NORGES HANDELSHØYSKOLE
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Urban women, rural men

An investigation into the sex ratios in Norwegian municipalities and their determinants.

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ABSTRACT

This thesis investigates the causes of the relatively high numbers of women in urban areas in Norway compared to rural areas. Edlund (2005) explains this pattern for Swedish municipalities with a model predicting that unskilled women migrate to urban areas in response to the presence of wealthier men, despite lower probabilities of marriage. The theory supporting the model is investigated and found to be justified. Edlund's empirical analysis is replicated on Norwegian municipal data for the ages 25 to 44. The analysis yields a negative effect on the sex ratio from men's earnings, especially in the age group 35 to 44 years. Transactions within marriage, explaining negative effect on the gender ratio from men's earnings in the model, are supported by finding women's lower marriage rates in municipalities with low male earnings.

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INTRODUCTION

In 2012 a calendar featuring single men posing with athletic gear, on skis, bare-chested and in hunting gear was published from Nore in Numedal. The calendar was produced in a humorous attempt to attract women to the district, pointing to the men as potential partners for available women.[1] Are rural communities really experiencing a dearth of young women, leaving men deserted? Across the country, rural municipalities experiencing outbound migration are working to combat an exodus of young professionals, attempting to retain and attract both men and women who seem to prefer living in the cities.

The Norwegian population is getting increasingly urbanized, women even more so than men. If some municipalities have a lack of women, some municipalities must have a surplus, what are the determinants of this differential migration between men and women?

Contrary to what one might expect, the municipality in which the men in the calendar live, Nore og Uvdal, has a fairly equal number of men and women of marriageable age, a slight surplus of men very close to the national average. In other municipalities however, the lack of women is much greater. In 2008, 51 municipalities had *more* than 120 men per 100 women between the ages of 25 and 34, leaving more than every sixth man in this age group single even if all the women found a partner. These 51 municipalities are predominantly small, with an average population of 2300. Comparing this to the average number of inhabitants in Norwegian municipalities, 11165, indicates that this issue predominantly affects smaller municipalities. In the urban areas themselves, there are even higher proportions of women compared to in rural areas This thesis looks at the distribution of the sexes at the municipal level, without considering the fact that municipalities often contain both urban and rural areas, instead looking at the population as an indicator for urbanity.

In the paper "Sex and the City", Edlund explains the lower sex ratios in urban areas are a result of men's higher earnings in these locations. Edlund develops a theoretical model to explain how men's higher wages could predict lower sex ratios, and conducts an empirical analysis on Swedish data to substantiate her claims. This thesis investigates the theoretical background and mechanics of Edlund's model, and replicates the empirical procedure on Norwegian data. Evidence is found which indicates that women migrate to the municipalities where men's earnings are highest, even when controlling for factors such as women's earnings, municipal population and centrality. Section (I) prepares the theoretical basis of the analysis of the sex ratio by exploring the mechanism by which men's income might induce the migration of women, and

[1] http://www.nationen.no/2012/01/20/aktiv_ferie_og_fritid/ungkar/singel/kalender/forelskelse/7198925/

how this might be tested using the model developed by Lena Edlund. Section (II) investigates the pattern of the sex ratio and other variables of interest and applies the method used by Edlund (2005) to test the hypothesis. Section (III) discusses the results of our regression analysis, and evaluates alternative explanations. Section (IV) concludes.

(I) THEORY AND FINDINGS REGARDING THE SEX RATIO AND DIFFERENTIAL MIGRATION

The sex ratio and migration within countries

Sex ratio is a measure of the relative abundance of the sexes, measured as the number of males per female by convention. This means that a sex ratio of 1.0 is a 50-50 split of men and women, 0.5 is a 33.3-66-6 distribution, and 2.0 is a 66.6-33.3 distribution. Naturally, the sex ratio is bounded at 0 when only women are counted, and can go to infinity when there are only men. This thesis uses the total population of a given age interval in computing the sex ratio, but alternative measures of the sex distribution exist and are used. An alternative way of measuring the sex ratio which is relevant to the study of the marriage market or migration is using only unmarried men and women, or discriminating by labor force participation. By defining the sex ratio for certain subdivisions of the population, factors which are relevant to the study of migration such as marriage and labor force participation can be studied in more detail. The sex ratio could also be measured by defining sex ratios for educational or ethnic groups. This text only looks at top-level variation in the sex ratio for specific age groups, and only takes simple average values for income measures where this is relevant, without delving into differences in the characteristics of either gender. This grouping of the population by age, taking the sex ratio as is from these subdivisions are justified by simplicity, as it allows us to study the variation in the sex ratio without complicating factor such as weights in regressions, introducing extra dimensions in our plots, or separate analyses for specific subgroups. It also allows direct comparison of results to those of Lena Edlund (2005).

Though large deviations from an equal sex distribution is unusual in censuses of developed countries, some variation is observed, especially within countries (UNdata 2011). The sex ratio at birth is close to 1.06 worldwide. However, the number of male births per female is influenced by a wide range of factors, including ambient temperature (Grech, Vassallo-Agius, and Savona-Ventura 2000), pollution (Mocarelli et al. 2000), paternal age (Bernstein 1958) and maternal stress (Rueness, Vatten, and Eskild 2012). In some places, such as India, China and Sub-Saharan Africa, the sex ratio is skewed in a positive direction before and even after birth due to active selection in favor of males (Hvistendahl 2011), this trend has been dubbed the *missing women of Asia* by Amartya Sen (1990), noting that the number of women in Asia is roughly 100 million lower than it would be had there been no sex selective abortions or infanticide. In an economic analysis of differences in sex ratios among more mature populations however, such factors are irrelevant.

After birth, differing physiologies cause the sex ratio to fall due to higher risks of death due to natural causes from birth through old age for males, and a lower life expectancy in general. In Europe and North America, the number of women is typically 4-5 percent higher than that of men, mostly due to the longevity of women. Given equal access to nutrition and medical treatment, women tend to outlive men by a noticeable amount, as the higher life expectancy of women shows. Males are also more likely to die in accidents and from violent action.[2] In the western world, migration is a much larger influence on the sex ratio than sex specific abortion, differing health issues, or tendencies to get involved in accidents and conflicts. In Norway, as with other countries, the number of men and women moving from one region to another give rise to virtually all the variation seen in the sex ratio within the country, other than the variation which is due to coincidence of birth.

The sex ratio in Norway in 2012 at birth is 1.05, reflecting a natural ratio of sexes, while the total population has a ratio of 0.98, mainly due to the longevity of women.[3] As with other countries however, the sex ratio varies greatly *within* the country, most notably along the rural-urban divide. This is a demographic feature Norway shares with most western countries, some of which exhibit dramatic differences in sex ratio between urban and rural areas. *Figure 1* shows the difference in European countries, with labels for selected countries. With the exception of Sweden, Switzerland and the Netherlands, all the countries have a higher sex ratio in rural areas than in urban, as can be seen by their placement above the diagonal indicating equal sex ratios. The sex ratios and other variables of interest on Swedish municipalities were used by Lena Edlund to study the determinants of the sex ratio; an analogous procedure is used in this thesis.

[2] CDC, Centers for Disease Control: *Death Rates for 113 Selected Causes 1999-2006.* http://www.cdc.gov/nchs/nvss/mortality/gmwk291r.htm

[3] CIA World Fact book, Norway. 2012. *People and Society; Sex Ratio.* https://www.cia.gov/library/publications/the-world-factbook/geos/no.html.

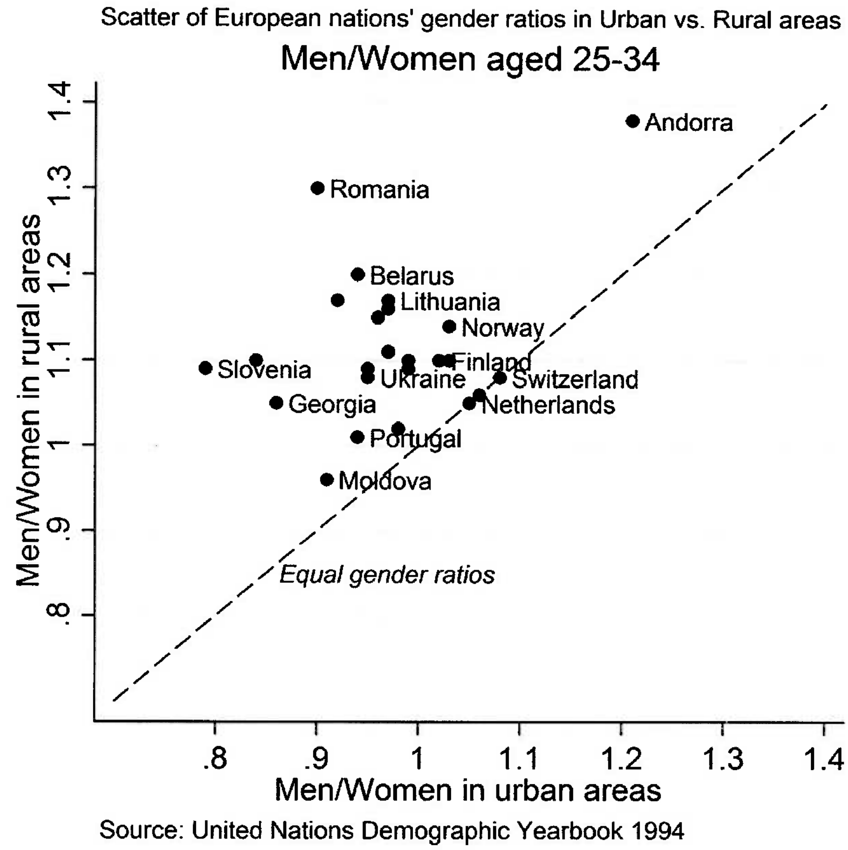

Figure 1, **The rural and urban sex ratios of European countries.**

With a relatively healthy and safe population, migration is the most likely explanation for the difference in urban and rural areas' sex ratio from the sex ratio at birth, 1.05. As with other countries, this migration between rural and urban areas in Norway differs with regard to the sexes. *Figure 2* shows the fraction of males in each municipality between the ages of 15 and 44 in all Norwegian municipalities, and provides an overview of how the genders are distributed across the nation. Bear in mind that some of the smaller municipalities are the most populous. The picture is quite muddled, and the sex ratio exhibits no clear-cut geographic trend, except for a concentration of municipalities around Oslo with low male fractions and some municipalities in the inland with a seemingly high male fractions. The differences we see between municipalities can be the result of migration which differs in its gender composition, or due to accidents of birth. The following pages look at the distribution of the sexes as measured by the sex ratio in light of other non-geographic characteristics defining the municipalities, such as average income, population and distances to urban centers, rather than strictly geographic measures. This data is used to find how these variables induce men and women to locate differently.

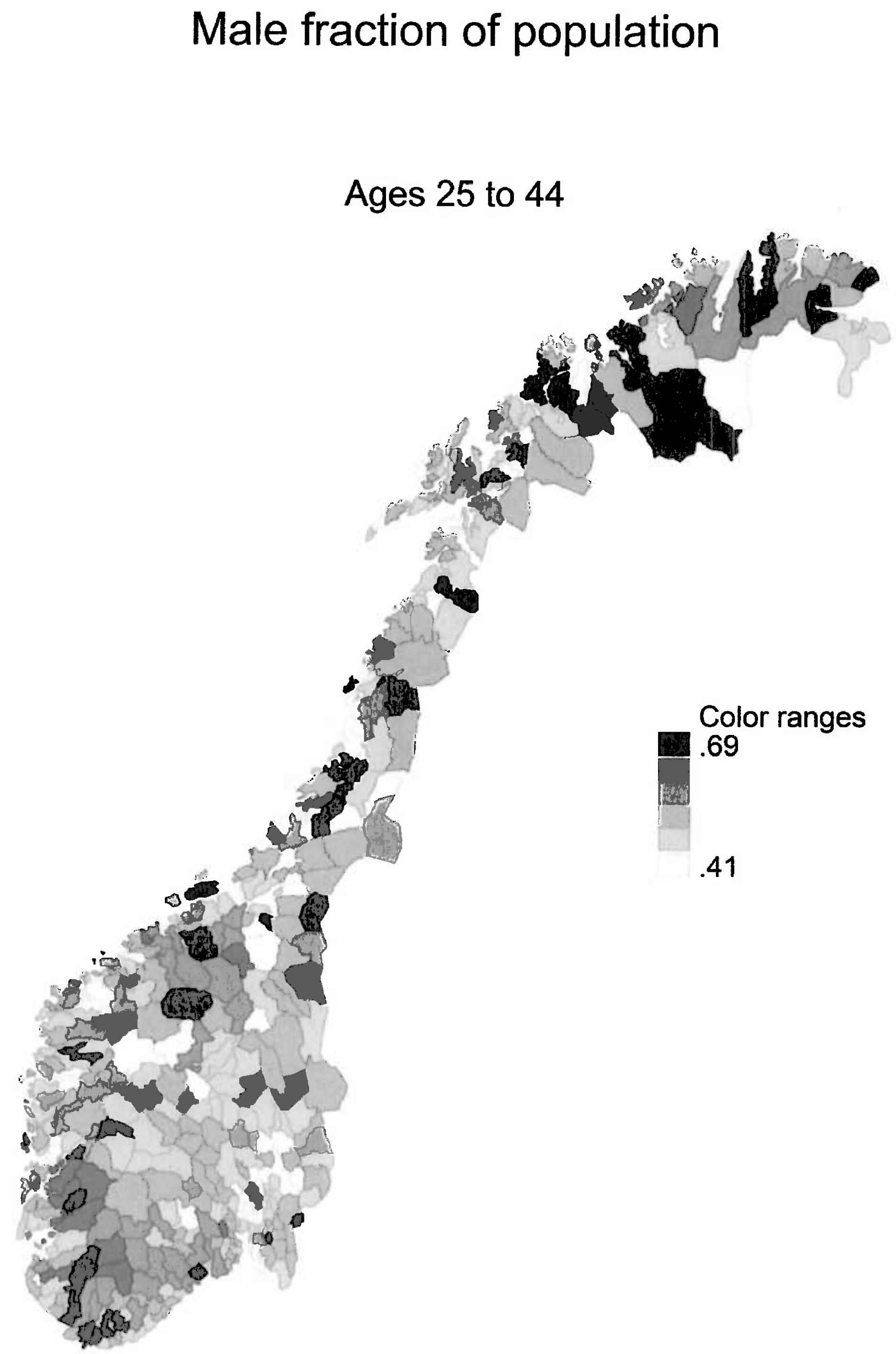

***Figure 2,* Geographic overview of Norwegian municipalities' male fractions.**

Source: *Norwegian Social Science Data Services*, darker areas have more men per woman than lighter areas.

The factors motivating relocation should be central when investigating the sex ratio. Some relocate to acquire an education, and later to acquire a source of employment. Others might move for the possibility of employment, or the possibility of finding a suitable partner. Some might also simply relocate due do preferences with regard to the environment, such as the size of the city, general atmosphere, access to recreational activities, and available services.

For large portions of the population, the following pattern would likely sound plausible. Relocation for the purpose of acquiring an education, followed by relocation for employment, with a partner towards new employment, or 'going home'. The neoclassic perspective on migration sees individuals relocating in response to regional economic factors (Sweeney 1995), this thesis also investigates migrants economic incentives, but includes a consideration of gender roles. In particular, the next section investigates how the condition in the marriage market necessitates and facilitates transactions from men to women. If education, employment and romantic interests are important determinants in migration decisions, how do these work to produce differences in sex ratios between Norwegian municipalities?

The marriage market

A man and a woman enter into a marriage agreement if both consent to it, meaning a marriage must benefit both the man and the woman compared to the alternative of staying single, or marrying someone else who is willing. The number and importance of different variables taken into account by men and women contemplating marriage are likely highly individual and complicated in actuality. How marriage is to be understood in an economic framework by modeling marriage terms and choices to predict outcomes will depend on which assumptions are taken by the model.

The theoretical study of marriage between men and women typically takes a distanced and unromantic view of courtship, instead focusing on quantifiable factors. In economic modeling, the pairing of men and women takes place in the marriage market, a theoretical construct in which men and women make decisions about marriage. Men and women pick possible partners from their local area, or relocate if no suitable and available partners are found. The criteria for choosing partners are sex dependent due to differing needs for biological and social reasons. Each man and woman has sufficient information about all partners to take decisions based on priority, and can make a choice about whether or not to get married to a particular person. Faced with a choice of partners, an individual will choose the one which maximizes personal utility, or 'happiness'. A potential partner's utility contribution to the other party might be that he or she meets a demand for safety, financial resources, the ability to produce or care for children, sexual or platonic companionship, class advancement, and so on. The utility contribution of a partner is also dependent on the marriage agreement, which can be seen as a contract stipulating obligations and benefits for the man and the woman. How men and women's matching decisions play out, and how this influences investments in human capital, gender roles, transactions between partners, and migration patterns can be made subject to economic modeling.

The following theoretical section shows why men's income might be important for the migration decisions of women. The connection between men's earnings and women's migration is established by first giving an outline of Lena Edlund's model, before examining the theoretical basis of the assumptions underlying the model. First, we examine whether women are scarce in the marriage market, and why this might be the case. Next we examine how and why women might want to leverage their scarcity in order to extract resources from a relationship. Finally we examine why men might pay women for marriage before moving on to the mathematical framework established by Edlund (2005) for showing why women move to urban areas.

An important fact to point out before making statements about the marriage market is that the motivations and conditions of men and women might be greatly variable on an individual level, but patterns for larger groups might still be possible to identify. If a theoretical model captures some of the truth, it might be valuable as an analytical tool even if most of the truth is unexplained.

"Sex and the City"

Lena Edlund's article in Scandinavian journal of Economics, "*Sex and the City*" investigates the sex ratios in Swedish municipalities and their determinants. The title of the article is a reference to a popular TV series with the same name, which chronicles the personal, professional and romantic journeys of four women in New York City. Though lauded with 50 Emmys during its six seasons, the show was also criticized as portraying women as dependent,[4] while others celebrate its vision of independent women.[5] A constant theme in the series is the romantic exploits of the main character, Carrie Bradshaw, a sex columnist with a spending habit and accompanying financial woes. Her financial situation generally fluctuates along with the direction of her career and her love life. Recurring throughout the series is an on-and-off relationship with Mr. Big, a wealthy financier who finally becomes Carries husband in the movie following the series. Before she settles down with Mr. Big, Carrie and her friends are bothered

[4] http://www.telegraph.co.uk/culture/film/7746119/Sorry-sisters-but-I-hate-Sex-and-the-City.html
[5] http://www.guardian.co.uk/media/2004/jan/29/broadcasting.tvandradio

with the fact that all the 'good' men in Manhattan are taken, and if a man is available, a host of other women are there to compete for their affection.

Edlund's article points to a puzzle in the surplus of women in urban areas; if cities offer more work opportunities for skilled workers, why don't urban areas have a surplus of men, when they are more skilled than women? Edlund's starting point is that since women generally have lower educational attainment, or less job specific skillsets, the relatively more skill dependent employment opportunities of urban areas should produce cities with a surplus of men, not women. The solution to this puzzle according to Edlund, is the migration of unskilled women to urban areas. These unskilled women move to areas where their chances of acquiring a partner with more financial resources are greater.

This might not seem like a puzzle at all for Sweden or Norway, where more women than men go on to take higher education. In Norway, 61 percent of all students taking higher education were women in 2008(Steinkellner 2010). The same pattern is seen in Sweden, where 50 percent of women and 39 percent of men take higher education (Petersson 2006). On the other hand, even though women participate more in higher education and study for a longer period on average, it is still the case in Norway that the majority of those completing higher educational courses of four or more years are men (Holøien and Nygård 2010). Women are also more 'traditional' in their choices, and represent a large majority in educational courses leading to jobs such as nursing and teaching, though the sex gap in higher technical education and longer courses such as engineering have been closing in recent years (Hollås 2007). Without delving too deep into why men might earn more than women, be it the work habits, level of ambition, relevance of educational or practical skills with regard to the labor market, or competing considerations, the fact remains that men earn more than women on average. One notable reason is that women tend to work part time more than men, especially married women (Seitz 1999). Edlund's puzzle might be reformulated as follows. Why do more women than men live in urban areas, when urban areas offer relatively more jobs which demand educational attainments predominantly held by men?

The essence of Edlund's theoretical model is that young fecund women are scarce (Trivers and Willard 1973) and that men value traits that are associated with fecundity such as youth and beauty (Todd et al. 2007), giving young women a choice of partners. The scarcity of fecund women follows from the fact that men can produce children for a relatively long period, and that women must invest more time and resources in their children. If women value financial security when choosing a partner, richer men will face better availability of partners. If these selection patterns exist, one would expect to see young women marrying rich men. If marriage and employment constitute separate sources of earnings for young fecund women, and rich men are predominantly located in urban areas, this might account for the lower sex ratios in these areas.

But why don't less well-off men follow these young women to the urban areas in hopes of more favorable marriage market opportunities, balancing out the sex ratio? One possibility is the way the differential fecundity affects *gender roles* and the way marriage and work interact. For men, employment is more often a requirement for marriage opportunities, while marriage and employment might constitute separate sources of earnings for women. Fecund women can bargain for financial resources in exchange for marriage, while men gain employment in order to attract women at a later date. There is some support for this proposition in that men are of a higher average age at first marriage than women, indicating some time is required to attain sufficient resources to attract a mate. This pattern for average age at first marriage is observed all over the world (Bergstrom and Bagnoli 1993). If men must attain sufficient wages of capital to attract mates, areas with higher wages may support a surplus of women, because women can attain resources both through marriage and employment. An indication of transactions in a marriage framework is the fact that married women participate less in the workforce than single women, indicating that marriage can constitute an alternate income source (Miller 1993). That doesn't necessarily mean that married women are less active than unmarried women however, since they more often are occupied with home production, such as taking care of children and do more households chores and so on.

Edlund's paper states that there is a pattern to explain, the lower sex ratio in urban areas, and that the mechanism of action is rich men's transfers to women in these areas, which allow for more women. The model thus hinges on the assumption that men actually pay women, a fairly controversial proposition. Despite this, there is some theoretical and empirical support for asserting that transfers take place from men to women both in marriages and outside of them. We first discuss why men might pay women by investigating the relative scarcity and investments of the sexes when initiating relationships and how this affects their motivations, and then how such transfers can be facilitated by marriage before explaining and discussing Edlund's mathematical model and other evidence on gender-specific migration.

Women's scarcity

There are some important differences between men and women which ultimately affect their decisions when choosing partners. Both men and women might become fertile many years before the desire and opportunity to have and care for a child emerges. Most men however, are able to produce children well into old age, while women stop being fertile at menopause, making their window of opportunity smaller. In practice, women's window of fertility is even smaller because they are at their most fertile in their teens and early twenties, after which fertility declines, and the chance of complications such as spontaneous abortions or birth defects increases. The relatively unequal fertility 'windows', and the fact that most men and women want to have children at some point in their lives, leads to a condition called *differential fecundity* (Hopcroft 2005). Men who are looking for a partner engage in competition for relatively scarce resource, young fecund women. Even though men might not be looking for mating opportunities with the express purpose of producing children, evolutionary biology has resulted is strong sexual selection for markers of health and fertility, such as youth and beauty. Women who possess such traits (predominantly the younger women) can in turn choose the most desirable mate among a larger pool of potential partners, leveraging their fecundity in order to attract the most desirable partner.

The importance of scarcity in the marriage market is illustrated by a study of France after the First World War, when the scarcity of men increased dramatically. When large shares of the men in marriageable age were killed, those men who survived faced a marriage market where the sex ratio was substantially decreased, down to 0.86 in some regions, meaning women were relatively plentiful. In general, men married women of higher standing than before, while lower-class women stayed single more often (Abramitzky, Delavande, and Vasconcelos 2011). Surviving men after the war were able to leverage their increased scarcity to improve their position in the marriage market. If men are able to 'marry up' more often when their numbers decrease, the same should also be true for women. Because an undeniably valuable asset in the marriage market is the youth that a woman possesses for a limited time period, women of this age are in high demand among a larger group of men. If women value financial security, as argued in the next section, richer men should have better prospects in the marriage market.

In the monogamous framework of traditional marriage, some of the differential fecundity of the sexes is eliminated due to the husband only mating with one woman. In a completely sexually liberated society, with free mating opportunities for both sexes, the reproductive capacity is effectively limited only by the availability of women. Known as *female dominance* (with regard to the number of each sex), this phenomenon is seen in certain species where few men can supply the reproductive needs of large populations. In tribes of the Hamadryas baboon (*Papio hamadryas*), the number of women per sexually active male is often four or more, these must be guarded closely by the dominant male (Schreier and Swedell 2009). In societies with monogamous relationship such as marriage however, reproduction is limited by the sex in shortest supply, this is known as *marriage squeeze (Johansen and Dagsvik 1999; Glick 1988)* . Preferences for age, education and so on may contribute to marriage squeeze, and this phenomenon is not uncommon, even though the sex ratio within areas delimiting the marriage markets rarely deviates very far from unity. Because of the relatively stable sex ratio, monogamous marriage tends to even out the differences in differential fecundity by limiting the mating opportunities for men. Remarriage is common after divorce or the death of a partner and as long as there is some remarriage, young women will be scarce. Even in the framework of monogamy, remarriage increases the scarcity of fecund women because men are more likely to remarry than women are. In the mid-1970's, men were more likely to remarry than women in all but three European countries, Austria, England and Wales (Chamie and Nsuly 1981). The reasons for this difference between men and women might be due to societal acceptance of men's remarriage versus women's or differences in economic prospects following a divorce. Women are also often left with most or full custody, which further lowers their economic prospects and attractiveness in the marriage market (Sweeney 1995). Even though the reasons might be complicated, the fact remains that remarriage is more common among men than women in Norway,[6] making women more scarce, and the competition among men tougher than if there was an equal remarriage rate.

Why women might want more wealthy men

In an analysis of the interaction between the marriage and labor market, Aloysius Siow (1998) investigated how differential fecundity and remarriage affected gender roles through participation in the labor market. Women in societies where the gender ratio is near unity are scarce because of differential remarriage rates and women's relatively short period of fertility. For this reason, men and women face different condition when choosing how to allocate their time between accumulating human capital in the labor market, and spending time with children. Siow finds that men have an incentive to accumulate more human capital. This is because in the case of a divorce, men will need to compete with younger men for the favor of young women.

[6]Statistics Norway, Statistical Yearbook 2011, table 96: http://www.ssb.no/aarbok/tab/tab-096.html

When participating in this competition, older men utilize their accumulated human capital to compensate for the age differential (Vella and Collins 1990). Women face different conditions in the marriage market than men, they do not have the same incentive for building up future human capital, and will instead choose to spend more time raising children and consuming goods provided in part by the husband. Women are able to do this because they have a relatively large selection of men to choose from, and will choose the man with the higher available human capital, which translates into income in Siow's model.

Another important difference between men and women is the amount of resources each party invests in a child; as a rule, women invest more in their children than men (Bethmann and Kvasnicka 2007; Buss 2005). Beginning at conception, women sacrifice resources for the nourishment of the child throughout pregnancy, and are in most societies the default caretaker of the child from birth until the child is self-sufficient. Children are therefore both a time consuming and financially burdening commodity for women, while the benefit of children goes to both parents. Children confer both psychological rewards and costs (Nomaguchi and Milkie 2003), but are clearly desired, as evidenced by the reproduction even of couples who have control over their reproductive health. The protracted period of investment required from the mother as opposed to the father (whose minimal contribution can be counted in minutes), establishes an imbalance from the outset in the investments faced by men and women.

Women face a relatively large required investment of time and resources. Fecund women's opportunity of picking and choosing the most desirable mate gives them the incentive and possibility to choose the man with the most available resources, for the convenience and safety of both themselves and their children. Indeed, from the study of marriages there is evidence that men's economic prospects are positively related to his marriage prospects: a wide range of studies have shown that unemployment or low earnings decrease the probability of getting married, and increase the possibility of divorce (Oppenheimer, Kalmijn, and Nelson Lim 1997; Sweeney 2002; Blossfeld 2005).

Why men pay women for marriage

As discussed, women are fecund for a shorter period of time than men, making them in demand across a relatively large group of men compared to their own availability. This goes at the expense of their ability to attract a mate at a later date due biologically dictated factors of attraction and is also a result of the larger potential time costs of initiating a relationship for women. Women invest more greatly in their children than men, both by nature, choice, and due to societal factors. Because of this differential investment of time and resources, the benefit of attracting additional partners is slight for women, while men can reproduce greatly without much required investment. While men reap all the reward of having children, and can have a large number of them if the opportunity to do so arises, women must factor in more of the costs associated with rearing children and can have a smaller total number of children. If marriage is a constraint on access to reproductive opportunities or a prerequisite for having children, men should have a higher willingness to pay for marriage due to their larger difference in benefit and costs associated with children. This creates grounds for competition among males for women on the income dimension. The differential fecundity involves a time constraint for women, but introduces some leverage in the negotiation of resources for women who have this fecundity, because women are the bottlenecks of reproduction (Campbell and Trivers 1973). Put simply, women must choose carefully who they initiate a relationship with, while men will try to reach as many women as they can (Symons 1981). Therefore, men generally reproduce according to their ability to attract partners, while women are much less constrained (Bateman 1948). The difference in reward for the acquisition of an additional partner creates a competition among men for the affection of women which is more intense than that among women competing for the affection of men if the sex ratios is near unity. With this in mind, it makes sense that men should pay women.

Transactions in the marriage framework

Marriage can be understood as a contract where men agree to transfer resources to the women in exchange for custodial rights, as a transfer in response to more intense competition for the favor of women. It can also be understood as an institutional framework within which children are produced. The custody rights typically fall to the mother if out of wedlock, but half the custodial rights fall to the husband if the child is conceived within a marriage, where paternity is typically more certain. Men value time with their children as well, and might be willing to transfer resources in order to attain part custody and the default assumption of paternity. If men can be thought to pay for rights to marriage and custodial rights, we should expect to see some evidence for this. Concrete evidence is given by societies where the practice of *bride price* is or was common, such as in traditional Chinese and Indian societies, and parts of Africa. In western societies, transfers from the man to the woman are not normally explicitly agreed upon, nor do they happen before the marriage, but rather throughout the marriage to both the wife and child, as transfers of wealth to a common spending pool, or as the shared consumption of goods paid for by men more than by women. While it is true that women often consume less than half of the potential goods and services purchased in a household, this within-household consumption inequality is decreasing (Lise and Seitz 2011). Men's investment in children can be seen as a transfer from men to women. When men spend money on children (a common good), they alleviate the financial situation for women compared to her financial situation out of marriage, as women would often be the default caretaker.

Differential migration: Edlund's model

A summary of the elements underpinning the mathematical model is in place before moving on to the mathematical presentation. The fact that young fertile women are scarce in the marriage market gives them leverage when negotiating in the marriage market. With a relatively large investment in children, she has the incentive to use this opportunity to extract financial resources from a marriage. Men are willing to accept this because they also value marriage, and participate in more intense competition for fecund women. If men pay women for marriage, wealthier men can afford larger transaction to women, giving women an incentive to relocate if such men are unevenly distributed.

In order to model the effects of differing skill levels and resulting wages on the migration decisions of men and women, a model with certain simplifying assumptions was constructed by Edlund, and is presented here to show how differing skills between men and women and the concentration of skilled jobs in urban areas makes possible the lower sex ratios in these areas.

The model is an elaboration on the Harris-Todaro model, which seeks to explain workers in agricultural areas migrate to the city, even though they are more likely to end up unemployed (Harris and Todaro 1970). With risk-neutral workers, higher unemployment can be expected in urban area so long as urban wages are higher than agricultural wages. With a given urban population, l_{us}, and a smaller number of urban jobs equal to the number of urban workers, l_e, the probability of finding a job in an urban area is l_e/l_{us}. If the wages in rural agricultural areas are w_r, and the wages in the urban area are w_u, migration from the rural agricultural areas to the urban areas will occur so long as $w_r < (l_e/l_{us})w_u$ or opposite if $w_r > (l_e/l_{us})w_u$ until an equilibrium is found at equality. In other words, the higher wages make up for the higher probability of unemployment.

In Edlund's model, higher expected transfers in marriage due to the presence of wealthier men make up for the higher probability of not getting married (due to a larger proportion of women) for rural unskilled women moving to the urban area. The Harris-Todaro model assumes random matching between jobs and workers, while Edlund's model assumes random matching with priority given to wealthy men in the marriage market. Harris and Todaro also assume invariant wages which are exogenously determined, while transfers from men to women in Edlund's model are determined by the location and skills of the man, with high-paying jobs only available in the urban areas. Edlund's model further assumes infinitely elastic labor demand, as opposed to an invariant number of jobs. Rather, it is the endogenous probabilities of different wage dependent transfer from men to women which varies, determined by the invariant number of high-skilled men in urban areas compared to the varying number of women. As explained later, it is the location choices of unskilled rural women which finally determines the sex ratio in rural and urban areas, and which is analogous to the Harris-Todaro model. In making this choice, rural unskilled women consider the transfers from men as an additional source of income, effectively increasing the number of women that an urban area can support, which we remember was the solution to the puzzle posited by Edlund.

Consider a population with an equal number of M men and F women. There are two types within each sex, those who are unskilled M_L and F_L,for men and women respectively, and those who are skilled, M_H and F_H. Skill is a measure of job-related competence, and indicates what productivity an employee achieves in the workforce, and which kinds of jobs a person can take. A higher fraction of men are assumed to be skilled than women, so $M_H \geq F_H$. As a consequence, there are more unskilled women than men, $F_L \geq M_L$. There are only two kinds of jobs, unskilled jobs which pay w_L, and skilled jobs which pay w_H. Skilled jobs pay more than unskilled jobs, $w_H > w_L$. Because high-skilled jobs are those with high wages, and unskilled jobs are those with low wages, the terms skilled/unskilled, high-paying/low-paying and high-wage/low-wage are used interchangeably. Those who are skilled can take both kinds of jobs, while those who are unskilled can only be employed in unskilled low-paying jobs.

The population in our model is born into two areas, Rural and Urban; denoted with superscripts R and U. Unskilled jobs are available in both locations, while skilled jobs may only be obtained in Urban. All inhabitants can choose freely where they want to locate themselves.

The initial population in Rural is m^R men and f^Rwomen, while the population in Urban is m^U men and f^Uwomen. Initial sex ratios are balanced in both locations, meaning that there's an equal number of men and women in both Urban and Rural, $m^R/f^R = m^U/f^U = 1$.

Men and women change locations if they believe they can achieve a higher expected payoff in the other location. Changing locations means entering a different job market and marriage market, these markets are local, meaning no one can live in one place, and have a partner or a job in another. Let Gj^i indicate the number of a certain sex G=(M, F) in a location i=(U, R), of a certain type j=(L, H).

In the marriage market, all women are assumed to be identical. This means that men show no preference with regards to the women's skills or jobs. Furthermore, men pay women for marriage, which is assumed to be a normal good. Normal goods are goods for which demand increases with wealth if price stays constant, meaning more wealthy men are more willing to pay for marriage than less wealthy men. Men's valuation of marriage, z, is therefore dependent on his earnings. Men with high wages thus pay more for marriage than men in unskilled jobs; $z(w_H) > z(w_H) > 0$.

Some assumptions apply to the payment of women for marriage. First, relationships are strictly monogamous, and there is no time dimension, so divorces do not happen. Secondly, men in low-paying jobs pay their valuation of marriage, z_L=$z(y_L)$, this means unskilled men or high-skilled men in unskilled jobs are indifferent with regards to marriage. Lastly, men in skilled jobs do not pay their full valuation, but they pay more than men in low-skilled jobs, $z_H \in (z(w_L), z(w_H)]$

Random matching with priority rankings in the marriage market is assumed, and the short side always marries. This means that with a surplus of women, all men get married because they are the short side, and vice versa. Priority matching means that high wage men marry before those with low wages. With more high wage men than women in a location i, high wage men marry with probability $min\ \{1, F^i/M_H^i\}$, where F^i is the number of women in that location, and M_H^i is the number of skilled men. If the number of women is greater than the number of skilled men, all skilled men marry. Unskilled men in the areas where the number of women is greater than the number of skilled men marry with probability $min\ \{1, F^i - M_H^i/M_L^i\}$, where $F^i - M_H^i$ is the number of women who didn't get married to a skilled man.

To determine the equilibrium state, we need to explore the conditional payoff expectations for each of the two locations for every type of person in the population, we have four kinds of people, unskilled and skilled men and women. In the equilibrium state, no one has anything to gain in expected payoff from migrating, given the location choices of everyone else.

Let p_j^idenote the probability that a man in location i with wage j marries, and ρ^i denote the probability that a woman in location i marries, and ρ_j^i the probability that a woman marries a man with wage j in location i.

A skilled man facing a choice between Urban and Rural will locate in Urban, as he can obtain higher wages there, and always has a nonnegative probability of obtaining marriage, so long as women are present. Unskilled men will not relocate, as unskilled jobs are available in both locations, and he is indifferent with regard to marriage versus bachelorhood. Remember that his valuation of marriage was the same as his price.

Skilled women's payoff from locating in Urban is

$$\Pi_H^U = \rho^U z_L + \rho_H^U (z_H - z_L) + w_H, \tag{1}$$

while her expected payoff from locating in Rural is

$$\Pi_H^R = \rho^R z_L + w_L. \tag{2}$$

The difference is that in Urban, she'll obtain higher wages, and have some probability of marrying a richer man who will pay more for marriage. The payoff to unskilled women from locating in Rural is the same as for skilled women (2), but her payoff from locating in urban is

$$\Pi_L^U = \rho^U z_L + \rho_H^U (z_H - z_L) + w_L. \tag{3}$$

This is the same as for the skilled women, except for the wages she can obtain.

The equilibrium variables of interest are the sex ratios in Urban and Rural, M^U/F^U and M^R/F^R. The final number of men in rural areas is $M^U = m_L^U + m_H^U + m_H^R$, since all high skilled men in Rural relocate to Urban, and neither unskilled men in Rural nor Urban have anything to gain by migrating. Skilled women also stay in Urban, or relocate from Rural to Urban. However, since $M_H \geq F_H$, this alone is not enough to establish a surplus of women in Urban. The migrants of interest are thus unskilled women. These women face identical labor markets in both locations; hence the marriage market must be what induces some of these women to move to Urban. If there were fewer women than men in urban areas, as there would be if only skilled women moved to Urban, women would marry with probability one in these areas. In addition, they would have some positive probability of marrying a high wage man. The payoffs of Urban and Rural thus cannot equalize unless there is a diminished chance of getting married in Urban.

From equation (2) and (3), we can establish that Urban is more attractive to unskilled women than Rural so long as

$$\rho^R z_L + w_L < \rho^U z_L + \rho_H^U (z_H - z_L) + w_L,$$

which can be simplified to

$$\frac{\rho^R - \rho^U}{\rho_H^U} < \frac{z_H - z_L}{z_L}. \tag{4}$$

Simply put, Urban is more attractive to unskilled women than Rural so long as the higher possible payoff from marrying a wealthier man makes up for the reduced probability of marriage in Urban for women in general.

The right hand side of equation (4) is positive due to the fact that wealthier men pay more for marriage, and the left hand side can be defined as

$$\frac{\min\{A,1\} - \min\{B,1\}}{\min\{C,1\}} \equiv \Phi(\delta) \tag{5}$$

where

$$A = \frac{m_L^R}{f_L^R - \delta}, B = \frac{m_H^R + m_H^U + m_L^U}{f_H^R + f_H^U + f_L^U + \delta} \text{ and } C = \frac{m_H^R + m_H^U}{f_H^R + f_H^U + f_L^U + \delta}.$$

$\delta \in [0, f_L^R]$ is the number of unskilled women who migrate from Rural to Urban. So long as the number of women is greater than men in Rural, A is the probability that a woman will get married in Rural, and is increasing with δ, since the number of competing women decreases with δ. B is the probability of a woman getting married in Urban, so long as there are more women than men. B is decreasing with δ, because the number of competing women per man increases. C is the probability of a woman marrying a wealthy man in Urban, so long as the number of skilled men in Urban is lower than the number of women, it too is decreasing with δ because of increased competition between women.

Let δ^* denote the equilibrium set of values of δ where the expected payoff from locating in Urban or Rural is equal for unskilled women, meaning that (4) becomes an equality. Also let δ' be the number of unskilled women who need to migrate to Urban for the sex ratios to balance. Migration to urban is attractive until equation (4) no longer holds, so

$$\delta^* = \left\{\delta : \frac{\rho^R - \rho^U}{\rho_H^U} = \frac{z_H - z_L}{z_L}\right\}$$

This establishes an equilibrium where $\delta > \delta'$ for all $\delta \in \delta^*$, meaning that the equilibrium number of unskilled women migrating from Rural to Urban is greater than that which equalizes the sex ratios, and establishes an equilibrium where the women outnumber men in urban. The reason for this is that $\Phi'(\delta) > 0$, while the right hand side of equation (4) is positive, and $\Phi(\delta') = 0$.

In simpler terms, the equilibrium established in this model predicts that a higher number of unskilled women will migrate to the cities than what is needed to balance the sex ratios because the relative probability of marriage in rural versus urban areas for unskilled women is increasing with the number of these women who migrate to urban areas. If only enough unskilled women migrated to urban areas to balance the sex ratio, migrating to urban areas would still be attractive to unskilled women because when the probabilities of marriage is equal in both areas, women prefer partners in high-paying jobs, who have a higher valuation of marriage. Thus the equilibrium value is higher than the one which establishes a one-to-one balance between women and men in urban and rural areas.

Other than the central prediction concerning the sex ratios in urban and rural areas, Edlund points out four other implications from the model. Firstly, employment in the urban area is both skilled and unskilled. Secondly, unskilled employment in the urban area is relatively more female than unskilled employment in rural area. Third, all singles in the urban area are female, while they are male in the rural area. Fourth, single women have higher earnings than single males. The last point follows from the fact that men are indifferent with regard to women's earnings when choosing a partner in this model, so some single females are skilled, while all single males are unskilled.

Some of the starting assumptions of the model might seem to be somewhat strong, and the predictions fairly simplistic. Simplifying assumption are necessary to create models which yield clear prediction, and can give a good starting position for an analysis, or a way to explain observed patterns. We should not expect the results of our analysis to yield patterns which are as clear cut as the implications from this model, that doesn't subtract from its usefulness in explaining why we see the sex ratio decrease with male earnings, as shown in tables 2 and 3 later in the text.

Labor demand is hardly perfectly elastic, but over time, employers and entrepreneurs generally find workable jobs for idle workers. Labor demand might therefor be said to be very elastic in the long run. If migration takes place over a shorter time period, and labor demand is somewhat inelastic, wage depression might predict a more muted result. On the other hand, the model does not contain any time considerations, so the approach to the equilibrium with regard to furnishing jobs for migrant workers might be something that takes place as the economy develops. Another assumption which might seem strong is that men in skilled jobs pay more for marriage than unskilled men. If the minimum price for marriage is set by unskilled men's highest valuation, skilled men should have no incentive to pay women more than a small amount above this price, especially when a surplus of women develops in urban areas. It's easy to see from a real-world perspective why men might transfer more resources to women than the "bare minimum" required to stay married, but harder to justify in the formal model. However, as long as it can be justified with basis in reality, it makes sense as an assumption for modeling purposes.

The other assumptions break with reality to some degree, but make the model simpler while still retaining some truth important to yield clear predictions. Obviously, jobs fall into more categories than two, but some jobs require specific skills, others do not. Similarly, some employees have job specific skills, while others do not. Generally, employers prefer hiring employees with relevant skills if they can. Even with the addition of different kinds of skills in the model, or introduction of a more general distribution of skills in the populace, the central prediction of the model would hold in that the available employment opportunities differ in the same ways as the workforce with regard to the level of skills attained or required.

Furthermore, rural municipalities *do* have employment opportunities for high-skilled workers. Almost any workplace which employs low-skilled workers needs some proportion of skilled workers; both private and governmental workplaces employ high-skilled workers throughout Norway. On the other hand, the relative share of jobs requiring specific educational attainments, or highly developed skills with regard to some tasks relevant to employers is higher in urban areas. If wages reflect the skill level needed to qualify for a position, more urban areas having higher average wages might reflect the fact that a higher share of high-skill jobs are located there. This connection between wages and women's migration to urban areas is the one that is utilized in the analysis as a stand-in for job-related skill, as wages ideally reflect the contribution of the employee to the employer. The population and centrality of the municipality form controls to better isolate the effect of sex-specific wages on differential migration.

The Norwegian landscape is also more nuanced than an Urban-Rural dichotomy. One might however make a case for a subdivision of Norwegian municipalities into degrees of centrality, this has been done, and is part of the analysis. Statistics Norway has subdivided Norwegian municipalities into categories dependent on the proximity to urban centers, creating categories on the rural-urban dimension which are useful for isolating the earnings effects in our analysis

Direct evidence on gender-specific migration

A large-scale natural experiment was observed in former East and West Germany after the fall of the Berlin wall in 1989, and dissolution of the Soviet Union. In the years 1989 to 2007, nearly ten percent of the population in former East Germany migrated to West Germany. The migrating population was largely composed of young women, meaning that the number of women per man in former the east decreased dramatically, down to 89 women per 100 men as a whole, and as low as 80 in rural areas. Authors studying the characteristics of different regions in East Germany, Kröhnert and Vollmer(2012), found that the regions with the most outbound female migration were those which had educational systems favorable to women, and whose job-markets favored men. With the mechanization of agricultural and industrial labor, and the resulting decrease in demand for manual labor in these sectors, women were to a larger degree than men pushed out of rural areas during the 19-hundreds, creating a stream of female migration towards rural areas (Chant 1992). In Soviet East Germany, migration was severely restricted, and when migration became possible, women left the east, particularly those women with higher educational attainments who were located in areas where prospects for future careers were bleak. Another panel-data study on female migration in Germany in this period found that westward migrating women did not experience any statistically significant increase in earnings, but spent more time on home production, such a childcare (Zaiceva 2010). Though there are complicating factors, such as migrants' and women's lowered career prospects in general (Boyd 1984), this indicates that women substituted some of their work for chores and part-time work when their income increased, keeping their earnings relatively constant.

These findings offer support for our hypothesis that migration is prompted by marriage possibilities and income prospects. It also indicates that marriage is a means of facilitating the making of and caring for children, supported by wages and transfers from men to women. On the other hand, it raises some issues with the income measure (gender and age-specific average annual earnings) used to predict the effect of income on the sex ratio. As discussed later in the text, earnings incorporate the substitution of leisure or home production for labor. Ideally we would like to have other measures of income, such as hourly wages to better capture the attractiveness of careers in different municipalities.

(II) EMPIRICAL ANALYSIS

Testing the hypothesis

Migration is commonly considered to be a response to expectations of a change in opportunities in response to *push-* or *pull*-forces, indicating some difference in the opportunities and hopes of each location. Such factor might be the possibility (or impossibility) of obtaining employment or marriage in a location, creating an incentive for migration to wherever is most ideal. Migration can also happen in response to a job offer, but searching for these might also be influenced by pre-established wage expectations, which in turn depend on available employment opportunities. If men and women behave similarly with regard to migration for employment purposes, but meet differing prospects because of their skills and the labor in demand, we would expect women to migrate to where their own expected earnings are highest, and that men should do the same.

The central pattern to be explained by Edlund's model is that urban areas have a lower sex ratio than rural areas. The reason this is the case, as explained by the model, is that rural and urban areas differ in the kinds of jobs that are available there. Urban areas induce those with high skill, both men and women, to relocate there, while rural offers only unskilled jobs. The location choices of high-skilled males towards urban areas induce low-skilled women to relocate here as well, beyond that level which balances the sex ratio, because the payoff from obtaining a high-wage husband is enough to offset the lower probability of actually getting married up to a certain point, dependent on the differences in what high and low-earning males transfer to women throughout a marriage.

In her article, Edlund utilizes the preceding prediction to analyze the sex ratio in Sweden, controlling for the same factors used in this analysis. The result she arrives at is a negative effect of male earnings on the sex ratio, vindicating the usability of her model as an explanatory framework. In the next sections, I duplicate Edlund's regression analysis on Norwegian data, arriving at similar results for at least one subdivision of the population. There are some differences in the data material, reflecting the different character of the countries. Firstly, Sweden has a far larger number of inhabitants, approximately 9.4 million in 2011.[7] The population in Norway only recently surpassed five million.[8] On the other hand, Norway is divided into a larger number of municipalities, 430 to Sweden's 289, meaning there are fewer inhabitants in each municipality. This might be a source of unexplained variation in an investigation of the sex ratio, as smaller municipalities are more likely to have large deviations in the sex ratio purely due to chance at birth. The next section of this thesis investigates whether this variability is grater or smaller than expected, before moving on to what and how the relevant explanatory variables affect the sex ratio through migration.

The following section (II) utilizes the predictions of Edlund's model on Norwegian data in order to establish whether men's earnings really induce women to migrate from one place to another. If our starting point is the hypothesis that women only take into consideration where their own earnings prospects are highest, men's earnings in the municipality should not matter to the number of women located in that municipality. If the sex ratio is a measure of the relative numbers of men and women, women's earnings should have a *negative* effect on this measure while men's earnings should have a *positive* effect. Our model however, predicts that men's average earnings have a *negative* effect on sex ratio.

[7] http://www.scb.se/Pages/TableAndChart____25891.aspx
[8] http://www.ssb.no/english/subjects/02/02/folkendrkv_en/2011k4/hittil00-en.html

In a regression of the sex ratio of the following form, male earnings would enter into the equation with a coefficient, α;

$$\frac{Number\ of\ men}{number\ of\ women} = \alpha \log(average\ male\ income) + controls + \varepsilon.$$

If the model's predictions are correct, α takes a negative value rather than a positive one. Possible relevant controls are women's earnings, the centrality or population of the municipality, whether it is an industrial municipality and so on. The reason population is included as a control variable is to test whether the hypothesized mechanism inducing women to move to the cities (men's income) is a pull-factor on its own, and not just an artifact of women moving to the cities, where men's income happens to be higher.

Data overview and exploration

The following subsection investigates data collected (*table 1*) on variables for Norwegian municipalities relevant to the study of the sex ratio and its determinants, and looks at correlations which might be interesting to our hypothesis. Data and results from other studies are discussed as well.

The unit of observation used to test the hypothesis is the municipality. All the variables were gathered for the year 2008, due to availability. Choosing the municipality as the unit of observation also allows for the easy collection of results, but introduces some complicating factors. Ideally, one would like a unit of observation across whose boundaries no marriage occurs without migration, and which forces cohabitation and work within the unit boundaries, in order to better capture income effects on migration. As a rule, marriage markets are local (Goldman, Westoff, and Hammerslough 1984), and most people meet potential mates and finally marry someone from their local community or nearby community (Lampard 1997). However, couples do form unions without necessary immediate migration captured by municipal records, and work also happens across municipal borders. Municipalities might be too small to capture the full picture in their records, or too large, concealing patterns which might be useful for analysis. In using total municipal numbers to compute sex ratio and average earnings numbers, there is still hope that the larger patterns of migration for marriage and employment purposes are captured.

Every non-dummy variable is separately generated for each of the age groups 25 to 34 and 35 to 44 years of age. The reason this age range is chosen rather than the population as a whole is that the ages 25 to 44 are those of family formation and migration, the age in which people make decisions about there to live and work. Census data on the Norwegian population

***Table 1*:** **Descriptive statistics** (Data is on Norwegian municipalities for the year 2008)

Variable	Mean	Std. dev.	Min.	Max.
Gender ratio, ages 25-34	1.06	0.14	0.66	2.60
Gender ratio, ages 35-44	1.06	0.10	0.74	2.07
Total population not aged 25-34	9708.818	26755.27	407	444276
Total population not aged 35-44	9484.368	27668.57	385	469722
Total municipal population	11165.82	32902.22	451	560484
*Share females not married (25-34)	0.60	0.10	0.28	0.90
*Share females not married (35-44)	0.32	0.09	0.10	0.61
*Avg. male earnings, ages 25-34	355.21	41.11	194.43	511.10
*Avg. male earnings, ages 35-44	425.48	57.82	266.27	679.58
*Avg. female earnings, ages 25-34	236.48	19.78	179.00	292.38
*Avg. female earnings, ages 35-44	283.06	26.99	216.59	410.74
Classifications of municipalities:				
suburb	0.31	0.46	0	1
industrial	0.18	0.36	0	1
rural	0.34	0.47	0	1
military	0.08	0.27	0	1
central	0.04	0.19	0	1

Sources: Norwegian Social Science Data Services
(*)Courtesy of Erik Ø. Sørensen, aggregated from administrative records, as part of the NFR VAM project in labor economics.

reveals that the year groups with the most within-country migration for unmarried men and women are 20 to 24 and 25 to 29, while peak migration rates for married men and women is in the age group 30 to 39.[9] The younger age groups, those aged 20 to 24, are the most frequent migrants. This is most likely because of migration for purposes of acquiring an education, or entering into the work force, which mainly happens at this age. For the purposes of this study, which investigates the sex ratio with marriage as a possible key for determining migration, data is collected on the population from 25 years because the age at first marriage in Norway was on average 28.9 years for women, and 31.6 years for men in 1999.[10] Noting the differences in age at first marriage, creating separate age categories for men and women by staggering the age categories could be justifiable in a study of the marriage market, because it allows us to better capture the sex ratio for the separate age groups most likely to form couples. For example, the sex ratio could be calculated as the number of men aged 25 to 29 divided by the number of women aged 23 to 27 (Guttentag and Secord 1983). However, significant variation around the

[9] Statistics Norway, Befolkningsstatistikk. Innenlandske flyttinger, 2011, table 10: http://ssb.no/flytting/tab-2012-05-11-10.html
[10] Statistics Norway, Samfunnsspeilet nr. 1, 2002, «Inngåtte ekteskap: "Halve Norge" har sagt ja»: http://www.ssb.no/ssp/utg/200201/05/

mean difference in age makes narrow boundaries of ages unadvisable because significant competition for mates occurs across age groups, and staggering of a few years in larger age groups might make the procedure unnecessarily complicated (Fossett and Kiecolt 1991). Subdividing the sampled population into two age groups of ten years allows us to look at which differences exist between the two while maintaining the simplicity of the basic measure, it also allows direct comparison to the results found by Edlund (2005).

As mentioned, the sex ratio is chosen as the variable of interest to easily understand what is being studied, and to allow comparison with Edlund's study. There is, however, one complicating factor with looking at the distribution of genders as a relative number of either gender. For instance, with a 70-30-split in men and women as percentages of the population, the gender ratio becomes 2.33, a 1.33 difference from the normal (50/50) split. If the split was the reverse, 30 and70 percent men and women, the gender ratio would be 0.43, only 0.57 from the normal 1.0, less than half the deviation when the sample of genders were 70-30. This means that when looking at a variable with potentially large deviations from unity, such as in the smaller municipalities, outliers will look much larger when deviation is in one of these directions, potentially giving us results which could be better understood if another measure was used. This concern is especially valid when looking at the effect of municipal size on the sex ratio. When analyzing how binomial variability might result in deviations from the predicted sex ratio, comparing smaller and larger municipalities, the number of women in an age group as a fraction of total population in that age group will be used instead of the sex ratio. This is done both because it is easier mathematically, and because it allows us to see a picture where the largest (and most likely to be the results of coincidences) upward deviations of the sex ratio are brought within the same bounds as downward deviations. Deviations in either direction thus have identical effects.

The sex ratio and municipal population

An important fact about Norwegian municipalities is the large amount of variation present across almost all included dimensions. The number of inhabitants in the municipalities varies a lot, from a low of 218 in Utsira, to well over 600.000 in Oslo at present date. While most of Norway's municipalities have less than 10.000 inhabitants, a significant share of the Norwegian population is located in the largest cities.

Due to the large amount of variation in population numbers, the number of women in each age group is then naturally highly variable as well. The minimum number of women between 25 and 34 in a single municipality is 16, while the highest number of the women of this age group in one municipality is over 58 thousand in Oslo. Logarithmic numbers of population are used throughout the analysis, allowing the study of relative effects of population differences, rather than absolute differences.

The sex ratio is conventionally calculated as the number of males per female. The data used to calculate these variables is collected from Norwegian Social Science Data Services (NSD). This is also the source of the population measures and the municipal typologies used to create the dummy variables central, rural and suburb.

A first glance at the sex ratio shows that it has an average value close to expectation of 1.06 in the collective age group 25 to 44, and that it is quite variable with a standard deviation of 0.14 and 0.11 for the younger and older age groups, respectively.

Considering the large variability in the sex ratio in the smaller municipalities, it might be useful to know if the large variation we see in the sex ratios (see *Figure 3*) in small municipalities versus the large ones is due to some effect other than their sample size. In a binomial distribution such as the sex categories of the population, we expect to see a larger variance in the sex ratio in smaller municipalities than in larger ones, as these have a smaller sample size of the general populace. With a sample of hundreds of thousands, such as in Oslo, a deviation of a few percent can be highly unlikely if assumed to be purely by chance, while a similar deviation from the general mean might be common in smaller municipalities.

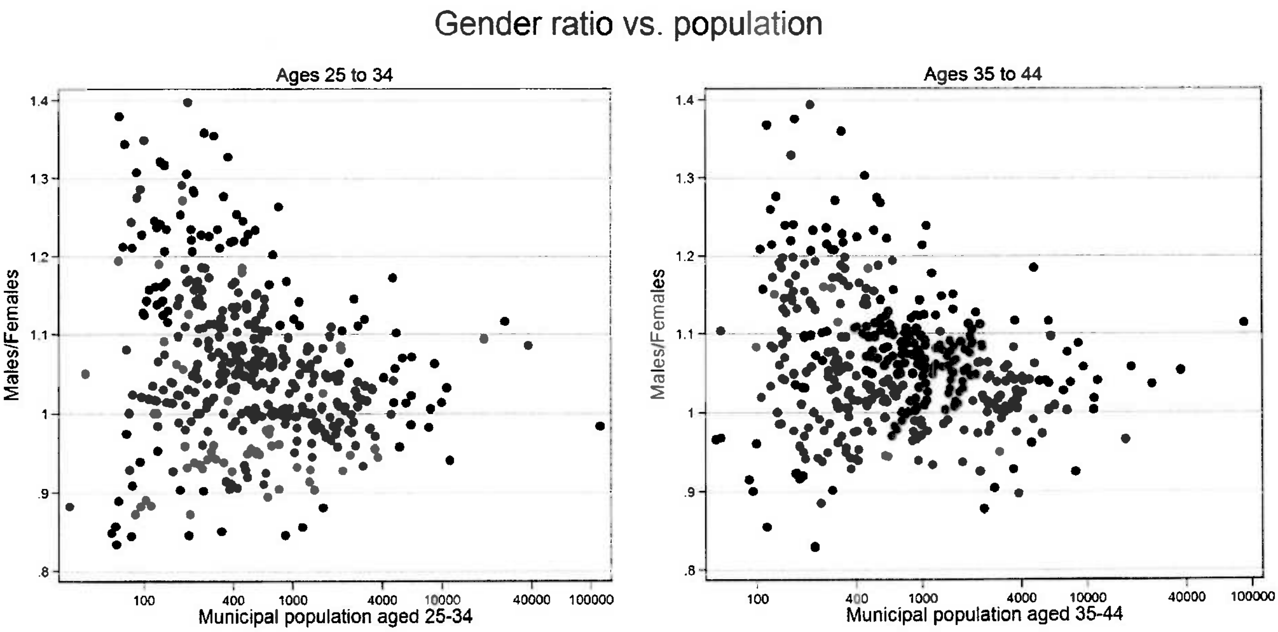

Figure 3, **Sex ratios and population numbers in Norwegian municipalities.**

In order to study whether the sex ratios vary as expected with the municipal sizes, we use the fraction the population that is female, instead of the sex ratio. This means that a sex ratio of one yields a fraction equal to one half, and a sex ratio of two means a fraction of approximately thirty-three percent. Regressing the fraction of women on the logarithmic population numbers for each age group yields a prediction of the female fraction (p) which is linear with regards to the logarithmic population numbers, and is increasing from approximately 47.5% in the smallest municipalities, and increases to a little more than half in the largest ones for the younger group, and slightly less for the elder. More precisely, the robust regression yields the relation $p = 0.454 + 0.00504 * \log(population)$ for the age group 25 to 34, and $p = 0.463 + 0.00345 * \log(population)$ for the age group 35 to 44 with a high degree of significance. This is in line with our earlier observations of the lower sex ratio (larger female fraction) in larger municipalities.

The variance of a binomial distribution is directly proportional to its sample size, the population numbers in each municipality, and is dependent on the expected fraction of each sex by the rule

$$var(number\ of\ women) = population * (1 - p) * p$$

where p is the probability of 'success', or the chance that an observation is a woman. The expected variance in the *fraction* of the population of either sex, however, is equal to the variance of the sample mean, which is inversely proportional to the square root of the sample size,

$$var(femalefraction) = var\left(\frac{number\ of\ women}{population}\right) = var(number\ of\ women)\left(\frac{1}{population^2}\right).$$

Taking the square root yields a prediction of the expected standard deviation of the fraction samples dependent on the municipality size. If the fractions are binomially determined, we should be seeing approximately 68.2 percent of the points falling within on standard deviation, the grey areas in *Figure 4,* for any interval of municipal population.

The actual deviation is the difference between the fraction of women in the municipality and the predicted fraction. Adjusting the actual deviation by subtracting the predicted standard deviation, and adjust for population-dependent expected difference (thus also the relative difference in empirical and expected deviance) by multiplying each point by square root of the municipal population, gives us a distribution of relative deviations (actual versus predicted) of the fraction which should have an expectation of zero, and be invariant with municipal size.

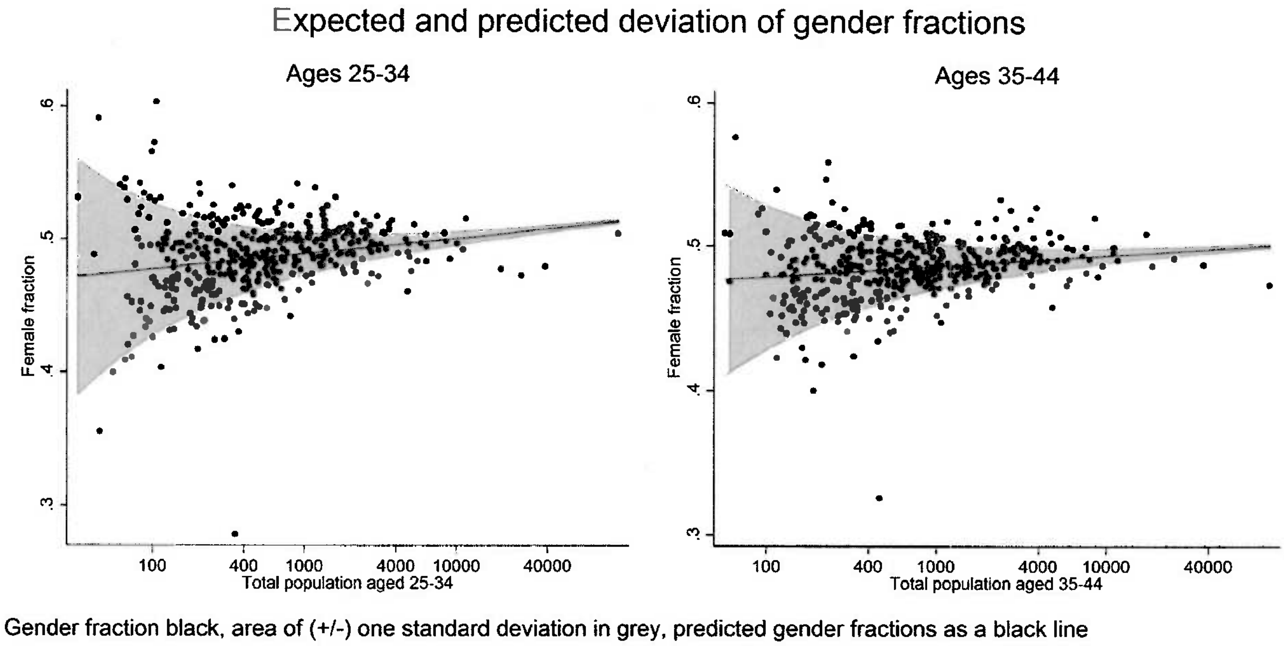

***Figure 4*, Predicted range and actual distribution of the municipal female fractions.**

Regressing this variable on logarithmic municipal population in each age group reveals that the variance in the female fraction is increasing with municipal size. On the other hand, Student t-tests on the alternative hypothesis that the mean of the adjusted deviations are different from zero offer no rejections. The reason for the increasing variability when adjusted for municipal size, it might be that small municipalities with skewed sex ratios have more of a pull-effect on the scarce sex than large ones, or an incentive for the plentiful sex to leave because of the lack of available partners. One reason this effect might be less apparent in larger municipalities could be that the absolute number of single partners is great enough to afford the possibility of finding a partner even if the sex ratio is skewed.

To control for population effects on the sex ratio, a measure of the population which excludes the age group we are studying is included in the final subsection of the empirical analysis. This allows correcting for the size of the municipality and its effect on the sex ratio while avoiding bringing the dependent variable into the control variable in any way. One of the effects we're trying to capture with the inclusion of the population measure is the possibility that men and women attach different weights to the importance of services and amenities more readily available in more populous municipalities, such as museums and cultural activities, a wider variety of goods and services, and so on. This might have an impact on the sex ratio through differential migration.

Men's and women's earnings

Arguably the most important determinant of migration is employment; I use earnings data to control for women's differing income prospects in the municipalities, so as to better isolate the effect of men's income. For a total of 6 municipalities, the population is so sparse that they are not included in the final dataset due to small sample sizes, this leaves 424 municipalities.

Women and men's earnings shows the arithmetic mean of annual earnings in number of thousands NOK in a year for the age and sex groups and can be seen in *Figure 5* as a scatterplot of female versus male earnings. When testing whether males' earnings have a significant negative effect on the sex ratio, one of the most important control variables is the earnings available to women themselves, it would be reasonable to believe that these variables are highly correlated as well.

In fact however, the data on average earnings for men and women in the younger group is hardly correlated at all (0.08), but follows each other more closely in the older age group (0.44). This might indicate that female earnings corrects more strongly for male earnings in the older age group when including both in a test of the sex ratio on male earnings and controls, looking at the results from the regressions in *Table 2* and *Table 3* reveals that this is the case, The coefficient on logarithmic male earnings is adjusted downward from -0.185 to -0.133 for the older age groups after female income is introduced, but only decreases from -0.132 to -0.126 for

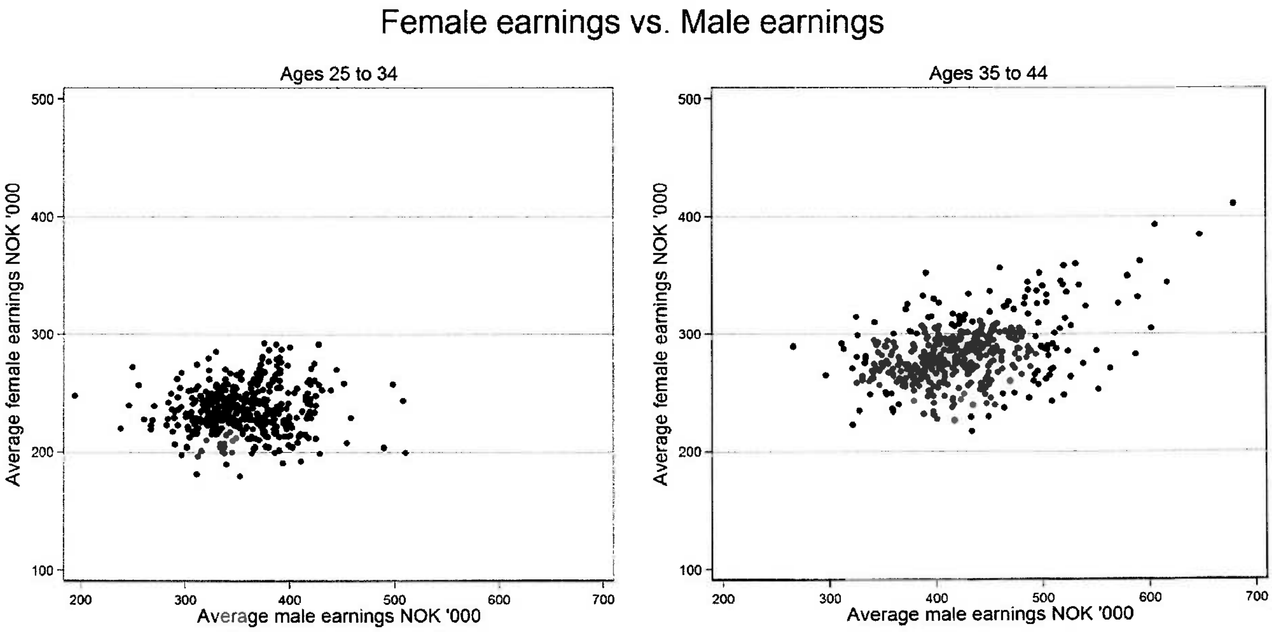

***Figure 5*, Average male and female earnings in Norwegian municipalities.**

the younger. Female earnings are clearly lower on the whole than male earnings; this is both due to varying wage levels and differences in labor force participation. This is as predicted by the model proposed by Siow (1998) where men have more of an incentive than women to work and accumulate human capital, to better compete for the favor of scarce women. Average earnings for males as a whole also increases more with age than it does for women, as can be seen from the differences in means for men and women of the two age groups in *Table 1.* Another interesting fact is the higher degree of variation in men's earnings in the older age group, indicating that the male earnings might be similar to women's in careers they have in common, but higher in some sectors with predominantly male Employees.

Ideally, one would like to have data on wage levels instead of earnings, as participants might choose to take more time off when moving to a municipality where higher wages are offered, lowering earnings by substitution. Earnings is thus an imperfect substitute for the measure of to what degree differential migration is caused by the wage prospects faced by men and women, which is an uncontroversial driver of migration. Female earnings might also decline as women chose to stay more at home if the husband's earnings are high.

Men's earnings and women's marriage decisions

If men's earnings have no effect on women's decisions regarding marriage, we would expect to see no particular relationship between the share of unmarried women and men's earnings. The Fraction never-married is the share of women who are neither married nor divorced of the populations in each age group and municipality. If we are to establish whether males' earnings have some effect on female migration, and that the hypothesized mechanism of action is transfers that take place within the marriage, we would expect a higher share of never-married females in both age groups in municipalities where male annual earnings are low. Indeed, it seems as if women are more reluctant to marry if the males' earnings are low, as can be seen by the downward movement of the fraction of females who've never married as the average income among men increases in *Figure 6.* This is even more interesting for our hypothesized effect as we further investigate the fact that the average number of eligible men per woman is higher in the municipalities where male earnings are lower. If women in low-earning municipalities have more men to choose from, why doesn't a higher share of these women get married? If the preceding theoretical exposition is to be believed, it is because they'd rather marry a man with a higher income, possibly migrating to another municipality to do so. One possible objection is that men's earnings in less populous municipalities are lower, and that we're rather seeing the effect of a lower absolute number of available men. There is also a correlation between the share

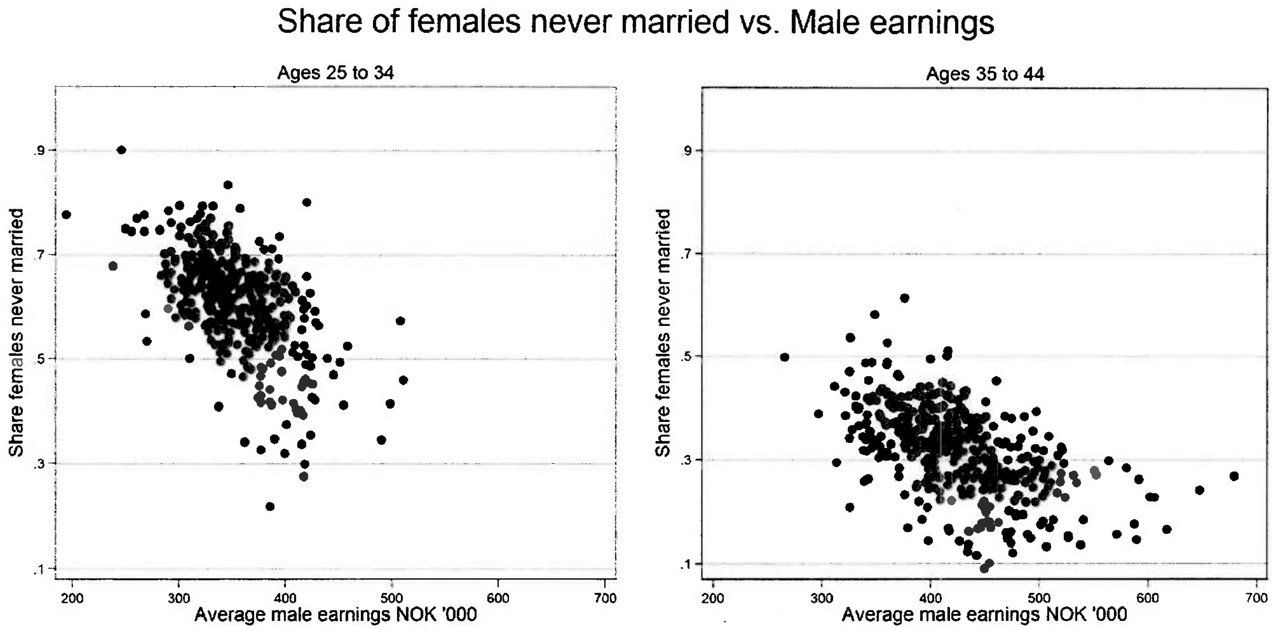

Figure 6, **Men's earnings and shares of never-married women.**

of unmarried women and the size of the municipality; this is another reason the population variable is included in the regression. We can also see from the data on the Norwegian municipalities that that the fraction of men that have never married in both age groups is relatively high compared to the women, giving support to the observations about remarriage rates for the sexes. If men are more likely to get married after a divorce than women, the number of men who go unmarried must be higher than the number of women who go unmarried.

Other control variables

The dummy variables central and suburb (*table 1*) are generated for the purposes of this thesis; the subdivisions are based on a municipal typology defined by Statistics Norway as the most central municipalities. Those counted as *central* municipalities have a value of 1 if the municipality has a population of 50.000 or more, while *suburb* has a value of 1 if it has less than 50.000 inhabitants, but is close by a central municipality. These variables are included to correct for any effects that might affect the sex ratio due to the centrality of these municipalities, other than the population effect.

The dummy variable included to correct for employment effects on sex in industrial municipalities takes a value of 1 if the municipality is defined as a municipality primarily occupied with industrial production according to the SSB Section for population statistics' classification of municipalities (1994). The workforce in the industrial sector is primarily male, outnumbering women roughly 3 to 1,[11] which might mean that municipalities with relatively large industrial workforces have a larger fraction of male inhabitants.

Comparing average numbers for industrial and nonindustrial municipalities, we find that their sex ratios when looking at the entire population between 25 and 44 are approximately 1.10 and 1.05, respectively. Interestingly, men's earnings are higher in industrial than in nonindustrial municipalities on average, while the opposite is true for women.

The rural dummy variable simply takes a value of 1 if it is classified as a least-central municipality according to the municipal typologies defined by Statistics Norway, meaning that they don't fulfill requirements for travel time to more central municipalities. A noted migration pattern is the tendency for young women in rural areas to leave to more central areas, while men stay at home. The rural dummy variable is included in an attempt to control for such effects; as they might be unique to particularly rural areas. It might also control for sex dependent employment opportunities in a similar way to the industrial dummy, as rural communities generally have a larger agricultural sector. Agricultural work has traditionally been a male dominated part of the economy.

Controlling for the presence of bases present in the municipality might isolate some effects these bases might have of the sex ratio. Military encampments are predominantly male; including a dummy variable to control for this might help isolate relationships between the variables of interest. This variable is included to allow comparison to Edlund (2005). Even though employment in such bases is predominantly male, most recruits do not change their location in the national population register to these bases for the duration of their stay. However, for the age group analyzed in this text, ages 25 to 44, the presence of enrolled reruits is less relevant.

Regression results

I proceed in the following section to analyze the municipal data in a regression of the sex ratio on male income, including various controls. Table 2 shows the coefficients resulting from 10 different ordinary least squares regressions (OLS) on the municipal data for the age groups 25-34. Table 3 presents the results form an identical procedure on the age group 35-44.

[11]Regjeringen.no; NOU 2008 6:Kjønn og lønn, 3.3.1 Horisontal segregering:

http://www.regjeringen.no/nb/dep/bld/dok/nouer/2008/nou-2008-6/4.html?id=501098

Regressions 1-5 in both regression tables omit female earnings as an independent variable, which is included in regressions 6-10. Each group of regressions introduces the dummy variables suburb, industrial, rural, military and central progressively through regressions numbered 1-5 and 6-10.

For both age groups the male earnings variable enters with the hypothesized negative sign throughout. This variable takes a coefficient value in regression (10) of -0.126 and -0.133 for the younger and older age groups, respectively, indicating that women have a tendency to migrate to areas where men's earnings are higher. This means that if young (old) men's earnings in a municipality increases by one standard deviation, 41 110 (57 820), then the sex ratio can be expected to fall by 0.0138 (0.0169). If men and women behaved the same with regard to migration and earnings, we would expect male earnings to predict a higher share of men, what we see is quite the opposite. Both male and female earnings have negative coefficients in all regression specifications, meaning women move to where average earnings is higher both for themselves and for men, even when corrected for population numbers and the nature of employment opportunities such as the industrial dummy, and possibly the central and suburb dummies.

The coefficient on the population numbers, measured as number of inhabitants minus the age groups measured in the sex ratio, is negative. This indicates that women have a preference for municipalities with higher population numbers. This might also be true for men, but the gender ratio is declining with population numbers even when controlled for income of either gender. Using total population numbers or the number of women in each municipality as population measures yields practically identical results in all regression specifications, except for the size of the coefficients. The relationship between the sex ratio and the population is the relation we briefly discussed in the previous section, declining sex ratio with population, but with much higher variance in smaller municipalities. The declining variation in the gender ratio with increasing population numbers is corrected for by reporting robust standard errors.

When female earnings are included in regressions 6-10 in tables 2 and 3 as an independent variable, some further differences between the age groups appear. The coefficient for female earnings is statistically significant for both groups, and enters with a large negative coefficient. In the final regression (10), where all the independent variables are included, the female earnings coefficient has a value of -0.234 and -0.283 for the younger and older age groups, meaning a 10% increase in average female earnings would predict a change in the sex ratio of approximately -0.02 and -0.026. The higher significance and larger value of the

Table 3: Regression analysis, dependent variable: municipality sex ratio ages 25-34 (OLS)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(male earnings; 25-34)	-0.066	-0.123	-0.126	-0.129	-0.132	-0.065	-0.117	-0.119	-0.123	-0.126
	(0.067)	(0.079)	(0.080)	(0.081)	(0.081)	(0.067)	(0.077)	(0.079)	(0.079)	(0.079)
log(female earnings; 25-34)						-0.281**	-0.234**	-0.223**	-0.230**	-0.234**
						(0.119)	(0.104)	(0.102)	(0.103)	(0.103)
log(population not aged 25-34)	-0.023***	-0.022***	-0.025***	-0.027***	-0.031***	-0.016**	-0.016**	-0.018**	-0.020**	-0.024**
	(0.006)	(0.006)	(0.008)	(0.008)	(0.009)	(0.007)	(0.007)	(0.009)	(0.009)	(0.010)
suburb	-0.032***	-0.032***	-0.040***	-0.038***	-0.033**	-0.032***	-0.032***	-0.036***	-0.034**	-0.029**
	(0.011)	(0.011)	(0.014)	(0.014)	(0.014)	(0.011)	(0.010)	(0.014)	(0.014)	(0.014)
industrial		0.079***	0.076***	0.078***	0.079***		0.072***	0.070***	0.072***	0.073***
		(0.030)	(0.029)	(0.029)	(0.029)		(0.028)	(0.027)	(0.027)	(0.027)
rural			-0.020	-0.021	-0.020			-0.011	-0.012	-0.011
			(0.021)	(0.022)	(0.021)			(0.021)	(0.021)	(0.021)
military				0.019	0.017				0.025	0.023
				(0.016)	(0.015)				(0.017)	(0.016)
central					0.047*					0.052**
					(0.026)					(0.026)
Observations	424	424	424	424	424	424	424	424	424	424
Adjusted R-squared	0.059	0.095	0.096	0.095	0.095	0.082	0.110	0.109	0.109	0.109

Note: Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%

Table 4: Regression analysis, dependent variable: municipality sex ratio ages 35-44 (OLS)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(male earnings; 35-44)	-0.139*	-0.178**	-0.180**	-0.182**	-0.185**	-0.084	-0.127*	-0.129*	-0.130*	-0.133*
	(0.075)	(0.083)	(0.084)	(0.084)	(0.084)	(0.063)	(0.072)	(0.074)	(0.074)	(0.074)
log(female earnings; 35-44)						-0.322***	-0.276***	-0.269***	-0.280***	-0.283***
						(0.118)	(0.105)	(0.102)	(0.104)	(0.105)
log(population not aged 35-44)	-0.017**	-0.014*	-0.017**	-0.019**	-0.022**	-0.006	-0.006	-0.008	-0.010	-0.014
	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
suburb	-0.029***	-0.030***	-0.038***	-0.037***	-0.031**	-0.036***	-0.036***	-0.041***	-0.039***	-0.033**
	(0.011)	(0.011)	(0.014)	(0.014)	(0.014)	(0.011)	(0.011)	(0.014)	(0.014)	(0.014)
industrial		0.080***	0.077***	0.078***	0.080***		0.071***	0.069***	0.071***	0.072***
		(0.029)	(0.028)	(0.028)	(0.028)		(0.027)	(0.026)	(0.026)	(0.026)
rural			-0.019	-0.020	-0.019			-0.013	-0.014	-0.013
			(0.021)	(0.021)	(0.021)			(0.021)	(0.021)	(0.021)
military				0.018	0.016				0.029	0.027
				(0.016)	(0.016)				(0.018)	(0.018)
central					0.049*					0.053**
					(0.025)					(0.027)
Observations	424	424	424	424	424	424	424	424	424	424
Adjusted R-squared	0.068	0.106	0.106	0.105	0.106	0.099	0.128	0.127	0.127	0.128

Note: Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%

coefficient for the older age groups might mean that female earnings are a stronger determinant of migration for older women than young. It is worth noting that the magnitude of the female earnings coefficient is approximately twice as large as the one for male earnings. We also need to keep in mind that men migrate too, and that they presumably migrate to areas where their own expected earnings is higher, any negative coefficient we see on male income should therefore be thought of as negative *despite* the fact that men also migrate to where they can achieve higher earnings.

The dummy variables correcting for centrality, suburbs and predominant industrial sectors show significant effects of the gender ratio, the coefficients on the other dummy variables are not significant, but they do modestly affect the scale and significance of the first three central variables, male earnings, female earnings and female population.

The coefficient on the independent industrial dummy is statistically significant at the 1% level in all regressions where it is included and has a positive value between 0.07 and 0.08. It looks as if the employment opportunities present do affect the sex ratio, and to a fairly large extent.

While the coefficients for industrial and military are positive, curiously, central is positive, and rural is negative, opposite what one might expect from the anecdotal evidence of women leaving the countryside to go to the cities, while men stay behind. This might indicate that the more important factors of population and earnings measures drive the migration rather than affinities for cities in themselves. Note that the central and rural dummies follow directly from population measures, and earnings are significantly higher in highly populous municipalities.

(III) DISCUSSION

Edlund (2005) found a large and statistically significant outcome on the male earnings' coefficient in her identical procedure on Swedish data. For the young group, the male income coefficient was around -0.2, for the elder it was around -0.14. The preceding regressions in this text on Norwegian data also found a negative effect on sex ratio from men's earnings. Approximately -0.12 for the younger group, and a larger and statistically significant outcome on the older group of around -0.13. In the final regression (10), the coefficients for the logarithmic male earnings variable were -0.126 and -0.133 for the younger and older age group, respectively.

The coefficients were not significant after adjusting standard errors for heteroscedasticity in the younger age group. On the whole however, it seems like the results I have arrived at are the same found by Edlund, a negative effect on the sex ratio by male income, when controlled for female earnings, municipal population etc.

The regression analysis shows us that the effect on the sex ratio of the population and female earnings measures were statistically significant in the regressions for the younger groups, the two earnings measures were significant for the elder age group. This might indicate a difference in the migration pattern between younger and older women if we are to strictly ignore results not adhering to the traditional 5% significance level. While young women move according to their own employment opportunities and towards more populated areas, older and more frequently attached women move according to the employment opportunities of both themselves and the partner, irrespective of the population of the location. This might be in line with what we expect of people in different period of their lives. We might expect young women to place greater weight on finding employment relevant and financially rewarding in a period of their lives where determining one's career path is central, and to aspire towards a life in the city. While the ages 25-44 are the prime age of family formation, the act of migration is a more frequent occurrence in this timespan. While migration might be affected by the possibility of finding a suitable partner, it's reasonable to expect migration to be caused by a change in occupation for oneself or one's partner. A change in occupation is also often accompanied by an increase in earnings, especially early in a career. Older women might be expected to have achieved some satisfaction in their career path, to have found jobs that suit their preferences, and to be more amenable to moving in as a pair with their partner. They are also more frequently attached, as we could see from the fraction women who were never married in the two age groups. In the older age groups, the share who's never been married is 0.32, with young women, it's 0.6.

Despite the lack of strictly significant results in parts of our test in a statistical sense, the pattern as a whole is toward a rejection of the null hypothesis of a positive sign on the male earnings coefficient. Remembering the correlation between the fraction of females who had never married and the male earnings strengthens our belief in the hypothesized mechanism of action, namely women moving to areas where men earn more, looking for marriage opportunities.

At least one important variable is not corrected for in this regression analysis, and that is the general price level in the individual municipalities. For instance, in high-earning and more populous municipalities, one expects prices to be higher. Migration might be significantly impeded by higher prices of such goods as housing and other necessities. One often quoted reason not to live in the cities is the high cost of living in general, and high real-estate prices in particular. By not including this variable in the regression, it is reasonable to believe that the earning variables' coefficients are lower than they would be if they were included, as prices and earnings are typically positively correlated, and price considerations might impede migration. If a clear pattern in the coefficients of an income measure is found, however, it is reasonable to believe that this at least has the right sign, since any price variable showing variation between municipalities is the result of differing wages in those municipalities, not the other way around. Though there may be some complicating factors, leaving prices out of the equation leaves us with a more muted result on the income variable, so any pattern that is actually observed should still be taken seriously. Furthermore, because variables correcting for centrality and the rural nature of municipalities are included, it is reasonable to expect that whatever price differences exist between these areas are corrected for. At least with regards to the cost of real estate, these variables should be expected to pick up some of the price effects that might influence the migration of men or women.

In discussing Edlund's model we identified a pattern, a lower sex ratio in urban areas than in rural areas. We also identified a potential mechanism to explain this phenomenon, the migration of unskilled women prompted by the higher transfers in marriage from wealthier men, who are more plentiful in urban areas. The discussion of theory in section (I) also elaborated and justified this view by explaining the ways in which women's scarcity due to differential fecundity, together with differential investment in children laid the basis for transaction from men to women in the marriage framework. The regressions found an overall negative effect of men's income on the sex ratio, indicating that women move to where men's income is higher more than men do. Does this mean that the migration single unskilled women are the main reason this pattern can be found? Perhaps women's relative abundance in urban areas are holdovers from their higher participation in higher education, which mainly takes place in urban areas where men's income is higher. The most interesting group for a study of the sex ratio (with an eye towards marriage), those aged 25- 34, showed no statistically significant coefficients on male earnings. Because this is the age group at which most marriages take place, we would expect this variable to have a highly significant coefficient if the model that was explained in section (II) should be believed. The fact that we found such a pattern in the older age group and not the younger, may point towards another explanation.

In the model developed by Edlund, all migrants were unmarried, and only took into consideration their own income and potential transfers from men. As *table 1* reveals, 60 percent of all women aged 35 to 44 were married or previously married. It is reasonable to expect that many migrate as couples. As young men and women migrate, they do so towards wherever they can achieve higher earnings. When sufficiently stable and rewarding employment is found, men and women find partners, marry, and have children. As a couple ages, they are likely to migrate again, but they now make decisions as a couple. When evaluating where to live, work, and bring up children, couples are take less heed of the size of the municipalities, but rather the combined income they can achieve wherever they migrate. As married women are more likely to be working part-time, and have lower earnings than men, men's expected income is most likely the deciding factor. The migration of couples decreases any deviation from unity of the sex ratio wherever they migrate to, and increases it in the municipality they left, if they migrate to and from the same place.

If a man and a woman move to the same location without previously living in the same municipality, the migrating spouse is the "tied mover", while the other is a "tied stayer" as coined by Robert Frank (1978). Frank attempted to explain women's relatively low wages by examining the way couples migrate and search for employment. As men are traditionally the breadwinner in a family or a couple, they are more often the tied stayer, and the employment of women is the secondary concern (Mincer 1977). This leads women to search for jobs in a suboptimal location, more often becoming overeducated compared to her position, while men are more often undereducated. This pattern has been confirmed in a study of Swedish men and women (Katz and Johansson 2007).

Because women in the age groups 35 to 44 are more frequently part of a couple, they migrate more often in response to concrete earnings differences between municipalities affecting the family while migrating as a unit, rather than as a result of a probability of obtaining higher transfers though marriage with a potential husband. If one party is a tied mover, the pattern seen with a relatively strong effect from men's earnings on the sex ratio in this group can be explained by women's decision to migrate to where the man lives, especially is that man is a high earner. Men in high-earning municipalities are also more likely to be married, whether this is because they are better able to attract women willing to marry from other locations, or because provide more desirable marriage markets for women, women will be more plentiful in such locations. If these men are tied stayers, their high earnings could explain the negative coefficient on the male earnings coefficient in the regression analysis in *table 3.*

(IV) Conclusion

Much of the variation in the sex ratio between municipalities can be explained by chance, as shown when discussing how the sex ratio varies with municipal population in section (II). Of the total variation in the sex ratio, only a little more than ten percent was predictable using men's and women's earnings, population numbers, regional identifiers and economic variables. It is reasonable to expect that including more variables detailing differences between the labor markets of municipalities would help explain some of the remaining variation in the sex ratio, but most of the differences between municipalities are likely to remain, because the variation cannot be shown to be greater nor smaller than that which is expected by pure chance. One way the data could be modified to eliminate some of the random variation would be grouping small, adjacent municipalities.

Edlund (2005), "Sex and the City", hypothesizes that the relatively high number of women in urban areas compared to rural areas is based on transactions from men to women in exchange for marriage. Wealthier men can afford larger transaction, and women are willing to migrate to the urban areas where these men are located even though their chances of getting married are diminished. Urban areas can sustain larger populations of women, because transaction in exchange for marriage is an additional source of income for these women. This thesis finds theoretical justification for Edlund's hypothesized mechanism of action, men's earnings constituting a pull-factor on women. The theoretical basis of this hypothesized relation between the sex ratio and men's earnings are women's scarcity, the importance of differential investment, and marriage as a framework for transactions between men and women. These concepts are justified both theoretically and with reference to earlier studies in section (I), with some important objections. For instance, it is harder to assert that women are less skilled than men when women take more higher education than men on average.

The hypothesized connection between marriage and earnings is strengthened further by the clear fact that for both age groups, women are less likely to be married or previously married if the average earnings among males in the municipality are low, despite the fact that more men are available per woman in these municipalities. If migration can be assumed to happen in response to opportunities in the marriage market, and the marriage opportunities are perceived as worse in municipalities with poorer men, low male earnings should induce the outward migration of women. There should exist a negative relationship between the sex ratio and male earnings if our hypothesis, as replicated from Edlund (2005), is correct

The sex ratio in Norwegian municipalities measured as the number of men per woman, in the population aged 25 to 44, is decreasing with municipal population. This confirms the pattern seen in many countries of lower sex ratios in urban areas compared to rural areas. For the age group 25 to 34, women's earnings also predicts a lower gender ratio. A similar but smaller negative effect on the sex ratio is also seen in men's earnings, though this effect is statistically speaking inconclusive. However, because both men and women migrate, the fact that the gender ratio is not increasing with male earnings might indicate that women migrate with an eye towards the financial situation of potential husbands. In the age group 35 to 44, both men's and women's earnings predict a lower sex ratio; the municipal population has no effect on the sex ratio of this group when controlled for these variables. This is evidence in support of our model, but can also be an indication that older women migrate in response to their partner's potential earnings, as older women are more frequently part of a couple.

The results arrived at in this text are less clear-cut than the ones found by Edlund (2005), but still confirm the pattern as a whole. Women are relatively more plentiful in more populous municipalities than men, women are also relatively more plentiful where earnings are higher, not just their own, but men's earnings as well. If variations in earnings indicate some real difference in job-related skills held in varying degree by men and women, the results verify that the model developed by Edlund might capture a kernel of truth to explain the differences in migration patterns among men and women. Women do to some degree take men's income into account, most certainly when deciding whether or not to get married, and also when making decisions about where to live. Because men with higher income are relatively more plentiful in populous municipalities, this provides an incentive for the urbanization of women beyond that which can be explained simply by a preference for cities or the pull of higher wages.

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