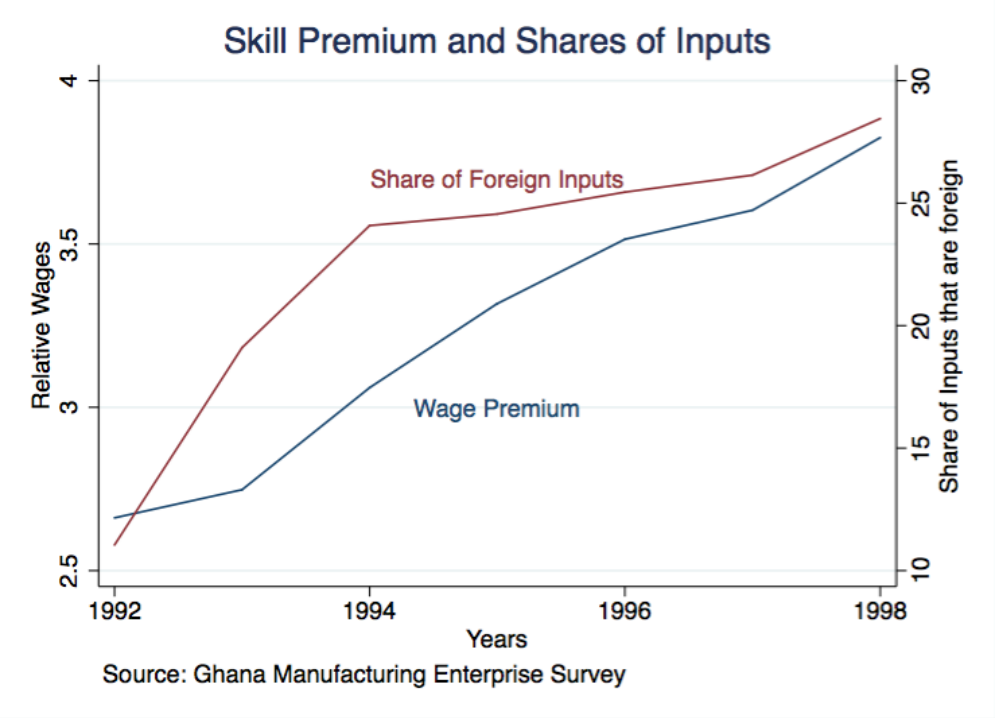


Figure 1.1: Skill Premium and Expenditure Share on Foreign Intermediate Inputs

The Share Of Skilled Workers Is Increasing In The Expenditure On Foreign Input

In this section, I analyze the skill intensity differences across firms by the utilization of foreign inputs of each firm.

Here, I first rank firms by their expenditure share on foreign inputs and group them into 10 bins. Within each bin, I compute the average share of skilled workers of those firms. Figure 1.2 plots the share of skilled workers across different expenditure share bins. Each point on the figure represents the average share of skilled workers of firms for each bin. From the figure, we can see a pronounced positive correlation between the share of skilled workers employed and the fraction of expenditure on foreign inputs. For example, in firms where the average expenditure on foreign inputs was 80%, the average

share of skilled labor was close to 45%; while for firms where the expenditure share was 20%, the skill composition was significantly lower, yielding an average of 15%. The strong positive correlation between skill intensity and utilization of foreign intermediate inputs suggests a strong complementarity between these two factors.

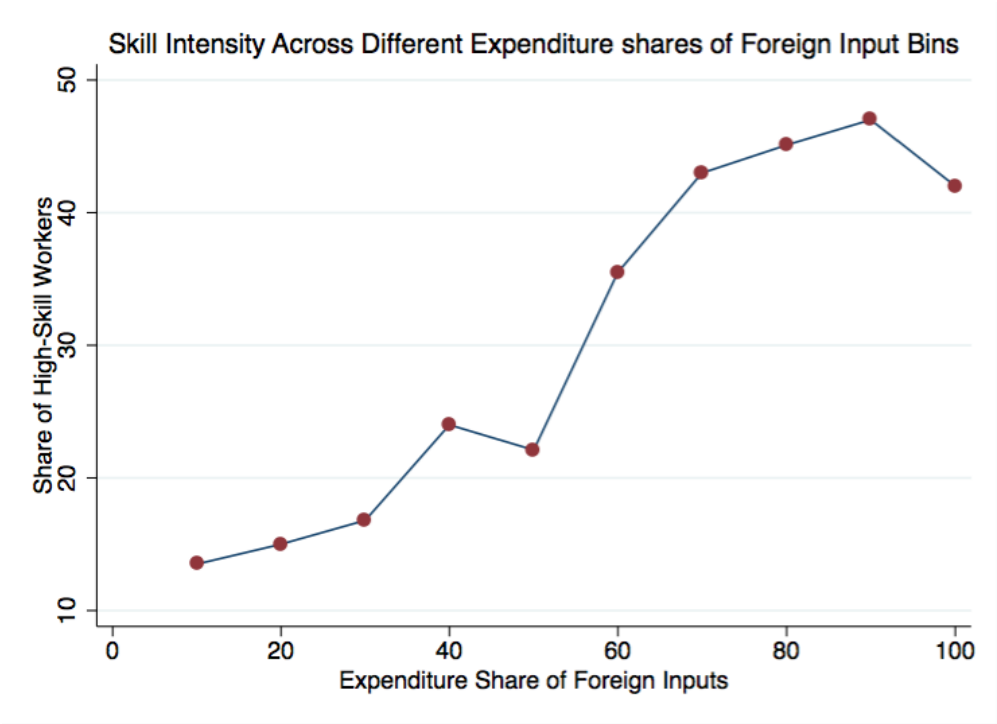


Figure 1.2: Expenditure Share on Foreign Intermediate Inputs and Skill Composition

In summary, this section provides evidence of a substantial increase in the skill premium in Ghana manufacturing firms during an episode of trade liberalization. Simultaneously, the utilization of foreign intermediate inputs also increased across firms during the same period. Moreover, at the cross section, I show that firms that employ more foreign intermediate inputs tend to also employ more of skilled workers. This positive correlation suggests a strong complementarity between foreign intermediate inputs and skilled labor.

1.5 A Model of Skill Premium with Intermediate Inputs

1.5.1 Environment

The model consists of a small open economy, and the country is characterized by its endowment of skilled labor $\bar{H}$ and unskilled labor $\bar{U}$. The country produces domestic intermediate inputs using unskilled labor, and imports foreign intermediate inputs at international prices. I ignore balanced trade considerations, since they are not essential to the analysis of the skill premium.

There are two sectors in the economy, one that produces a final consumption good y, and another that produces domestic intermediate good (x). To simplify the environment, we assume that the final good y is not tradable.

Unskilled labor (u) can handle only the domestic intermediate good, but not the foreign intermediate good inputs (x^*). In this environment, different types of labor handle different combinations of intermediate inputs. This setup is close to that of Kurokawa [2011], with the difference that in his environment, it requires more skill to handle more *variety* of inputs. Whereas, in the setting of this paper, different types of labor interacts with intermediate inputs at varying degrees of substitution. In a sense, the difference in the setting lies in the intensive and extensive margin of intermediate inputs traded.

Intermediate Domestic Input

The domestic intermediate good requires only unskilled labor to produce x.

The technology is given by the following constant returns to scale production function.

$$x = \frac{u}{b} \tag{1.1}$$

where u is the demand for unskilled labor to produce the domestic intermediate

good and b is the unit of unskilled labor requirement.

The intermediate input firm's maximization problem is defined as follows

$$\begin{aligned} \max_{u} \ & p_x x - w_u u \\ \text{s.t} \quad & x = \frac{u}{b} \end{aligned} \tag{1.2}$$

Since this is a constant returns to scale production function, the zero profit condition implies

$$x = \frac{w_u u}{p_x} \tag{1.3}$$

Final Consumption Good Producer

The final consumption good is non-tradable, it will only be used for domestic consumption. The producer combines foreign intermediate inputs x^* and domestic intermediate inputs x to produce y. The final good requires the handling of foreign intermediate inputs, and therefore requires skilled labor. This foreign intermediate good can be purchase at price p^*.

The technology is given by the following constant returns to scale production function

$$y = \left[\mu x^{\sigma} + (1-\mu)\Big(x^{*\rho} + h^{\rho}\Big)^{\frac{\sigma}{\rho}}\right]^{\frac{1}{\sigma}} \tag{1.4}$$

where y is the output of the final good, x, x^* and h are the demand for the intermediate domestic good, intermediate foreign good and the skilled labor, respectively. The parameters λ and μ governs the expenditures on intermediate inputs.

The curvature parameters $\rho < 1$ and $\sigma < 1$ determine the elasticities of substitution between inputs. In this specification, the elasticity between domestic intermediate input

x, and high skilled labor is given by $\frac{1}{1-\sigma}$, and the elasticity of substitution between foreign intermediate inputs and skilled labor is given by $\frac{1}{1-\rho}$. Given our assumption, that foreign intermediate inputs are skill complement, it requires that $\frac{1}{1-\sigma} > \frac{1}{1-\rho}$, i.e $\sigma > \rho$. If either of these values equals to zero, the production function corresponds to the Cobb-Douglas specification.

The final consumption good producers maximization problem is given by

$$\begin{aligned} &\max_{x,x^*,h} \; y - p_x x - p_x^* x^* - w_h h \\ &\text{s.t} \qquad y = \left[\mu x^\sigma + (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}}\right]^{\frac{1}{\sigma}} \end{aligned} \tag{1.5}$$

The FOC's of the final goods producer's profit maximization problem yields:

$$\{x\}: \quad \left[\mu x^\sigma + (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}}\right]^{\frac{1}{\sigma}-1} \mu x^{\sigma-1} = p_x \tag{1.6}$$

$$\{x^*\}: \quad \left[\mu x^\sigma + (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}}\right]^{\frac{1}{\sigma}-1} (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}-1} x^{*(\rho-1)} = p_x^* \tag{1.7}$$

$$\{h\}: \quad \left[\mu x^\sigma + (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}}\right]^{\frac{1}{\sigma}-1} (1-\mu)\left(x^{*\rho} + h^\rho\right)^{\frac{\sigma}{\rho}-1} h^{\rho-1} = w_h \tag{1.8}$$

The optimal ratio of intermediate input mix is given by

$$h = \left(\frac{p_x^*}{w_h}\right)^{\frac{1}{1-\rho}} x^* \tag{1.9}$$

and

$$x = \left(\frac{1-\mu}{\mu}\right)^{\frac{1}{\sigma-1}} \left(\frac{p_x}{p_x^*}\right)^{\frac{1}{\sigma-1}} \left(\left[1 + \left(\frac{h}{x^*}\right)^\rho\right]^{\frac{\sigma-\rho}{\rho(\sigma-1)}}\right) x^* \tag{1.10}$$

Similar to equation (1.10) we get the following relationship between x and h

$$x = \left(\frac{1-\mu}{\mu}\right)^{\frac{1}{\sigma-1}} \left(\frac{p_x}{w_h}\right)^{\frac{1}{\sigma-1}} \left(\left[1 + \left(\frac{x^*}{h}\right)^\rho\right]^{\frac{\sigma-\rho}{\rho(\sigma-1)}}\right) h \tag{1.11}$$

The Skill Premium in the Model

We can derive the skill premium using the fact that all factors of production are paid according to their marginal products, the skill premium in this environment is as follows:

$$\begin{aligned}
\frac{w_u u}{p_x} &= \left(\frac{1-\mu}{\mu}\right)^{\frac{1}{\sigma-1}} \left(\frac{p_x}{w_h}\right)^{\frac{1}{\sigma-1}} \left(\left[1+\left(\frac{x^*}{h}\right)^{\rho}\right]^{\frac{\sigma-\rho}{\rho(\sigma-1)}}\right) h \\
\left(\frac{w_u}{p_x}\right)^{\sigma-1} &= \frac{1-\mu}{\mu}\left(\frac{p_x}{w_h}\right)\left[1+\left(\frac{x^*}{h}\right)^{\rho}\right]^{\frac{\sigma-\rho}{\rho}}\left(\frac{h}{u}\right)^{\sigma-1} \\
\frac{w_h}{w_u} &= \frac{1-\mu}{\mu}\left(\frac{p_x}{w_u}\right)^{\sigma}\left[1+\left(\frac{x^*}{h}\right)^{\rho}\right]^{\frac{\sigma-\rho}{\rho}}\left(\frac{h}{u}\right)^{\sigma-1}
\end{aligned} \tag{1.12}$$

Finally using the fact that $p_x = bw_u$ we define the skill premium as:

$$\frac{w_h}{w_u} = b^{\sigma}\frac{1-\mu}{\mu}\left[1+\left(\frac{x^*}{h}\right)^{\rho}\right]^{\frac{\sigma-\rho}{\rho}}\left(\frac{h}{u}\right)^{\sigma-1} \tag{1.13}$$

Differentiation of equation (1.13) indicates that as long as $\sigma > \rho$, which is the case where foreign intermediate inputs are more complement to skilled workers than unskilled worker, we have that

$$\frac{\partial w_h/w_u}{\partial x^*} > 0 \tag{1.14}$$

This last expression shows that as long as foreign intermediate inputs are skill-complement, an increase in the quantities of foreign intermediate inputs corresponds to increases in the demand for skilled workers, and hence, the skill premium.
Log-linearizing equation (1.13) , and dropping the constant term, yields:

$$\ln\left(\frac{w_h}{w_u}\right) \simeq \frac{\sigma-\rho}{\rho}\left(\frac{x^*}{h}\right)^{\rho} + (\sigma-1)\ln\left(\frac{h}{x}\right) \tag{1.15}$$

Let g_{sp} be the growth rate of the skill premium, and g_z, be the growth rate of a variable z, and differentiating with respect to time, we can express equation (1.15) in term of growth rates.

$$g_{sp} = (\sigma - 1)(g_h - g_x) + (\sigma - \rho)\left(\frac{x^*}{h}\right)^{\rho}(g_{x^*} - g_h) \tag{1.16}$$

Expression (1.16) resembles the standard wage premium equation in the literature of wage inequality (see Krusell et al. [2000]) with the differences that it contains the effect of the composition of intermediate inputs on the skill premium. Equation (1.16) indicates that two channels affects the growth rate of the skill premium: (i) growth rate of the supply of skilled workers relative to the growth rate of domestic intermediate inputs, i.e h/x. (ii) and, the growth rate of foreign intermediate inputs relative to the growth rate of skilled workers, i.e. x^*/h.

The first channel, $(\sigma - 1)(g_h - g_x)$, that affects the skill premium is the *supply effect* of the growth rate of skilled h labor relative to domestic inputs x. Given the assumption in the model specification, that to handle domestic inputs it requires only low skilled labor, this channel could be reinterpreted as the effect that the difference between the growth rates of skilled labor versus unskilled labor has on the skill premium. The relative supply of skilled labor has a negative effect on the growth rate of the skilled premium since $\sigma < 1$.

The second channel, $(\sigma - \rho)\left(\frac{x^*}{h}\right)^{\rho}(g_{x^*} - g_h)$, is the *foreign intermediate input complementarity effect*. This channel, in turn, can be divided into two components: the difference in the growth rate of foreign intermediate inputs and the growth rate of skilled labor $(g_{x^*} - g_h)$, and the ratio of foreign intermediate inputs to skilled labor (x^*/h). If foreign intermediate inputs are more complement to skilled labor than unskilled labor, i.e. $\sigma > \rho$, the growth rate of foreign intermediate inputs relative to skilled labor increases the skilled premium. Through this channel, the increase utilization of foreign intermediate inputs increases the skill premium due to the complementarity effect.

The impact of $(x^*/h)^{\rho}$ on the growth rate of skill premium depends on the shape of the isoquants of the production function. The parameter that governs the shape isoquants is precisely ρ. If $\rho > 0$, meaning that foreign intermediate inputs and skilled

labor are more substitutable than Cobb-Douglas, increases in the ratio of $(x^*/h)^\rho$ will increases the skill premium over time, but it decreases when $\rho < 0$.

In sum, in this environment, changes in the composition of intermediate inputs have an effect on the skill premium due to the feature of skill complementarity. Hence, cheaper foreign intermediate inputs, induced by trade liberalization, affect the optimal mixture of intermediate inputs, and in turn, the skill premium in the economy.

1.6 Estimation

In this section, I describe the estimation procedure.

There are two parameters in the model that are crucial for our question, the parameter of elasticity between different types of inputs and different types of labor, $\Theta \equiv (\sigma, \rho)$. These two parameters determine how different combinations of intermediate inputs shape the skill premium observed in the economy. The remaining two parameters are just b, and μ, the productivity of unskilled labor and the weight in the CES nesting of the production function, respectively. These two parameters are just scaling parameters, and they are not relevant in delivering the quantitative results on growth rate of the skill premium.

I use a form of GMM for estimation. The estimate $\hat{\Theta} \equiv (\hat{\sigma}, \hat{\rho})$ minimize the distance between the skill premium $\widehat{sp_{j,t}}$ in the model and the empirical counterparts $\overline{sp}_{j,t}$ for each firm j and each period t:

$$\min_{\Theta} g(\Theta)' W g(\Theta) \tag{1.17}$$

where $g(\Theta) = (g_1(\Theta), \cdots, g_N(\Theta))'$ and $g_k = \overline{sp}_{j,t} - \widehat{sp_{j,t}}$.

The estimates are reported in table (1.3), and the implied substitution elasticities are reported in table (1.4). The estimates from (1.3) are consistent with the theory of complementarity between foreign intermediate inputs and skilled labor, i.e. $\sigma > \rho$.

Table 1.3: Estimated Elasticities Parameters

Parameters	Explanation	Value (S.E)
ρ	Elasticity of Substitution Parameter between x^* and h	-0.069
σ	Elasticity of Substitution Parameter between x and x^*	0.404

Table 1.4: Estimated Substitution Elasticities

Estimated Substitution Elasticities	Values
Between Skilled Labor	
Domestic Intermediate Inputs $1/(1-\sigma)$	1.678
Foreign Intermediate Inputs $1/(1-\rho)$	0.936

As we can see from table (1.4), the implied elasticity of substitution between foreign intermediate inputs and skilled labor is lower to that between foreign intermediate inputs and unskilled labor. The elasticity of substitution between domestic intermediate inputs and foreign intermediate is 1.67, which is also by symmetry of the CES nesting, the elasticity of domestic intermediate inputs and skilled labor. Given that to produce domestic intermediate inputs, it requires solely unskilled labor, this elasticity can be interpreted as the elasticity between unskilled labor and skilled labor. The estimated elasticity is close to the one reported by Krusell et al. [2000] using time series data from the U.S. This estimate is also similar with the elasticity of 1.5 reported by Johnson [1997], and within the range of values survey in Acemoglu [2002]. The estimate implies that both type of labor are highly substitutable. Finally, the elasticity of substitution between skilled labor and foreign intermediate is 0.93, which is slightly less substitutable than Cobb-Douglas.

Now, I use the estimated elasticities from table (1.4), and use equation (1.16) that compute the growth rate of the skill premium as a function of the growth rate of the quantities, to assess how much these observables can account for the increase in the skill premium observed during the period studied. I use the information on the time series on expenditure on foreign intermediate inputs and domestic intermediate inputs,

and the skill composition of the workforce, to compute the skill premium implied by the model.

Figure 1.3: Model's Prediction on the Skill Premium

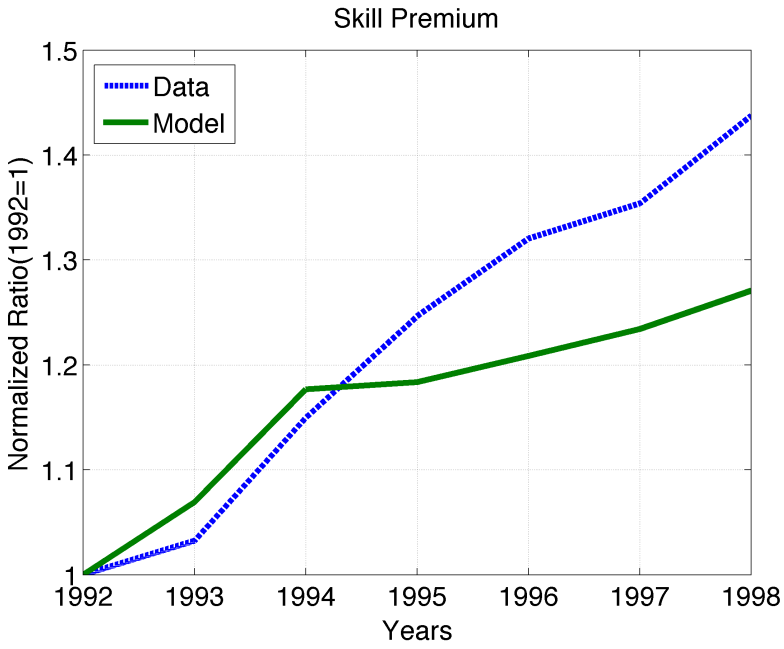


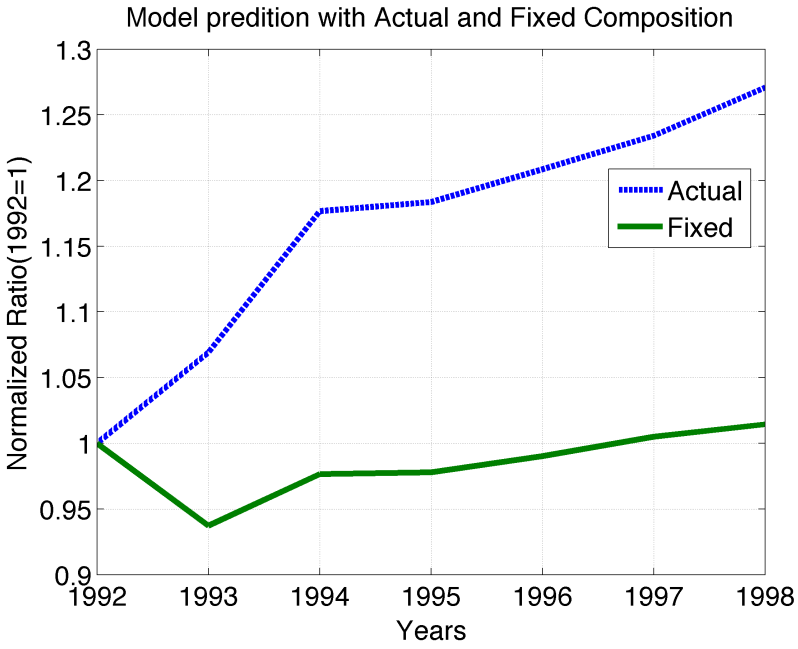
Figure (1.3) shows both the normalized skill premium to its ratio in 1992 from the data and the prediction of the model for the skill premium between 1992-1998. The model is able to generate the steady increase in the skill premium observed in Ghana. The model captures almost 75% of the rise in the relative wage. The model generates a sharp rise in the skill premium between 1992 and 1994, which matches the similar rise observed in the data. Thereafter, the model predicts a steady increase, while in the data the increase was much pronounced.

Overall, the skill premium increased by almost 50%, while the model implies an increase of almost 30%. The model underpredicts the rise in the skill premium by 20 percent points. Even abstracting away from any physical capital accumulation mechanism, the model is quite successful in generating the trend and the level of the change

in the skill premium. The prediction of the estimated benchmark model is broadly consistent with the data.

1.6.1 Counterfactual Experiment: The Contribution Of Foreign Intermediate Inputs On The Rise In The Skill Premium

Figure 1.4: The Contribution Of Foreign Intermediate Inputs On The Rise In The Skill Premium



To quantify to what extent the increase access of foreign intermediate inputs has contributed the rise in the skill premium, I perform a counterfactual experiment. I feed into the model expenditure on foreign intermediate inputs observed in 1992, and hold it constant throughout these periods. Figure (1.4) plots the normalized skill premium implied by the model with actual data on the composition of intermediate inputs, and with fixed composition from its level of 1992. The figure shows that once we remove the changes in the composition of foreign intermediate inputs, the skill premium does

not display an upward trend. Moreover, the skill premium would have dropped during 1993 -1994 by approximately 5%. This decline is generated by small changes in the skill composition of the labor force, but its magnitude is minuscule. This exercise shows that had the composition of intermediate input remained constant to its level of 1992, the skill premium would have stayed the same to its level of 1992. This experiment shows that complementarity between foreign intermediate inputs and skilled labor is the key factor in understanding the rise of the skill premium.

1.7 Conclusion

This paper shows that international trade has sizable effect on the skill premium through the trade in intermediate inputs. In my framework, the composition of intermediate inputs used in production is crucial in generating the sharp increase in the skill premium observed in developing countries following trade liberalization. In this framework, distinct types of labor, high skilled and low skilled, interact with different degrees of substitution with foreign and domestic intermediate inputs, i.e., the elasticity of substitution between foreign intermediate inputs and skilled workers is lower than that between foreign intermediate inputs and unskilled workers. The implication of the model is that cheaper intermediate inputs increase the marginal product of the skilled labor, but decreases the marginal product of unskilled labor.

In addition, I provide direct micro-level evidence in support of this mechanism using firm-level data from Ghana. I use variations in the composition of intermediate inputs, and workforce to estimate my model. My estimates are consistent with the theory of complementarity between foreign intermediate inputs and skilled labor. The elasticity of substitution between foreign intermediate inputs and skilled labor is less than that of Cobb-Douglas. However, skilled labor and unskilled labor display a much higher elasticity of substitution, which is consistent with estimates using aggregate data from the U.S, and within the range of estimates from the micro literature.

Finally, I find that, with marked differences in substitution elasticities, changes in the observed composition of inputs account for two-third of the rise in the skill premium observed in the data. This paper supports the view that changes in the composition of foreign intermediate inputs is a key factor in understanding the rise in the skill premium in developing countries.

Future Research

Empirical studies suggest that imported inputs explain a significant fraction of the introduction of new products in developing countries (see Goldberg et al. [2010]). Given that intermediate inputs are an increasing share of the inputs traded across borders, a natural step is to investigate how access to different variety of intermediate inputs foments innovation of new products, which are usually skill-biased tasks. I leave for future research how this channel may amplify the role of trade in the rise of the wage inequality.

Chapter 2

Education and Household Formation

2.1 Introduction

In this paper I ask what can account for the significant differences in the divorce rate of first marriages between college and non-college educated people. In the U.S., the divorce rate, measured as the fraction of marriages ending in divorce, is consistently much lower for college educated people. This observed difference persists even after controlling for the early entry into marriage of the non-college educated group.

Despite this prominent difference in divorce behavior across educational groups, little research has explored the stabilizing effect of education on marital outcomes. These observations are puzzling in the context of standard models of household formation, which are based on the trade-off between gains from consumption and match quality. In these models, the gain from joint consumption is lower for college educated people due to decreasing returns in consumption, but the gain from match quality is higher. Hence, when the quality of the current match deteriorates, college-educated people have a higher incentive to dissolve the union. In addition, the outside option (the state of

being single) for college-educated people is also higher given their higher earnings. Given these two forces, the prediction of these models is that the propensity to divorce should be higher, contrary to what we observed in the data, for people with higher levels of education.

This paper makes two contributions. First, I document that the presence of a child has a strong influence on the divorce behavior across educational groups, especially for those couples in which the father is college educated. Couples with children divorce less than couples without children regardless of their college attainment level. Furthermore, college-educated parents divorce much less than non-college-educated parents (the difference is approximately 14 percent), whereas the opposite holds true for college educated couples without children (the gap is 12 percent). In addition, I provide evidence, which suggests that divorce reduces the chances of college completion for children. Moreover, this reduction is much more pronounced for children with college-educated parents than for those with non-college educated parents.

This additional cost for college-educated parents, in the form of a lower likelihood that their offspring complete their college degree, provides extra stabilization effect. Secondly, I develop and estimate a model of household formation where parents differ in gender, education, and preferences over the college attainment of their offspring. I use the model to assess the roles of the two mechanisms in accounting for the divorce patterns across educational groups: (1) the higher destruction in chances of college attainment. (2) heterogeneity in preferences for educated offspring.

I find that a simple version of the model that takes into account the higher costs for college-educated parents accounts for 70 percent of the divorce gap between college and non-college educated parents observed in the data. This result supports the findings from recent work by Lundberg and Pollak [2013], where they suggest that college-educated couples use marriage as a commitment device to support high levels of investment in children.

Understanding these demographic differences is important because the household

structure in which children are brought up greatly impacts their success later in life (for a comprehensive survey on the impact of single mother families on the outcome of children see Sigle-Rushton and McLanahan [2004]). Neal and Johnson [1996] found that the skill gap between white and black adults account for almost all of the observed black-white wage gap, and this skill gap, in turn, can be traced back to observable differences in the family background. In a related study, Regalia and Rios-Rull [2001] suggest that changes in the marital status composition of the population have an amplifying effect on the inter-generational earnings correlation: being born into a single-female-headed household increases the likelihood of becoming a low-earning type adult by 30%.

Since the 1980s, the difference in the marital dissolution rate has been increasing between college and non-college educated people. The divorce rate has plummeted for college-educated couples since 1980, while little has changed for couples without a college degree (McLanahan [2004]). This demographic shift was the key driver in the decline of the crude divorce rate during this period. A natural step following this paper is to ask what has changed over time that can account for these different behaviors.

I organize the paper as follows. In section 2.4, I describe the empirical findings on divorce behavior across educational groups, and the empirical relationship between family disruption and children's college attainment . In section 2.5, I highlight the key features of the data. Section 2.6, I describe a model of household formation and divorce. Section 2.7 describes the estimation procedure of the model. Section 2.8 reports the results. Finally, section 2.9 holds the conclusion.

2.2 Literature Review

Empirical evidence on the stabilizing role of education on marital stability has been widely documented in the literature. Heckman et al. [2009] found that graduating from college decreases the probability of divorce even after controlling for other characteristics - namely cognitive skills - that may be correlated with schooling decisions. Bramlett

and Mosher [2002] also found that married women who have attained higher levels of education are less likely to divorce. In a related study, Kim [2012] found that while the divorce rate is lower for most white females with a college degree, higher education does not confer the same protection in marriage for African-American women.

Growing up in a single parent or stepparent family appears to have strong adverse effects on the educational attainment of children. McLanahan [1999] explored the impact of family structure on children's college attainment and found that the effect of family disruption[1] is particularly costly for children with college-educated parents. For these families, a family disruption increases the high school dropout risk by a factor of 3 and teen birth risk by a factor of 5. For those who live in disrupted families, the risk of dropping out of high school and becoming a teen mother is around 1.5 and 2 times greater, respectively. The success rate of children with parents with lower levels of education is rather small on average, regardless of their family structure. It appears that family disruption takes away the advantages of having parents with a college education. It places a children with divorced parents on par with children whose parents have never been to college but have remained together.[2]

Piketty [2003] suggests that these previous estimates of divorce cost on the success of children may in fact be the outcome of the adverse effect of parental conflicts rather than the impact of family structure. In other words, the sample of children whose parents are divorced may be composed of children with lower performance due to the adverse effect of parental conflict *during* marriage. In a recent paper, Tartari [2006] addresses this concern, she found that the success of children of divorced parents would have been higher had parents not been divorced. In a related study, Ginther and Pollak [2003] found that children raised in traditional nuclear families not only tend to have better educational outcomes than stepchildren from stable blended families, but they

[1] A family disruption is a transition from living in a two-parent family to a one-parent family by the age of sixteen (including children born to unmarried parents).

[2] Estimates are based on logistic regression models and control for race, sex of child, mother's education, father's education, place of residence and number of siblings.

also tend to do better than the joint biological children from stable blended families.

2.3 The Nature of the Puzzle

Consider a simple model of marital formation where marriage generates two sources of benefits: (i) increasing returns to consumption while living with a partner. (ii) the value of match quality derived from living with a spouse.

The trade-off between these two potential gains can be represented as follows:

$$U(c, b; \phi) = U[c\phi] + b \tag{2.1}$$

where $U(c, b; \phi)$ is the utility derived from consumption c scaled up by ϕ (via economies of scale), and match quality b. This representation takes into account the trade-off between *money* and *love* (see Fernandez et al. [2005], Regalia and Rios-Rull [2001], and Greenwood and Guner [2004]).

Since the marginal gain from joint-consumption is decreasing in the level of earnings, hence also decreasing in the level of education, in this setting, college-educated people have a higher propensity to dissolve the union whenever the quality of the current matches deteriorates. This prediction of the model, that the propensity to divorce is higher for college-educated people, is the opposite of the empirical facts documented below.

2.4 Empirical Facts

2.4.1 Marital Dissolution and Education

I document the empirical relationship between educational attainment and marital dissolution by using data from Wave 2 Topical Modules of the 2001, 2004, and 2008 panels of the Survey of Income and Program Participation (SIPP), conducted by the U.S. Census Bureau. SIPP contains comprehensive information on marital history for men and

women aged 15 and over in the United States. It also provides information about both spouses for people who are currently married. I focus on the outcome of first marriages so that the hazard of divorce reflects the average person's marital experience rather than the average of a marital experience. Additionally, those who marry at an early age (20-24) have the highest rate of divorce. In order to control for differences in earlier entry into marriage, in much of my analysis, I focus on people who where older than 24 years old when they first married.

Figure (2.1) and (2.2) show the difference in the divorce rate across educational groups for women and men, respectively. The figures highlight that for each cohort of marriage there is a difference in the divorce rate between college-educated women and their counterparts. By the 15th anniversary, the difference in divorce rate is approximately 6 percent. This is consistent with recent findings by Isen and Stevenson [2010]. They found that college-educated women are less likely to marry than their less-educated counterparts. However, when they do marry, they are less likely to divorce.

Figure 2.1: Difference in divorce rate between college-educated women and non-college educate women

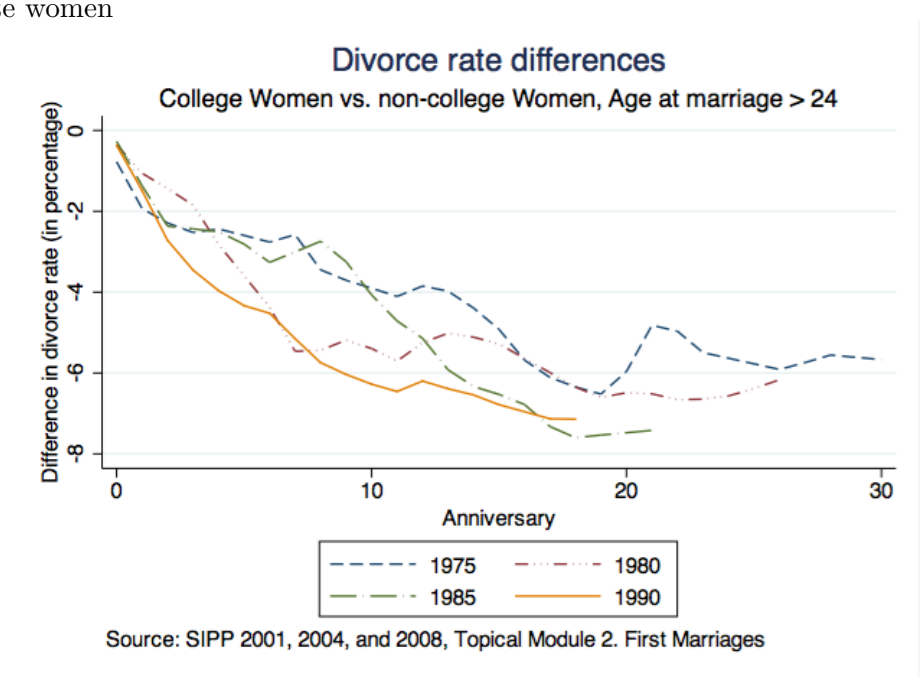
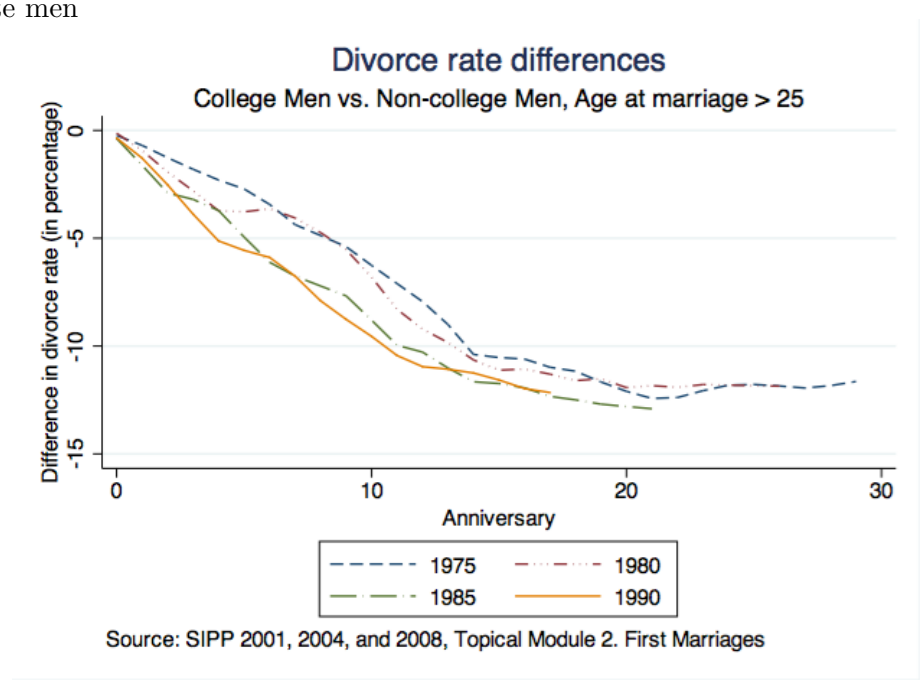


Figure 2.2: Difference in divorce rate between college-educated men and non-college educate men



The difference in the divorce rate between college and non-college educated people persists even one takes into account the higher age at first marriage of the college-educated group. To demonstrate the pervasiveness of the role in education in determining differences in divorce rate, I estimate empirically a Cox Hazard regression of the following form:

$$\log h_i(t) = \log h(t) + \beta \mathbf{X_i} + \theta_i + \delta_{\mathbf{iy}} \tag{2.2}$$

where $h_i(t)$ is the person i's hazard of divorce after t years of marriage, $\mathbf{X_i}$ are the covariates (education and race, and other demographic characteristics), δ_{iy} is a vector of variable indicating the year when the person first got married and θ_i dummies for age at marriage. This specification requires that the impact of the covariates on the hazard rate of divorce to be proportional. Treating age at marriage as a group of dummies

variables allows for the estimates to capture a non-linear relationship between age at marriage and divorce. It is widely documented that marriages beginning at age of 18 are twice as likely to end in divorce than those starting when they are 22 (see Becker et al. [1977], Rotz [2011], Lehrer [2008]).

Table (2.1) and (2.2) below report the hazard ratio of divorce for the female and male sample, respectively. college-educated people have approximately 60% of the hazard that non-college educated have of divorce. The estimated hazard ratio was 0.60 for both groups, indicating that college-educated person have a 40% lower risk of divorce than non-college educated person. This relative hazard rate implies that, by the 10th anniversary, the dissolution rate of marriage for college-educated people is 10% lower than that of non-college educated people. Figure (2.3) and Figure (2.4) show the implied dissolution rate for first marriages for females and males, respectively.

Table 2.1: Cox Hazard Regression: implied hazard ratios (Female Sample)

	Empirical Estimation	
	Haz. Ratio	Std. Error
Education at Marriage	.737***	.018
Presence of a Child	.304***	.005

Other covariates: race, age at marriage and year of marriage.

Table 2.2: Cox Hazard Regression: implied hazard ratios (Male Sample)

	Empirical Estimation		
	Haz. Ratio	p-value	Std. Error
Education at Marriage	.618	.000	.014

Other covariates: race, age at marriage and year of marriage.

Figure 2.3: Marriage dissolution rate for Female Sample

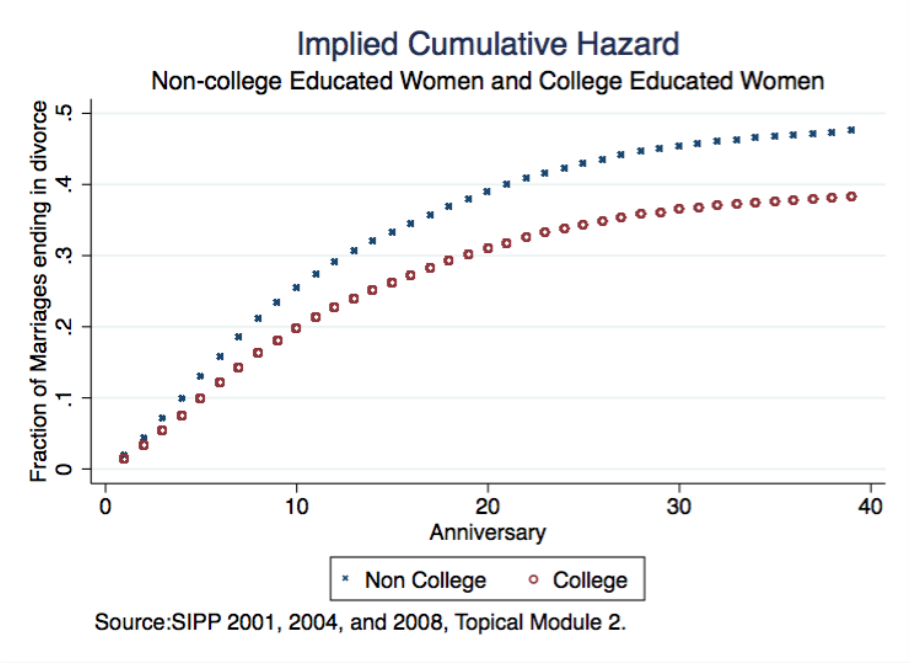
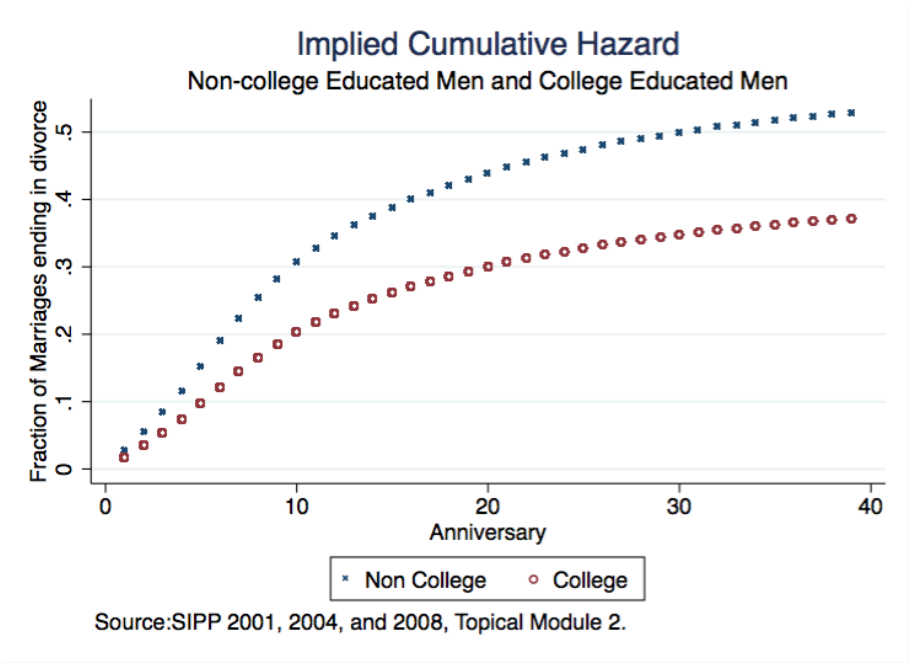


Figure 2.4: Marriage dissolution rate for Male Sample



2.4.2 Family Structure And Educational Outcome Of Children

To capture the correlation between family structure and the educational outcomes of the children, Consider the following probit model that regress college completion outcome on the set of variables X_i that includes gender, race, and an indicator for the education attainment of his parents, and family disruption.

$$\text{Probit}(Y_i) = \alpha + \beta \mathbf{X_i} - \epsilon_i \tag{2.3}$$

A child is raised in a disrupted family if he did not live with his biological parents through the age of 18. Table (2.3) shows the estimates of the probit regression.

Table (2.4) displays the probability of college completion conditional on parents

Table 2.3: Effect of Family Disruption on Children

	Coef.	Std. Error
Mother college educated	.572*	.035
Father college educated	.711*	.032
Family Disruption	.410*	.024
Race	.109*	.011
Gender	.198*	.023
Constant	–1.765*	.059
No. of cases	19269	
* pvalue <0.05		

Source: NLSY 1979-1997

educational backgrounds and family structure of the children.[3] The estimates suggest that the intergenerational correlation of college attainment is strong - the education of the parents is strongly correlated to that of their offspring. Children from college-educated parents that had stayed in their marriage have approximately 60 percent chance of obtaining a college degree, while the chances for children from couples with lower levels of education are under 15 percent.

Table 2.4: Probability of college completion by parents' educational type and family structure

Parent's Education	Family Structure		
Mother / Father	Disrupted	Intact	Difference
N/N	0.075	0.151	0.076
N/C	0.232	0.374	0.142
C/N	0.192	0.322	0.131
C/C	0.436	0.599	0.162

Note: The probability are adjusted for race, sex, mother's education, father's education, number of siblings, and place of residence.

[3] All probabilities are adjusted for the demographic backgrounds of the children.

However, the impact of family disruption on the educational attainment of children varies according to the specific characteristics of their parents. The success rate of children of parents with lower levels of education is slim in general, regardless of their family structure (7 versus 1 percent). On the other hand, for children of highly educated parents, family disruption has a greater effect on their educational attainment. Divorce reduces the chances of college completion for children of highly educated parents by 16 percent, while the same reduction is only 7 percent for children of parents with lower levels of education.

2.4.3 Marriage Dissolution Rate By The Presence Of Children

In this section, I show that the presence of a child has a strong stabilizing effect on marriage, especially for those couples in which the father is college educated. To control for early marriages, I limit the sample to all women who married at the age of 25. Those who married with a premarital birth are also excluded from the sample.

A nice feature of SIPP data is that it contains comprehensive data on marital history, but it does not contain information on the characteristics of their spouses unless the marriage stays intact. Instead, I use data from NSFG 1995 to show the divorce pattern across different mixtures of marriages. NSFG is a cross-sectional survey that also provides retrospective information on marriage and divorce. However, the sample includes the population between the ages of 15 and 44. This difference in the age structure of the NSFG sample implies on average a higher divorce rate for any given duration of marriage.[4] Given this discrepancy, I limit my analysis on the outcome of marriage at a shorter duration (15th anniversary).

[4] The NSFG samples are limited to age 44, the marriage outcome of those who got married at age 25 is not observed by the 20th anniversary.

Table 2.5: Divorce Rate By The Presence Of Children

Marriage dissolution rate by the 15th anniversary			
	With a child		
Women/Men	Yes	No	Difference
N/N	30.3%	37.1%	6.80%
	(0.10%)	(0.07%)	
N/C	13.4%	41.8%	28.40%
	(0.05%)	(0.16%)	
C/N	31.3%	55.2%	23.83%
	(0.14%)	(0.19%)	
C/C	17.6%	49.2%	31.59%
	(0.08%)	(0.14%)	

Source: NSFG 1995. Marriages with a premarital birth are excluded (age at marriage older 24). Standard Errors are reported in parenthesis.

Table (2.5) shows the fraction of first marriages that ends in divorce by their 15th anniversary by presence of a child and educational attainment of the spouse. The first column indicates the combinations of education attainment of the spouses. We can observe 3 marked patterns. (1) couples without children divorce more than couples with children regardless of their educational levels. (2) The educational level of the father has a greater effect on marriage stability when the marriage involve the birth of a child. The divorce rate for parents where the mother has a higher educational level than the father is 18 percent more than that of parents where the mother has a lower educational level. (3) For the group of marriages that does not involve the birth of a child, the divorce rate increases as the education of the spouses increases. The divorce rate is the highest for the mixture of marriages that involves a college-educated wife and a non-college educated husband.

2.5 Summary of the Evidence

In this section, I summarize the evidence from previous sections.

1. The divorce rate is increasing in the couples' level of education when the marriage does not involve the birth of a child. The gap is 12 percent.

2. College-educated parents divorce less than non-college educated parents. The gap is approximately 13 percent.

3. The divorce rate for parents in which the mother has a higher level of education than the father is 17 percent higher than that of parents where the father is more educated.

4. College-educated parents divorce much less than couples without children with similar college attainment level. The difference in divorce rate is approximately 30.

5. Family disruption reduces the chances of college completion for children. Moreover, the reduction is much larger for children of highly -educated parents. Family disruption reduces the chances of college completion for children of college-educated parents by 16 percent, while the same reduction is only 7 percent for children of non-college educated parents.

2.6 A Model of Household Formation

In this section, I develop a simple model of household formation to account for the facts described in previous sections.

Consider a household composed of females and males $g \in \{m, f\}$ that can be college educated or non-college educated $e \in \{c, d\}$. A household may have a child or not $n \in \{0, 1\}$. At the beginning of the period, they draw a marital bliss shock b and they decides whether to stay married or divorce $q \in \{m, s\}$. The match quality is specific and

i.i.d. drawn from a density function $f(b)$ (the details of this process will be explained in section 2.7.2). This match quality effectively increases the value of being married and it is symmetric between spouses. This setting is similar to that of Aiyagari et al. [2000].

2.6.1 Preferences

The utility of being married for a couple with a child with education level (e, e^*) is given by

$$U^m(e, e^*, c, n, b) = U^m[c\phi(n)] + b + \chi n \log(\sum_{e'} P_m(e'|e, e^*)w_{e'}) \tag{2.4}$$

The utility of being married is composed of three components. First, the direct utility derived from consumption c adjusted by $\phi(n)$ via economies of scale. Second, the draw of marital bliss, and third, the utility that derives from the college attainment of their children, where χ is the utility weight that a household place on the college attainment of their offspring. The probability of college attainment of their offspring is given by $P_m(e'|e, e^*)$, which depends on the college attainment of the parents and their decision staying in marriage.

The utility of divorcing with a child is given by

$$U_s(e, e^*, c, n) = U^s[c\phi(n)] + \chi n \log(\sum_{e'} P_s(e'|e, e^*)w_{e'}) \tag{2.5}$$

The utility of being single is the sum of two components. The first component corresponds to the utility attained from c, adjusted by $\phi(n)$ via economies of scale - adjusted for the absence of an adult in a family. The second component consists of the utility derived from the college attainment of their offspring, where χ is the utility weight that a household put on the college attainment of their child. In this state, not only the household experiences a reduction in the gain from joint consumption, but also a decrease in the probability of college attainment of its offspring, given by $P_s(e'|e, e^*)$.

2.6.2 Gain from Marriage

In this framework, marriage delivers three types of potential gains for the household, (i) the value of bliss derived from living together, e.g $b > 0$ (ii) increasing returns to consumption while living with a partner. (iii) marriage generate difference in the return of educational attainment of a child.

The decision rule to the problem is a threshold for the marital bliss $\bar{b}(e, e^*, n)$, such that the value of staying in marriage at that value is equal to the value of ending the match, e.g. $U(e, e*, c, n, \bar{b}) = U(e, e*, c, n)$. These cut-offs determine the divorce rate across different type of couples.

2.6.3 Education, Wage And Consumption

Education in this economy determines the wage and also gives an advantage to parents in educating their children. This economy incorporates the wage structure observed in the data, namely, wage premium and gender premium. The wage, $w_{e,g}$, is indexed by education and gender. In addition to these characteristics, the marital status affects directly the total income of the household. I make the assumption that in marriage, the spouses pool perfectly their incomes; and upon divorce, the total income is split evenly among the couple.

$$c = \begin{cases} w_e^f + w_e^g & \text{if married} \\ (w_e^f + w_e^g)/2 & \text{if divorce} \end{cases} \tag{2.6}$$

2.7 Estimation

2.7.1 Preferences Specification

The current utility is of a CRRA form with a risk aversion parameter of $\sigma = 2$ and the equivalence scales, ϕ, are taken directly from the OECD.

$$\phi(n) = \begin{cases} 1 + 0.7 + n * 0.5 & \text{if married} \\ 1 + n * 0.5 & \text{if divorce} \end{cases} \tag{2.7}$$

2.7.2 Distribution of Bliss

The property of the distribution of bliss is approximated with a mixture of two normal distributions $f(x) = \sum_{i=1}^{2} p_i f(x|\mu_i, \sigma_i)$. This mixture allows for a flexible density approximation. This specification requires 5 parameters, hence 5 moments from the data.

2.7.3 Wage Structure

The wage structure in this economy features a gender gap premium and return to education. I normalize the wage of college educated males to be one. The gender gap for the college educated group is around 26 percent. The wage premiums for females and males are 30 percent and 46 percent, respectively.

Table 2.6: Wage Structure

	College Educated	Non-college Educated
Female	0.744	0.402
Male	1.000	0.546

Source: Current Population Survey

2.7.4 Estimation Procedure

I estimate the model by targeting the main features of divorce behavior of non-college educated women, and college-educated women without children. Specifically, estimation consists of the vector of 6 parameters:

$$\theta \equiv \{p, \mu_1, \mu_2, \sigma_1, \sigma_2, \chi\} \tag{2.8}$$

These 6 parameters, $\theta \equiv \{p, \mu_1, \mu_2, \sigma_1, \sigma_2, \chi\}$, of the model are estimated jointly by matching 6 moment conditions, the fraction of marriages that ends in divorce of couples without children (both college and non-college couples). It is important to emphasize that the information on the divorce rate for college-educated parents is not used in the estimation. Rather, the estimation procedure uses the information on the divorce rate for couples without children (college and non-college couples), and the divorce rate for non-college educated parents to identify these parameters. In this version of the model, parents care equally about the success of their children.

The estimates $\hat{\theta}$ solve

$$\min_{\theta} g(\theta)' W g(\theta) \tag{2.9}$$

where $g(\theta)$ is the distance between the empirical divorce rate and the simulated divorce data implied by the model, and W, the weighting matrix (here we use the identity matrix).

2.8 Findings

2.8.1 Estimated Parameters

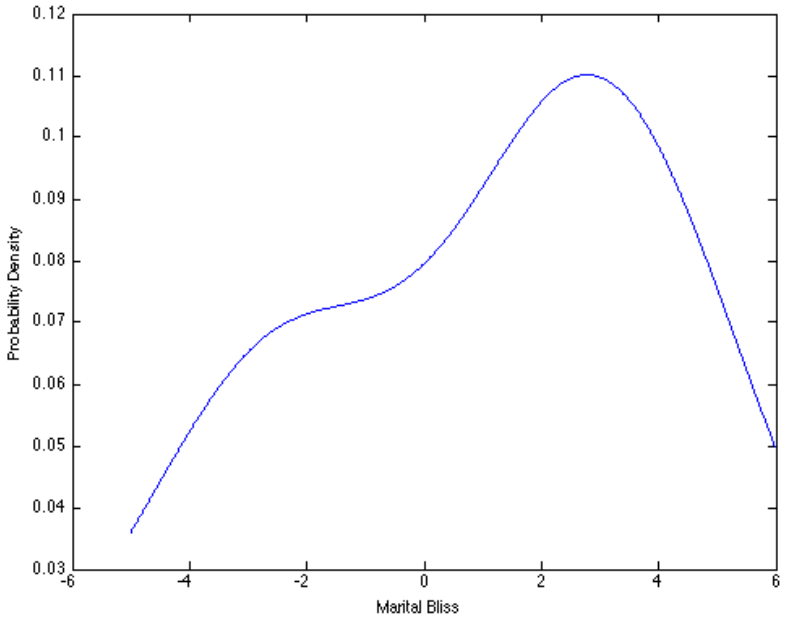
The parameters estimates are reported in table (2.7). From the estimates, we can infer that parents care a lot about the college completion of her children. They are willing to forgo 13 percent of consumption to increase the odds of college attainment for their

children by 10 percent. Figure (2.5) shows the distribution of bliss estimated from the model.

Table 2.7: Estimated parameters

Parameter Estimates		
Mixture weight	p	0.21
Mixture parameters	μ_1	0.70
Mixture parameters	μ_2	0.00
Mixture parameters	σ_1	8.66
Mixture parameters	σ_2	7.03
Weight on college completion	χ	78.54

Figure 2.5: Distribution of Match Quality



The performance of the model are reported in table (2.8). The model fits well the divorce behavior across educational groups. The model captures the positive relationship between divorce and education for couples without children. In the model, higher college attainment increases the outside option of being single. In other words, a standard model where education only plays the role of higher wages is capable of generating the divorce behavior for couples without children.

Table 2.8: Parental Education offers an advantage in rearing children

Fraction of Marriages ending in divorce (15th anniversary)	Data	Model
Mother - Father		
(N, N) without children	0.371	0.420
(N, N) with children	0.303	0.284
(N, C) without children	0.418	0.445
(N, C) with children	0.134	0.150
(C, N) without children	0.552	0.520
(C, C) without children	0.492	0.471
Implication of the model (untargeted moments)		
(C, N) with children	0.313	0.206
(C, C) with children	0.170	0.185

We now use the estimates to look at the prediction of the model for divorce behavior for college educated mothers. Notice that these moments of the data were not used to estimate the model. What is the prediction of the model for the divorce rate of college educated mothers?

The model predicts a 19 percent of divorce rate for the college educated parents, very similar to the data counterpart of 17 percent. In other words, the higher costs for college-educated parents accounts for 70 percent of the divorce gap between college

and non-college educated parents observed in the data. The success in the model in generating this pattern is well captured because the divorce rate for parents with the educational mixture (N,C) is quite low (13 percent). This suggests that the importance that parents, regardless of their education level, place on the success of their children has a stabilization effect.

However, the model underestimates the divorce rate for parents where the mother has a higher level of education. The model predicts a divorce rate of 20 percent, whereas the data counterpart is 30 percent. If college-educated mothers care equally about the college attainment of their children, they should divorce less regardless of the attributes of the father. In other words, the higher cost of divorce of college-educated couples, as measured by a reduction in the chances of college completion for their children, is sufficient to induce educated parents to stay in marriage. But it fails to account for the divorce rate of parents where the mother is more educated than the father. Considering explicitly the attributes of the father provides a better understanding of divorce patterns across educational groups.

To sum up,

1. The higher reduction in the chances of college completion for children with college-educated parents accounts for 70 percent of the divorce gap between educational groups.

2. The model underestimates the divorce rate for parents where the mother is more educated than the father (31 percent in the data versus 21 percent in the model). In other words, if they value the college attainment equally, they would divorce much less regardless of the attribute of the father. Hence, considering explicitly the attributes of the father improves the understanding of the divorce behavior of this group.

3. Parents care a lot about the college completion of her children. They are willing to forgo 13 percent of consumption to increase the odds of college attainment for

their children by 10 percent.

2.8.2 Extended Model

Now we explicitly target the divorce behavior for college-educated parents where both are college educated. In this exercise, parents care differently about the college attainment of their children. Formally, we implement this theory by letting χ be indexed by the education of the parent, in particular, that of the father. Table (2.9) shows one of the best outcomes.

I find that giving heterogeneity in preference for college completion of their offspring does provide a better picture of the divorce rate of parents where the mother is more educated. This extra incentive in the model increases the divorce rate of this group to 37 percent, 6 percent more than the counterparts in the data.

Table 2.9: Heterogeneous preference over educational attainment of offspring

Model with Heterogeneous preference over educational attainment of offspring		
Fraction of Marriages ending in divorce (15th anniversary)	Data	Model
Mother - Father		
(N, N) without children	0.371	0.400
(N, N) with children	0.303	0.320
(N, C) without children	0.418	0.445
(N, C) with children	0.134	0.150
(C, N) without children	0.552	0.520
(C, C) without children	0.492	0.471
(C, C) with children	0.170	0.175
Implication of Model (untargeted moment)		
(C, N) with children	0.313	0.370

These two exercises support the notion that the benefits of marriage conferred on college-educated parents in rearing children is the primary factor in shaping the differences divorce behavior across educational groups.

2.9 Conclusion

In this paper, I developed and estimated a model of household formation to assess to what extent the higher costs of divorce for college educated parents, in terms of reduction in the chances of college attainment of their offspring, can explain the divorce patterns across educational groups. I estimate that these costs are capable of accounting 70 percent for the divorce gap observed in the data. These higher costs can explain why college-educated parents divorce less than childless college educated couples. But it is not sufficient to account for the high divorce rate of parents where the mother has a higher level of education. It seems that it is important to explicitly consider the role of heterogeneity of preferences for college educated children. This finding suggests that the benefit of marriage conferred on college-educated parents in rearing children is the primary factor in shaping the differences in divorce.

Chapter 3

Education and Entrepreneurship

3.1 Introduction

In this paper, I investigate the determinants of occupational choice of different educational groups. Up until the early 1980s, both college graduates and high school graduates had the same propensity of becoming entrepreneurs. The fraction of these two groups who are entrepreneurs was 13%. However, after the 1980s, there was a substantial gap between the number of college and high school entrepreneurs. In 2010, the fraction of college graduates who were entrepreneurs increased to 20%, while the same fraction stayed at 14% for high school graduates.

In this chapter, I pose a model of educational choice and occupational choice to unravel the underlying economic forces in shaping the increasing gap of entrepreneurial entry between college graduates and high school graduates. Specifically, I evaluate quantitatively the role of complementarity between education and managerial talent in accounting educational differences in entrepreneurship entry. The findings of this paper suggest that an increasing complementarity between managerial ability and education is the main driver of the gap in the entrepreneurship entry.

This paper is complementary to Akyol and Athreya [2009] and Terajima [2004]

where they extend the basic model of precautionary savings, including Huggett [1993] and Aiyagari [1994], to incorporate entrepreneurs and occupational choice to study the role of financial friction in generating high accumulation of wealth and business size distribution.

The paper is organized as follows. Section 3.2 describes the trend in the entrepreneurship entry behavior across educational groups. Section 3.3 describes the baseline model. Section 3.4 and 3.5 report the estimation of the model and discuss the quantitative results. Lastly, section 3.6 holds the conclusions.

3.2 Evidence On Educational Differences In Occupational Choice

In this section, I show the empirical findings on the changes of occupational choices experienced by different educational groups over the period of 1983 to 2010. For this purpose, I use data from the Survey of Consumer Finances (SCF). I use a standard definition of entrepreneurship from the literature (see De Nardi et al. [2007] and Cagetti and Nardi [2006]). The unit of observation is the household, and I classify entrepreneurs as those households in which the head is self-employed, owing a business, and having an active management role in the firm. By imposing the extra condition that the entrepreneur takes an investment in the business, it is likely to exclude those who are self-employed because of limited outside option.

Table (3.1) shows the fraction of people who are entrepreneurs by educational levels in 1983 and 2010. The table shows that, back in the 1980s, the fraction of high school graduates who are entrepreneurs was very similar to that of college graduates (13%). However, the entry into entrepreneurship has increased substantially for college graduates over the past 30 years, while it remains virtually constant for high school graduates. The gap in the entrepreneurship entry behavior of these two groups has widened over the past 30 years mainly due to an increase in the number of entrepreneurs among

college graduates.

Table 3.1: Educational Differences in Occupational Choice

Educational Attainment	Entrepreneurs (%)		
	1983	2010	Change (Percentage points)
College Graduates	13.2	20.0	+6.8
High School Graduates	13.0	14.8	+1.8

Source: Survey of Consumer Finances (1983-2010)

3.2.1 Evidence On Changes In Business Value By Educational Groups

In this section, I document the cross-sectional differences between college graduates and high school graduates entrepreneurs over time. SCF reports the net worth position for different households over time. Business net worth is calculated as net equity of business were sold today, plus loans from households to business, minus loans from business to the household not previously reported, plus value of personal assets used as collateral for business loans.

Table 3.2: Total Value of Actively Managed Business (normalized)

Educational Attainment	1983	2010
College Graduates	2.08	3.39
High School Graduates	1.00	1.10

Source: Survey of Consumer Finances (1983-2010)

I normalize the actual value of actively managed business relative to the value of the high-school group in the 1980s. Table (3.2) reports the cross-sectional differences in size of their business by educational group over time. Back in the 1980s, the value of the business for college graduate entrepreneurs was considerably larger than their

counterparts. On average, the value of a college graduate entrepreneur was twice as large. Moreover, that difference has grown over time. In 2010, on average, the value of a business from a college graduate was three times as much as that of a high school graduate.

3.3 Baseline Model

In this section, I describe a simple model of educational and occupational choice. In this simple model, education affects the earnings and the managerial skill productivity. This version of the model is closely related to Quadrini [2000], Cagetti and Nardi [2006], and Terajima [2004] in the sense that it highlights the role of financial friction in determining the entry into entrepreneurship.[1]

3.3.1 Demographics

The model features a stochastic life structure. Each generation of agents differs in education $e \in \{c, h\}$. They can be either entrepreneurs or workers $d = \{m, w\}$ with an asset position $a \geq 0$. There is a unit measure of households, and they are subject to idiosyncratic shocks as in Bewley [1977], Aiyagari [1994], and Huggett [1993]. The economy does not feature any aggregate uncertainty.

Each household faces a constant probability of ϕ of dying. When a generation dies, an offspring is born and takes over the household assets position a, and occupational status $d \in \{m, w\}$ for one period. The education of the offspring, denoted by e', depends upon the investment x that the parent household incurred in the previous period. Investment in children increases the probability of educational attainment of the offspring. I denote this education production function as $e' = H(x)$.

[1] Recent empirical findings from Hurst and Lusardi [2004] cast doubts on the role of liquidity constraints as the key determinant of entry into entrepreneurship .

3.3.2 Endowments and Technology

Households are endowed with 1 unit of labor, which they can supply to the market and receive a wage w, or used in their own project. In addition to labor endowment, a person with education e is endowed with two types of abilities: entrepreneurial ability $z_e \in Z_e$, and working ability $y_e \in Y_e$. The entrepreneurial ability z_e follows a first-order Markov process with transition matrix $\Gamma(z'_e|z_e)$. The process for y is modeled to feature the wage distribution in the data.

As in Quadrini [2000], the economy has two sectors producing homogeneous goods. One sector is composed of entrepreneurs firms, and one is composed by non-entrepreneurial firms. In both sectors, capital stocks depreciate at a constant rate δ.

Entrepreneurial Project

An entrepreneur can borrow and invest in physical capital k in a technology denoted by $z_e k^\nu$, where $0 < \nu < 1$. This technology features decreasing returns in investment, and the process of z_e governs the marginal and average returns on capital (as in Lucas Jr [1978]). If the household choose to invest $k = 0$, then she considered as a worker. If a household decides to enact a project, and she chooses a positive level of physical capital $k > 0$, then she will receive revenue plus the level of capital net of depreciation.

$$q(z_e, k) = z_e k^\nu + (1 - \delta)k \quad 0 < \nu < 1 \tag{3.1}$$

Corporate Technology

The corporate sector or non-entrepreneurial sector is modeled with a standard Cobb-Douglas production function:

$$F(K_c, L_c) = K_c^\alpha L_c^{1-\alpha} \quad 0 < \alpha < 1 \tag{3.2}$$

where K_c and L_c are capital stock and labor inputs in the non-entrepreneurial sector.

3.3.3 Borrowing constraints

Households in this economy can invest at most a level of capital that relies on their level of asset a in the entrepreneurial project. Specifically, the agent can borrow to invest at most $(1+\kappa), \kappa \in \{0,1\}$, times their asset position a. Hence, the amount of asset that an entrepreneur can borrow is κa, at an interest rate r.

3.3.4 Household Decision Problem

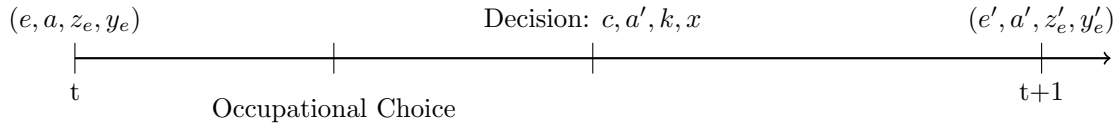
Household maximizes the its lifetime expected utility derived from consumption.

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t) \tag{3.3}$$

Household starts the period with a given education level e, asset position a, and managerial ability z_e, and working ability y_e. Thus, the individual state is summarized by (e, a, z_e, y_e). In any period, whenever a parent is replaced by his offspring, the educational attainment of the offspring is determined by the investment incurred by the household. In this setting, individuals care about their descendants as much as themselves, i.e., agents are perfectly altruistic. To simplify further the model, I assume that the child inherits the occupational choice and the asset position of his parent for one period.

Figure 3.1 describes the timing of the problem.

Figure 3.1: Timing



His value function is:

$$V(e, a, z_e, y_e) = \max_{m,w}\{V^m(e, a, z_e, y_e), V^w(e, a, z_e, y_e)\} \tag{3.4}$$

The entrepreneur's problem

$$V^e(e, a, z_e, y_e) = \max_{c,a',k,x}\{u(c) + \beta\phi\mathbb{E}V^e(e', a', z'_e, y'_e) + \beta(1-\phi)\mathbb{E}V(e', a', z'_e, y'_e)\} \tag{3.5}$$

Subject to:

$$c + a' + x = (1 + r)(k - a) + z_e k^\nu + (1 - \delta)k \tag{3.6}$$

$$e' = H(x) \tag{3.7}$$

$$a' \geq 0 \tag{3.8}$$

$$k \leq (1 + \kappa)a \tag{3.9}$$

The expected value of the value function for $V^e(e', a', z'_e, y'_e)$ is taken with respect to (z'_e, y'_e) conditional on (z_e, y_e)

$$\mathbb{E}V^e(e', a', z'_e, y'_e) = \sum_{z'_e}\sum_{e'}\sum_{y'_e}\gamma(z'_e|z_e)\gamma(y'_e|y_e)h(e'|x)V^e(e', a', z'_e, y'_e) \tag{3.10}$$

The worker's problem

$$V^w(e, a, z_e, y_e) = \max_{c,a',x}\{u(c) + \beta\phi\mathbb{E}V^w(e', a', z'_e, y'_e) + \beta(1-\phi)\mathbb{E}V(e', a', z'_e, y'_e)\} \tag{3.11}$$

Subject to:

$$c + a' + x = (1 + r)a - wy_e \tag{3.12}$$

The expected value of the value function for the worker is taken with respect to

(z'_e, y'_e) conditional on (z_e, y_e)

$$\mathbb{E}V^w(e', a', z'_e, y'_e) = \sum_{z'_e} \sum_{e'} \sum_{y'_e} \gamma(z'_e|z_e)\gamma(y'_e|y_e)h(e'|x)V^w(e', a', z'_e, y'_e) \tag{3.13}$$

The continuation value for the worker that survives is given by $\mathbb{E}V(e', a', z'_e, y'_e)$.

3.3.5 Stationary Equilibrium

Let $\mu = (e, a, z_e, y_e)$ be the state vector for an individual in this economy. From the decision rules on consumption, savings, and investment in education, and the exogenous process for income and entrepreneurial ability, the transition function that provides the probability distribution μ' next period is given by:

$$\mu' = T(\mu) \tag{3.14}$$

A **stationary equilibrium** is a set of value functions and decision rules, and a constant distribution of people over the state variables (e, a, z_e, y_e), such that, given factor prices w and r

- The decision rule solves for household problem described in 3.3.4.
- The capital and labor markets clears.
- The wage and interest rate are given by the marginal products of each factor.
- The μ^* is the invariant distribution of the economy.

3.4 Calibration

3.4.1 Fixed Parameters

Table (3.3) lists the set of fixed parameters for the model. All households have a period CRRA utility function with coefficient of relative risk aversion $\sigma = 1.5$:

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma} \tag{3.15}$$

The survival probability is set to be 1/35 so that agents have 35 years of work-life. The depreciation rate and labor share of the economy are standard from the literature. The liquidity constraint parameter determines that at most, an entrepreneur can leverage the project up to 1.5 times his asset position.

Table 3.3: List of Fixed Parameters

Description	Parameter	Value	Source - Explanation
Risk Aversion	σ	1.5	Attanasio et al. [1999]
Survival probability	ϕ	1/35	35 years work-life
Productivity	A	1	Normalization
Labor Share	α	0.33	Stokey and Rebelo [1995]
Depreciation	δ	0.06	
Liquidity Constraint	κ	0.5	Evans and Jovanovic [1989]

In addition, I adopt a form of educational technology from Rios-Rull and Sanchez-Marcos [2002] by letting the college attainment in next period as a function of investment incurred in the last period: $H(x) = 1 - \exp(-x^{0.9})$.

Finally, the values and the transition of the income process are taken from Storesletten et al. [2004] and Terajima [2004]. The possible values for the income process are $y_e = \{1.0, 3.6, 1.01, 6.45\}$ and the transition matrix $\Gamma(y'|y) = [0.62, 0.39; 0.4, 0.6]$.

3.5 Findings

Table (3.4) and table (3.5) show the estimated parameters and results of the model, respectively. The model captures the ratio of wealth between entrepreneurs and workers,

but it underestimates the levels. The model underestimates the value of being an entrepreneur for each type. In addition, the model implies a larger business value for the college group. In the data, it is twice as large for college-graduate entrepreneurs, while in the model, it generates a factor of 1.5. Given that the model underestimates the level of the wealth position of entrepreneurs, it also misses the target of the income share for entrepreneurs.

Table 3.4: Estimated Parameters (8)

Parameter	Value
β	0.9
$(z_{hs}^1, z_{hs}^2, z_c^1, z_c^2)$	(0.3, 1.37, 0.35, 1.5)
$\Gamma_z(z', z)$	[0.940, 0.060
	0.250 0.750]
ν	0.72

Table 3.5: Calibration Results

Moments		Data (1983)	Model
Relative Wealth	HS Worker	1.00	1.00
	HS Entrepreneur	3.17	2.29
	C Worker	2.47	1.92
	C Entrepreneur	5.88	3.70
Rel. Business Value	HS	1.00	1.00
	C	2.08	1.521
$Prob(m'\|w)$	HS	0.13	0.11
	C	0.132	0.16
Interest Rate		4%	6%
Entrepreneur's Income Share		0.16	0.10

3.5.1 Changes in the Wage Structure

Now we feed in changes in the relative wages observed in the data into the model to generate predictions on entrepreneurship entry. The changes of the wage structure feature a larger college premium.

With the new wage structure, the model predicts a much lower entrepreneurship entry for the two groups, especially for the college educated group. Contrary to the changes observed in the data, the model implies a decrease of 9% and 12% in entrepreneurship entry for high-school graduates and college graduates, respectively. This finding suggests that being an entrepreneur is less valuable, in particular, for the college group given the recent changes in the college premium.

Table 3.6: Changes in the Wage Structure

Moments		Change Data (%)	Model Change(%)
Rel. Business Value	HS	10.000	5.250
	C	62.981	18.796
$Prob(m'\|w)$	HS	13.846	-9.091
	C	51.515	-12.500

3.5.2 Skill complementarity with Managerial Ability

Now we proceed to reestimate the managerial ability by directly targeting the changes in the entry behavior. Table (3.7) reports the estimation results. The model captures the increase in the relative value of the business by each educational group, but it misses the levels. The implied change is twice as large as the change observed in the data. It appears that it is difficult to target simultaneously the change in the relative value, and the observed change in the entry behavior. While the model overestimates the changes in the value in the business, it misses the target on entry behavior. At most, the model can generate an increase of 20% in the entry of the college-educated group. Further

investigation is required to dissect the underlying determinants of the changes in the behavior.

Table 3.7: Targeting the Change in Entry

Moments		Change Data (%)	Model Change(%)
Rel. Business Value	HS	10.000	8.250
	C	62.981	120.000
$Prob(m'\|w)$	HS	13.846	-0.150
	C	51.515	21.000

3.6 Conclusions

In this paper, I document an increasing gap in the entrepreneurial entry between college graduates and high school graduates. I build a model of educational choice and occupational choice to quantitatively assess the role of skill complementarity of managerial ability in explaining this fact. The results of this paper show that the skill complementarity of managerial ability is crucial in generating the increasing number of entrepreneurs among college graduates.

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Appendix A

Appendix for Chapter 1

A.1 Tables and Figures

Data and Sample

Table A.1: Summary statistics

Variable	Mean	Std. Dev.	N
Real Manufactured Output	1256858.13	9310693.65	1220
Real Manufactured value added	454569.65	3916153.35	1216
Capital Per Worker	6299.14	19085.31	1218
Share of Skilled Workers	0.21	0.14	1247
Total Number of Workers	74.59	158.89	1258
Number of Skilled Workers	13.71	29.28	1247
Number of Unskilled Workers	60.62	136.41	1247
Exp. Share on Foreign Int. Goods	21.78	35.55	1393

Measured in 1991 USD

Table A.2: Distribution of firms by sector

Distribution of Firms across sectors	
Sector name	Number of Firms
Alcohol	60.0
Bakery	288.0
Chemical	204.0
Food (exc drink)	444.0
Furniture	648.0
Garment	660.0
Machines	108.0
Metal	648.0
SSRII	36.0
Textile	120.0
Wood	276.0
Total	3,492.0
Sample size	3,492

Source: Ghana's manufacturing firm data

Share of Skilled Labor by Sector

Table A.3: Workforce composition by sectors

Sector name	Mean Share Skill Labor
Alcohol	0.302
Bakery	0.204
Chemical	0.362
Food (exc drink)	0.308
Furniture	0.161
Garment	0.191
Machines	0.216
Metal	0.241
SSRII	0.198
Textile	0.242
Wood	0.185
Total	0.221

Source: Ghana's manufacturing firm data

Table A.4: Average Wages 1992-1998 by Sector

Sector	Average Wage by Type of Labor		
	Unskilled	Skilled	Relative Wage
Alcohol	462.74	1,349.15	2.92
Bakery	126.74	215.23	1.70
Chemical	434.78	1,265.70	2.91
Food (exc drink)	178.56	555.63	3.11
Furniture	109.28	379.07	3.47
Garment	68.44	198.52	2.90
Machines	115.85	624.71	5.39
Metal	160.77	530.93	3.30
Textile	266.03	876.48	3.29
Wood	202.61	498.35	2.46
Total	212.58	649.38	3.15

Source: Ghana's manufacturing data (1991 USD).

Appendix B

Appendix for Chapter 2

B.1 Marriage Dissolution Rate

B.1.1 Female Sample

Table B.1: Fraction of Marriages ending in divorce by their 10 anniversary, age at marriage older than 25

Year of Marriage	Education at Marriage		
	Non College Educated	College Educated	Difference
1970	0.164	0.100	0.064
1975	0.195	0.152	0.043
1980	0.206	0.149	0.057
1985	0.199	0.153	0.046
1990	0.208	0.142	0.066
Total	0.194	0.139	0.055

Source: SIPP 2001, 2004, 2008 (Weighted)

B.1.2 Male Sample

Table B.2: Fraction of Marriages ending in divorce by their 10 anniversary, age at marriage older than 25

Year of Marriage	Education at Marriage		
	Non College Educated	College Educated	Difference
1970	0.186	0.135	0.051
1975	0.203	0.133	0.071
1980	0.209	0.132	0.077
1985	0.218	0.121	0.098
1990	0.224	0.124	0.100
Total	0.208	0.129	0.079

Source: SIPP 2001, 2004, 2008 (Weighted)

B.2 Regression Tables: Hazard of Divorce

B.2.1 Female Sample

Table B.3: Cox Hazard Regression coefficients (Female Sample)

	Empirical Estimation	
	Coef.	S.E
Education at Marriage	–.306***	(.025)
Age at Marriage less than 18	.000	(.)
Age at Marriage (18- 19)	–.354***	(.022)
Age at Marriage (19-22)	–.777***	(.021)
Age at Marriage (22-26)	–1.083***	(.028)
Age at Marriage (27-29)	–1.376***	(.029)
Age at Marriage (30-34)	–1.778***	(.046)
Age at Marriage(34-39)	–2.210***	(.082)
Age at Marriage older than 40	–3.077***	(.113)
Presence of a Child	–1.190***	(.016)

Source: SIPP 2001-2008

Other covariates include year of marriage and race.

Table B.4: Cox Hazard Regression: implied hazard ratios (Female Sample)

	Empirical Estimation	
	Haz. Ratio	Std. Error
Education at Marriage	.737***	.018
Presence of a Child	.304***	.005

Other covariates: race, age at marriage and year of marriage.

B.2.2 Male Sample

Table B.5: Cox Hazard Regression coefficients (Male Sample)

	Empirical Estimation	
	Coef.	S.E
Education at Marriage	–.481***	(.022)
Age at Marriage ¡ 18	.000	(.)
Age at Marriage (18- 19)	–.388***	(.036)
Age at Marriage (19-22)	–.776***	(.034)
Age at Marriage (22-26)	–1.001***	(.034)
Age at Marriage (27-29)	–1.178***	(.039)
Age at Marriage (30-34)	–1.354***	(.042)
Age at Marriage(34-39)	–1.471***	(.057)
Age at Marriage ¿40	–1.944***	(.073)

Source: SIPP 2001-2008
Other covariates include year of marriage and race.

Table B.6: Cox Hazard Regression: implied hazard ratios (Male Sample)

	Empirical Estimation		
	Haz. Ratio	*p*-value	Std. Error
Education at Marriage	.618	.000	.014

Other covariates: race, age at marriage and year of marriage.

B.2.3 Divorce hazard over time

Figure B.1: Female Sample

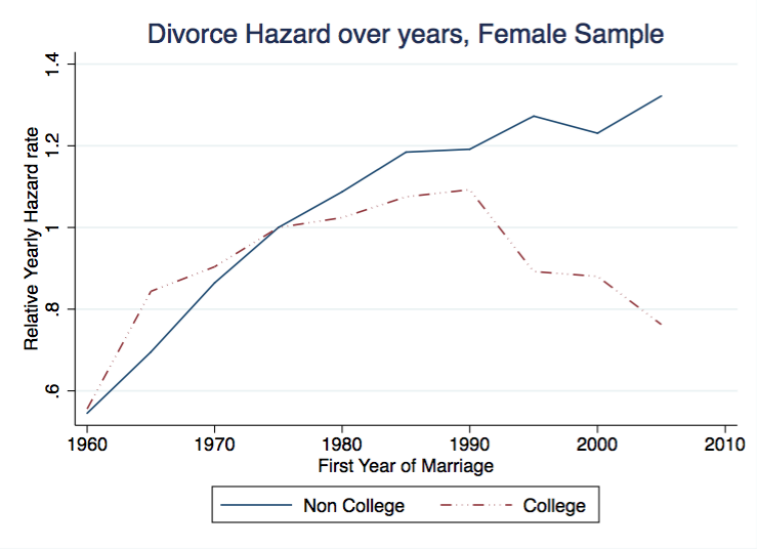
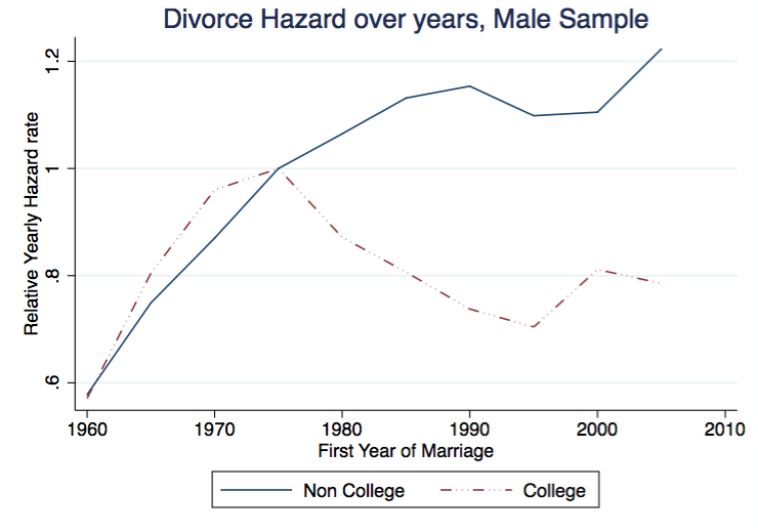


Figure B.2: Male Sample



B.3 Family disruption and children's college attainment

B.3.1 Empirical Estimates

Table B.7: Effect of Family Disruption on Children

	Coef.	Std. Error
Mother college educated	.572*	.035
Father college educated	.711*	.032
Family Disruption	.410*	.024
Race	.109*	.011
Gender	.198*	.023
Constant	–1.765*	.059
No. of cases	19269	
* pvalue <0.05		

Source: NLSY 1979-1997

Table B.8: Estimated Parameters, Extended Model

Parameter Estimates		
Mixture weight	p	0.21
Mixture parameters	μ_1	0.66
Mixture parameters	μ_2	0.00
Mixture parameters	σ_1	4.88
Mixture parameters	σ_2	9.03
Weight on college completion	$\chi(u*)$	18.15
Weight on college completion	$\chi(e*)$	80.85