THE PHASE-OUT OF THE NUCLEAR FAMILY?

EMPIRICAL STUDIES ON THE ECONOMICS AND STRUCTURE OF MODERN SWEDISH FAMILIES

by

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To my late grandmother Sanny Magdalena Norberg,
not a day goes by without me thinking about you,
I miss you…

Abstract

This thesis consists of three papers on the economics and structure of Swedish families.

Paper [I] examines the determinants of children's educational achievement in Sweden. Special attention is given to the labour market work by mothers and fathers in terms of its influence on the educational outcome of their children, measured as grade point average (GPA) in compulsory as well as upper secondary school. The results show that there is a positive relationship between parental income and GPA. Regarding the number of hours worked in the labour market, the results differ between mothers and fathers. Having a mother that works less than full time has positive effects on the child's grades throughout the schooling of the child, whereas significant effects of the hours of work that the father puts in are found during upper secondary school only.

Paper [II] explores the role of financial surprises and match quality in the dissolution of relationships. The analysis is carried out both for surprises in the short term earnings and surprises in the long-run earnings capacity. It is found that positive surprises in short term earnings have a destabilizing effect for a relationship. Generally, a negative surprise in long-run earnings capacity for males has a destabilizing effect. However, if it is combined with a female positive surprise, the effect is stabilizing. Commitments become more stable the older the spouses are at the start, and if young children are present.

Paper [III] studies the role of unemployment in the dissolution of relationships by applying a two-step estimation method to an extensive data set, which contains information about young Swedish males and females. Unemployment is recognized as endogenous in the separation decision, and the results show that the effect of unemployment on separation is biased when unemployment is assumed to be exogenous in the separation equation. The probability of separation is found to be increasing with male unemployment, while female unemployment decreases the probability of dissolution.

Keywords: Time allocation; labour-force participation; educational achievements; match quality; financial surprises; unemployment; divorce; family structure

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Umeå, April 2007
Magdalena

This thesis consists of an introductory part and the following three empirical papers:

[I] Norberg-Schönfeldt, M., 2007, "Children's School Achievement and Parental Work: An Analysis for Sweden", *Education Economics*, Reprinted with permission from the Taylor & Francis Group. Forthcoming as iFirst in *Education Economics* 2007.

[II] Norberg-Schönfeldt, M., 2007, "Match Quality, Financial Surprises and the Dissolution of Commitments among Young Adults in Sweden", *Umeå Economic Studies*, No. 706.

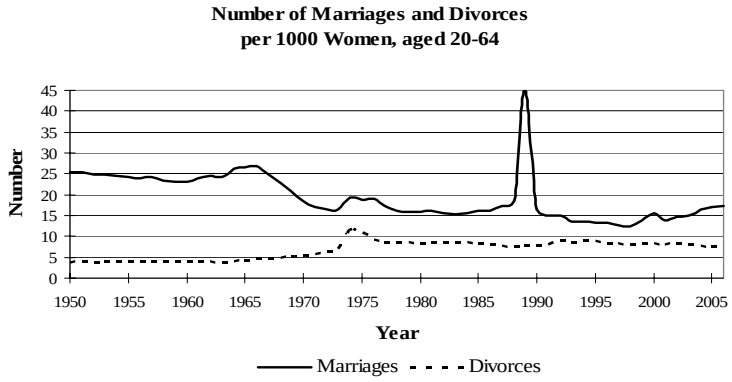
[III] Norberg-Schönfeldt, M., 2007, "The Role of Unemployment in the Commitment Dissolution Decision among Young Swedes", *Umeå Economic Studies*, No. 707.

1 Introduction

Swedish society has changed over the past four decades. As in the rest of Western Europe, the society of today is characterized by a high degree of specialization, which has made it possible to go to the market and purchase virtually whatever you need instead of producing it at home. In addition, the production that still takes place at home is typically more efficient, meaning that less time is spent in household production than before. Women have entered the labour markets and are as educated as men, and there are well-developed public child care systems. These developments have most likely affected the conditions under which (potential) partners make their choices and may, therefore, influence their decisions of whether to enter or to exit a relationship. Furthermore, the reallocation of resources and time within the household may have had an influence on the opportunities and behaviour of the children.

In Sweden, the number of marriages has decreased since the mid 1960's, as can be seen in Figure 1 below. The extreme exception was 1989 when a change in the widow-pension-law was announced. Figure 1 also shows that the number of divorces has increased over the past forty years. The peak in 1974 was a consequence of a change in the divorce-law.

Figure 1. Divorce and Marriage Patterns in Sweden



Note: Data from Statistics Sweden: database, Population and Population Changes 1749-2006.

At the same time as the number of marriages has decreased, another form of togetherness has become more common in Sweden. Today, it is more a rule than an exception to cohabit prior to marriage; in fact, many couples never get married at all, but continue their civil status as cohabi-

tants. This trend has resulted in an increase in the number of out of wedlock births, and being born out of wedlock is no longer socially unacceptable. In 2005, as can be seen in Table 1 below, about one third of the children in Sweden were living with parents who were not married. Worth mentioning is that children living with parents that are not married are about twice as likely to be subjected to their parents separating than children whose parents are married.

Table 1. Share of Parents Living Together and their Civil Status, children 0-19 years old

Year	*Share of Parents Living Together*	*Married of those Living Together*	*Cohabiting of those Living Together*
1991	84	83	17
1996	81	78	22
2000	77	75	25
2002	77	73	27
2004	78	71	29
2005	78	69	31

Note: From Statistics Sweden, Barn och deras familjer 2005.

Unilateral divorce and the possibility to leave an unsatisfactory relationship may be good for the adults involved, but it may have negative effects on the school performance and labour market outcomes of their children (e.g. Keith and Finlay, 1988, Gruber 2004). The fact that about 25 percent of Swedish born seventeen-year-olds have lived through a separation alone highlights the need for more research on why people decide to separate.

The role played by economic factors in separation decisions has so far largely been neglected in Sweden. Several interesting questions remain unanswered. Do unexpected changes in income have an impact on the probability of separation? Does unemployment of one spouse increase the probability of divorce? Is the effect of unemployment different depending on whether the unemployment is experienced by a man or a woman? Such factors have been found to be important in separation studies relating to other countries, for example in Aassve (2001) and Burgess et al. (2003), both using American data, and in Hansen (2005) using Norwegian data.

In economics, a child is sometimes considered as a household public good for its parents. Therefore, parents' reallocation of time between household and market work, as well as the fact that separation is more frequent now than it used to be, may have changed their contribution towards this public good. How these changes affect the well-being of

children is well worth studying. For instance, the greater participation in market work by mothers could, if the alternative child carer is not as good as the mother in providing for the child's needs, affect the child's well-being. In addition, the increased time spent in labour market production by mothers may also change the father's role in contributing to the child's well-being. It is quite possible that the role of the father as a child carer has become more important as mothers are spending more time away from home.

This thesis consists of three papers all connected to the economics of the family. The first paper concerns the effect of market work by parents on the educational achievements by their children. The two following papers deal with economic explanations for separation, with special focus on the role of unexpected events.

The reminder of the introduction is outlined as follows. Section 2 explains the economic incentives to engage in a relationship. Section 3 gives a short theoretical and empirical background to labour division within a couple and its consequences for the children involved. Section 4 gives a theoretical background to the economics of divorce and presents some previous empirical findings. Section 5 summarizes the three papers of the thesis.

2 Why Marry?

To most of us, marriage is believed to be connected to love. Love is certainly a good reason to get married, and a good ground for a lasting relationship. Love is likely to reduce the magnitude of any conflicts of interest that may arise in the relationship. If happiness of one's spouse is a determinant of one's own happiness, spouses who love each other share a common interest in keeping each other happy.

Although love is a good reason to get married, it might not be the only reason. Within economics, there are also assumed to be other, more tangible, reasons as to why it should be preferable for a person to live in a union rather than living alone. For example, living in a union allows for economies of scale, efficient public good provision for the union as a whole, risk sharing, coordination of investments, and division and specialization of labour, even though the need for the latter might be less obvious nowadays.

Within economics, the idea is that people get married when the expected utility from being married (where love is included) exceeds the expected utility from remaining single. The theory explaining this phenomenon

assumes that the utility obtained by an individual from being in a relationship depends on his or her own characteristics, the characteristics of the partner and the quality of the commitment match. The individual also obtains utility from commitment-specific capital that is accumulated during the relationship; for instance, relationships with mutual friends and the quality and quantity of children. In addition, the utility for an individual of being in a relationship naturally also depends on how the resources are allocated between spouses.

3 Division of Labour and the Child as a Public Good

The economic view of how the resource allocation decision within the marriage is carried out, once a couple has tied the knot, has changed over time. The traditional approach to studying the household supply and demand decision has been that the household maximizes a single utility function (see, for example, Samuelson, 1956, and Becker, 1974). The division of labour within the household, as well as between the household and the market, was determined by relative marginal productivities, and comparative advantage was the ground for an effective outcome.

The view of the family as one single decision unit emerged during a time when the husband was considered to be the breadwinner. Since then women have entered the labour market, and are as highly educated as males, which is one reason as to why the view of decision making has been modified. The newer, and nowadays more realistic, view of resource allocation within the family is based on the theory of bargaining, which recognizes that households may not behave as a single decision unit (see, for example, Manser and Brown, 1980, and McElroy and Horney, 1981).[1]

Weiss and Willis (1985) were among the first to introduce the well-being of children as a household public good that enters the utility functions of the parents. One of the most widely used proxies for measuring the well-being of children is their performance in school. The spouses are not necessarily equally productive in providing the proper care the child needs to succeed in school, and the outcome will therefore be determined both by the time allocated to childcare, in terms of providing help with homework etc., and their productivity, which depends on, for instance, their own education. The educational achievement is also likely to depend on the productivity of the school attended by the child.

[1] See Bergstrom (1997) for a review on how economists' view of decision-making within the family has developed over time.

Many theories and hypotheses have been developed in the quest of trying to explain why some children succeed in life while others do not. One of the hypotheses that has gained a great deal of attention in previous research, focusing on the allocation of time between market and non-market work, is the "working mother hypothesis" (see, for example, Haveman et al. 1991). Labour force participation by mothers is said to have two offsetting effects on the school outcomes of a child. The mother working and contributing to family income may have a positive effect on the child's future success, since higher family income could guarantee participation in better schools, living in better neighbourhoods or participation in extracurricular activities that are otherwise too expensive. At the same time, the mother's absence from home may have a negative impact on the child's development, for instance, if the alternative care giver is not as good at providing for the child's needs as the mother. The working mother hypothesis was developed during a time period when the mother was still considered to be the prime care giver in many senses. Nowadays it is not as obvious that only the labour market activities by mothers should be of importance for the educational achievements of the child. The father's hours of work could be equally important.

Paper [I] of this thesis studies the determinants of children's educational achievement with special focus on the effect of market work by both parents.

3.1 Empirical Evidence on Parental Work and Child Success

When it comes to testing for the influence of parental work on children's educational achievement, there is no evidence that the father's work is of any importance, as long as he works. In fact, none of the previous studies has utilized extensive data on the father's hours of work. When it comes to testing for the influence of the mother's work on children's educational achievement, the results are inconclusive.

Stafford (1987) analyses the relationship between family resources, market work by mothers, fertility, child spacing, and the grades reported by teachers. Using a sample of 77 American children, he finds a significant and negative effect of the mother's market work on the teacher's ratings of the child, and recognizes that there is a trade off between market work and household work, which is in line with the "absent from home" part of the working mother hypothesis. Total family income is found to have a positive significant effect on teacher's ratings, but the mother's wage rate only has weak effects.

Haveman et al. (1991) estimate the effects of a variety of socioeconomic circumstances on children's performance in school, measured as high school completion. Using a sample of 1 300 American children, the authors find a positive relationship between market work by mothers and the child's high school completion, but they are not able to separate between the number of years the mother worked and the income she contributed to the family. The mother working, and thereby contributing to family income, has a positive and significant effect on the probability of high school completion, if she works while the child is twelve to fifteen years old. The influence is smaller when the child is younger. The results found in this study are interpreted as contradicting the "absent from home" aspect of the working mother hypothesis and the authors argue that the positive effect of the mother contributing additional resources while working dominates the negative effect of her being absent from home.

Ermisch and Francesconi (2002) focus on the relationship between parents' employment during the first five years of a child's life and the subsequent educational achievement, measured as achievement of an "Advanced-level" qualification as a young adult. They are among the first to include any measure of the father's hours of work. For a sample of young British adults, they find a negative impact on the child's educational attainment if the mother worked full-time when the child was young. Part-time work by mothers had a less distinguished negative effect. For fathers, the authors distinguish between employment and unemployment and they find that, given income, the effect of employment is negative, although not always significant. Higher full family income increases the children's educational attainment, but given full income, higher wage rates have negative impacts.

Öster (2006) studies the effect of parental unemployment on children's performance in school. She uses a longitudinal sample of 35 550 Swedish upper secondary school graduates and studies whether the children move over GPA percentiles with parental unemployment. The findings are that children who are subjected to maternal unemployment during upper secondary school slightly improve their grades. Paternal short-term unemployment has a negative effect on the child's grade, while no significant effect is found by long-term unemployment. This is interpreted as the shock of the unemployment wearing out with time.

Studies concerning children's well-being are numerous[2], while those explicitly focusing on market work by parents and children's educational achievements are more scarce. The role of fathers' market work is to a large extent a neglected area, even though it is not clear that only the hours of work by mothers should be of any importance.

4 Why Divorce?

The economic theory of divorce is the opposite side of the economic theory of marriage and, therefore, the reason for divorce is explained as the opposite of the reasons for marriage. Thus, divorce occurs whenever the expected utility from remaining married falls below the expected utility from living as a single person. The pioneering article in the economic theory of divorce is Becker et al. (1977). It recognizes two reasons for divorce: the first is related to the quality of match, and the second to uncertainty about partner characteristics and future utility from the relationship.

Quality of match refers to how well your characteristics fit together with the characteristics of the partner you choose. As a result of this reasoning, search theory plays a substantial role. If the search for a partner is assumed to be costly, people will tend to search for a shorter period of time, which may reduce the quality of the match. Moreover, since meetings occur randomly, a marriage that is initially acceptable can become unacceptable, as a result of finding a better match. What you search for in a partner might differ between different types of societies, and in any given society it might evolve over time. In a society characterized by the more traditional division of labour, with the male as the sole breadwinner, so-called negative assortative mating might be dominating. In a society characterized by a more equal division of labour, such as Sweden today, positive assortative mating instead dominates. Negative assortative mating means that people seek somebody to complement the characteristics they possess to allow for the use of competitive advantages. Positive assortative mating, on the other hand, means that people are looking for their equal in terms of personal characteristics, such as age, education and income.

When you meet someone, certain characteristics are directly observable while others are not. This means that the decision to engage in a committed relationship will partly be based on the characteristics that are ob-

[2] There are, for instance, many studies relating to drug abuse and the sexual behaviour of youths (e.g. Rashad and Kaestner , 2004), to children and poverty (e.g. Jolliffe et al., 2005) and to children and family structure (e.g. Winkelmann, 2006).

servable and partly on the predictions you can make about unobservable characteristics. Hence, the decision will be associated with some degree of risk of disappointment, and new information or unexpected events can change the expected gains from staying in the relationship. Examples of unexpected events are changes in income, changes in money transfers or unemployment. This is, so far, the least explored part of the Becker et al. theory, although some empirical research exists.

Papers [II] and [III] of this thesis are concerned with the role of unexpected events for the probability of dissolution. Paper [II] focuses on the role of unexpected changes in short-run earnings and long-run earnings capacity, respectively, while Paper [III] instead studies the role of unemployment.

4.1 Empirical Evidence of the Role of Financial Surprises

Neither the theory, nor the existing empirical evidence gives any clear-cut answers as to how unexpected events will influence the risk of dissolution. For example, as long as there is some degree of income pooling, an unexpected increase in the earnings capacity of one spouse increases the value of the commitment for the other person, which would work towards a more stable commitment. At the same time, a higher earnings capacity increases the utility of being single, and increases the probability of meeting a match of higher quality that accepts you, which will, in turn, decrease the stability of the commitment.

Hoffman and Duncan (1995) study the role of changes in money transfers for the divorce rate among a sample of 1 098 American couples. They find that increases in AFDC (Aid to Families with Dependent Children) benefits slightly increase the probability of dissolution, while increases in the husband's earnings and the wife's wage rate slightly reduce the probability of divorce.

Weiss and Willis (1997) study the relationship between divorce and unanticipated changes in economic circumstances. Using a sample of 7 588 young Americans, they predict the long-run earnings capacity and analyse if differences between the predicted and observed value of earnings capacity affect the probability of divorce. They find that an unexpected increase in the husband's earnings capacity reduces the probability of divorce, while an unexpected increase in the wife's earning capacity tends to increase the probability of divorce.

Svarer (2005) instead predicts short-run earnings and analyses if deviations between observed and predicted values have an impact on the divorce hazard. The sample consists of 10 822 married Danish couples,

and the results show that short-run deviations between expected and observed earnings do affect the risk of divorce in a way that is asymmetric between men and women. For women, deviations in either direction increased the divorce hazard while for men, positive deviations stabilize and negative deviations destabilize the marriage.

Others who focus on the role of income and unexpected changes in economic circumstances include Aassve (2001), Burgess et al. (2003), Böheim and Ermisch (2001), and Walker and Zhu (2006).

4.2 Empirical Evidence of the Role of Unemployment

Besides changes in income or changes in money transfers, unemployment can also be regarded as an unexpected event since it may be hard to foresee. Unemployment can stress the relationship in different ways. For example, unemployment will often lead to financial stress which may reduce the partner's expected utility of staying in the relationship. Besides the monetary factors associated with unemployment, unemployment may lead to the perception of moral failure, either for the unemployed or for the spouse. In addition, unemployment is often connected to a deterioration in both psychological and physical well-being that can reduce the expected gains from staying in the relationship.[3]

As previously discussed, the results regarding unexpected changes in income or money transfers have been found to be asymmetric between males and females. When it comes to unemployment, the findings are once more different depending on gender. Jensen and Smith (1990) analyse a panel of 3 000 Danish couples and find male unemployment to have a positive and significant effect on the divorce risk, while there is no significant effect of female unemployment. This study was conducted some years ago and it is possible that female unemployment would play a more substantial role nowadays. However, similar results are found by Kraft (2001) who analyses the role of unemployment for the divorce risk of 7 300 German individuals. Even though the data is more up to date, the results show male unemployment to be more important than female unemployment. Male unemployment has a positive and significant effect on divorce, while for females, the magnitude of the effect is only half that of the male, and it is not significant in all specifications.

Hansen (2005) is the only study finding female unemployment to be as important as male unemployment as a determinant of divorce. Analysing a panel of 8 933 Norwegian couples, he finds that the divorce risk in-

[3] See, for example, Winkelmann and Winkelmann (1998).

creases, by the same magnitude, with both male and female unemployment.

Kraft (2001) and Hansen (2005) utilize panel data methods, in terms of fixed and random effects approaches, when analysing the effect of unemployment on the probability of dissolution. This seems reasonable since individual-specific effects could be present. However, they both treat unemployment as exogenous in the divorce equation. If unemployment is endogenous, the estimated parameters will be biased and the effect of unemployment on divorce will be misinterpreted.

5 Summary of the Papers

Paper [I]
Children's School Achievement and Parental Work: An Analysis for Sweden

This paper examines the determinants of children's educational achievement in Sweden. Special attention is given to the market work by mothers and fathers and their children's educational achievement, measured as GPA from the ninth year of compulsory school and as GPA from the last year of upper secondary school, while controlling for a wide range of socioeconomic variables. The idea is that the child's educational achievement is a household public good from which both parents derive utility. Both parents may contribute to the production of the household public good by allocating time to household production.

The empirical part of the paper is based upon a dataset that contains information on about 70 000 students graduating from compulsory school and entering upper secondary school in 1994. The dataset includes gender, nationality, age, place of residence, graduating GPA from the last year of compulsory school and the last year of upper secondary school, choice of educational programme in upper secondary school and finally, information about family structure and socioeconomic situation.

One of the contributions of the paper is that the empirical part is based up Swedish data instead of data from the US. The institutional and social environment in Sweden differs from that of the US. For instance, Sweden has a well developed public child care system. It is possible that differences in institutional setting or social environment could alter the results of the so-called "working mother hypothesis". Since there is information about the GPA both when the student graduated from compulsory school and when he/she graduated from upper secondary school, it is possible to analyse how the socioeconomic history of the child influ-

ences educational achievement during different stages of schooling. However, the most important contribution, pertaining from the richness of the data, is that the dataset contains information about the market work of both parents, making it possible to test if the work hours of fathers are of importance in explaining children's educational achievements.

The analysis is carried out in three steps. First, the grade from the last year of upper secondary school is used as a dependent variable. This step captures the effects of parental market work on the children's upper secondary school achievement. Second, the grade from the last year of compulsory school is used as a dependent variable. This captures the effect of parental labour market activities on the children's school achievement until compulsory school graduation. As a third step, in order to isolate the effects on GPA during upper secondary school, i.e., the value added effects, the difference between upper secondary school GPA and compulsory school GPA is used as the dependent variable.

The main findings are that, in line with the working mother hypothesis, there is a positive effect of the mother's income (conditional on hours of work) on the child's performance in school. A higher income of fathers is also associated with higher GPA among children. The hours of labour market work by mothers influence the educational achievements of the children. If the mother works part time, this has a positive effect on the child's grades as compared to if she works full time, which further confirms the existence of a working mother hypothesis. The effects are not only found in compulsory school, but are to some extent reinforced in upper secondary school, leaving quite an impact on the GPA when graduating from upper secondary school. There are no significant effects of the father's hours of work on the compulsory school grades, but some evidence of a positive effect of part time work by fathers is found on upper secondary school GPA, which is in line with the effects of the mother. Therefore, the existence of a working father hypothesis cannot be rejected.

Another finding is that children whose parents are divorced obtain lower grades, which could be explained in the setting of under-provision due to the non-cooperative behaviour of parents following divorce.

Paper [II]
Match Quality, Financial Surprises and the Dissolution of Commitments among Young Adults in Sweden

The two dominating theories of divorce are (i) that a good quality of match is crucial for the stability of marriage, and (ii) that deviations between expected and realised utility from marriage can cause divorce. This paper analyses the role of financial surprises for commitment dissolution among Swedish couples. Two approaches are used to study the role of financial surprises on the probability of dissolution. First, the effects of short term surprises are studied, where a surprise is calculated as a deviation between predicted and observed earnings, following Svarer (2005). Second, the effects of surprises in long-run earnings capacity are studied. Surprises in long-run earnings capacity are calculated as in Weiss and Willis (1997).

The empirical part is based upon a sub sample from a cohort of 110 000 individuals born in 1973 and registered in Sweden on December 31, 1990. The sub sample consists of those who were born in 1973 and committed to a partner who was also born in 1973 during the time period 1991-2002. A couple is defined to be committed if they are cohabiting with children or if they are married, with or without children. This leaves a sample consisting of 3 392 couples.

The analysis is carried out in two steps. The first step involves calculating surprises in short-run earnings and long-run earnings capacity. For short-run earnings this is done by predicting earnings in each subsequent year based on observed characteristics in the year before and then comparing the predictions to the observed values. If the deviation is larger than 20 percent, it is regarded as either a positive (if the observed value is larger than the predicted value) or a negative (if the observed value is smaller than the predicted value) surprise. For long-run earnings capacity a prediction, based on observables, about the earnings capacity at the last year of observation is made at the year of the start of the relationship. The prediction is then revised every subsequent year based on the information in that year. The new prediction is finally compared to the original one and if the deviation is larger than 20 percent, it is interpreted as a surprise. Once more, the deviations are divided into positive and negative surprises in the same way as above. Step two involves probit estimation on the probability of separation in every year while controlling for a wide range of determinants including the financial surprises calculated in the first step.

The results show that unanticipated changes in economic circumstances do influence the stability of relationships. Positive surprises in short term earnings, by either partner, are associated with an increased probability of dissolution. This suggests that the experience of a positive surprise in earnings for either partner seems to raise the values of outside options sufficiently for the relationship to end. If both partners experience a positive surprise at the same time, the effect is, instead, stabilizing. In this case, it seems as if the increased gain from staying in the commitment dominates the effect of a higher value of the outside alternative.

For surprises in long-run earnings capacity, an unexpected decrease in male earnings increases the probability of dissolution. However, if the female experiences a positive surprise at the same time as the male experiences a negative surprise, the effect is stabilizing. A possible explanation is that women, who are able to change their labour market activities when their expectations about their partners' long-run earnings capacity are lowered, actually do so. Another possibility is that these effects are the result of a deliberate choice made by the couple, i.e. there is an agreement that the male should decrease his labour market activity for the female to be able to increase hers.

Other findings are that the relationship becomes more stable if the partners start their commitment when they are older. Couples who live in a city are more likely to dissolve their relationship than others. The presence of very young children stabilizes the relationship, while there are no effects of the number of children. Higher income has a stabilizing effect, as does a higher educational level in some of the models specified. Negative shocks, i.e. unemployment for females, unemployment for males and having to receive social assistance, give ambiguous results. It seems as if partners are providing some insurance for each other in the case of unemployment, but that being on social assistance tends to increase the probability of dissolution.

Paper [III]
The Role of Unemployment in the Commitment Dissolution Decision among Young Swedes

This paper studies the role played by unemployment, as an unexpected event, in the commitment dissolution decision among young Swedes. In previous literature, unemployment has been introduced as a control variable, which is assumed to be exogenous. This may be problematic, however. First of all, when using the actual divorce date in these types of studies, the unemployment may have taken place after the relationship

has gone bad, even though it is observed before the actual divorce, since there is often a time gap between the decision and the reinforcement. The role of unemployment would then be misinterpreted. Another reason why using unemployment as a control variable may be problematic is that there might be some, to the researcher, unobserved characteristic that influences the occurrence of both unemployment duration and probability of separation. An example might be the ability to live up to one's obligations or promises. Such information is likely to influence both the number of days an individual will spend in unemployment in a given year and, at the same time, influence the probability that the individual will end up separating. If an individual who has, on average, longer unemployment spells also has a less serious view of relationships, the effect of unemployment on separation will be biased upwards if unemployment is introduced as an exogenous control variable.

Because of the above discussion, the model estimated in this paper is a two-step simultaneous equation model accounting for the possible endogeneity of unemployment. The possible appearance of additional individual-specific effects is accounted for by using a random effects method. The first step involves generalised least squares predictions of unemployment and the second step is a probit estimation of the separation equation.

The empirical part is based upon a sub sample from a cohort of 110 000 individuals born in 1973 and registered in Sweden on December 31, 1990. The sub sample consists of those who were born in 1973 and committed to a partner during the time period 1993-2002. A couple is defined to be committed if they are cohabiting with children or if they are married, with or without children. Only the first committed relationship of every individual in the sample is considered. Since it is possible that the effects of unemployment, or the correlation between unemployment and divorce, differ between men and women, the analysis is carried out separately for males and females. The final sub samples contain information on 18 764 males (with female partners) and 26 356 females (with male partners).

The findings are that unemployment is endogenous in the separation decision, and that the effect of unemployment on separation is biased when unemployment is assumed to be exogenous in the separation equation. When taking the endogeneity into account, the positive effect of unemployment on dissolution is greater for males than when unemployment is treated as exogenous. This means that the effect in the simple probit equation was underestimated. The interpretation is that unobserved characteristics cause a downward bias. One example could be if you are

a careerist, which would have a negative effect on unemployment but could, if you work long hours, have a positive effect on the probability of separating.

For females, the effect of unemployment on dissolution is instead negative. This result differs from earlier findings. One explanation could be the fact that, in previous studies, females have been found to initiate a separation more often than males, but that they are less likely to do so when they are unemployed. Another possible explanation may be that when females are unemployed, the non-market work is taken care of and the relationship becomes more stable. Unemployment may also reduce the double burden of market and non-market work for some females, which may act as stabilizing for the relationship. The effect could, naturally, also be the result of a deliberate choice of the couple regarding division of labour.

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Children's School Achievement and Parental Work: An Analysis for Sweden

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ABSTRACT *Data from Statistics Sweden on 70 000 students entering upper secondary school in 1994 are used along with socioeconomic characteristics from the 1990 census to explore the relationship between market work by parents in Sweden and their children's educational achievement, measured as the Grade Point Average. The results show that there is a positive relationship between parental income and Grade Point Average. Regarding the number of hours worked in the labour market, the results differ between mothers and fathers. Having a mother that works less than full time has positive effects on the child's grades throughout the schooling of the child, whereas significant effects of the hours of work that the father puts in are found during upper secondary school only.*

KEY WORDS: Time allocation; labour force participation; educational achievements

Introduction

During the past 20 years, researchers in social sciences have been trying to find explanations for why some children succeed in life while others do not. The research has generated a number of theories and hypotheses regarding parental characteristics and their influences on children's success, measuring the degree of success in several different ways; educational performance being the outcome variable most widely used. The purpose of this paper is to explore the relationship between the market work by mothers and fathers in Sweden and their children's educational achievement, measured as the Grade Point Average (GPA), while controlling for a wide range of other socioeconomic variables.

One of the hypotheses that have gained a lot of attention in previous research is the 'working mother hypothesis',[1] where the labour force participation by mothers is said to have two offsetting effects. The mother working and contributing to family income may have a positive effect on the child's future success. At the same time, the mother's absence from home may have a negative impact on the child's development. One of the reasons why it is interesting to do this type of research using Swedish data is that Sweden, since the mid-1960s, has had an

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extensive public child care system, which has encouraged the labour force participation of women. Seen in the light of the working-mother hypothesis, it is not obvious that such a policy would solely have positive effects on the child's development in the long run. Also, it is not obvious why only the hours worked by mothers should matter; labour force participation by fathers might be of importance as well. Previous studies have not included data on fathers' labour force participation.

Among the studies focusing on the school achievement, the centre of attention has been on a variety of socioeconomic factors and parental characteristics. In these studies, parental income has generally been found to have a strong positive effect. Parental education and occupational status are also found to have positive and significant effects on the children's educational achievements (see Hill and Duncan, 1987, for a review). The educational level of the mother has often been found to be more highly correlated with the educational achievements of the child than has the educational level of the father. The explanation is thought to be that mothers usually spend more time with their children than fathers do (see Leibowitz, 1977 ; Hill and Stafford, 1980). Growing up in a single-parent household seems to have a negative impact on outcomes, so does the number of siblings if you are not the eldest (see McLanahan, 1985; Keith and Finlay, 1988). The number of regional moves by the family and the number of school moves by the student are also associated with poor academic performance. Other variables found to be of importance are, for instance, gender, race and religion of the child.

When it comes to testing for the influence of the mothers' work on the children's educational achievement, the results are inconclusive. Murnane *et al.* (1981) find no evidence that children in low-income families whose mothers work outside the home achieve less in school than children whose mothers do not work outside the home. Leibowitz (1977) finds the same result for middle-class families. Both these studies indicate that mothers who work outside the home decrease their time spent on housework, but that they do not substantially decrease their time spent with their children. Stafford (1987) finds a significant and negative effect of mothers' market work on the teacher's ratings of the child, and recognizes that there is a trade-off between market work and household work, which is in line with the working-mother hypothesis. For children aged 12–15, Haveman *et al.*(1991) instead find a positive relationship when studying market work by mothers and its effect on the child's performance in school, measured as high school completion. The authors find no evidence of the 'absent from home' aspect of the working-mother hypothesis.

Socioeconomic background is not the only thing taken into consideration in the literature on children's educational achievements. School specific variables such as the number of students in each class, the number of teachers and the overall school spending is also often included. In a series of reviews on research considering production and efficiency in public schools by Hanushek (1986, 1989, 1996, 1997, 2003), educational inputs are found to be relatively unimportant in explaining student outcomes, and the impact of any particular input has been varying across studies. Krueger (2003) reanalyses the data in Hanushek's reviews and finds that the results from the literature summaries are critically dependent upon the weight that each study is given. Moreover, there are some recent studies finding effects of school variables and this makes it important to control for them as well. Bonesrønning (2003), for example, in a study based on Norwegian data, finds a negative effect of class size on individual student's school performance.

One of the contributions of this paper, as mentioned before, is that the empirical part is based upon Swedish data instead of data from the United States. The institutional and social environment in Sweden differs from that of the United States; for instance, Sweden has a well-developed public childcare system, where a large portion of children participates.[2] In addition, it is fairly common for Swedish fathers to take parental leave,[3] and parents often share custody after divorce. It is possible that a different institutional setting and a different social environment could alter the results of the working-mother hypothesis. For instance, the 'away from home' part of the working-mother hypothesis might not be present due to somebody educated in caring for children stepping in for the mother when she is working. It could also be the case that, since women from all different social groups to a large extent are working in Sweden, it is more social acceptable for woman to be away from home, which could in turn lessen the negative effects on children. Another contribution is the richness of the data. The data-set contains about 70 000 individuals and includes a wide variety of socio-economic variables, enabling control for many aspects that may influence children's educational achievement. Moreover, there is information about the GPA both when the student graduated from compulsory school and when he/she graduated from upper secondary school. This means that it is possible to analyse how the socioeconomic history of the child influences educational achievement during different stages of schooling. However, the most important contribution, pertaining from the richness of the data, is that the data-set contains labour force participation of both parents, making it possible to test whether the labour force participation of fathers is of importance in explaining children's educational achievements.

The paper is outlined as follows: the empirical strategy together with a description of the data can be found in the next section, and in the third section the empirical findings are presented and discussed. The final section gives a concluding summary.

Empirical Strategy and Data

The tradition in Swedish schooling is that the schools are run by municipalities and that schooling is free of charge.[4] The Swedish public school system consists of nine years of compulsory schooling. After that, students can continue on to two or three years of non-compulsory schooling[5] in the form of upper secondary school. The most common way that students are accepted to upper secondary school is on the basis of their GPA from compulsory school, within the specific reception area of their municipality; and almost all students in Sweden do continue on to upper secondary school (about 95% in 1994). The upper secondary school drop-out rate was about seven per cent among those who entered in 1994.

This paper is based on the idea that the child's educational achievement is a household public good, to which both parents may contribute.[6] The setting is as follows. Consider a household with two adult members and a child. Each adult household member derives utility from the consumption of leisure, purely private goods and services, and a household public good. The latter is to be interpreted as the educational achievements of the child, which is partly produced within the household.[7] There is a trade-off between the consumption of private goods and services and the quality of the household public good since, by choosing to work at home, the spouse contributes to the child's educational

achievement. The spouses are not by necessity equally productive in providing the proper care that the child needs to succeed in school. Their productivity in doing so is determined by, for instance, their own education, since the latter could be expected to be closely related to their ability to provide proper help with homework, and so forth.

As suggested by the empirical studies discussed in the Introduction, the child's educational achievement is most probably not fully explained by parent-related variables, such as the time that the parents devote to their children or their productivity, but might also be depending on municipality-specific variables such as the number of teachers available, and variables specific to the child itself such as gender or ethnicity. The variables used to estimate the influence of socioeconomic characteristics on the child's educational achievement are therefore divided into three groups: child-related variables, parent-related variables, and municipality-related variables.

The data-set contains information on about 70 000 students graduating from compulsory school and entering upper secondary school in 1994.[8] The data were retrieved from Statistics Sweden (SCB) and contain school information along with socioeconomic characteristics from the 1990 census. The data-set includes gender, nationality, age, residence, graduating GPA from the last year of compulsory school and the last year of upper secondary school, choice of educational programme in upper secondary school and, finally, information about family structure and socioeconomic situation. The parent-related variables, describing family structure and socioeconomic situation, were measured in 1990 and are therefore treated as exogenous in the estimations. One can debate about the ideal age (of the child) at which to measure parental characteristics. Ideally, one would like to measure the accumulated parental effort and income over the entire childhood. One advantage of having an early measure of parental effort could be that the ground for good grades is built early and that more parents would be observed as part-time workers when their child is young. The advantage of measuring parental effort later during the childhood is that it is likely that parental inputs during the schooling of the child—such as, for instance, help with homework—are important contributors to the child's educational achievements. Another advantage is that parents who are observed as working part-time in 1990 are likely to have been doing so during the child's entire childhood. Therefore, the effects of having parents working part-time earlier during the childhood are also likely to be captured. If parental characteristics are measured early, one risk is that parents are observed to be working part-time due to the birth of a younger sibling. Here, the latter seems less likely, considering that the child has reached the age 12 when the parental characteristics are measured. To be able to address the effects of measuring parental characteristics earlier or later during the childhood, much more comprehensive data would be required.

For the purpose of exploring the determinants of children's educational achievement during the different stages of schooling, with special attention given to the effects of market work by mothers and fathers, the analysis will be carried out in three steps. First, the grade from the last year of upper secondary school is used as the dependent variable. This step captures the effects of parental labour force participation on the children's upper secondary school achievement. Second, the grade from the last year of compulsory school is used as the dependent variable. This captures the effect of parental labour force participation on the children's school achievement up until compulsory school graduation. As a third

step, in order to isolate the effects on GPA during upper secondary school (i.e., the value added effects), the difference between the upper secondary school GPA and the compulsory school GPA is used as the dependent variable. The dependent variables used in the regressions are further explained in the next subsection, and the explanatory variables are subsequently discussed. Descriptive statistics are presented in Tables 1 and 2.

Dependent Variables

The students that graduated from compulsory school with grades from a norm-referenced grading system where the 'average class' of the nation (*riksklass*) set the standard; the grading was to follow a normal distribution where the spread of abilities among the students in the whole country was represented. That grading system had a scale from 1 to 5, with 5 being the highest grade you could obtain and 3 representing average achievement. During the schooling of these students, the grading system in Sweden was changed. When graduating from upper secondary school, the students were instead graded according to a criterion referenced system where the focus was to estimate how well the student had met a standardized knowledge criterion instead of comparing the students with the 'average class'.[9] The new grading system had, and still has, four levels; fail, pass, pass with distinction, and pass with special distinction. This four-level scale can then be converted into a quantified scale, where the grade is weighted with course load and length of the course. The grade is then positioned on a scale between 0 and 200.

Since the grade system was changed during the schooling of these students, the grades are not directly comparable. Therefore, in order to facilitate comparisons, both grades are transformed into standard normal variables, with mean zero and variance one.[10] When analysing value added effects, the difference between the transformed grades is taken and it is then possible to study whether a student changes his or her position within the distribution in upper secondary school.

When studying effects on upper secondary school GPA and value added effects, the estimation is carried out separately for different types of educational programmes. This is done because children in different educational programmes take different courses, and because teacher ratings might differ between educational programmes. The division into educational programmes is further motivated by the fact that the choice of educational programme is likely to be endogenous in the context of educational achievement, since a child with a specific grade tends to choose a specific programme. The educational programmes have been divided into three groups,[11] based on types of courses and admission GPA: three-year social sciences (SS) education, three-year natural or technical sciences (NT) education and two-year vocational training (VT). Programme-specific descriptive statistics are presented in Table 2.

Explanatory Variables

Child-related variables. The child-related variables consist of child-specific characteristics that might influence the child's grade, such as gender, ethnicity and whether the child has lived through a divorce.[12] In addition, a dummy variable indicating having parents born abroad is included since having immigrant

Table 1. Descriptive statistics and variable explanations

Variable	Description	Mean	
Child-related variables			
GPA ninth grade	Grade point average, average grade when graduating from ninth-grade compulsory school. Scale 1–5	3.34 (0.63)	
GPA upper secondary	Grade point average, average grade when graduating from upper secondary school. Scale 0–200	126.49 (26.81)	
Male	A dummy that takes the value one if the child is male	0.50	
Parents born abroad	A dummy that takes the value one if the child was born in Sweden but at least one of the parents was born outside of Sweden	0.12	
Child born abroad	A dummy that takes the value one if the child as well as at least one of the parents was born outside of Sweden	0.03	
Child born abroad, Swedish parents	A dummy that takes the value one if the child was born outside of Sweden but the parents where born in Sweden, this includes, to a large extent, children that where adopted	0.02	
Divorce	A dummy that takes the value one if the child comes from a single parent household	0.20	
Parent-related variables		Mother	Father
Parent age	Age of the mother and father respectively in the year of 1990, squared deviation from the mean age is also included to account for possible non-linearities	39.74 (4.84)	42.32 (5.45)
Parent upper secondary education	A dummy that takes the value one if the parent attended upper secondary school	0.38	0.30
Parent higher education	A dummy that takes the value one if the parent attended higher education in the form of graduate or undergraduate university studies	0.29	0.28
Parent 0 hours	A dummy that takes the value one if the mother or the father was unemployed in 1990	0.04	0.01
Parent 1–19 hours	A dummy that takes the value one if the mother or the father worked 1–19 hours per week in 1990	0.06	0.01
Parent 20–34 hours	A dummy that takes the value one if the mother or the father worked 20–34 hours per week in 1990	0.43	0.06
Parent hours missing	A dummy that takes the value one if information about hours of work is missing for the mother or the father respectively.	0.17	0.20

Table 1. *(continued)*

Variable	Description	Mean	
Total income	Total income, in hundred thousands, of the mother and the father respectively in the year of 1990, the squared deviation from the mean total income is also included to account for possible nonlinearities.	1.21 (0.75)	2.11 (2.27)
Info missing	A dummy that takes the value one if information about the mother or the father is missing	0.06	0.15
Municipality-related variables		Compulsory school	Upper secondary school
Number of thousand students	Average number of students registered in the municipality during the three years of upper secondary school and the last three years of compulsory school respectively, in thousands	10.66 (12.83)	4.01 (4.80)
Teacher density	Average number of teachers per 100 students in the municipality during the three years of upper secondary school and the last three years of compulsory school, respectively	8.45 (0.57)	7.09 (0.97)

Note: Standard deviations are presented in parentheses.

Table 2. Descriptive statistics, programme specific

Variable	Programme mean					
	SS		NT		VT	
Child-related variables						
GPA upper secondary	130.21 (25.59)		141.16 (29.99)		116.38 (23.37)	
Male	0.38		0.63		0.55	
Parents born abroad	0.12		0.12		0.11	
Child born abroad	0.03		0.04		0.03	
Child born abroad, Swedish parents	0.02		0.01		0.02	
Divorce	0.19		0.14		0.24	
	Mother	Father	Mother	Father	Mother	Father
Parent-related variables						
Parental age	40.19 (4.68)	42.65 (5.37)	40.61 (4.54)	42.95 (5.11)	38.97 (4.98)	41.76 (5.62)
Parent upper secondary education	0.37	0.30	0.31	0.28	0.41	0.32
Parent higher education	0.36	0.35	0.49	0.48	0.13	0.12
Parent 0 hours	0.04	0.01	0.03	0.01	0.05	0.01
Parent 1–19 hours	0.05	0.01	0.05	0.004	0.07	0.01
Parent 20–34 hours	0.43	0.05	0.44	0.04	0.44	0.07
Parent hours missing	0.14	0.19	0.15	0.17	0.18	0.22
Total income	1.29 (0.92)	2.28 (2.21)	1.34 (0.83)	2.43 (3.54)	1.08 (0.52)	1.82 (1.42)
Info missing	0.06	0.15	0.05	0.12	0.07	0.16

Note: Standard deviations are presented in parentheses.

parents might affect the grade, since, for example, these parents may have a harder time helping their children with homework because of unfamiliarity with the school system or difficulties with language. This might be even more obvious in the case of the child itself being born abroad, simply because the parents have been in Sweden for a relatively short time period. The child itself might also have trouble with the language; therefore, a second dummy is included for this group. A third dummy is included for children born abroad with Swedish born parents, since this group to a large extent consists of adopted children who, according to some earlier research (see, e.g., Brodzinsky *et al*., 1984), have been found to have a harder time succeeding in school.

A dummy measuring whether the child has lived through a divorce or not is included because it is likely that living in dissolved families is associated with different kinds of problems. Divorced parents might not have the same resources, in the form of time and money, to provide for their children as do two-parent families. As a consequence, children from dissolved households might have disadvantages compared with other children, which might affect their achievements.

Parent-related variables. The parent-related variables are from the 1990 census and they consist of total parental income and parental hours of work in the labour market as well as other parent-related variables. The other parent-related variables are included to control for the productivity of parents in the production of educational achievement of the child, since it is not possible to directly observe this productivity. There are some missing observations for the parent-related variables and, in order to account for possible systematic effects of the missing observations, all the parent-related variables have been reconstructed and multiplied with a dummy variable that takes the value one if the observation from one, or the other, of the parents is missing. For example, the mother's age is included as:

$$\beta_i \text{ mother's age} * (1 - \text{info. missing, mother}) + \gamma_i \text{info. missing, mother.}$$

This means that if the information about maternal age is missing, the dummy variable for missing information about the mother will take the value one, and the expression within parentheses will be zero. The effect about having missing observations on parents will, hence, be captured by the parameter γ_i.[13]

Following the working-mother hypothesis, the total labour income is likely to have positive effects on the child's grade. A squared deviation from the mean total income is also included in order to account for possible non-linearities. Even though it follows from the working-mother hypothesis that children's school achievements should be increasing with income, it is likely that the effect is declining as the income increases. Regarding the hours of work that the parents put into the labour market, the reference case is working full time (35 hours or more). Parents not working at all or working part-time, either between 1 and 19 hours or between 20 and 34 hours, is then compared with the reference case. (The parental hours of work variables are the variables that are characterized by the greatest number of missing observations. Since these variables are of special interest here, additional missing observation constructions, like the one mentioned above, are created for parental hours of work.) The other parent-related variables consist of parental age, together with squared deviations from the mean age (to account for possible non-linearities) and two dummy variables for parental upper

secondary education and parental higher education, in the form of undergraduate or graduate university studies, respectively.[14] The reference case for parental education is compulsory school. The parental education dummies are likely to have a positive effect on the child's school achievements.

Municipality-related variables. The municipality-related variables consist of the average number of students registered in the municipality during the three years of schooling and the average number of teachers per 100 students. The first is meant to capture the effect of living in a larger municipality with larger schools and larger classes. The second variable is included since it might have a positive effect on the child's school performance if there are more teachers devoting their time to the child.

Empirical Findings

Effects on Upper Secondary School GPA

This subsection concerns the determinants of upper secondary school achievements by the child. The GPA when graduating from upper secondary school, transformed into a standard normal variable, is used as dependent variable. Special attention is given to the role of parental labour force participation on the child's educational achievement. The analysis is carried out separately for three types of educational programmes and the results are presented in Table 3.

Child-related variables. As can be seen in Table 3, the signs and significance levels of the coefficients are not changing much between the three programmes. In accordance with previous research, male students achieve a lower upper secondary school GPA than do female students.

For students participating in VT or taking the SS programmes, the effect of having parents that were born abroad is negative. However, there is no significant effect for students taking the NT programmes. It seems that the students in the VT and SS programmes are more sensitive to having parents that might not be able to provide as much help with homework. When the student is born abroad with parents being born abroad as well, this has a negative effect on the total GPA regardless of educational programme. This might be due to the fact that having a good knowledge of the language, in which the courses are being taught, is crucial in order to benefit from the education; the effect here is greater than the effect of only having parents born abroad. Being a child born abroad with Swedish-born parents has a negative effect on the grades. One might suspect that many of the children in this group are adopted, which means that they should not be experiencing the same language difficulties as their foreign-born peers might be experiencing. The negative coefficient is in line with some previous findings (see, e.g., Brodzinsky *et al*., 1984) and might be due to identity issues that some of these children are faced with. Furthermore, as in McLanahan (1985) and Keith and Finlay (1988), the experience of a separation between the parents is found to have a negative effect on the child's GPA from upper secondary school. In the setting of the educational achievement of the child as the household public good, is not surprising that a lesser amount of the household public good will be produced in the case of divorce, since a divorced couple is more likely to behave non-cooperatively than a married couple.[15]

Table 3. Estimation results for the upper secondary school GPA, programme specific

Variable	SS GPA	NT GPA	VT GPA
Constant	–0.97***	–0.82***	–0.46***
Male	–0.42***	–0.38***	–0.42***
Parents born abroad	–0.10***	–0.03	–0.11***
Child born abroad	–0.32***	–0.26***	–0.37***
Child born abroad, Swedish parents	–0.53***	–0.35***	–0.44***
Divorce	–0.06***	–0.07***	–0.08***
Mother age	0.009***	0.01***	0.01***
Mother age, squared deviation from mean	–0.0007***	–0.0003	–0.001***
Father age	0.006***	0.005**	0.006***
Father age, squared deviation from mean	–0.0001	–0.0002	–0.0002
Mother upper secondary education	0.08***	0.07***	0.08***
Father upper secondary education	0.03	0.02	0.06***
Mother higher education	0.28***	0.28***	0.24***
Father higher education	0.19***	0.23***	0.09***
Mother 0 hours	–0.04	–0.03	–0.05
Mother 1–19 hours	–0.05	0.14*	0.12*
Mother 20–34 hours	0.08***	0.08***	0.06***
Mother hours missing	0.05*	0.03	–0.04**
Father 0 hours	–0.01	–0.07	–0.06
Father 1–19 hours	0.21***	–0.04	–0.05
Father 20–34 hours	0.05	0.13**	–0.03
Father hours missing	–0.10***	0.10**	–0.06**
Mother total income	0.07***	0.09***	–0.01
Mother income, squared deviation from mean	–0.000001*	–0.00001***	0.000006
Father total income	0.02***	0.01**	0.02**
Father income, squared deviation from mean	–0.0000001***	–0.00000003*	–0.0000003**
Info missing, mother	0.37***	0.62***	0.40***
Info missing, father	0.44***	0.22*	0.20**
Number of students	0.01***	0.01***	–0.004***
Teacher density	0.03***	–0.005	0.001
R^2 adjusted	0.10	0.10	0.08
Number of observations	21716	13888	28036

Note: Dependent variable: upper secondary school GPA (standard normal). *Statistically significant at the 10% level, **statistically significant at the 5% level, ***statistically significant at the 1% level.

Parent-related variables. Both total income and human capital of the parents, measured as the number of years of schooling, are variables that frequently are included in studies of children's educational achievement. The two variables are almost always found to be positively associated with the educational achievement of the child. For students taking SS programmes or the NT programmes it can be seen that, when hours of work are controlled for, the child's upper secondary school GPA increases with parents' total income (although the effect is decreasing as the income is increasing above the mean income) as well as with parents' education. The mother's income having a positive effect on the child's educational achievement is consistent with the working-mother hypothesis. For students in VT, however, the total income of the mother has no significant effect. The total income of the mother, however, is lower for students in this group, and

the variation is smaller, than in the other groups. The positive effect of the mother's educational level is larger than that of the father's, which suggests that for upper secondary school GPA the human capital of the mother is more important. This result is in accordance with previous research (e.g., Leibowitz, 1977; Hill and Stafford, 1980). When it comes to parental age, children whose parents were young when their child was born attain lower grades than those whose parents where older. For mothers, the effect is present, as long as she is not more than a few years older than the mean age. This result is in line with previous findings, and could be explained by the results found by Sousa-Posa *et al.* (2001); that is, time spent on childcare by both mothers and fathers respectively increases with the age of parents.

Again, in accordance with the working-mother hypothesis, the hours of work performed by mothers seems to be of importance for children's educational achievements. If the mother works part time when the child is 12 years old this has a positive effect on the child's upper secondary school GPA relative to the reference case of the mother working full time. The exception is that no significant effect of having a mother that works 1–19 hours is found for the students in SS programmes. These results are in line with the findings by Stafford (1987). The analysis in Stafford was performed using US data and it was suspected that since Sweden has an extensive public childcare system there would not be any effects of the mother being away from home. However, the results show that despite the high participation in public childcare among children in Sweden, the 'away from home' part of the working-mother hypothesis is present. Even though the effects are significant, it is important to note that they are small compared with the effect of, for example, higher education of the parents. However, given that there is a positive effect of having a mother working part-time, the effects here are likely to be underestimated, since more mothers would probably have been observed as working part-time had the measure been taken at an earlier point of time during the childhood. Having a mother that does not work at all is just as bad as having a mother that works full time, which is instead speaking against the working-mother hypothesis. If not working at all is due to involuntary unemployment, there may be other factors associated with this that are equally bad for the child's educational achievements as having a mother that works full time.

The numbers of hours worked by the father also seem to be of some importance. There are positive effects on the upper secondary school grades for students in the SS programmes of having a father that works 1–19 hours. There is also a positive effect of having a father that works 20–34 hours for students in the NT programmes. According to these results the existence of a working-father hypothesis cannot be rejected. One should, however, keep in mind that the variance in the number of hours worked by the fathers is small, and the results should therefore be interpreted with caution.

Municipality-related variables. For students in the SS programmes and the NT programmes the GPA is increasing with the number of students in the municipality. This implies that students in larger municipalities perform better than students in, for example, the countryside. On average, the schools are larger in larger municipalities, which suggest that children in larger schools perform better. For students in VT, however, the effect is the opposite. The reason for this might be that there is a different view on VT programmes in the countryside than in other parts of the country, and that these programmes, therefore,

attract more able students in the countryside than in the cities. As has been stated, educational inputs are often found to be relatively unimportant in explaining student outcomes. The same is true for the number of teachers per 100 students; it does not seem to be important except for students in the SS programmes where the GPA is found to be increasing with teacher density. One possible explanation might be that the students in the SS programmes to a larger extent choose their field of special interest[16] than do students in the other programmes, and if there are more teachers available they are more likely to get their preferred field. If they get their preferred field of study, they might be more interested in their studies and, as a consequence, might perform better.

Compulsory School and Value Added Effects

In this subsection the estimation of the determinants of GPA when graduating from compulsory school and the change in GPA during upper secondary school are presented and analysed separately. Again, the role of parental labour force participation is given special attention, and both grades are transformed standard normal variables.

Compulsory school effects. When estimating the determinants of compulsory school GPA, the GPA when graduating from ninth grade is the dependent variable. The results are presented in Table 4.

It is apparent that male students perform worse than female students already in compulsory school. Having parents that were born abroad has no significant effect on the GPA when graduating from compulsory school; these effects are therefore likely to appear first in upper secondary school. The other child-related variables show the same signs and significance, and are of roughly the same size, as when the upper secondary school GPA was analysed.

The effects of parental age, income and education are similar to those that were found for upper secondary school GPA. The effects of maternal labour force participation are present already in compulsory school, but when it comes to the number of hours worked by the father there are no significant effects on the child's grades. There seems to be no support for a working-father hypothesis in the earlier schooling of the child. Finally, the compulsory school GPA is increasing both with the number of students in the municipality and with the number of teachers per 100 students.

Value added effects. For the analysis of achievements during upper secondary school, the difference between the upper secondary school GPA and the compulsory school GPA, both transformed into standard normal variables, is used as a dependent variable. The analysis is again carried out separately for the three types of educational programmes and the results are presented in Table 5.

In Table 5 it can be seen that male students are increasing their grade more than female students during upper secondary school; however, the positive effect is smaller than the negative effect they were experiencing during compulsory school, which gives the total negative effect found when upper secondary school GPA was analysed. Having parents that were born abroad is here found to be negative for students participating in VT or taking the SS programmes; this is an

Table 4. Estimation results for the compulsory school GPA

Variable	GPA ninth grade
Constant	−1.07***
Male	−0.40***
Parents born abroad	0.02
Child born abroad	−0.08***
Child born abroad, Swedish parents	−0.53***
Divorce	−0.14***
Mother age	0.01***
Mother age, squared deviation from mean	−0.001***
Father age	0.005***
Father age, squared deviation from mean	−0.0002**
Mother upper secondary education	0.15***
Father upper secondary education	0.13***
Mother higher education	0.49***
Father higher education	0.39***
Mother 0 hours	0.02
Mother 1–19 hours	0.10**
Mother 20–34 hours	0.08***
Mother hours missing	0.05**
Father 0 hours	−0.04
Father 1–19 hours	−0.02
Father 20–34 hours	−0.01
Father hours missing	0.001
Mother total income	0.08***
Mother income, squared deviation from mean	−0.000001***
Father total income	0.02***
Father income, squared deviation from mean	−0.0000001***
Info missing, mother	0.65***
Info missing, father	0.26***
Number of students	0.003***
Teacher density	0.01**
R^2 adjusted	0.17
Number of observations	69348

Note: Dependent variable: compulsory school GPA (standard normal). *Statistically significant at the 10% level, **statistically significant at the 5% level, ***statistically significant at the 1% level.

effect that was not visible when the compulsory school grades of all students were analysed, but that was found for students in these programmes when the upper secondary school GPA was studied.

Being born abroad with parents that were born abroad was found to have negative effects both on compulsory school GPA and on the upper secondary school GPA. For students in NT programmes and students in VT, it is clear that the negative effect on the upper secondary school achievement does not solely have to do with not being able to catch up during upper secondary school. For these students, there are additional negative effects of being a first-generation immigrant during upper secondary school. Being a child born abroad with Swedish born parents or having lived through a divorce at a young age seems to matter only during the earlier stages of schooling, since there are no additional effects during upper secondary school.

Table 5. Estimation results for value added effects, programme specific

Variable	SS GPA	NT GPA	VT GPA
Constant	−0.82***	−1.01***	−0.26***
Male	0.14***	0.26***	0.06***
Parents born abroad	−0.04***	−0.001	−0.05***
Child born abroad	0.04	−0.07**	−0.18***
Child born abroad, Swedish parents	−0.03	−0.09	−0.02
Divorce	−0.003	−0.02	0.003
Mother age	0.006***	0.006***	0.001
Mother age, squared deviation from mean	−0.0001	−0.0002	−0.00002
Father age	0.004***	0.001	0.003**
Father age, squared deviation from mean	−0.0002	−0.00001	−0.00001
Mother upper secondary education	0.02*	0.03	−0.003
Father upper secondary education	0.01	0.02	0.002
Mother higher education	0.05***	0.05***	−0.04**
Father higher education	0.06***	0.09***	−0.01*
Mother 0 hours	−0.03	0.01	−0.07**
Mother 1–19 hours	−0.01	0.06	0.08
Mother 20–34 hours	0.02*	0.03**	−0.03**
Mother hours missing	0.04*	0.05*	−0.03
Father 0 hours	−0.02	0.06	−0.001
Father 1–19 hours	0.05*	−0.009	−0.08
Father 20–34 hours	−0.01	0.07**	−0.03
Father hours missing	−0.01	0.06*	−0.01
Mother total income	0.03***	0.02*	0.007
Mother income, squared deviation from mean	−0.0000003	−0.000003	0.0000004
Father total income	0.02***	0.01**	0.02***
Father income, squared deviation from mean	−0.0000001***	−0.00000002*	−0.0000003***
Info missing, mother	0.28***	0.29***	0.08
Info missing, father	0.27***	0.08	0.19***
Number of students	0.001***	0.006***	−0.01***
Teacher density	0.03***	0.05***	0.008*
R^2 adjusted	0.03	0.05	0.01
Number of observations	21716	13888	28036

Note: Dependent variable: difference between compulsory and upper secondary school GPA (standard normal). *Statistically significant at the 10% level, **statistically significant at the 5% level, ***statistically significant at the 1% level.

For students taking the SS programmes or the NT programmes, it can be seen that there are additional positive effects during the child's upper secondary education from parental education, when hours of work are controlled for. During upper secondary school there is no longer a dominating effect of the mother's human capital; instead, the human capital of the father is more important. For students in VT, the GPA achieved during upper secondary school is decreasing with parental education. The reason could be that, when being in compulsory school, these students could get help with theoretical courses from highly educated parents. However, in upper secondary school, they need help with more practical courses, and highly educated parents are not by necessity able to better provide that help than less educated parents.

During upper secondary school there are additional positive effects of parental income; the exception is again students in VT, where the income of the mother does not seem to matter at all. There are some additional positive effects during upper secondary school of having older parents, but now the effects are linear. There are also additional positive effects on the GPA achieved during upper secondary school for the SS and NT students, if the mother worked less than full time but more than half-time when the child was 12 years old. For VT students, on the other hand, there is instead a small negative effect of having a mother that worked less than full time, but more than half-time. A negative effect of unemployed mothers is also found for the VT students. The positive effects of fathers working less than full time, which were discussed when the upper secondary school GPA was analysed, are arising during upper secondary school.

For all students, the effects of going to school in a larger municipality are the same as they were when the upper secondary school GPA was studied. During upper secondary school, the grades are increasing with teacher density for students in NT and SS programmes.

Conclusions and Suggestions for Future Research

This paper examines the determinants of children's educational achievement. Special attention is focused on the effects of parental hours of work on children's educational achievement, measured as the GPA from ninth year of compulsory school and as the GPA from the last year of upper secondary school, while controlling for a wide range of socioeconomic variables. The empirical part is based on data for students graduating from compulsory school and entering upper secondary school in 1994 (about 70 000 individuals).

The main findings are that, in line with the working-mother hypothesis and with previous research, there is a positive effect of the mother's income (contingent on hours of work) on the child's performance in school. A higher income by fathers is also associated with a higher GPA among children. The hours of labour market work by mothers influences the educational achievements of the children. If the mother works part-time it has a positive effect on the child's grades. This confirms the working-mother hypothesis and is in line with previous studies, for example Stafford (1987). The effects are not only found in compulsory school, but are to some extent strengthened in upper secondary school, leaving quite an impact on the GPA when graduating from upper secondary school. There are no significant effects of the father's hours of work on the compulsory school grades, but some effects in line with those of the mother are found on upper secondary school GPA. Therefore, the existence of a working-father hypothesis cannot be rejected. However, because of the small variation in the hours of work by fathers, this area must be further explored before the existence of a working-father hypothesis can be considered proven.

Unfortunately the data-set used in this paper does not contain information on the labour force outcomes of children. Since the effects of parental labour force participation are, to some extent, strengthened during upper secondary school, future research with a different data-set could be focused on analysing whether the effects found in this paper prevail into adulthood. To further investigate the working-mother hypothesis and the existence of a possible working-father hypothesis, it would be desirable to have more extensive information on parental

labour force participation. For example, in the present data-set it is not possible to separate between voluntary and involuntary unemployment. In the light of the working-mother hypothesis the effects of parental unemployment on the educational achievement of children are likely to be very different depending on whether the unemployment is voluntary or not. It would also be interesting to have information about parental labour force participation during the whole childhood of the children. In that case it could be investigated at what time children are most sensitive to the parents being away from home.

Another interesting area for future research is the sharing of parental leave and its effects on children's educational achievements later in life. Sharing parental leave is something that is becoming more and more common in Sweden and there is an ongoing debate about a proposed legislation relating to shared parental leave. With regard to this debate, future research could be focused on analysing whether it matters for the future educational achievement of children if the father or the mother was staying at home when the child was really young. There might also be different effects depending on whether the child is a boy or a girl.

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Notes

1. The hypothesis is first mentioned by Haveman *et al.* (1991). Hetherington *et al.* (1983) found results consistent with the hypothesis.
2. According to Statistics Sweden, in 1980 approximately 600 000 children were between the ages of one and six. Of those, about 360 000 were registered in public childcare. In 1985, 424 000 out of 565 000 were registered. During the pre-school age of the children in this study, public childcare consisted of daycare centres (nowadays preschools), registered childminding homes and nursery schools (the two latter are both almost non-existent today). Even though the demand for public childcare has exceeded the supply by far during its whole existence, the supply and availability in Sweden is large compared with the supply of public childcare in many other countries. For more information on the Swedish public childcare system, see for instance Gustafsson and Stafford (1992).
3. In 1978 paid parental leave was restricted to eight months and less than five per cent of the available days were never collected. About seven per cent of the paid parental leave days were collected by fathers.
4. Private schools have traditionally been scarce in Sweden, partly because of restrictive policies and partly due to limitations in receiving public grants or other funding. In 1994 there were 166 private compulsory schools and 21 private upper secondary schools in Sweden. Since then, private schools have become more common, and in 2004 there were 506 private compulsory schools and 234 private upper secondary schools.
5. The group of students examined here was the last one that was able to choose a two-year upper secondary education. Now, the upper secondary school in Sweden consist only of different three-year educational programmes.

6. See Bergstrom (1997) for an overview of production functions for household public goods.
7. Weiss and Willis (1985) are among the first to treat the well-being of children as a household public good that enters the utility of both parents.
8. About 65 000 of the students were born in 1978, 500 were born in 1979 and 4500 were born in 1977. A large portion of the students born in 1977 are first-generation or second-generation immigrants.
9. The grade system was changed due to criticism that it was not knowledge orientated enough and that the comparisons led to strong competitiveness among the students. For more information about the Swedish school and grade system before and after the changes, see for example Wikström and Wikström (2005).
10. Regression results without transformations can be obtained from the author upon request.
11. When dividing the students into three types of programmes, the sample is reduced with about 7000 individuals. The students that have been excluded are participants in minor programmes; for example, those who are studying an individually adapted programme. The reason for the exclusion is that there are too few of these students to separately study them.
12. It is not always obvious to which specific group a variable should belong, and the division is therefore very subjective at times. For instance, the divorce dummy could be argued to be parent related. The reason why it is included as child related is that it is supposed to capture whether the child has lived through a divorce between its biological parents. The parents themselves could have been divorced more than once.
13. The idea to treat missing observations in this manner comes from Weiss and Willis (1997).
14. The information available on parental education is whether they attended compulsory school, whether they attended upper secondary school (in the form of vocational training or a theoretical track), whether they have more or less than three years of university education and whether they have a PhD degree. Different specifications for parental education have been tried without affecting the qualitative results. For instance, a model with five different educational dummy variables, one for each educational level, has been considered.
15. The most famous non-cooperative game theory model for intra-household distribution is developed from the literature of private provision for public goods (see, e.g., Warr, 1982; Bergstrom *et al.*, 1986). For a more specific example of the behaviour of divorced parents, see Weiss and Willis (1985).
16. The social sciences students take their first year of studies together and are then able to choose whether to take a special interest in business administration, media and communication, languages (depending on which ones are offered at the school) or social sciences.

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Match Quality, Financial Surprises and the Dissolution of Commitments among Young Adults in Sweden

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Abstract. The role of financial surprises and match quality in the dissolution of relationships is explored. The analysis is carried out both for surprises in the short term earnings and surprises in the long-run earnings capacity. It is found that positive surprises in short term earnings have a destabilizing effect for a relationship. Generally, a negative surprise in long-run earnings capacity for males has a destabilizing effect. However, if it is combined with a female positive surprise, the effect is stabilizing. Commitments become more stable the older the spouses are at the start of the relationship, and if young children are present.

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1 Introduction

When you make a commitment to another person, the decision is based on the stock of information available at that point in time. There will, however, be a number of factors about which you will lack knowledge. You cannot know with certainty, for example, the long-run earnings capacity of the person to whom you are committing. It may even be hard to foresee the income your partner will have next year. Indeed, factors of this kind could cause you to revaluate the gain you may obtain from the commitment. The purpose of this paper is to estimate the role of financial surprises and match quality on the separation rate in Sweden.

As in other Western societies, Sweden has been experiencing decreasing marriage rates along with increasing divorce rates over the past four decades. In their pioneering article, Becker et al. (1977) identified two main explanations for marital instability. First, a marriage that is initially acceptable can become unacceptable, if you encounter a better match. Second, factors that influence the utility of marriage can change unexpectedly over time. The first studies to use longitudinal data in the examination of the explanations of divorce, discussed by Becker et al. (1977), were Hoffman and Duncan (1995) and Weiss and Willis (1997). Hoffman and Duncan focus on the second of the two explanations of divorce. They find that income and wages have only minor effects on divorce rates; and that whilst increases in AFDC (Aid to Families with Dependent Children) benefits slightly increase the probability of marriage dissolution, increases in the husband's earnings and the wife's wage rate slightly reduce the probability of divorce. Weiss and Willis, when examining both explanations of divorce, find, in line with Becker et al., that couples who marry later in life are more likely to have a lasting relationship. When studying unanticipated changes in economic circumstances, they find that an unexpected increase in the husband's earnings capacity tends to reduce the probability for divorce, while an unexpected increase in the wife's earning capacity, instead, tends to increase it.

One of the more recent papers focusing on both explanations is Svarer (2005). He finds that cohabitation prior to marriage decreases the probability of divorce, and that short-run deviations between expected and observed earnings affect the probability of divorce in a way that is asymmetric between men and women. In the case of women, deviations in either direction increase the divorce rate, while, for men, positive deviations have a stabilizing effect and negative deviations have a destabilizing effect on the marriage. Georgellis (1996) and Svarer (2002, 2004) all focus on the first explanation and investigate whether cohabitation

prior to marriage decreases the probability of divorce. Aassve (2001), Böheim and Ermisch (2001), and Walker and Zhu (2006) focus, instead, on the role of unexpected changes in economic circumstances.

Even though Sweden is among the countries with the highest divorce or separation rates in the world, very little has been written on the Swedish situation. The three studies that, to our knowledge, exist are based on data from the 1981 fertility survey called Women in Sweden. These are Bennett et al. (1988) who focused on the question of premarital cohabitation and subsequent divorce, and Hoem and Hoem (1992) and Trussell et al. (1992) who examined different determinants of union dissolution. These studies based on Swedish data were conducted using data that was obtained during a period when women in Sweden where still in the process of entering the labour market and cohabitation prior to marriage was not as widespread as today.

Except for the three Swedish studies, the earlier literature regarding divorce is largely based on data from the UK, the US and Denmark. Sweden differs from both the US and the UK in several aspects, but displays many similarities to Denmark. For instance, the female labour force participation is higher in Sweden (and in Denmark) than in the US and the UK. This suggests that a divorce in Sweden (or Denmark) would not necessarily imply as great changes for women as in the other two countries (for example, having to enter the labour market following a divorce). In addition, the social security system, which includes, for example, parental leave benefits, unemployment benefits and social assistance is considered to be more generous in Sweden (and in Denmark) than in the US and in the UK. The public child care system is also more developed. This implies that a woman may not be as dependent on her ex-husband following a divorce as in the other two countries. The combined facts that the Swedish studies are not very up to date, that they do not include any information on unanticipated changes in economic conditions and that Sweden is a country that differs from some of the other studied countries in several respects makes it important to further investigate the Swedish family formation and dissolution patterns.

The data used in this paper originates from Statistics Sweden, the National Service Administration and the Swedish Employment Service. The study is based on a sub sample of individuals born in 1973 who, during the time period 1991-2003, committed to another individual born in the same year, a total of 3 392 couples. Commitment is defined as cohabiting with children or being married with or without children. The dataset is unique in the sense that it contains information on results from cognitive and non-cognitive evaluations for almost all the male subjects,

who were Swedish citizens, the year they turned 18. This means that it is possible to observe some characteristics of the males, which their partners are likely to observe prior to commitment, in a way that has not been done before.

Financial surprises are defined in two ways. First, following Svarer (2005), the effects of short term deviations between predicted and observed earnings are analysed. Earnings[1] in each year are predicted based on information for the previous year. The predictions are then compared to the observed value. Second, following Weiss and Willis (1997), the effects of unanticipated changes in long-run earnings capacity are analysed. Here, the earnings at the end of the observation period are used to represent the long-run earnings capacity. For each year, predictions of the long-run earnings capacity are made based on the information available at that point in time. These predictions are then compared with the initial prediction made at the time when the commitment was formed. The effects of match quality and short as well as long-run financial surprises on commitment dissolution are then analysed using a probit model.

The paper is outlined as follows. In section two, the theory underlying the role of financial surprises in commitments is explained. Section three gives a description of the data. In section four the empirical strategy is outlined, and in section five the estimation results are presented and analysed. Conclusions are given in section six.

2 Commitment and the Role of Financial Surprises

How is it possible that a union, which was optimal to enter at one point in time, may become optimal to leave at another point in time? One way to explain this phenomenon is to assume that the utility obtained by an individual from being in a relationship with another person is given by:

$$U_i^C = U^C(X_i, X_j, \theta_{ij}, K_{ij}) \tag{1}$$

where X_i represents personal characteristics and X_j those of the partner. θ_{ij} includes unobservable characteristics specific to the commitment, such as love and other aspects of match quality. K_{ij} includes commitment capital accumulated during the relationship, but which is not specific to the commitment itself, for instance the quality and quan-

[1] Earnings are defined as gross income and include both labour and non labour income.

tity of children. All in all, the above means that the utility obtained by the individual from being in a commitment depends both on material and emotional factors.

Outside of the relationship, each partner has the alternative of living as a single person, or to remarry. This means that the value of the outside alternative can be specified as:

$$U_i^A = U^A(X_i, E[U_i^{new}], K_{ij}) \tag{2}$$

where $E[U_i^{new}]$ is the expected gain from a (possible) future commitment that includes the characteristics of the future partner, the match quality of the new commitment, and the expected future commitment capital. K_{ij} is the part of the commitment capital that remains from a previous relationship. This may affect the utility from being single but it may also affect the chances of recommitment as well as the utility gain of a future commitment.

Divorce occurs whenever one or both of the partners find that the utility of staying in the relationship is exceeded by the value of the outside alternative. Within economic theory, there are two general explanations for this phenomenon (Becker et al. 1977). The first explanation has to do with match quality and the possibility of meeting a superior match. If searching for a partner is costly; then people are likely to search for a shorter time than they might otherwise have done. Accordingly, people who marry early are more likely to have made a relatively poor match, which decreases the value measured by equation (1). Further, encounters occur at random, which means that one day you might simply meet someone who suits you better. This would then increase the value of the outside alternative given by (2). The second explanation has to do with the possibility that, given the quality of the match, the gains from marriage can change unexpectedly over time. This means that there could be a deviation between the actual and the predicted satisfaction from the relationship decreasing the value measured by (1), which, in turn, could trigger divorce. Weiss and Willis (1997), Burdett and Coles (1998), and Svarer (2005) argue that the reasons behind the dissolution of a marriage are that the choice to enter a relationship is based upon the information available about the partner's characteristics at the time that the commitment starts, together with predictions made about unknown characteristics, on the basis of the known information. This information is likely to be limited at the start, but as the relationship evolves, both partners acquire new information about each other.

In view of the fact that the partners, to some extent, are matched into the commitment based on predictions, deviations between predictions and what is later actually observed can lead to dissolution of the relationship. It is also likely that couples with a low match quality are more sensitive to surprises, both negative and positive. In addition, it is also possible that in the beginning of the relationship, when the information that the partners have about each other is limited, they are more sensitive (i.e. they react stronger) to negative surprises than later on when they have gathered more experience and the stock of information is larger (Svarer 2005). It is, therefore, likely that the probability of dissolution decreases the better the quality of match as well as the longer the duration of the commitment.

As the commitment evolves, the partners are more prone to increase their investments in it. For example they add to the stock of information they have about their partner, they could have children and acquire property together. These investments increase the gains from staying in the commitment i.e. they increase the value of the relationship given by (1). The investment in commitment capital would, therefore, decrease the probability of the break up of the marriage.

The above leads to the conclusion that earnings could have several implications for the stability of a commitment. This is because, as long as there is some degree of income pooling, it is likely that having a high income partner would increase the value of the commitment for the other person, through (1), which would work towards a more stable commitment. On the other hand, a higher income potential increases the value of outside alternatives (i.e. increases the utility of being single and the possibility of meeting a match of higher quality who accepts you), which, in turn, decreases the stability of the commitment. In addition, the effects of financial surprises experienced by both spouses may interact. This means that financial surprises in the form of deviations between expected and observed income will have an ambiguous effect and could influence the outcome of the commitment in either way, regardless of which of the partners is exposed to the surprise.

3 Data

The empirical study is based on data from the LOUISE part of the LISA-database along with compulsory and upper secondary school[2] graduation registers obtained from Statistics Sweden. The LISA-database is longitudinal and contains yearly observations on civil status, education, income and labour force participation for all Swedes aged between sixteen and sixty four. The graduation registers contain information about grade point average from compulsory and upper secondary school and the chosen academic track in upper secondary school. In addition, the data contain information on results from the evaluation of cognitive and non-cognitive traits obtained from the National Service Administration which is responsible for enrolling and administering those eligible for military service. The evaluations are subjected to virtually all males who are Swedish citizens the year they turn 18.

The sample comes from a cohort of 110 000 individuals born in 1973 and registered in Sweden on December 31, 1990. The individuals were followed between the years 1990 and 2003. The purpose of this paper is to study matching into commitment and the effect of financial surprises on commitment dissolution. However, as the data is register based, information about partners is not available for all individuals included in the data. Therefore, the study is limited to a sub sample were partners could be identified, i.e. those who were born in 1973 and committed to a partner also was also born in 1973 during the time period 1991-2002. As it is not possible to isolate cohabitation prior to having children, couples cohabiting with children as well as married couples, with or without children, are regarded as committed. This leaves a sample consisting of 3 392 couples. In the data, dissolution is only observed annually, meaning that relationship break up could have occurred at any time during a given year.

Table 1 gives the survival pattern for commitments in this sample. Judging by the table, the probability of dissolving a commitment early (after entering it) is lower if the commitment starts later during the observation period, i.e. when the couple is older.

[2] The Swedish public school system consists of nine years of compulsory schooling. After that, students can continue on to two or three years of non compulsory schooling in the form of upper secondary school.

Table 1. Survival Frequency by Commitment Year

	Year for Start of Commitment											
Dur.	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.67	0.93	0.86	0.89	0.93	0.96	0.96	0.98	0.98	0.98	0.98	0.98
2	0.52	0.76	0.77	0.82	0.88	0.90	0.93	0.95	0.95	0.95	0.95	
3	0.48	0.63	0.70	0.74	0.82	0.85	0.88	0.92	0.93	0.93		
4	0.38	0.61	0.59	0.70	0.80	0.81	0.83	0.89	0.90			
5	0.33	0.59	0.51	0.67	0.77	0.77	0.81	0.86				
6	0.24	0.52	0.47	0.64	0.72	0.75	0.79					
7	0.24	0.48	0.45	0.59	0.70	0.72						
8	0.14	0.48	0.42	0.56	0.65							
9	0.14	0.41	0.38	0.53								
10	0.14	0.41	0.37									
11	0.14	0.37										
12	0.14											
N	21	46	110	174	220	246	283	334	416	496	504	542

In Table 2, descriptive statistics for the individual-specific explanatory variables are given. For time varying variables, the descriptive statistics are measured the year before divorce for divorcing couples, and the year before the observation period ends for couples who remain committed throughout the period of observation, which makes it hard to directly compare the means of the variables over relationship outcome. As can be seen in the table, women whose commitment ends in dissolution, have a higher degree of unemployment, they have lower grades from both compulsory and upper secondary school, and a higher portion of these women were born outside of Sweden. It also looks as though these women have lower earnings and are less well educated. This is, however, likely to be due to the discrepancy in years of measurement. The pattern is repeated for males. It is also clear from Table 2 that males in a commitment that ends in dissolution during the observed period of time have lower scores on their military service evaluations than those whose commitment remains intact during the observed period of time.

Table 2. Means (SD) of Individual-Specific Variables by Commitment Outcome

Variable Name	Continuing$_t$	Dissolving$_t$
Labour Market		
Earnings$_{t-1}$, Females	150.64 (83.012)	91.05 (73.87)
Earnings$_{t-1}$, Males	250.78 (123.69)	153.38 (106.47)
Days in Unemployment $_{t-1}$, Females	41.45 (95.34)	102.41 (126.60)
Days in Unemployment $_{t-1}$, Males	21.69 (70.08)	113.34 (193.02)
Education Females		
Compulsory School$_{t-1}$	0.05	0.25
Vocational Training$_{t-1}$	0.21	0.35
Theoretical Education$_{t-1}$	0.26	0.24
University Short$_{t-1}$	0.15	0.08
University Long$_{t-1}$	0.33	0.09
Compulsory School GPA	3.38	2.89
Secondary School GPA	3.37	3.07
Education Males		
Compulsory School$_{t-1}$	0.08	0.26
Vocational Training$_{t-1}$	0.30	0.38
Theoretical Education$_{t-1}$	0.23	0.22
University Short$_{t-1}$	0.13	0.09
University Long$_{t-1}$	0.24	0.06
Compulsory School GPA	3.16	2.74
Secondary School GPA	3.28	3.02
Ethnicity Females		
Sweden	0.97	0.93
Other	0.03	0.07
Ethnicity Males		
Sweden	0.97	0.94
Other	0.03	0.06
Military Service Variables (Males)		
Command adequacy	5.62	4.91
Evaluation of Non-Cognitive Traits	5.47	4.50
Test of Cognitive Traits	5.16	4.33
Number of Couples	2 831	561

Note: Earnings are annual earnings, in the price level for the year 2000, expressed in thousands of SEK. Education is measured as the highest level achieved in each year.

In Table 3, descriptive statistics for couple specific explanatory variables are given. Couples who break up have more children than those who stay together. They are also more often of different ethnic backgrounds and are more frequently receipt of social assistance. The degree of difference in the level of education between partners is, however, about the same in dissolving commitments as in those that continue. From Table 1 it can be seen that commitments that start early during the observation period i.e. when the couple is young, have a higher probability of dissolution. One might suspect that the commitments that last throughout the observation period simply do so because they have not had enough time to end. However, as observed in Table 3, the relationships that dissolve consistently have shorter commitment duration.

Table 3. Means (SD) of Couple-Specific Variables by Commitment Outcome

Variable Name	Continuing$_t$	Dissolving$_t$
Couple Characteristics		
Age at Start of Commitment	26.10 (2.46)	22.94 (2.74)
Duration of Commitment	4.89 (2.45)	3.34 (2.15)
Number of Children$_{t-1}$	1.32 (0.84)	1.46 (0.63)
Different Ethnicity	0.05	0.09
Different Levels of Education$_{t-1}$	0.61	0.63
Living in City$_{t-1}$	0.41	0.41
Social Assistance Recipients	0.01	0.23
Number of Couples	2831	561

Note: The variable *Different ethnicity* takes the value one if the partners were born in different countries; the variable *Different level of education* takes the value one if the level of education differs between the partners

4 Empirical Strategy

In this section, the empirical strategy is described. The first step involves determining measures of financial surprises. Financial surprises are defined in two ways. First, short term deviations between predicted and observed earnings are specified and, second, unanticipated changes in long-run earning capacity are defined.

Svarer (2005) considers short run deviations between expected and realized earnings. In his paper, expected earnings are estimated by OLS, where earnings are regressed on education, age, number of children, geographical location, number of sickness days and number of days in

unemployment in each year. The expected earnings are then subtracted from the observed earnings to determine whether there is a positive or a negative deviation. In the present paper, the earnings equation for short term earnings takes the following expression[3]:

$$\log Y_{i,t+1} = \alpha' z_i + \beta_t' x_{i,t} + \delta_t \log Y_{i,t}\left(1 - d_{i,t}\right) + \gamma_t d_{i,t} + \omega_{i,t+1} \quad \text{for } t = 90, 91, \ldots, 02 \tag{3}$$

where z_i is a time invariant vector of background variables for individual i, which includes GPA for females and military service evaluations for males, ethnicity, parental income and parental education.[4] The vector $x_{i,t}$ contains time varying explanatory variables. It includes information about education[5], number of days in unemployment, geographical location, the number of children and civil status. $\log Y_{i,t}$ is the log of observed earnings at time t. $d_{i,t}$ is a dummy indicating zero earnings. It means that if the income is zero, then $d_{i,t} = 1$ and $\left(1 - d_{i,t}\right) = 0$ and the effect is instead captured by the parameter γ_t.[6] The error term is denoted $\omega_{i,t+1}$ and contains the part of individual i's earnings at time t+1 that cannot be explained by information available in t. The earnings equation is estimated using OLS with the White estimator of the variance-covariance matrix to account for heteroscedasticity[7]. At time t, the expected value of the error term is zero, meaning that the expected earnings, $\log \hat{Y}_{i,t+1}$, can be predicted by using (3).

One of the main interests in this paper is the effect of financial surprises on the probability of the dissolution of a relationship. After predicting earnings, deviations between predicted and observed earnings can be

[3] The difference between this approach and the traditional Mincer equation is that the approach adopted here includes information on observed earnings along with background information on the subjects, which increases the precision of the predictions.

[4] Parental income was measured in the years 1990, 1991 and 1992. The mean income for these years was calculated and the parents were divided into high income, mid income and low income parents. Parents that were within two thirds of a standard deviation from the mean were defined as mid income parents. The educational level of parents was measured at the same three points in time, and divided into compulsory school, upper secondary school and university education.

[5] As this first step of the empirical study involves prediction of earnings, the education levels will be included as they are presented in Table 2.

[6] This construction is used, as it allows for the possibility that there is a difference between having zero earnings and having low earnings. Weiss and Willis (1997) use the same type of construction.

[7] Se for example Green (2000).

calculated. However, it is likely that a deviation has to be of a certain magnitude for the partner to perceive it as a surprise. In this paper, the predicted value has to differ from the observed value by 20 percent or more[8] to qualify as a surprise. To allow for the possibility that a positive surprise has a different effect than a negative surprise on the dissolution of the commitment, two separate surprise variables will be included in the analysis. The surprise variables are defined as:

$$\text{Positive surprise}_{i,t} \text{ in SEK if } \frac{Y_{i,t} - \hat{Y}_{i,t}}{\hat{Y}_{i,t}} \geq 0.20$$

$$\text{Negative surprise}_{i,t} \text{ in SEK if } \frac{Y_{i,t} - \hat{Y}_{i,t}}{\hat{Y}_{i,t}} \leq -0.20$$

$$\text{for } t = 1, 2, \ldots, T$$

If the deviation between observed and predicted earnings meets the above criteria i.e. exceeds 20 percent it is included as the deviation in SEK, and if it does not meet the criteria it is included as a zero. Interaction dummies between surprises in female and male earnings will also be used, for instance a dummy is included that takes the value one if both partners experience a positive surprise. The co-variation[9] between observed and predicted short run earnings is displayed in Table 4, together with descriptive statistics of surprises.

Table 4. Surprises in Short Term Earnings

	Mean	***(SD)***	***N***	***%***
Females				
Positive Surprise in SEK	75.57	(49.71)	9377	72
Negative Surprise in SEK	90.90	(109.66)	2148	17
Co-Variation between Observed and Predicted Earnings	0.36		12891	
Males				
Positive Surprise in SEK	94.84	(68.01)	6461	50
Negative Surprise in SEK	91.00	(90.89)	2467	19
Co-Variation between Observed and Predicted Earnings	0.53		12891	

[8] Limits between 10 and 30 percent have been tried. However, the results do not seem to be sensitive to the choice of cut-off.

[9] The co-variation is the percentage of observed earnings in each year described by the predictions.

Weiss and Willis (1997) evaluate the effects of unanticipated changes in the predicted long-run earnings capacity on the probability of divorce, by considering the difference between predicted earnings at time t and the initial prediction made at the time of marriage. Earnings are predicted based upon work history, years of schooling and highest degree attained together with variables describing family background and personal characteristics. Following Weiss and Willis, the earnings for the last year of observation, here 2003, are assumed to be representative of the long-run earnings capacity of the partners and are, therefore, used to construct a prediction scheme to recursively estimate the long-run earnings capacity for each individual. As a first step, the following equation is estimated:

$$\log Y_i^{03} = \alpha' z_i + \beta_{91}' x_{i,91} + \delta_{91} \log Y_{i,91}\left(1 - d_{i,91}\right) + \varsigma_t d_{i,91} + \varepsilon_{i,91}^{03} \quad (4)$$

where $\log Y_i^{03}$ is the observed long-run earnings capacity. The other variables are the same as those included in the short run predictions. The parameters from (4) are then used to predict $\log \hat{Y}_{i,91}^{03}$, which is the prediction of the long-run earnings capacity made in 1991. In a second step, predictions about long-run earnings capacity are made for each subsequent year. In order to incorporate past information, the prediction about the long-run earnings capacity made the previous year is included as an explanatory variable in the estimation of the long-run earnings capacity in year t ;

$$\log Y_i^{03} = \gamma_t \log \hat{Y}_{i,t-1}^{03} + \beta_t' x_{i,t} + \delta_t \log Y_{i,t}\left(1 - d_{i,t}\right) + \varsigma_t d_{i,t} + \psi_{i,t}^{03} \quad (5)$$
$$\text{for } t = 92, 93, \ldots, 02$$

where $\log \hat{Y}_{i,t-1}^{03}$ is the prediction of long-run earnings capacity made for the preceding year. $x_{i,t}$ contains any new information available about education, level of unemployment, geographical location, number of children and civil status. Co-variation between the observed long-run earnings capacity and the predictions made each year, for each gender, is given in Table 5. The first row of the table is drawn from the baseline regression specified in (4), and the other rows are from the recursive regressions specified in (5).

As can be seen from Table 5, the early predictions are not very precise, even though a considerable amount of information about the individuals is available. The predictions are better for males than for females: earnings for males are usually easier to predict, but one additional explana-

tion is that more information is available on males because of the Military Service variables.

Table 5. Co-Variation between Predicted and Observed Values of Long-Run Earnings Capacity

	Co-Variation	
Year	Females	Males
1991	0.05	0.09
1992	0.07	0.10
1993	0.08	0.10
1994	0.09	0.11
1995	0.10	0.12
1996	0.10	0.13
1997	0.11	0.14
1998	0.13	0.16
1999	0.15	0.18
2000	0.19	0.24
2001	0.23	0.30
2002	0.32	0.47

After the long-run earning capacity has been estimated, the prediction made each year during the commitment is compared with the prediction made at the beginning of the commitment. The same definition of a surprise as before applies, i.e. the deviation has to be larger than 20 percent in order to count as a surprise. This gives the surprise variables as:

$$\text{Positive surprise}_{i,t} \text{ in SEK if } \frac{\hat{Y}_{i,t}^{03} - \hat{Y}_{i,1}^{03}}{\hat{Y}_{i,1}^{03}} \geq 0.20$$

$$\text{Negative surprise}_{i,t} \text{ in SEK if } \frac{\hat{Y}_{i,t}^{03} - \hat{Y}_{i,1}^{03}}{\hat{Y}_{i,1}^{03}} \leq -0.20$$

$$\text{for } t = 2, 3, \ldots, T$$

Surprise variables are included in three different ways. First, in resemblance with Weiss and Willis (1997), a surprise in earnings of each partner is included as a single variable (without being separated into positive and negative surprises), together with the squared deviation from the mean surprise. This is done in order to make comparisons easier. Second, positive and negative surprises are included as two separate variables for each partner. Finally, in a third stage interaction dummies between surprises in female and male earnings are included. In Table 6, descriptive statistics of surprises in predicted long-run earnings capacity are given.

Table 6. Surprises in long-run earnings capacity

	Mean	***(SD)***	***N***	***%***
Females				
Positive Surprise in SEK	52.56	(31.66)	2466	19
Negative Surprise in SEK	44.59	(33.10)	2197	17
Males				
Positive Surprise in SEK	96.88	(133.88)	2773	21
Negative Surprise in SEK	77.88	(60.49)	1521	12

A potential problem when analyzing the determinants of the dissolution of relationships is that certain individual characteristics are (at least in part) formed during the commitment period and, therefore, not exogenous. This could, for example, be true for earnings as it is possible that a woman, who experiences a decline in the quality of the commitment, may change her labour market activities when considering a divorce, i.e. increase her labour market participation. Weiss and Willis (1997) make an attempt to deal with this possible endogeneity by including a variable concerning the reported happiness of the marriage for their respondents. However, it is not entirely clear how a measure that is reported after the divorce would eliminate (or reduce) this possible endogeneity. It is likely that the problem of women changing their labour market activities prior to divorce is much smaller among young women in Sweden during the 1990's than it was in the US during the 1970's, simply because young Swedish women participate in the labour market to a greater extent regardless of civil status. The same is true for Danish women of today, and Svarer (2005) does not deal with this possible issue either.

In each period of time, an individual will stay in the commitment if the utility from the commitment exceeds the value of outside alternatives. Dissolution can be initiated by either of the partners, and it does not have to be a joint decision to separate. Following the notation used by Fan and Lui (2004), this means that either partner will choose to dissolve a partnership in period t if:

$$\begin{aligned} D_{j,t} &= E\left[Value\ of\ \ outside\ alternative\right]_{j,t-1} \\ &\quad - E\left[Utility\ \ from\ commitment\right]_{j,t-1} > 0 \\ &\quad \text{for } j = \text{male, female} \end{aligned} \tag{6}$$

D is unobservable, but it is possible to observe a proxy indicator I^* for continuing the commitment or dissolving it. The empirical analysis is based on a probit model where $I^* = 1$, if $D_{female} > 0$ and/or $D_{male} > 0$, meaing that dissolution occurs, whereas $I^* = 0$ otherwise, meaning that

the commitment remains intact. As was previously stated, dissolution is only observed on a yearly basis. Accordingly, explanatory variables at time t-1 are used to explain the probability of divorce in period t. This is done to avoid the possible influence of the dissolution event on the value of any of the variables of interest. In order to control for possible non-independence of observations over time, the standard errors are adjusted for clustering on couples.[10]

The economic theory about partnership dissolution suggests that couples with a low match quality are more sensitive to surprises, and that the quality of the match is likely to increase the greater amount of time spent on the search for a partner. Couples who met at a younger age should, therefore, be faced with a higher probability of dissolution when surprises occur. The theory also implies that early on in a relationship, when the information partners have about each other is limited, they are likely to be more sensitive to surprises. Accordingly, when analysing the effects of surprises in short run earnings and surprises in long-run earnings capacity, some additional interactions will be included. This is done in order to investigate whether a low match quality due to the young age of the couple at the start of the relationship makes the relationship more sensitive to surprises; and whether couples are more sensitive to surprises earlier in a relationship because they have a low stock of information.

5 Results

In this section, the empirical results from the probit model in (6) are presented and analysed. The first subsection deals with the results from the probit estimation of dissolution, with surprises in short term earnings from (3). The second subsection discusses the results from the probit estimation with surprises in predicted long-run earnings capacity from (4) and (5). In both subsections, in order to analyse whether couples with low match quality and/or low information are more sensitive to surprises, financial surprises are interacted with the age at the start of the relationship.

5.1 Surprises in Short Term Earnings

The results of the probit estimation with surprises in short run earnings are given in Table 7. Column one gives the estimates of the model without interaction terms for the "surprise variables". In the second column, interaction terms are included.

[10] See for example Böheim and Ermisch (2001).

Table 7. Probit Model of Commitment Dissolution with Financial Surprises in Short Term Earnings

	Column	
	1	2
Variable Name	Coefficient (Robust s.e.)	Coefficient (Robust s.e.)
Couple Characteristics		
Year for Start of Commitment	-0.030*** (0.011)	-0.031*** (0.011)
Log Duration of Commitment	0.038 (0.044)	0.037 (0.044)
Number of Children	0.009 (0.043)	0.007 (0.043)
One Child < 3 Years Old	-0.015 (0.061)	-0.015 (0.060)
More than One Child < 3 Years Old	-0.183** (0.090)	-0.181* (0.092)
Different Levels of Education	0.106** (0.046)	0.107** (0.046)
Different Ethnicity	0.163 (0.130)	0.168 (0.131)
Living in City	0.136*** (0.043)	0.136*** (0.043)
Social Assistance Recipients	0.479*** (0.072)	0.483*** (0.072)
Labour Market		
Earnings, Female	-0.002*** (0.0005)	-0.002*** (0.0005)
Squared Deviation from Mean, Female	0.0000003 (0.0000003)	0.0000003 (0.0000003)
Earnings, Male	-0.001*** (0.0003)	-0.001*** (0.0003)
Squared Deviation from Mean, Male	0.00000002* (0.00000001)	0.00000001 (0.00000001)
Days in Unemployment, Female	-0.0002 (0.0002)	-0.0002 (0.0002)
Days in Unemployment, Male	0.0003 (0.0002)	0.0003 (0.0002)

Table 7. Continued

Financial Surprises		
Positive Surprise, Female	0.003*** (0.0006)	0.003*** (0.0006)
Negative Surprise, Female	0.0006 (0.0006)	0.0005 (0.0006)
Positive Surprise, Male	0.0006* (0.0003)	0.001*** (0.0005)
Negative Surprise, Male	-0.0005 (0.0005)	-0.0007 (0.0007)
Female Pos. Surprise / Male Pos. Surprise		-0.155** (0.070)
Female Pos. Surprise / Male Neg. Surprise		-0.004 (0.087)
Female Neg. Surprise / Male Neg. Surprise		-0.100 (0.155)
Female Neg. Surprise / Male Pos. Surprise		-0.096 (0.100)
Ethnicity		
Born Outside of Sweden, Female	0.043 (0.127)	0.038 (0.128)
Born Outside of Sweden, Male	-0.219* (0.127)	-0.231* (0.127)
Education Female / Male		
Basic / Basic	0.205*** (0.073)	0.206*** (0.072)
University / Basic	0.002 (0.094)	0.004 (0.094)
Basic / University	0.095 (0.102)	0.090 (0.102)
Constant	58.215*** (21.987)	59.808*** (22.116)
Model Information		
Wald Chi-Square	344.72 (24df)	349.79 (28df)
Pseudo R^2	0.078	0.079
Log Pseudo-Likelihood	-2127.737	-2124.626
N (Couple Years)	12891	12891

Note: * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

As can be seen from Table 7, the probability of dissolution is lower for commitments that started late in the sample period than for ones that started earlier, ceteris paribus. Because the respondents are all the same

age, this result is equivalent to the probability of dissolution decreasing the older the spouses are at the start of the commitment. This result is in line with the findings of Weiss and Willis (1997), and Böheim and Ermisch (2001), and it supports the hypothesis that the quality of a match increases with the time spent on searching for a partner. Another explanation is that people who meet early are less mature than those who meet later and/or that they diverge in their continued individual development (see, for example, Hoem and Hoem 1992). The probability of dissolution does not seem to be related to the duration of the commitment. Hence, there is no support for the theory that the gains from the commitment increase the greater the length of the commitment.

The presence of more than one young child tends to decrease the probability of dissolution, but the probability is not affected by having only one young child or by the number of children. Having more than one child aged under three is likely to imply that, at least, one child is very young. Weiss and Willis (1997) argue that fertility decisions could be one type of decision that is endogenous in the decision to discontinue the commitment. Other researchers, such as Lillard (1993), have tested this explicitly and found that there is a negative correlation between the two decisions. However, in spite of this, Lillard still finds the first child born to couples to have a stabilizing effect on the relationship. This is in line with the theory of investment in commitment capital.

Having different ethnical backgrounds does not seem to affect the stability of the commitment, indeed relationships where the male was born in another country are more stable. The latter finding may be related to culture or religion. If the male is born abroad, his attitude to divorce might be different than that of Swedish born males. This would, in turn, imply a higher disutility from leaving a relationship i.e. a higher value of eq. (1). Living in a city increases the probability of dissolution. One explanation is that more alternative matches are available in the big cities. The latter result is in line with findings by Svarer (2002, 2004, 2005).

If the partners have different levels of education[11], this has a destabilizing effect on the commitment. In addition, the educational level itself seems to be of some importance. If both partners have only compulsory school or upper secondary school education, the relationship has a higher probability of dissolution than if both have at least some univer-

[11] Here, compulsory school, vocational training and theoretical education are added into the variable basic education and long and short university education are added into university education. The variable "different level of education" in Table 3 is included to account for differences within groups.

sity education. These results are confirmed in many other studies of marital break ups, see, for example, Georgellis (1996).

The probability of dissolution decreases the higher female and male earnings. The stabilizing effects confirm the idea that the gains from a commitment increases the greater the earnings. This is also confirmed by other studies, e.g. Hoffman and Duncan (1995) found that increases in the husband's earnings and the wife's wage rate reduced the probability of divorce. Table 7 shows that the effect for female earnings is linear, while the effect of male earnings is significantly nonlinear in the first model but not in the second.

Although unemployment does not affect the probability of divorce, the probability for a break up of the relationship increases if the couple is receiving social assistance. These variables could be classified as representing negative surprises, or unexpected events. Svarer (2002) argues that it is unfortunate if the probability of dissolution increases with these types of variables, as the theory developed by Weiss and Willis (1997) suggests that risk sharing is one of the advantages of being in a commitment. This is because one partner could provide insurance for the other in a time of bad surprises. Here, it seems as though partners do indeed provide insurance in the case of unemployment, but that the insurance motive becomes weaker in really bad times, i.e. when a couple is in need of social assistance. However, it is unlikely that the effect captured by the social assistance parameter is due to the fact that the couple is receiving social assistance, but rather that there are probably other factors behind being on social assistance that have a negative influence on the relationship. Accordingly, this result does not by necessity imply that risk sharing is not effective.

Positive financial surprises, calculated as the difference between the observed and the predicted earnings each year, affect the stability of the commitment. This can be seen in column one. A positive surprise is associated with a less stable relationship, regardless of gender. Svarer (2005) found that deviations between expected and observed earnings affected the probability of divorce. For woman, he found that deviations in either direction increased the divorce rate. However, for men, he found that positive deviations had a stabilizing effect on the marriage whereas negative deviations were destabilizing. The findings here are quite different from those of Svarer, particularly for males.

In column two, interaction dummies are included to control for the possibility that a deviation in the expected earnings of one partner could have different effects depending on the deviations in expected earnings

of the other. The introduction of interaction dummies does not change the results of the original model in column one. Positive surprises in female or male earnings are still destabilizing, as long as both partners do not experience positive surprises at the same time. In this case, the effect is, instead, the opposite. Judging by the theory outlined in section 2, a positive surprise in earnings for either partner seems to increase the value of his or her outside alternatives, which, in turn, increases the probability of separation. However, if both experience a positive surprise at the same time, it seems as if the gains from staying in the commitment outweigh the effect of a higher value in an outside alternative.

Even though the probability of dissolution decreases the older the spouses are at the start of the relationship, the data show no support for the idea that couples meeting earlier would be more sensitive to surprises in short run earnings. The inclusion of interactions between age at the start of the relationship and financial surprises shows no significant results. These interactions are, therefore, not presented. However, there is some evidence that the sensitivity to surprises is dependent on the duration of the commitment. The results of the interaction terms, where financial surprises are interacted with the duration of the commitment, are given in Table A1 in Appendix A.

A positive surprise in female earnings is still associated with an increased probability of divorce, regardless of the duration of the relationship. There is a stabilizing effect from negative surprises in male earnings, but this stabilizing effect is reduces the longer the duration of the relationship. In addition, there is a destabilizing effect from a positive surprise in male earnings that increases nonlinearly with duration. Instead of giving evidence of couples being more sensitive to surprises early in the relationship when the stock of information is low, these results suggest the opposite. When couples have been together longer and a financial surprise occurs, they seem more likely to dissolve the relationship. One explanation could be that couples that have been together longer are more likely to have made large investments in commitment specific capital and could, therefore, be more dependent on the expected income of his or her spouse. Another explanation could be that from the beginning, when you are madly in love, you might be more indulgent if your partner does not measure up to your expectations.

5.2 Surprises in Predicted Long-run Earnings Capacity

The results of the probit estimation with surprises in long-run earnings capacity are given in Table 8. The model in the first column resembles the model estimated by Weiss and Willis (1997), while the model in the second column includes deviations separated into negative or positive surprises in the same way as was done in the previous section. The third column includes interaction variables for surprises in predicted long-run earnings capacity.

Table 8. Probit Model of Commitment Dissolution with Deviations in Long-Run Earnings Capacity

	Column		
	1	2	3
Variable Name	Coefficient (Robust s.e.)	Coefficient (Robust s.e.)	Coefficient (Robust s.e.)
Couple Characteristics			
Year for Start of Commitment	-0.033*** (0.011)	-0.032*** (0.011)	-0.031*** (0.011)
Log Duration of Commitment	0.040 (0.044)	0.045 (0.048)	0.052 (0.049)
Number of Children	-0.009 (0.045)	-0.011 (0.046)	-0.011 (0.046)
One Child < 3 Years Old	0.005 (0.061)	0.002 (0.061)	-0.002 (0.061)
More than One Child < 3 Years Old	-0.135 (0.096)	-0.136 (0.098)	-0.139 (0.098)
Different Ethnicity	0.217 (0.134)	0.214 (0.135)	0.211 (0.134)
Different Levels of Education	0.107** (0.045)	0.108** (0.045)	0.105** (0.045)
Living in City	0.111*** (0.043)	0.112*** (0.043)	0.112*** (0.043)
Social Assistance Recipients	0.381*** (0.078)	0.372*** (0.077)	0.386*** (0.078)
Labour Market			
Predicted Earnings at Time of Commitment, Female	-0.002*** (0.0006)	-0.002*** (0.0005)	-0.002*** (0.0006)
Predicted Earnings at Time of Commitment, Male	-0.001*** (0.0003)	-0.002*** (0.0003)	-0.001*** (0.0003)
Days in Unemployment, female	-0.0001 (0.0002)	-0.00007 (0.0002)	-0.0001 (0.0001)
Days in Unemployment, Male	0.0005** (0.0002)	0.0005** (0.0002)	0.0005** (0.0002)

Table 8. Continued

Financial Surprises			
Surprise, Female	0.0001 (0.0001)		
Squared Surprise, Female	-0.00002* (0.00001)		
Surprise, Male	-0.00002 (0.00005)		
Squared Surprise, Male	0.00000003 (0.0000001)		
Deviation, Female * Male	-0.00001 (0.00001)		
Positive Surprise, Female		-0.002*** (0.001)	-0.001 (0.001)
Negative Surprise, Female		-0.002 (0.001)	-0.002 (0.001)
Positive Surprise, Male		-0.00001 (0.0006)	-0.0001 (0.001)
Negative Surprise, Male		0.0007 (0.0007)	0.001* (0.0008)
Female Pos. Surprise / Male Pos. Surprise			-0.0001 (0.001)
Female Pos. Surprise / Male Neg. Surprise			-0.232* (0.115)
Female Neg. Surprise / Male Neg. Surprise			-0.131 (0.113)
Female Neg. Surprise / Male Pos. Surprise			-0.011 (0.101)
Ethnicity			
Born outside of Sweden, female	0.038 (0.131)	0.038 (0.131)	0.041 (0.130)
Born outside of Sweden, male	-0.309** (0.132)	-0.309** (0.132)	-0.307** (0.132)
Education at time of commitment *Female / Male*			
Basic / Basic	0.055 (0.081)	0.062 (0.081)	0.059 0.081)
University / Basic	0.036 (0.108)	0.039 (0.107)	0.039 (0.107)
Basic / University	-0.107 (0.100)	-0.103 (0.100)	-0.102 (0.100)
Constant	65.078*** (21.476)	63.380*** (21.553)	60.509*** (21.623)

Table 8. Continued

Model Information			
Wald chi-square	335.36 (23df)	333.59 (22df)	343.40 (26df)
Pseudo R^2	0.078	0.078	0.079
Log pseudo-likelihood	-2125.976	-2126.669	-2124.951
N (couple years)	12891	12891	12891

Note: * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

In this analysis, the initial prediction of the long-run earnings capacity is used instead of the observed income of each individual. Higher predictions about female and male long-run earnings capacity are, in both cases, associated with a decreasing divorce probability. Similar results are found by Weiss and Willis, and it seems as though individuals are matched into commitments based on their earnings capacity. Here, the educational level at the time when the partnership was formed is used instead of educational level during the time of the commitment. Contrary to the findings by Weiss and Willis, the educational level at the time of commitment does not seem to affect the stability of the relationship. Having different levels of education is again found to be destabilizing.

For males, being unemployed increases the probability of dissolution of the relationship, whereas the stability is not affected by female unemployment. In other words, there is here some evidence contradicting the idea of the partner as an insurer in a time of negative surprises. At least, it seems as if women are less prone than men to provide this type of insurance. Families receiving social assistance are, again, found to be associated with a higher probability of divorce.

Weiss and Willis found that an unanticipated increase in the husband's earnings capacity tends to reduce the probability of divorce, while an unexpected increase in the wife's earning capacity has the opposite effect. However, the latter result was not statistically significant. In the first column of Table 8, an approach similar to theirs has been used. The findings are that surprises in predicted long-run earnings capacity have no effect on the probability of divorce. Accordingly, there seems to be a difference between young Swedish individuals during the 1990's and young Americans during the 1970's and 80's in this respect.

In column two of Table 8, the financial surprises are divided into positive and negative surprises in order to allow for different impacts on the probability of dissolution (this separation of surprises differs from the

model used by Weiss and Willis). The results imply that positive surprises in the predicted long-run earnings capacity for women decrease the probability of divorce. The explanation could be that the utility from staying in the commitment increases for males when their female partner experiences a positive surprise, and that this effect dominates the effect of the female wanting to leave the relationship due to a better outside alternative.

In column three, interaction dummies are introduced, and this gives some additional information about surprises in the long-run earnings capacity. The only interaction term that has a statistically significant effect on the probability of separation is when there is a positive surprise in expectations about female earnings at the same time as there is a negative surprise in expectations about male earnings. The coefficient is negative, meaning that these couples tend to stick together. The inclusion of the interaction variables also changes the result of the original surprise variables in column two. The effect of positive female surprises is now insignificant, whereas, the coefficient for negative male surprises shows a destabilizing and significant effect. A possible explanation is that women who are able to change their labour market activities when their expectations about their partners' long-run earnings capacity are decreasing actually do so. Another possibility is that these effects are the result of a deliberate choice that the couple has made, i.e. there is an agreement that the male should decrease his labour market activity in order for the female to be able to increase hers.

Running a probit model with additional interaction terms gives no support for the theory that reactions to surprises in long-run earnings capacity are sensitive to a low quality of match because of the couple's young age at the start of the commitment or to a low stock of information due to the short duration period of the relationship.

6 Conclusions and Suggestions for Further Research

The two dominating theories of divorce are that a good quality of match is crucial for the stability of a marriage, and that deviations between the expected and the realised utility of a marriage can cause divorce. In this paper, the roles of financial surprises and the quality of match on dissolution of the relationship have been analysed. Financial surprises are defined in two ways. First, following Svarer (2005) the effects of short term surprises, calculated as deviations between predicted and observed earnings, are analysed. Second, following Weiss and Willis (1997), the effects of surprises in long-run earnings capacity are analysed. The results show that unanticipated changes in economic circumstances do

have an influence on the stability of a relationship. Positive surprises in short term earnings, for either partner, are associated with an increasing probability of the break up of a relationship. If both partners experience a positive surprise at the same time, the effect is, instead, stabilizing. For surprises in long-run earnings capacity, an unexpected increase in the female earnings tends to reduce the probability of divorce when the male experiences a negative surprise. The experience of a negative surprise in male earnings has, itself, a destabilizing effect. No support is found for the idea that couples meeting earlier in their lives i.e. when they are younger are more sensitive to surprises in their earnings. There is, on the other hand, some evidence that surprises in short run earnings are correlated with the duration of the commitment.

Other findings are that the relationship becomes more stable if the partners start their commitment at an older age, but that couples who live in a city are more likely to dissolve their relationship than others. The presence of very young children stabilizes the relationship, while there are no effects from the number of children. Higher income has a stabilizing effect, as does a higher educational level in some of the regressions. Negative shocks, i.e. unemployment for females, unemployment for males and having to receive social assistance, give results that are ambiguous. It seems as if partners provide some insurance for each other in the case of unemployment, but that being on social assistance tends to increase the probability of dissolution.

It has been shown in earlier empirical studies that the experience of a divorce has negative effects on the labour market outcomes and on the performance in school of children affected by divorce (see for example Keith and Finlay, 1988), and as divorce has become more socially acceptable, further research within this field is called for. One interesting aspect would be to further investigate the correlation between financial surprises and the duration of the commitment, as some of the results presented here seem to contradict the underlying theory. Another aspect that would be interesting to analyse is the possible effects of the Swedish maximum fee for child care reform, proposed in 2000 and implemented in 2002, on the probability of dissolution. The reform meant that the charges for municipal child care were effectively lowered in most cases, which might, in turn, affected the divorce rate. Finally, since cohabitation out of wedlock is increasingly common in Sweden nowadays, it would be interesting to analyse the effect of cohabitation on the probability of dissolving a relationship. The studies by Bennett et al. (1988), Hoem and Hoem (1992) and Trussell et al. (1992) all found that premarital cohabitation increased the probability of dissolution for Swedish couples, while Svarer (2002, 2004 and 2005) found the opposite for

Danish couples. Is there really a profound difference between the Swedish and the Danish marriage markets, or is the difference simply due to the point in time at which the studies were conducted?

Appendix A

Table A1. Duration of Commitment and Financial Surprises

Variable Name	***Coefficient (Robust s.e.)***
Positive surprise, female	0.003*** (0.001)
Negative surprise, female	0.0004 (0.0008)
Positive surprise, male	0.0006 (0.0007)
Negative surprise, male	-0.003*** (0.001)
Positive surprise, female * Duration	0.0000004 (0.0002)
Negative surprise, female * Duration	-0.0003 (0.0005)
Positive surprise, male * Duration	0.0003* (0.0002)
Negative surprise, male * Duration	0.0008** (0.0004)
Positive surprise, female * Squared deviation from mean duration	0.00002 (0.00005)
Negative surprise, female * Squared deviation from mean duration	0.0001 (0.0002)
Positive surprise, male * Squared deviation from mean duration	-0.00008* (0.00004)
Negative surprise, male * Squared deviation from mean duration	-0.0002* (0.0001)
Female pos. surprise / Male pos. surprise	-0.166** (0.071)
Female pos. surprise / Male neg. surprise	0.0004 (0.087)
Female neg. surprise / Male neg. surprise	-0.061 (0.158)
Female neg. surprise / Male pos. surprise	-0.092 (0.100)

Note: * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

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The Role of Unemployment in the Commitment Dissolution Decision among Young Swedes

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Abstract. This paper studies the role of unemployment in the dissolution of relationships by applying a two-step estimation method to an extensive data set, which contains information about young Swedish males and females. Unemployment is recognized as endogenous in the separation decision, and the results show that the effect of unemployment on separation is biased when unemployment is assumed to be exogenous in the separation equation. The probability of separation is found to be increasing with male unemployment, whereas female unemployment decreases the probability of dissolution.

JEL classification: J120
Key words: Unemployment; divorce; family structure

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1 Introduction

There has been an increase in the number of divorces in Sweden over the past 40 years, with a peak in the mid 1970's. Since then, the number of divorces has been stabilized at a fairly high level as compared to the level before the 1970's. At the same time, even though the unemployment rate has decreased as part of the recovery from the 1990's recession, it is still higher than its pre-recession level. Becoming unemployed is likely to be a vital event in an individual's life. Being subjected to unemployment is often associated with deterioration in both the individual's psychological and physical well-being (e.g. Winkelmann and Winkelmann, 1998). Deteriorating physical and mental health can, together with economic hardship following on unemployment, increase the probability of marital dissolution among couples. The purpose of this paper is to analyse the effects of unemployment on the probability of separation[1] among committed couples.

The economic theory of divorce stems from the influential article of Becker et al. (1977), which suggests two main explanations for divorce. First, learning about match quality is crucial for the stability of a relationship, and separation could be initiated if either partner meets someone that is considered as a better match. Second, there can be a deviation between the utility you originally expected from marriage and the utility that is actually realized. Both these explanations have been subject to empirical investigation and in several of the previous articles on the subject, unemployment has been introduced as a control variable. For instance, Bracher et al. (1993), Böheim and Ermisch (2001), Jalovaara (2001), Svarer (2004, 2005) and Norberg-Schönfeldt (2007) find positive relationships between unemployment and divorce. However, it is possible that there is a problem of introducing unemployment in a divorce equation. It may be hard to determine the timing of unemployment and divorce; is the divorce caused by unemployment, or do people end up in unemployment because their relationship is bad? Unemployment may be endogenous for the divorce decision as some underlying unobservable factors may influence both variables.

Studies that explicitly focus on the role of unemployment in the decision to divorce have, so far, been very few. Jensen and Smith (1990) use panel data from Denmark and find male unemployment to be associated with an increased probability of divorce, while no effects are found for female unemployment. Jensen and Smith base their analysis on the ac-

[1] The words separation, dissolution and divorce will be used interchangeably throughout the paper.

tual divorce date, which brings attention to the question of causality. If there is a deviation between the date of separation and the date of actual divorce, the unemployment may begin in between. Therefore, the results may show an increased probability of divorce following unemployment, when the true effect is, instead, that the separation (i.e. the impending divorce) has increased the risk of unemployment.

Lampard (1994) addresses the issue of timing more explicitly when analysing whether unemployment affects divorce, or whether divorce affects the risk of unemployment. The results show that the causality works in both directions. One way of minimizing the potential problem with causality is to use the separation date instead of the actual divorce date when analysing the effect of unemployment, as is done in Kraft (2001). Kraft is the first to actually utilize panel methods, in terms of fixed and random effect approaches, in analysing the effect of unemployment on divorce. He claims that this is important, since it is possible that individual-specific characteristics have an influence both on the risk of becoming unemployed and the probability of separation. For the same reason as Kraft (2001), Hansen (2005) also utilizes panel data methods in his study of the effect of unemployment on marriage stability among Norwegian couples. Although the use of fixed or random effects methods accounts for individual-specific effects, which could certainly be present when studying divorce, these methods do not necessarily account for the fact that something may be omitted that influences both occurrences, in which case unemployment would be correlated with the error term of the divorce equation.

Therefore, the model used when analysing the effect of unemployment on divorce in this paper is a two-step simultaneous equation model accounting for the possible endogeneity of unemployment. The possible appearance of additional individual-specific effects will be accounted for using a random effects method. To ensure that the correct causality is observed, the date of separation instead of the divorce date will be used.

This study contributes to the existent literature in that it is the first attempt to deal with the possible simultaneity problem of introducing unemployment in the divorce equation. The data set used is extensive and the number of observations and explanatory variables exceed those of previous studies. Finally, this is the first attempt to more thoroughly analyse the role played by unemployment in the termination of relationships using Swedish data.

The paper is outlined as follows. Section 2 discusses the existing theories and empirical results on the determinants of divorce in general, and

the role of unemployment in particular. Section 3 gives a description of the data and section 4 specifies the empirical model. Section 5 presents the results and section 6 gives a concluding summary.

2 Existing Theories and Empirical Results

Over the past three decades, many researchers have addressed the question of why the divorce rates in the western world have increased. This has lead to several theories and explanations of divorce and divorce patterns, some of which are economic, while others are related to other areas such as sociology[2]. Within economics, the theory of family formation and dissolution is based on utility maximization. One of the most important contributions to the economic theory of divorce is the article by Becker et al. (1977), which explains that people get married or engage in committed relationships when their expected utility from being in the relationship exceeds their expected utility from remaining single, and that they divorce when the opposite occurs.

Like many other decisions, getting married is associated with rewards as well as a substantial risk. At the time of engagement, there is uncertainty about several factors that influence the utility from the relationship. Hence, marital instability is a natural consequence of incomplete information about partner characteristics, productivity and spousal needs. Therefore, the expected and the realized utility from the relationship can deviate, and the Becker et al. model indicates the importance of, for example, age at the start of commitment, education, income, number of children and unexpected events for the probability of divorce. The implications do, to some extent, depend on the society surrounding the couple. In a society characterized by the traditional division of labour, so-called negative assortative mating may be preferable where opposites, who are able to complement each other, are attracted to each other. In a society characterized by a more equal division of labour (market and non-market), positive assortative mating may instead apply and people are looking for an equal.

[2] One theory linking unemployment to marital instability is the ABC-X model (e.g. Voydanoff, 1983). It implies that the infliction of unemployment on a family depends upon the interaction of the family's coping resources and the family's perception of the crisis. Unemployment can stress a relationship in several ways. For example, unemployment will often lead to financial stress. In addition, it may lead to the perception of moral failure either for the unemployed or for the spouse, and it may cause psychological deterioration which could stress the relationship. Another theory is the social exchange theory, which recognizes the economic, social and psychological costs and gains from marriage (e.g. Levinger, 1982).

The implication of age at the start of commitment is connected to search theory. If the search for a partner is costly, people will tend to search for a shorter time period. This increases the probability of making a relatively poor match which, in turn, would increase the probability of dissolution. Different levels of, for example, education and income or different religions or different ethnicities are also connected to the quality of the match, and if there are large deviations between spouses, the probability of divorce increases in a society where positive assortative mating is relatively beneficial. Even if there are no considerable differences at the time of engagement, i.e. the match quality is initially high, the spouses may come to deviate in terms of the level of education or income as the relationship goes on, which would then increase the divorce probability of dissolution. The number of children is, together with acquiring property and adding to the stock of information about ones' partner, examples of investments in commitment specific capital that are considered to increase the gains from remaining in the commitment. There are several studies that are concerned with both marriage formation and marital dissolution, and the results generally confirm the importance of the above mentioned factors.

Since partners are matched into commitment based on the information that is known at the time of commitment and the predictions that can be made about the unknown characteristics of the partner, new information can change the expected gains from staying in the relationship. The least explored contribution of the Becker et al. model is the role of unexpected events, which is where unemployment belongs. Factors like unexpected changes in money transfers, income or long-term earnings capacity have been explored in some studies (e.g. Weiss and Willis 1997, Böheim and Ermisch, 2001, Svarer, 2005, Walker and Zhu, 2006, and Norberg-Schönfeldt, 2007). However, as has already been mentioned, the number of studies focusing on the role of unemployment on divorce, in a more extensive fashion than just including it as a control variable, has been limited.

If a person becomes unemployed, this can be interpreted as an unexpected event since unemployment may be hard to foresee. Unemployment by one spouse may reduce the partner's expected utility of staying in the relationship because of the financial stress, and the probability of divorce would then increase with the number of days in unemployment. Besides the monetary factors associated with unemployment, unemployment is often connected to other psychological factors that can reduce the expected gains from marriage. Preferences for risk sharing can, to some extent, counteract the effect of unemployment on divorce.

In her review on unemployment and families, Ström (2003) discusses the empirical work up to date that has paid special attention to unemployment and its role in the divorce decision. Some of the studies she mentions focus on male unemployment only; Ross and Sawhill (1975) analyse the role of male unemployment and find that unstable male employment increases the divorce probability; Conger et al. (1990) and Sander (1992) confirm these results. Jensen and Smith (1990), Lampard (1994) and Starkey (1996) analyse both male and female unemployment, and find male unemployment to be more closely linked to marital dissolution than female unemployment.

It is interesting that all the above results indicate that the effect of male unemployment is more severe than the effect of female unemployment. Ström (2003) hypothesizes that this may be due to women having more developed social networks outside the labour market, and that unemployment would reduce their double burden of paid and unpaid work. Moreover, because of the traditional division of labour, females may be less traumatized by unemployment, which may be the reason for the results found in the above studies. Sweden is, however, considered to be a country of high gender equality, at least when it comes to female education and labour force participation, which means that this may not be the case for Swedish couples. However, the same type of results as the above are found by Kraft (2001) whose study relates to modern German families where the traditional gender roles, with the male as a breadwinner, may not be as clear cut either.

The one exception to the above results is the study by Hansen (2005) on Norwegian data. He finds that the divorce probability increases with both male and female unemployment in a similar fashion. Since Sweden and Norway are quite similar with respect to female labour force participation and social security systems, the same results as found by Hansen may also apply to Swedish data.

3 Data

The empirical study is based on data from the LOUISE part of the LISA-data base along with compulsory school and secondary school graduation registers obtained from Statistics Sweden. The LISA-data base is longitudinal and contains yearly observations on family situation, education, income and labour force participation for all Swedes aged 16-64. The graduation registers contain information about grade point average (GPA) from compulsory and upper secondary school. In addition, the data contain information on an evaluation of cognitive and non-

cognitive traits[3] obtained from the National Service Administration, which is responsible for enrolling, enlisting and administering those eligible for national military service. The tests are taken by most males who are Swedish citizens in the year they turn 18.

The sample comes from a cohort of 110 000 individuals born in 1973 and registered in Sweden in December 31, 1990. The individuals were followed between 1990 and 2003. A sample of 45 120 individuals has been selected from this data set. The selected individuals are those who entered a committed relationship between the years 1993 and 2002. A relationship is defined to be committed if the individual is cohabiting with children or is married (with or without children). Only the first committed relationship of every individual in the sample is considered. The individuals are observed annually from the first year of commitment until they separate or the observation period ends.

Since the information about partner characteristics is limited, it is not possible to choose either males or females as representatives for the couple. It is, however, possible that the effects of unemployment, and the correlation between unemployment and divorce, differ between men and women. Therefore, the analysis is carried out separately for males and females. The samples contain information on 18 764 males (with female partners) and 26 356 females (with male partners). Survival frequency by commitment year for the observed males and females is given in Table 1 and Table 2, respectively.

Tables 1 and 2 show that the probability of dissolution is decreasing with the year for the start of the commitment. Males tend to enter into committed relationships later than females, as the commitment year of females is more evenly distributed over the observation period. The survival frequency for males is in general lower than the survival frequency for females for any given year.

[3] The evaluation of non-cognitive traits consists of medical and physical tests and one interview with a psychologist and one with an enrolment officer. Physical fitness and strength are also evaluated. The enrolment test of cognitive traits includes measurements of linguistic comprehension, technical understanding and logistical and spatial awareness.

Table 1. Survival Frequency by Commitment Year, Males

	Year for Start of Commitment									
Duration	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.87	0.91	0.92	0.93	0.94	0.96	0.96	0.97	0.97	0.98
2	0.78	0.81	0.83	0.85	0.88	0.91	0.92	0.94	0.93	
3	0.69	0.72	0.76	0.80	0.83	0.86	0.88	0.90		
4	0.63	0.67	0.70	0.75	0.79	0.82	0.85			
5	0.57	0.63	0.66	0.70	0.75	0.79				
6	0.52	0.57	0.62	0.67	0.72					
7	0.50	0.53	0.60	0.64						
8	0.48	0.51	0.56							
9	0.46	0.48								
10	0.45									
N	484	732	1 042	1 338	1 595	1 855	2 313	2 897	3 105	3 403

Table 2. Survival Frequency by Commitment Year, Females

	Year for Start of Commitment									
Duration	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.91	0.92	0.94	0.95	0.95	0.96	0.97	0.97	0.98	0.98
2	0.82	0.84	0.87	0.89	0.90	0.92	0.93	0.94	0.95	
3	0.76	0.77	0.81	0.84	0.85	0.89	0.90	0.91		
4	0.70	0.71	0.77	0.80	0.80	0.85	0.87			
5	0.64	0.67	0.73	0.76	0.77	0.82				
6	0.60	0.63	0.69	0.73	0.73					
7	0.56	0.59	0.67	0.70						
8	0.53	0.56	0.64							
9	0.50	0.53								
10	0.47									
N	1 611	1 837	2 165	2 281	2 557	2 660	3 017	3 482	3 313	3 442

The variables used in the empirical analysis are based on earlier literature dealing with quality of match and gains from commitment. The variables are divided into individual-specific characteristics, parental characteristics, partner characteristics and characteristics related to the relationship. Parental characteristics are included in order to control for socioeconomic circumstances during childhood. Earnings, schooling and age of the spouses and differences in schooling age and ethnicity between spouses are all variables that have previously been found to have negative effects on the probability of separation.[4] Variables that are

[4] See Weiss and Willis (1997) and Svarer (2004, 2005).

likely to influence the number of days an individual spends in unemployment in a given year are also included. These variables reflect are individual characteristics, parental characteristics and regional characteristics. Ethnicity, age and schooling are variables likely to affect the number of days an individual spends in unemployment in a given year, but socioeconomic background is also likely to be of importance.[5] Definitions and explanations of variables are given in Table A1 of Appendix A.

Descriptive statistics for males and females are displayed in Table 3 below. The descriptive statistics are displayed separately for individuals whose relationships remained committed throughout the observation period (i.e. were still committed at year 2003) and individuals whose relationships ended during the observation period. Descriptive statistics for time varying variables are measured the year before the relationship ends for individuals who end up separating and the year before the observation period ends for individuals who remain committed throughout the observation period, which makes it hard to directly compare the means of the time varying variables over relationship outcome.

As can be seen from Table 3, individuals who separated were younger when their relationship started, and they have attained a lower grade point average (GPA). They are also to a larger extent born outside of Sweden. For men, it is also apparent that those who end up separating are those achieving a lower result in cognitive and non-cognitive traits on the evaluation performed by the National Service Administration. Once more, it is clear that males enter into committed relationships later than females. When comparing the columns of Table 3, it also looks as though individuals who separate have lower annual earnings, spend more days in unemployment and have a lower educational level, measured as the number of years of schooling, than those who remain committed. When making comparisons between the columns in the below table, it must, however, be remembered that the year of measurement differs over relationship outcome.

[5] See, for example, Machin and Manning (1999) and Altonji and Blank (1999).

Table 3. Individual Specific Characteristics, Means

	Males		***Females***	
Variable Name	$Committed_t$	$Dissolved_t$	$Committed_t$	$Dissolved_t$
Age at Start of Commitment	26.43 (2.29)	23.87 (2.42)	25.70 (2.60)	23.05 (2.38)
Labour Market Variables				
$Earnings_{t-1}$	2.47 (1.19)	1.56 (1.08)	1.54 (0.87)	0.92 (0.78)
Days in $Unemployment_{t-1}$	31.92 (84.62)	101.74 (138.38)	49.65 (103.10)	116.46 (132.52)
Education				
$Compulsory\ School_{t-1}$	0.10	0.27	0.06	0.24
$Upper\ Secondary\ School_{t-1}$	0.60	0.62	0.53	0.62
$University_{t-1}$	0.29	0.11	0.41	0.14
GPA Compulsory School	3.04 (0.70)	2.64 (0.74)	3.33 (0.67)	2.92 (0.74)
Ethnicity				
Sweden	0.95	0.89	0.95	0.91
Born Abroad	0.05	0.11	0.05	0.09
Military Service Variables				
Evaluation of Non-Cognitive Traits	5.21 (1.71)	4.43 (1.82)		
Test of Cognitive Traits	4.87 (1.88)	4.10 (1.85)		
Number of Observations	15 437	3 327	21 151	5 205

Note: Standard deviations are given within parentheses. Earnings are annual earnings, in the price level for the year 2000, expressed in hundred thousand SEK.

Apart from individual characteristics, one thing that may influence the number of days an individual spends in unemployment in a given year is the state of the labour market where he or she participates. To control for this, a variable measuring the regional employment growth rate will be included in the analysis.[6] Since parental characteristics are often found to have an influence on children's labour market success, characteristics such as parental income, parental education and parental ethnicity are of interest. Descriptive statistics for parental characteristics are displayed in Table 4 below. Once more, they are displayed separately for males and females and for relationship outcome.

[6] Other variables could have been chosen, for example, the unemployment rate in the labour market region or the number of labour market opportunities. All these measures are, however, likely to be highly correlated and in that case, the choice will be of minor importance. For an explanation of this variable, see Table A1 of Appendix A.

Table 4. Parental Characteristics, Means

	Males		***Females***	
Variable Name	$Committed_t$	$Dissolved_t$	$Committed_t$	$Dissolved_t$
Mothers' Earnings	1.21 (0.62)	1.12 (0.60)	1.22 (0.61)	1.14 (0.60)
Fathers' Earnings	1.94 (1.08)	1.71 (0.90)	1.98 (1.06)	1.77 (1.04)
Mothers' Education				
Compulsory School	0.31	0.35	0.31	0.37
Upper Secondary School	0.47	0.50	0.47	0.47
University	0.22	0.15	0.22	0.16
Fathers' Education				
Compulsory School	0.38	0.42	0.37	0.40
Upper Secondary School	0.42	0.45	0.42	0.44
University	0.20	0.13	0.21	0.16
Mothers' Ethnicity				
Sweden	0.87	0.80	0.88	0.83
Born Abroad	0.13	0.20	0.12	0.17
Fathers' Ethnicity				
Sweden	0.86	0.79	0.87	0.81
Born Abroad	0.14	0.21	0.13	0.19
Number of Observations	15 437	3 327	21 151	5 205

Note: Standard deviations are given within parentheses. Parental characteristics are measured over the years 1990-1992. Earnings are mean annual earnings, in the price level for the year 2000, expressed in hundred thousand SEK.

The stability of a relationship is naturally not only dependent upon one person and his or her characteristics, but is also dependent upon the characteristics of the partner. For the partners of the individuals in the sample, there is information about age, earnings, ethnicity and education. The descriptive statistics for partner characteristics are given in Table 5 below.

Table 5. Partner Characteristics, Means

	Males		***Females***	
Variable Name	$Committed_t$	$Dissolved_t$	$Committed_t$	$Dissolved_t$
Age at Start of Commitment	26.07 (3.68)	23.51 (3.91)	28.64 (4.14)	26.86 (4.62)
Partner's $Earnings_{t-1}$	1.39 (0.83)	0.87 (0.80)	2.53 (1.40)	1.63 (1.16)
Partners' Education				
Compulsory $School_{t-1}$	0.08	0.27	0.09	0.23
Upper Secondary $School_{t-1}$	0.54	0.59	0.58	0.63
$University_{t-1}$	0.38	0.13	0.34	0.15
Partners' Ethnicity				
Sweden	0.92	0.87	0.92	0.84
Born Abroad	0.08	0.13	0.08	0.16
Number of Observations	15 437	3 327	21 151	5 205

Note: Standard deviations are given within parentheses. Earnings are annual earnings, in the price level for the year 2000, expressed in hundred thousand SEK.

Apart from the characteristics of the partners in the relationship, there are also some characteristics specific to the couple that could influence the relationship outcome. One such characteristic is the number of children of the couple. Descriptive statistics for the couple specific characteristics are given in Table 6 below.

Table 6. Couple Characteristics, Means

	Males		***Females***	
Variable Name	$Committed_t$	$Dissolved_t$	$Committed_t$	$Dissolved_t$
Duration of $Commitment_{t-1}$	3.57 (2.29)	3.02 (1.92)	4.29 (2.60)	3.41 (2.15)
Number of $Children_{t-1}$	1.31 (0.86)	1.26 (0.80)	1.39 (0.84)	1.25 (0.77)
Living in $City_{t-1}$	0.40	0.38	0.40	0.39
Social Assistance $Recipients_{t-1}$	0.02	0.25	0.01	0.20
Different Ethnicity	0.09	0.13	0.09	0.17
Different level of $education_{t-1}$	0.37	0.43	0.37	0.43
Number of Observations	15 437	3 327	21 151	5 205

Note: Standard deviations are given within parentheses.

4 Empirical model

This section presents the empirical model. As previously discussed, one problem when evaluating the impact of unemployment on divorce is that individuals systematically act on the basis of unobservable characteristics. In this case, one possible characteristic would be the ability to live up to one's obligations or promises. Such information is likely to influence both the number of days an individual will be unemployed in a given year and, at the same time, it may influence the probability that the individual will end up separating. If an individual who, on average, has longer unemployment spells also has a less serious view on relationships, the effect of unemployment on separation will be biased upwards if estimated as a single probit.

To control for the possible bias due to the endogeneity of unemployment, the model used to analyse separations in this paper is a two-equation simultaneous panel data model of the following form:[7]

$$U_{i,t} = \alpha_1 + \beta_1 x^1_{i,t} + \gamma_1 z_{i,t} + \mu_{i,t} \quad (1)$$

$$D_{i,t+1} = \alpha_2 + \beta_2 x^2_{i,t} + \gamma_2 z_{i,t} + \delta U_{i,t} + \omega_{i,t} \quad (2)$$

where the dependent variables $U_{i,t}$ and $D_{i,t+1}$ measure the number of days in unemployment in year t and the occurrence of separation in year t+1, respectively[8]. The vectors $x^1_{i,t}$ and $x^2_{i,t}$ are explanatory variables specific to each equation, while $z_{i,t}$ contains explanatory variables included in both equations. The two disturbance terms $\mu_{i,t} = \varepsilon^1_{i,t} + u^1_i$ and $\omega_{i,t} = \varepsilon^2_{i,t} + u^2_i$ both consist of time-varying components, $\varepsilon^1_{i,t}$ and $\varepsilon^2_{i,t}$, and time invariant individual-specific terms, u^1_i and u^2_i. A random effects approach is used, which is mainly motivated by the fact that the size of the cross section exceeds the time series observations by far, and by the fact that several of the control variables are time invariant.

[7] An alternative approach would have been to specify the model as a bivariate probit. A bivariate probit model would, however, have required a binary specification of unemployment. Different specifications of unemployment have been tried in a bivariate probit but, when trying to utilize the panel structure of the data, the estimation becomes unsuccessful.

[8] As previously mentioned, the reason for using the number of days in unemployment the year before the separation is to avoid including observations on unemployment that have, in fact, been measured after the separation has occurred.

Since separation is only observed annually, the explanatory variables from the previous period are used in order to avoid including values on explanatory variables that are measured after the separation has occurred. As previously mentioned, the effect of unemployment on divorce could differ between males and females. Therefore, the above model will be estimated separately for males (controlling for characteristics of their female partners) and females (together with their male partners).

The inclusion of the number of days in unemployment in equation (2) poses a potential problem. If unemployment is correlated with the disturbance term of equation (2), that is, if the stochastic components of the disturbances from the two equations are correlated, an ordinary probit estimation of equation (2) will result in biased estimates. Therefore, the model is estimated using a two-step estimation procedure, in a way similar to Bollen et al. (1995) and Norton et al. (1998). The first step involves a generalized least squares (GLS) estimation of equation (1). The estimated coefficients are used to predict the number of days in unemployment ($\hat{U}_{i,t}$) for each individual in every period of time. The predicted values are then used to replace the actual days of unemployment in equation (2). The second step is a probit estimation of equation (2), where the estimated standard errors must be adjusted because of the inclusion of the predicted value of the number of days in unemployment. The correction is carried out using the Murphy and Topel (1985) correction of the estimated covariance matrix.

In order to determine whether unemployment is, indeed, endogenous in the divorce equation, or whether the divorce equation could be estimated as a single equation probit model, an exogeneity test is carried out; see, for example, Smith and Blundell (1986) or Rivers and Voung (1988). This test examines whether the unobservables in the equation for the number of days in unemployment help explain the variation in the probability of divorce after controlling for the observable explanatory variables. In the test, the estimated error term from equation (1) is included together with the actual number of days in unemployment in the divorce equation. A *t*-test of the significance of the coefficient on the estimated error term is then performed. If the coefficient is not significantly different from zero, the null hypothesis that the number of days in unemployment is exogenous in the divorce equation cannot be rejected. If so, equation (2) could be estimated by simple single probit regression.

If unemployment is found to be endogenous, identifying restrictions must be imposed on the exogenous variables in order to obtain consistent parameter estimates. Since there is one supposedly endogenous vari-

able, at least one variable must be excluded from the separation equation. The model must then be tested for validity of the instruments.

5 Results

In this section, the results from the estimation of the two equation simultaneous panel data model in equations (1) and (2) are presented and discussed. The results for the male sample are presented and analysed in subsection 5.1, whereas the results for the female sample are given in subsection 5.2.

5.1 The effect of unemployment on divorce, male sample

This subsection begins with a discussion about the GLS results from the unemployment equation (1), which are presented in Table 7. This is followed by a discussion about the probit results for the separation equation (2), which are displayed in Table 8.

Table 7. GLS Results for Unemployment Equation, Males

Variable Name	***Coeff.*** ***(s. e.)***
Individual-Specific Characteristics	
Age	-12.47*** (0.18)
Born Abroad	16.93*** (2.59)
Upper Secondary School	-10.62*** (1.64)
University	-8.18*** (2.19)
Compulsory School GPA	-16.30*** (1.05)
GPA Missing	-17.85*** (4.46)
Evaluation of Non-Cognitive Traits	-4.63*** (0.40)
Evaluation Missing	-10.73*** (2.57)
Living in City	-15.57*** (1.17)
Regional Employment Growth Rate	-3.19*** (0.24)

Table 7. Continued

Parental Characteristics	
Mother Earnings	-3.91*** (0.94)
Father Earnings	-3.89*** (0.52)
Constant	484.68*** (5.49)
Model Information	
LM test of no random effects (1 df)	29591.16
R^2-adjusted	0.16
Number of Observations	65 125

Note: * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

The null hypothesis of no unobserved heterogeneity can be rejected judging by the high value of the *LM*-test statistic reported in Table 7, which is well above the critical value for any level of significance. The number of days in unemployment seems to be decreasing with age, education and compulsory school GPA. It is also decreasing with the evaluation of non-cognitive traits from the National Service Administration, as can be seen by column 2. The variable "evaluation missing", which is reported in the table, shows a large negative impact on unemployment of not having participated in the non-cognitive evaluation. Besides being an immigrant, those with a missing result from the evaluation are those who had already started their higher education by the time of enrolment and those who studied four years of upper secondary school and were, therefore, excused. These individuals are expected to be less likely to become unemployed. Others who miss the evaluation are, for instance, those with allergies, bad eyesight or hearing problems.

The number of days in unemployment is lower for people living in an urban area and for those who live in a labour market region with a high employment growth rate. Parental earnings also have a negative impact on the number of days in unemployment.[9]

[9] Versions of the model that include parental education have also been estimated since this is likely to be a determinant of the child's labour market performance. Parental education is, however, highly correlated with own education and parental earnings and it is, therefore, excluded in the final model without any consequences for the main results.

Table 8 below gives the probit results from the separation equation. Column 1 reports the result of a probit estimation, where unemployment is treated as an exogenous variable.[10]

Much as expected, the results in column 1 of Table 8 show that the probability of dissolution increases with the number of days in unemployment. In order to determine whether to use the observed number of days in unemployment as an explanatory variable in the separation equation or not, let us first discuss the predictive power of the estimated unemployment equation. The reported R^2 from Table 7 is 0.16. If the R^2 is less than 0.1, the simple probit estimator could be preferred over the two-step estimator, at least when sample sizes are small according to Bollen et al. (1995). The R^2 of Table 7 is higher than 0.1, the sample size is fairly large, and the parameter estimates are highly significant. Although this is interpreted as "enough" predictive power, the reader should keep the somewhat low R^2-value in mind.

As has previously been mentioned, for the separation equation to be identified, at least one restriction must be imposed on the separation equation. The excluded variables, i.e. the instrumental variables, are the variables measuring participation and result from the evaluation of non-cognitive traits, the variable measuring employment growth rate and the variable measuring if the individual was born abroad. It is important to choose instrument variables that are unlikely to be directly correlated with relationship outcome. The use of employment growth rate as an instrument can easily be motivated as being directly connected to labour market activities. When it comes to the result from the non-cognitive test, the measured characteristics are probably observed by the potential partner at the start of the relationship. Therefore, it is highly likely to be a determinant of whether you are matched into a commitment to start with. Since these characteristics are likely to be observed at the start, they should not be of any significance for the future of the relationship. Being born abroad is also something that is known at the start of the relationship; it is unlikely that simply the fact that an individual is born abroad should have any significant influence on the relationship outcome. However, if the spouses are of different ethnicities, it is likely to influence the relationship since it is probably harder to keep a relation-

[10] There is no evidence of random effects in the separation equation, which may be due to the respondents of the sample entering into relationships relatively late and that there are not enough time series observations for any random effects to be detected. However, to control for the possibility of other forms of non-independence of observations over time, than what is supported by the random effects approach, the standard errors are adjusted for clustering on individuals.

ship stable if you have different religions or different cultural backgrounds.

To make an assessment of the validity of the instruments, four tests have been performed. First of all, the instruments need to have a significant impact on the number of days in unemployment. Individual *t*-tests of the instruments show that each instrument significantly affects the number of days in unemployment. To determine whether the instruments, as a group, affect the number of days in unemployment, an *F*-test was performed. The *F*-test returned a value of 222.7 with four degrees of freedom, which is well above the critical value for any level of significance. These tests conclude that the instruments are strong predictors of the number of days in unemployment. The third test involves a likelihood ratio test between the log likelihood of the model of column 3 (where the endogeneity of unemployment days is accounted for) and the likelihood of its counterpart where the instruments are used to substitute for the predicted number of unemployment days. The null hypothesis of validity means that the model of column 3 is the correct specification. If the instruments are valid, there should be no significant difference between the log likelihoods. The *LR*-test gives a value of 6.23 with three degrees of freedom, which is not significant at the 90 percent level. The fourth test involves *t*-tests on the coefficients for the instruments when all but one are included in the model of column 3. Neither of the coefficients is significant. The above discussion leads to the conclusion that the instruments are valid. Therefore, these instruments will be used.

Column 2 of Table 8 presents the probit regressions for divorce; both the observed number of days in unemployment and the estimated residual from the unemployment equation are included as regressors. A *t*-test for the coefficient on the estimated error term from the unemployment equation is the test of the null hypothesis that the number of days in unemployment is exogenous. The test rejects exogeneity of the number of days in unemployment. Therefore, the suggested two step procedure is more appropriate for estimating the impact of the number of days in unemployment on separation. Due to the above discussion, the following analysis will be based on the results from column 3. Marginal effects for the variables can be found in Table B1 of Appendix B.

Table 8. Probit Results for Separation Equation, Males

	Column		
	1	2	3
Variable Name	Coeff. (s. e.)	Coeff. (s. e.)	Coeff. (s. e.)
Individual-Specific Characteristics			
Predicted Unemployment Days			0.002** (0.001)
Unemployment Days	0.0002** (0.001)	0.002*** (0.001)	
Estimated Error from Unemployment Equation		-0.002*** (0.001)	
Age	-0.03*** (0.005)	0.007 (0.01)	0.006 (0.01)
Upper Secondary School	-0.12*** (0.02)	-0.10*** (0.03)	-0.10*** (0.03)
University	-0.26*** (0.04)	-0.24*** (0.04)	-0.24*** (0.04)
Compulsory School GPA	-0.10*** (0.01)	-0.06** (0.02)	-0.06** (0.02)
GPA missing	-0.27*** (0.06)	-0.24*** (0.06)	-0.24*** (0.06)
Earnings	-0.05*** (0.01)	-0.05*** (0.01)	-0.06*** (0.01)
Partner Characteristics			
Older (in years)	0.01* (0.005)	0.01* (0.005)	0.01* (0.005)
Younger (in years)	0.05*** (0.006)	0.05*** (0.006)	0.05*** (0.006)
Born Abroad	-0.17*** (0.04)	-0.17*** (0.04)	-0.17*** (0.04)
More Educated	-0.08*** (0.02)	-0.08*** (0.02)	-0.08*** (0.02)
Less Educated	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)
Earnings	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Parental Characteristics			
Mother Earnings	0.03** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Father Earnings	-0.05*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)

Table 8. Continued

Couple Characteristics			
Different Ethnicity	0.21*** (0.03)	0.20*** (0.03)	0.20*** (0.03)
Living in City	0.09*** (0.02)	0.12*** (0.02)	0.12*** (0.02)
Social Assistance Recipients	0.42*** (0.03)	0.41*** (0.03)	0.43*** (0.03)
Children ≤ 3 Years	-0.03* (0.01)	-0.03* (0.01)	-0.03* (0.01)
Children 4-6 Years	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)
Children 7-10 Years	0.08*** (0.03)	0.07*** (0.03)	0.07*** (0.03)
Children 11-15 Years	-0.01 (0.05)	-0.02 (0.05)	-0.02 (0.05)
Children 16-17 Years	0.14 (0.13)	0.14 (0.13)	0.14 (0.13)
Constant	-0.50*** (0.12)	-1.37*** (0.44)	-1.36*** (0.44)
Model Information			
Log likelihood	-12325.78	-12323.66	-12326.45
Chi squared	1620.07 (23df)	1624.31 (24df)	1618.75 (23df)
Pseudo R-squared	0.06	0.06	0.06
Number of Observations	65 125	65 125	65 125

Note: Standard errors of columns 2 and 3 have been Murphy and Topel corrected for the inclusion of predicted values of unemployment days and the predicted error term, respectively. All standard errors are adjusted for clustering. * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

From Table 8 above, it is clear that the probability of separation is increasing with the number of days in unemployment for the male sample. From Table B1 of Appendix B, it can be seen that the marginal effect of unemployment is 0.0002, which may seem small as compared to the separation probability as a whole for males, which equals 0.051. However, it must be remembered that this is the effect of one additional day in unemployment. One additional month would apparently have quite a substantial effect on the probability of separation. It is, however, likely that the effect of one additional unemployment day is nonlinear.[11] Compared to the marginal effect of unemployment in the simple probit esti-

[11] A loglinear specification has been tried as well as squared and cubed terms without adding to the information.

mation, the effect is larger when endogeneity is controlled for. This means that the effect in the simple probit equation was underestimated, instead of overestimated as expected. There must be some unobserved characteristic that is causing a downward bias; an example could be if you are a careerist. This would have a negative effect on unemployment but could, if you work long hours, have a positive effect on separation probability.

There is no direct effect on dissolution of own age. This result somewhat contradicts the theory of match quality but, on the other hand, age here is not equivalent to age at the start of the commitment, which could be the reason for the result. It should also be remembered that a large negative effect of age was found on unemployment days in Table 7. The coefficients for the variables measuring deviations in age both show that the probability of separation increases with larger differences in age. Similar results have been found in several other studies and suggest that people at different levels of maturity have less stable relationships.

Having a partner who was born abroad has a stabilizing direct effect on the commitment. This should, however, be interpreted with caution. There was no direct effect of the individual himself being born abroad on divorce which allowed for the use of that variable as an instrument. Therefore, it is possible that no direct effect would be found from the partner being born abroad, if it were possible to control for partner unemployment, since being born abroad could be a proxy for unemployment. Being of different ethnicities is, instead, destabilizing, which is something that confirms the idea of positive assortative mating.[12] This could be related to people of different cultures or religions having different attitudes towards relationships and/or divorces which could complicate matters.

For educational level, the direct and indirect effects both work in the direction of reducing the separation probability, but the probability is somewhat higher for couples where the male is more educated than the female. Living in a city has a direct destabilizing effect on relationships, which is in line with previous findings (e.g. Svarer, 2004, 2005) and one explanation is that there are more alternative matches for people living in a city. The indirect effect through unemployment reduces the negative impact, however.

[12] The simultaneous inclusion of the two being born abroad variables together with the different ethnicities variable may seem somewhat odd. The variable measuring different ethnicities is, however, defined in such a way that even if both spouses were born abroad, they can still be of different ethnicities.

Male earnings seem to be more important for a steady relationship, since the probability of separation is decreasing with male earnings. This shows that, at least for women, the gains from commitment are increasing with income. A couple receiving social assistance are more likely to separate than others. As stated in Norberg-Schönfeldt (2007), receiving social assistance could often be connected with other factors that may be the real cause of the instability.

In the male sample, the idea that children have a stabilizing effect does not seem to apply in general. This opposes the theory of investments in commitment specific capital to some extent. There is a stabilizing effect of having very young children but the presence of children between ages four and ten has a destabilizing, instead of a stabilizing, effect. This may be due to the relatively young mean age of spouses in the male sample. To be able to have a child over the age of four, the average female partner had to be very young when the child was born, which may, in itself, be destabilizing.

5.2 The effect of unemployment on divorce, female sample

In this subsection, the results from the model in equations (1) and (2) are given for the female sample. The GLS results from the unemployment equation are presented in Table 9, and the probit results from the separation equation are displayed in Table 10.

The results of the unemployment equation in Table 9 show that, as for the male sample, female unemployment is negatively related to age. When it comes to schooling, the number of days in unemployment increases with upper secondary school compared to compulsory school, but there is a large negative effect of university studies. A woman living in a city or in a labour market region characterized by a high employment growth rate on average experiences shorter spells of unemployment than other women. Women born abroad are unemployed for longer periods. The number of days in unemployment is decreasing with the earnings of both parents.

Table 9. GLS Results for Unemployment Equation, Females

Variable Name	***Coeff.*** ***(s. e.)***
Individual-Specific Characteristics	
Age	-9.05*** (0.16)
Born Abroad	17.15*** (1.93)
Upper Secondary School	2.80** (1.38)
University	-25.82*** (1.72)
Compulsory School GPA	-18.60*** (0.75)
GPA Missing	-54.41*** (3.57)
Living in City	-36.13*** (0.91)
Regional Employment Growth Rate	-0.85*** (0.22)
Parental Characteristics	
Mother Earnings	-6.54*** (0.70)
Father Earnings	-2.53*** (0.39)
Constant	409.37*** (4.60)
Model Information	
LM test of no random effects	29510.92
R^2-adjusted	0.13
Number of Observations	108 600

Note: * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

Table 10 below gives the probit results from the separation equation. Column 1 reports the result of a probit estimation for the separation equation with unemployment treated as exogenous. Once more there is no evidence of unobserved heterogeneity in the separation equation, and according to the results in column 2, unemployment is found to be endogenous and the two step procedure will be applied.

Since females are not eligible for military service in Sweden, evaluation of non-cognitive traits can not be used as an instrument for unemployment. However, since the variable measuring the regional employment

growth rate and the born abroad variables exist for females, these will be used as instruments. Individual *t*-tests of the instruments show that each instrument significantly affects the number of days in unemployment. The *F*-test for determining the significance of the instruments in the unemployment equation gives a value of 75 with two degrees of freedom, which is again well above the critical value for any level of significance. The likelihood ratio test between the log-likelihood of the model in column 3 and the likelihood of its counterpart, where the instruments are substituted for the predicted number of unemployment days, shows that there is no significant difference between the two log likelihoods, since the value is 0.16 with one degree of freedom. The critical value for significance at the 90 percent level is 2.71. The *t*-tests of the coefficients for the instruments when they are included in the model of column 3 are not significant. Therefore, the following discussion will be based on the results in column 3. The marginal effects for the variables can be found in Table B2 of Appendix B.

The coefficient for the predicted number of days in unemployment in column 3 of Table 10 shows that the effect of number of days in unemployment on divorce is negative for the female sample. This is somewhat surprising, but shows that the effect of unemployment on divorce is indeed overestimated when the endogeneity of unemployment is not accounted for. From Table B1 of Appendix B, it can be seen that the marginal effect of one additional unemployment day is -0.001, to be compared with the general separation probability in the female sample of 0.048.

The negative effect of female unemployment on divorce could be a sign that when females are unemployed, the non-market work is taken care of and the relationship becomes more stable. Therefore, the division of labour in Sweden may not be as non-traditional after all. Naturally, the effect could also be the result of a deliberate choice of the couple regarding the division of labour. Another likely explanation is that women are often the initiating party in the divorce decision, which has been found by, for example, Sayer et al. (2005), and a woman who is unemployed will probably be less likely to initiate a divorce since the value of her outside alternative will be lower than when she was employed.

Table 10. Probit Results for Separation Equation, Females

	Column		
	1	2	3
Variable Name	Coeff. (s. e.)	Coeff. (s. e.)	Coeff. (s. e.)
Individual-Specific Characteristics			
Predicted Unemployment Days			-0.007*** (0.002)
Unemployment Days	0.0002*** (0.0001)	-0.007*** (0.002)	
Estimated Error from Unemployment Equation		0.007*** (0.002)	
Age	-0.02*** (0.003)	-0.08*** (0.02)	-0.08*** (0.02)
Upper Secondary School	-0.14*** (0.02)	-0.12*** (0.02)	-0.12*** (0.02)
University	-0.28*** (0.03)	-0.46*** (0.05)	-0.46*** (0.05)
Compulsory School GPA	-0.10*** (0.01)	-0.23*** (0.03)	-0.23*** (0.03)
GPA missing	-0.34*** (0.05)	-0.66*** (0.10)	-0.67*** (0.10)
Earnings	-0.02** (0.01)	-0.03** (0.01)	-0.03*** (0.01)
Partner Characteristics			
Older (in years)	0.01*** (0.002)	0.01*** (0.002)	0.01*** (0.002)
Younger (in years)	0.08*** (0.01)	0.08*** (0.01)	0.08*** (0.01)
Born Abroad	-0.07** (0.03)	-0.07** (0.03)	-0.07** (0.03)
More Educated	-0.04** (0.02)	-0.04** (0.02)	-0.04** (0.02)
Less Educated	0.04** (0.02)	0.04** (0.02)	0.04** (0.02)
Earnings	-0.06*** (0.01)	-0.06*** (0.01)	-0.06*** (0.01)

Table 10. Continued

Parental Characteristics			
Mother Earnings	0.03*** (0.01)	-0.02 (0.02)	-0.02 (0.02)
Father Earnings	-0.05*** (0.01)	-0.06*** (0.01)	-0.06*** (0.01)
Couple Characteristics			
Different Ethnicity	0.20*** (0.03)	0.22*** (0.03)	0.22*** (0.03)
Living in City	0.08*** (0.01)	-0.16*** (0.06)	-0.16*** (0.06)
Social Assistance Recipients	0.39*** (0.02)	0.40*** (0.02)	0.40*** (0.02)
Children ≤ 3 Years	-0.08*** (0.01)	-0.08*** (0.01)	-0.09*** (0.01)
Children 4-6 Years	0.07*** (0.01)	0.07*** (0.01)	0.08*** (0.01)
Children 7-10 Years	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)
Children 11-15 Years	0.14** (0.06)	0.14** (0.06)	0.14** (0.06)
Children 16-17 Years	-0.05 (0.17)	-0.05 (0.17)	-0.05 (0.17)
Constant	-0.63*** (0.09)	2.20*** (0.69)	2.24*** (0.69)
Model Information			
Log likelihood	-19736.73	-19727.36	-19732.29
Chi squared	2309.11 (23df)	2327.84 (24df)	2318.00 (23df)
Pseudo R-squared	0.06	0.06	0.06
Number of Observations	108 600	108 600	108 600

Note: The standard errors of columns 2 and 3 have been Murphy and Topel corrected for the inclusion of predicted values of unemployment days and the predicted error term, respectively. All standard errors are adjusted for clustering.* Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level

For females, there is both a direct and a negative effect of age on the probability of separation, but the indirect effect through unemployment is now destabilizing and the probability of separation is once more increasing with age difference between partners. The direct effect of schooling decreases the probability of separation, but the probability is increasing if the male spouse has a lower education, the latter being the opposite of the result found for males. Being committed to a partner

born abroad is again stabilizing. As for the male sample, being of different ethnicities has a destabilizing effect on the relationship.

Living in a city has a negative direct effect on the probability of dissolution for females. This could be interpreted in terms of the marriage market. According to Edlund (2005), women, in fertile ages, outnumber men in urban areas. She suggests that the reason may be linked to higher male incomes in urban areas, and that women migrate to urban areas in order to achieve better matches. This means that, ceteris paribus, females in cities are less likely to divorce. Receiving social assistance is once more negative for stability, but having a high earning father is stabilizing. As was the case for the male sample, the presence of very young children is stabilizing for the relationship whereas the effect of having older children works the other way around.

6 Conclusions

This study focuses on unemployment and its effects on the probability of separation. Unemployment is often included as a control variable in the economic divorce literature, but research more explicitly focusing on the role of unemployment in the divorce decision has so far been limited. This paper takes the investigation of the role played by unemployment in the dissolution of relationships further than has previously been done. By applying a two step estimation method to an extensive data set, unemployment is recognized as endogenous in the separation decision. In the few studies that actually do focus on unemployment and divorce, little attention has been given to the role of female unemployment. Besides finding unemployment to be endogenous, this study sheds some new light on the role of female unemployment by separately studying two samples of individuals, one female sample and one male sample, while controlling for the characteristics of their respective partners.

The findings are that for males, the probability of separation is increasing with the number of unemployment days, and that the effect is underestimated when unemployment is treated as exogenous. For females, treating unemployment as exogenous in the separation equation instead overestimates the role played by unemployment. For females, the separation probability is found to be decreasing with unemployment, which differs from findings in previous studies. One explanation could be that the division of labour in Sweden may not be as non-traditional and that unemployment eases the double burden of paid and unpaid work for females. Since females have in previous studies been found to be those often initiating a separation, another possible explanation is that a woman is less likely to initiate a separation during unemployment.

As indicated by the results of this study, there is more to unemployment and its role in the separation decision than has previously been known, especially when it comes to female unemployment. Therefore, more research is called for. For example, if data were available, it would be interesting to do the same type of analysis as is done here for both spouses in a couple.

Appendix A

Table A1. Variable Definitions and Explanations

Variable Name	***Explanation***
Individual-Specific Characteristics	
Age at Start of Commitment	The age of the individual at the start of the commitment, the individual's age in every year will be used in estimations.
Earnings	The individual's gross income expressed in hundreds of thousand. Includes both labour and non labour income.
Days in Unemployment	The number of days in unemployment in a given year.
Compulsory School	Takes the value 1 if the highest level of schooling that the individual has completed in a given year is nine years of compulsory school, used as a reference case.
Upper Secondary School	Takes the value 1 if the highest level of schooling that the individual has completed in a given year is 2-4 years of upper secondary school.
University	Takes the value 1 if the highest level of schooling that the individual has completed in a given year is more than upper secondary school education.
GPA Compulsory School	Grade point average from the final year of compulsory school, scale 1-5.
Sweden	Takes the value 1 if the individual was born in Sweden, used as a reference case.
Born Abroad	Takes the value 1 if the individual was born outside of Sweden.
Evaluation of Non-Cognitive Traits	Psychological evaluation, males only, scale 1-9.
Test of Cognitive Traits	Practical and theoretical tests, males only, scale 1-9.
Parental Characteristics	
Parental Earnings	The mean gross income over the years 1990-1992 expressed in hundreds of thousand. Includes both labour and non labour income.
Parent Compulsory School	Takes the value 1 if the highest level of schooling completed in 1992 is nine years of compulsory school.
Parent Upper Secondary School	Takes the value 1 if the highest level of schooling completed in 1992 is 2-4 years of upper secondary school.
Parent University	Takes the value 1 if the highest level of schooling completed in 1992 is more than upper secondary school.
Parent Sweden	Takes the value 1 if the mother or father respectively was born in Sweden, used as reference case.

Table A1. Continued

Parent Born Abroad	Takes the value 1 if the mother or father respectively was born outside of Sweden.
Partner Characteristics	
Age at Start of Commitment	The age of the partner at the start of the commitment, partner age in every year will be used in the estimations. In order to account for different effects depending on who is older, partner age will be divided into two separate variables, measuring whether the male or the female is older in the estimations.
Partner's Earnings	The partner's gross income expressed in hundreds of thousand. Includes both labour and non labour income.
Compulsory School	Takes the value 1 if the highest level of schooling that the partner has completed in a given year is nine years of compulsory school, used as reference case.
Upper Secondary School	Takes the value 1 if the highest level of schooling that the partner has completed in a given year is 2-4 years of upper secondary school.
University	Takes the value 1 if the highest level of schooling that the partner has completed in a given year is more than upper secondary school education.
Sweden	Takes the value 1 if the partner was born in Sweden, used as a reference case.
Born Abroad	Takes the value 1 if the partner was born outside of Sweden.
Couple Characteristics	
Duration of Commitment	Describes how long the commitment has lasted, cannot be used with age in the estimations.
Number of Children	Measures how many children a couple has in a given year, will be divided into age intervals in the estimations.
Living in City	Takes the value 1 if the couple lives in one of the three larger cities of Sweden in a given year.
Social Assistance Recipients	Takes the value 1 if the couple received social assistance in a given year.
Different Ethnicity	Takes the value 1 if the spouses are of different ethnicities, this variable is on a finer scale than the "born abroad" variables.
Different level of education	Takes the value 1 if the spouses have different levels of education in a given year. In the estimations, this will be divided into two separate variables, measuring whether the male or the female has a higher degree of education, in order to account for different effects depending on who is more educated.
Regional Employment Growth Rate	Measures the change in employment growth rate in the labour market region between two years.

Appendix B

Table B1. Marginal Effects, Separation Equation, Males and Females.

	Males	***Females***
Variable Name	Marginal Effects	Marginal Effects
Individual-Specific Characteristics		
Predicted Unemployment Days	0.0002**	-0.001***
Age	0.01	-0.01***
Upper Secondary School	-0.01**	-0.01***
University	-0.02***	-0.03***
Compulsory School GPA	-0.01***	-0.02***
GPA missing	-0.02***	-0.03***
Earnings	-0.005***	-0.04**
Partner Characteristics		
Older (in years)	0.008*	0.001***
Younger (in years)	0.004***	0.01***
Born Abroad	-0.01***	-0.01**
More Educated	-0.007***	-0.004**
Less Educated	0.008***	0.003**
Earnings	-0.001	-0.01***
Parental Characteristics		
Mother Earnings	0.004***	-0.001
Father Earnings	-0.004***	-0.01***
Couple Characteristics		
Different Ethnicity	0.02***	0.02***
Living in City	0.01***	-0.01***
Social Assistance Recipients	0.05***	0.05***
Children ≤ 3 Years	-0.002*	-0.01***
Children 4-6 Years	0.01***	0.01***
Children 7-10 Years	0.01***	0.003
Children 11-15 Years	-0.001	0.01**
Children 16-17 Years	0.01	-0.004
Constant	-0.12***	0.19***
Model Information		
Log likelihood	-12326.45	-19732.29
Chi squared	1618.75 (23df)	2318.00 (24df)
Pseudo R-squared	0.06	0.06
Number of Observations	65 125	108 600

Note: Marginal effects are computed at the means of the variables, marginal effects for dummy variables are $P|1-P|0$. * Statistically significant at the 10 percent level, ** Statistically significant at the 5 percent level, *** Statistically significant at the 1 percent level.

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