

Sex and the Single Girl: Cultural Persistence and the Pill*

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Abstract

Historical differences in out-of-wedlock childbearing predict a quarter of demand for the Pill in Sweden. The positive relationship is robust to the inclusion of extensive economic and demographic controls, marriage market characteristics, and religion measures. Alternative estimators and empirical models that account for fixed community characteristics yield similar results. A model of demand for premarital sex is developed where social sanctions and marriage customs play a prominent role. The model illustrates how these features of culture influence both unwed birth and adoption of new contraceptive technologies. The model and empirical evidence paint a consistent picture; culture matters for contraception demand.

JEL Codes: J13, N3, O33, Z10

Keywords: contraception, out-of-wedlock birth, culture

* *Sex and the Single Girl* was the title of Helen Gurley Brown's 1962 advice book translated into Swedish in 1966 and published under the title *Sexrecept för en ensam flicka* (Sex recipes for a lonely girl).

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1 Introduction

Culture does not run riot. Although the Sexual Revolution represented a seismic shift in Swedish society its impact, as measured by the adoption of liberating contraceptive technologies, was consistent with centuries old differences in pre-marital sexual behavior. Single women bore the brunt of severe social sanctions against pre-marital sex in Sweden during the 19th century and before. Oral contraception (‘the Pill’) afforded women increased sexual freedom at reduced personal cost, and quickly became the most popular modern method of contraception in Sweden, but its adoption was not uniform. Despite contraceptive innovations and the Sexual Revolution, social sanctions from the past left their imprint on contraceptive demand, accounting for a quarter of demand for the Pill across Swedish markets.¹

Unique data on demand for the Pill is used to investigate how long standing differences in social constraints influenced its adoption. This paper extends the scope of empirical studies of cultural persistence to the domain of sexual behavior and contraception. The analysis makes explicit a role for culture in technology adoption by modeling and estimating how out-of-wedlock birth behavior from a century ago influences adoption of the Pill. The paper complements studies of the role of culture in fertility decisions, such as Fernandez and Fogli (2006, 2009), who make a convincing case that culture matters for fertility choices using data on second generation immigrants.² The analysis presented here emphasizes the long run persistence of cultural influences and how culture operates through the contraception channel. In taking stock of the recent literature on culture Fernandez (2011) notes a dearth of studies on how contraceptive innovations interact with cultural forces and conjectures that technology and culture jointly influence one another. Greenwood and Guner (2010) provide a persuasive example of how adoption of new contraceptive technologies can influence culture. I provide evidence on the other half of this feedback mechanism, demonstrating how differences in culture influence the adoption of new contraceptive technologies.

¹A fixed effects regression of pill demand is used to compute the permanent component of pill demand for each market. The fixed effects from this regression are then regressed on past illegitimacy rates to determine what share of the variation in the fixed component can be explained.

²The quantitative importance of culture in fertility decisions is echoed in the findings of Guinnane, Moehling, O’Grada’s (2006) and Blau (1992) who study immigrants to the U.S. and find that home country differences in fertility have a significant effect on immigrants fertility decisions even after accounting for differences in observed characteristics.

Empirical studies of the introduction of the Pill have largely ignored culture. Goldin and Katz (2002), Bailey (2006, 2010), and other empirical studies which focus on the differential pattern of access to the Pill across the U.S. rely on strong identifying assumptions; differences in legislative and legal outcomes cannot be correlated with local cultures and institutions. Such assumptions preclude any evaluation of culture's role in contraception demand. My empirical investigation addresses this largely ignored, though quantitatively important, social aspect of contraceptive technology adoption.

The theoretical literature on the determinants of out-of-wedlock child bearing, such as the erosion of "shotgun marriage" customs discussed in Akerlof, Yellen and Katz (1996), and the role of marriage market conditions emphasized in Willis (1999), influence the model and empirical analysis. Marriage customs play a prominent role in the model developed in Section 3, but the detailed empirical analysis takes into account a variety of current and past economic and marriage market conditions emphasized in Willis (1999). The empirical analysis reveals a strong and robust positive relationship between past illegitimacy and demand for the Pill, consistent with the model predictions.³ Demand for the Pill is highly responsive to culture, as measured by past illegitimacy, having an elasticity of between 0.20 and 0.25. The quantitative importance of culture is large even relative to current economic factors and explains more variation in demand for the Pill than female labor force participation rates.

Persistent differences in social constraints are consistent with the non-marital fertility behavior observed in the data. Non-marital fertility is highly correlated over time; out-of-wedlock births per 100 births in 1910 have a correlation of 0.76 with measures from fifty years earlier, and 0.59 with measures fifty years later. Though highly correlated, out-of-wedlock birth rates are not constant, but evolve differentially across communities. Some communities have low and stable non-marital fertility over many decades, while other communities have rising non-marital fertility. The relative ranks of communities are stable over time, but they have very different trajectories for how non-marital fertility evolves. This distinctive pattern

³While it may not be surprising that historical illegitimacy matters for contraceptive demand, it is not clear *a priori* which way this relationship would go in the aggregate. Mechanisms where contraceptive technology adoption are negatively related with illegitimacy are many. Communities which provide more support to single mothers may experience more non-marital fertility and lower demand for contraception to avoid such outcomes. Contraceptive cultures which diffuse knowledge more effectively may lead to lower unwed birth rates as well as more rapid adoption of new contraceptive technologies. Such mechanisms may be at work, but on their own they cannot account for the strong positive relationship observed in the data.

of long run time variation in unwed birth rates is used to estimate a model in differences, to account for unobserved local characteristics. Places where cultures regarding sex and marriage became more liberal, represented by an increase in the rate of out-of-wedlock birth at the turn of the century, have more rapid take-up of the Pill. The model in differences uses a very different source of variation to identify the effect of culture, yet the conclusions regarding the role of culture in contraception demand are the same.

The paper proceeds with a review of historical trends, the Swedish institutional setting, and related literature. Next, a model of demand for pre-marital sex is developed and used to analyze the introduction of the Pill. The unique data on Pill use is described in Section 4. The empirical framework and main results are presented in Section 5. Section 6 concludes.

2 The Historical and Institutional Setting

2.1 Social Sanctions and Courting Customs

Social constraints on individuals' reproductive decisions were particularly strong in 19th and early 20th century Sweden. Evolutionary biologist Bobbi Low (1990) described the setting, "19th century Sweden represents an extreme of societal constraints on people's reproduction: highly monogamous, little remarriage, essentially no divorce, and a low rate of illegitimacy." Societal constraints took many forms; ethnological studies emphasize social sanction against pre-marital sex and courting customs which regulated sexual behavior among the young and meted out punishment on those who violated local customs.

A woman who engaged in sex outside of marriage was a *hora* (whore) or a *löndahora* (immoral woman). If her sexual encounter resulted in a birth, the child would be referred to as a *horunge* (whore youngster). Sanctions against unmarried women whom engaged in *lönskaläge* (affairs with unmarried men) or *enkelt hor* (with married men) were subject to punishment under the law.⁴

In addition to legal sanctions, women also faced social and financial penalties levied by the church. "Churching" required unmarried mothers to confess their transgressions in conjunction with ceremonies designed to publicly humiliate them before their children

⁴See Chapters 2 and 13 of the Giftermålsbalken and Chapter 17 of the Strafflagen.

could be baptized. Confession as penance for unlawful intercourse was abolished in 1855 but continued to be practiced into the 20th century in some parts of Sweden. These ceremonies culminated in absolution, but women who confessed illicit sexual behavior would never regain their status and sat apart from the community during church services. The church also imposed fines and work levies on women who conceived children in relationships that did not lead to marriage.

Community sanctions, both social and financial, against women who engaged in pre-marital sex were extensive. The most visible included the wearing of a red cap, called a *horluva* (whore cap), to signify her status when out in public. Folk customs attributed any number of the consequences of poor nutrition among children or livestock to whores. Rickets was commonly believed to be caused by whores, and suspected whores were banned from working near children or livestock.⁵ Instead, these women were relegated to heavy field work at reduced wages. Other women were the main monitors of sexual behavior. Married women inspected the breasts of single women, in conjunction with the tending of geese, to find out if they had given birth or were pregnant.⁶

Courting customs also operated as a check on illicit sex and a means for enforcing marriage among the young. Sweden has several distinct courting customs, as discussed by Wikman (1937), but all of these customs carried with them severe penalties for women who had children outside of legitimate marriages. Regions or social groups that were tolerant of pre-marital sex within courting rituals were strictly opposed to loose sexual relations. Families played an important role in monitoring courting behavior in the south, while in the north courting was monitored by gangs of young men who punished and excluded individuals who violated *nattfrieri* (night courtship) customs. Customs differed by region according to Frykman (1975); social sanctions were stronger in southern Sweden, while monitoring and enforcement of courting customs was stronger north of the *limes norrlandicus*.⁷

⁵Rickets were referred to as *horeskåver*.

⁶Such monitoring had been used to catch child murderers since the Middle Ages.

⁷*Limes norrlandicus* roughly marks the frontier of medieval society as well as a biological divide between different climate zones with different types of plant growth.

2.2 Fertility Control: Coitus Interruptus and Abortion

The agrarian society that typified Sweden in the 19th century relied heavily on social control as a substitute for contraception. Reduced coition through prolonged abstinence and late marriage was the main means of fertility control, but methods for preventing conception or inducing abortion played a role. Early explanations of divergent fertility patterns in Sweden made little reference to contraception.⁸ Although family planning and the spread of neo-Malthusian ideas among intellectual circles was underway in Europe during the 1870's the spread of contraceptive technologies was limited.⁹

Detailed historical analysis of contraceptive practices is scant. The lack of attention paid to contraception in 19th century historical studies may be due to widely held views of family planning as a sign of moral weakness. This view was codified in the anticontraceptive laws of 1910. From 1911 until 1938, it was illegal to provide knowledge of contraceptive techniques or publicly sell contraceptives "intended for immoral use or to prevent the results of sexual intercourse." Knut Wicksell pamphleted and lectured on contraception and was denounced as an "apostle of promiscuity" and jailed for spreading birth control propaganda.

Quantitative evidence from Gotland suggests that interrupted intercourse had been practiced among married couples since the 1700's and throughout the rest of Sweden by the end of the 19th century.¹⁰ Anecdotal and quantitative evidence also leads Frykman (1975) and Santow (1993) to conclude that knowledge about coitus interruptus was widespread by the late 19th century or earlier.¹¹ These conclusions are supported by the findings of a survey conducted by the Swedish Population Commission undertaken during the early 1930s which found that knowledge of coitus interruptus was widespread, while familiarity with condoms, diaphragms and other methods for limiting fertility were minimal.¹²

⁸Nils Wohlin (1915) emphasized marital delay and abstinence in his analysis of the extremely low marital fertility rates on Gotland.

⁹Technical contraceptive measures that preceded the Pill were a very recent phenomenon in Sweden according to Frykman (1975).

¹⁰See Carlsson (1966) and Gaunt (1973).

¹¹Frykman (1975) provides an account, of an exchange between a mother, and her son of around 20 which occurred in 1916. The mother implores her son to be careful while visiting a dance that evening saying "Olle, my dear, I tell you: don't let it drip where it sits unprotected." Her son, recently returned from military service, responds, "Oh no, Mum! I'll push all of it up their arses!" Frykman argues coitus interruptus was known to both the mother's and son's generation.

¹²Although coitus interruptus was well known by 1900, it should be noted that women may have had limited control over its use. Knowledge of the technique does not assure that it was used. The occurrence

The regulation of abortion has a long history in Sweden.¹³ The 13th century Västergötland Law forbade any form of induced abortion under threat of severe penalty. The criminal code of 1734 placed abortion on par with infanticide and made it punishable by death. In 1864 and again in 1890 the law was liberalized, and the maximum sentence for abortion was reduced to six years of penal servitude. The law was further liberalized 1921.

Although knowledge of abortifacients was rudimentary, many women attempted to use home remedies to induce abortion.¹⁴ In the last half of the 19th century provincial doctors were required to perform autopsies of suspected suicides and evidence from these autopsies shows that attempted abortion was widespread according to Hedren (1901). From 1851-55 through 1901 an increasing number of suicides were committed by unmarried pregnant women. These suicides increased quickly from 1870 onward, although they showed little systematic variation by region. The majority of women captured in the suicide statistics were in the final stages of pregnancy and their suicides occurred by poison, ninety percent of which occurred due to phosphorous.¹⁵

2.3 The Geography of Swedish Illegitimacy

Social constraints were strong but not uniform. Illegitimacy differed dramatically across Swedish communities at the turn of the century, and had since the first population statistics were collected. These differences formed the basis of a division of Sweden into the distinct demographic regions described by Sundbärg (1910) and depicted in Figure 1.¹⁶

Before 1850 illegitimacy was highest in the area west of Stockholm and in the most southern parts of Sweden. A single characteristic that defines illegitimacy patterns is difficult to discern; high rates of illegitimacy are seen north and south of the *limes norrlandicus*, along coasts and plains. Mining and industrial regions have relatively high occurrence of unwed

of out-of-wedlock birth may be seen as reflecting social norms regarding responsibility more than knowledge about the art of interrupted intercourse.

¹³The lack of geographically disaggregated abortion data precludes a study of abortion demand.

¹⁴Informal measures included phosphorous, arsenic, quicksilver, ergot, saffron and strong laxatives like aloe.

¹⁵Matches containing phosphorous were banned in 1901 due to their use in abortions, which in many cases were fatal to women.

¹⁶The figure is from Gustav Sundbärg (1910) *Emigrationsutredningen Bilaga V: Ekonomisk-statistisk beskrifning öfver Sveriges olika landsdelar*. Sundbärg (1910) also included characteristics based on the incidence of suicides, age of marriage, and rates of marital fertility in his analysis.

birth, but many areas with high levels of illegitimacy were primarily agrarian. Heckscher (1949) argued that urbanization led to the differential pattern of out-of-wedlock fertility, but the detailed maps of illegitimacy during this early period constructed by Frykman (1975) suggest that illegitimacy was independent of population concentration. Frykman (1975) shows how areas with high illegitimacy had population densities no different from central Småland, an area of low illegitimacy.

Increasing out-of-wedlock births during the 19th century have been attributed to many factors. A series of land reforms, begun in the eighteenth century, disrupted rural communities making it difficult to monitor and enforce norms related to sex and marriage among the young. Growing resource extraction industries in the middle of Sweden led to migration of single men to these areas. Women were also more mobile, moving to regions that offered employment in textile industries. A regression of out-of-wedlock births per 100 births in 1910 on indicators for areas where land reform was carried out most extensively, as well as areas where forestry was most prevalent are positive and significant.¹⁷ Historical constraints on community capacity to enforce marriage and pre-marital sex norms appear, in part, to play a role in observed non-marital fertility patterns from the early 20th century.

2.4 Literature Review and the Contemporary Setting

Gustav Sundbärg, the father of Swedish population statistics, argued that community characteristics, persistent across generations, drove the persistent differences in non-marital fertility he documented back through 1750; he coined the phrase "public mood" to refer to these characteristics.¹⁸ The model developed in the next section makes these community characteristics specific in a way that is consistent with the social sanctions and marriage customs emphasized in depictions of 19th century Sweden. Sundbärg's hypothesis and the model developed here

¹⁷A regression of out-of-wedlock birth rates in 1910 on fixed effects for communities where the *enskifte* and *lagaskifte* land reforms were carried out most "enthusiastically" and "rapidly", according to Helmfrid (1961, p. 127), and a fixed effect for the three counties where the forestry industry employed 7 percent or more of the rural population are positive, highly significant in the case of forestry employment, and significant at the 10 percent level for the land reform measure. This suggests that the forces which constrained the ability of communities to enforce norms of behavior among the young may have led to higher rates of non-marital fertility in the past.

¹⁸See Gustav Sundbärg's *Bevolkeringsstatistik Schwedens 1750-1900* as well as his volume *Emigrationsutredningen Bilaga V: Ekonomisk-statistisk beskrifning öfver Sveriges olika landsdelar*.

are in keeping with Guiso, Sapienza and Zingales' (2006) definition of culture as "those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation."

Willis (1999) emphasizes the role of men's and women's absolute and relative incomes as a driving force behind non-marital fertility trends. Social institutions do not play an explicit role in Willis (1999), but the ability of communities to force men to share in the cost of children could raise the "supply price" of unmarried children and diminish the attractiveness of non-marital fatherhood. Akerlof, Yellen and Katz (1996) argue that the introduction of the Pill contributed to the decline of "shotgun marriage" customs and in turn the rise of out-of-wedlock childbearing in the U.S. during recent decades. Greenwood and Guner (2010) analyze how the contraceptive revolution changed the cost of sex and attitudes toward pre-marital sex. Beyond the contribution of the Pill to the erosion of social norms, Goldin and Katz (2002) argue that increases in women's employment and education can be attributed to innovations such as the Pill. Chiappori and Orreffe (2008) present a theoretical analysis of how the Pill shifted the balance of power between women and men and, according to Orreffe (2007), altered allocations between spouses.

The question I examine, the data used, and the empirical strategies employed differ from previous work on culture, fertility and contraception. Norms about sex, marriage, and reproduction are difficult to elicit. Using historical measures of illegitimacy to proxy for differences in culture is similar to Fernandez and Fogli (2006, 2009), who emphasize culture as a feature of the preference environment. The focus on contraception as a specific channel through which culture influences fertility is unique to this paper.¹⁹ The institutional setting of this paper also differs from studies such as Fernandez (2007) and Blau et al (2008) which analyze the behavior of second generation immigrants using measures of behavior in the parents' home country to proxy for norms. This approach addresses the challenge of separating cultural and institutional influences by looking at immigrants residing in an institutional setting unrelated to the cultural background of their parents. The localities I

¹⁹Fernandez and Fogli (2006 and 2009), and other papers on culture transmission such as Bisin and Verdier (2000 and 2001), emphasize the joint influence of culture as transmitted by parents (direct) and the communities in which women reside (oblique). I estimate the composite effect of both forces as proxied for by observed behavior of previous generations of women in a locality.

study face the same legal, educational, medical, and retail drug market institutions.

The homogeneity of institutions in Sweden induced by the extensive regulatory environment is unprecedented. The assumption of uniform institutions is difficult to support in some settings, but in the context of Sweden this assumption is accurate in both the *de jure* and *de facto* sense. The laws regulating the sales of contraceptives do not differ by jurisdiction, and are set by national regulatory bodies. In addition, the medical and retail pharmacy sectors are operated by public entities subject to uniform administration. Pharmacies offer the same assortment of contraceptives, at the same prices, throughout the country. Private insurance is virtually non-existent during this period, so the prices set by the pharmacy monopoly reflect the cost faced by consumers.²⁰

Unique sales data from 70 markets constitute the entire universe of oral contraceptive sales in Sweden. The 1970 through 1974 period is the earliest for which data is available following the approval of the Pill for contraceptive use.²¹ This period predates changes in abortion access brought about by the Swedish Abortion Act of 1974.²² Although abortion was illegal, it had become unofficially acceptable to perform abortions in cases of clear medical, social, or humanitarian necessity, as determined by a medical board that reviewed individual petitions for abortion. The Abortion Act granted women access to abortions without the approval of a medical board or two physicians, as required during the period studied here. This period also predates the revision of the sex education curriculum in 1975.^{23,24} In addition to a common curriculum in the schools, all maternal health clinics provided information about contraceptives and supplied diaphragms to women regardless of their marital status since the 1950s. The Riksförbundet för Sexuell Upplysning (RFSU) kept a list of doctors known to provide contraceptives, but by the late 1960s they deemed this unnecessary as doctors were universally willing to provide contraceptive services to women. Swedish law also provided the right to women as young as 15 to receive help with birth control measures without parental knowledge. In 1968, of those couples using some type of preventative method at their most

²⁰This period predates the introduction of uniform subsidies on oral contraceptives.

²¹In May of 1964 the Svenska medicinalstyrelsen approved the use of oral contraceptives in Sweden.

²²Lack of disaggregated abortion data precludes an analysis of culture on abortion demand.

²³It should also be noted that advertising by pharmaceutical companies to consumers was prohibited.

²⁴Since 1970, Swedish law has not distinguished between children born in and out-of-wedlock with regard to paternal inheritance rights, and changes in the marriage code that expanded the scope for civil marriages predate the period studied.

recent intercourse, condoms and coitus interruptus were the most common methods, followed by the Pill.²⁵

Sweden's institutional setting is well suited for an analysis of culture's effect on demand for the Pill. The legal, medical, retail pharmacy and educational institutions that played a role in the supply of the Pill and contraceptive information were all subject to uniform rules during the period studied. In this unique environment, where all of the salient institutional features are constant, large differences in sales of oral contraceptives are arguably demand driven.

3 Model

The primitives in the model are different technologies for preventing out-of-wedlock child-bearing. Demographic studies have emphasized how land reforms and differences in customs affected the capacity of communities to monitor and enforce norms of behavior among the young. Differences in the capacity to prevent out-of-wedlock births and norms regarding pre-marital sex can have long lived effects on demand for new contraceptive technologies according to the model developed here.

Out-of-wedlock births per woman in community j is a function of the share of women in locality j that engage in out-of-wedlock sex, n_j , and the probability that a woman engaging in pre-marital sex in locality j would incur an out-of-wedlock birth, p_j

$$owb_j = n_j p_j.$$

The share of women that choose to engage in sex outside of marriage will be determined in equilibrium, given the probability p_j . p_j is a function of local constraints on the contracts that can be enforced between couples or the contraceptive technologies available in the community, and is taken as given. Women in community j choose whether to engage in pre-marital sex in order to maximize their utility, which reflects the utility they receive if they do not engage in sex, V , as well as the joy they receive from engaging in non-marital sex, β_i , where this taste parameter varies across women.²⁶ Women also take into account the costs of out-of-wedlock

²⁵See Lewin (2000).

²⁶For simplicity I assume β_i shares a common distribution across communities and that V is a constant.

sex. These costs include both a social sanction, γ_j , as well as the relative cost of an out-of-wedlock birth, C , that happens with probability p_j .²⁷ The utility of engaging (or not) in pre-marital sex is given by

$$U_{i,j} = \begin{cases} V & \text{abstain} \\ \beta_i - \gamma_j - p_j C & \text{pre-marital sex} \end{cases}$$

Each community will have a critical threshold, β_j^{sex} , where women with larger benefits from pre-marital sex will choose to engage in sex and women whose benefit is less than this threshold will choose to abstain. This threshold value, β_j^{sex} , is increasing in both the social sanction and the expected out-of-wedlock birth cost,

$$\beta_j^{sex} = V + \gamma_j + p_j C.$$

Assume that β_i is distributed according to the cumulative distribution function $\Phi(\cdot)$. The fraction of women engaging in pre-marital sex in each community is

$$n_j = 1 - \Phi(V + \gamma_j + p_j C).$$

The social sanction associated with engaging in out-of-wedlock sex is higher if fewer women in your community have sex outside of marriage.²⁸ If no one engages in pre-marital sex in the community this cost may be large, $\lim_{n_j \rightarrow 0} \gamma(n_j) = \infty$, but the more women whom engage in sex outside of wedlock the smaller will be the social sanction of doing the same, $\frac{\partial \gamma_j}{\partial n_j} < 0$.²⁹

Changes in the cost of non-marital sex brought about by changes in p_j have an ambiguous effect on the out-of-wedlock birth rate. The direct effect of an increase in p_j is to raise out-of-wedlock births for a given share of the population engaging in out-of-wedlock sex, while the

These assumptions could be relaxed without changing the general conclusions of the model. Persistent heterogeneity across communities in the relative utility derived from abstinence may be another way culture affects both out-of-wedlock birth rates and demand for the Pill.

²⁷The cost of an out-of-wedlock birth is both an economic and social outcome. Persistent heterogeneity in this cost across communities, just as with the relative utility derived from abstinence, may be another way culture affects both out-of-wedlock birth rates and demand for the pill. With sufficiently long data on pill demand it may be possible to distinguish between fixed differences in the value of abstaining, V , over different communities and the dynamic evolution of the social sanction term, γ_j , but this is beyond the scope of the current paper.

²⁸This is consistent with a conformity norm. If few women have pre-marital sex then there will be more women to punish deviators.

²⁹A function that satisfies these conditions is $\gamma_j = \frac{1}{n_j} - 1$. In this case the equilibrium share of the population engaging in pre-marital sex, n_j , is characterized by the following equation $n_j = 1 - \Phi(V + \frac{1}{n_j} - 1 + p_j C)$.

indirect effect works in the opposite direction, reducing the fraction of the population that engages in non-marital sex,

$$\frac{\partial owb_j}{\partial p_j} = \frac{\partial p_j n_j}{\partial p_j} = n_j + p_j \frac{\partial n_j}{\partial p_j}.$$

The total response will be positive when the elasticity of the share having sex with respect to p_j , $\varepsilon_{n,p}$, is less than unity,

$$\varepsilon_{n,p} = \frac{\partial n/n}{\partial p/p} > -1.$$

This mild condition will be maintained in the analysis and for examples calibrated such that both the social sanction and the expected cost of an out-of-wedlock birth have similar weight in the decision problem women face $\frac{\partial owb_j}{\partial p_j}$ is weakly positive.³⁰

What happens when the Pill is introduced? The inherited social sanction γ_j , a function of the existing technologies in a community, does not adjust immediately to the introduction of the Pill. In the short run the social sanction is fixed.

The probability of a costly out-of-wedlock birth is p_p when using the Pill, and this comes at cost c_p . Each woman compares abstaining to the utility she would obtain using the technology that is least costly to women in her community. She compares using the existing technology, with associated probability p_j , to the birth control Pill with the probability of out-of-wedlock birth p_p and cost c_p . Women will use the Pill if the net benefit of using the new technology exceeds the cost,

$$c_p < (p_j - p_p) C$$

and the value of using the Pill and engaging in out-of-wedlock sex exceeds the value of abstinence,

$$V < \beta_i - \gamma_j - p_p C - c_p.$$

This will lead to another critical threshold in each community, β_j^{Pill} , that will partially determine the choice to adopt the Pill if $\beta_i > \beta_j^{Pill}$, where

$$\beta_j^{Pill} = V + \gamma_j + p_p C + c_p.$$

³⁰ $\Phi(\cdot)$ is assumed to be the Normal cdf and $\gamma(\cdot)$ follows the example in the previous footnote in these computations.

Demand for the Pill will depend on two conditions:

$$n_{Pill} = \underbrace{\left[1 - \Phi(V + \gamma_j + p_p C + c_p)\right]}_{\text{Social Sanction}} \times \underbrace{1 [\text{if } c_p < (p_j - p_p) C]}_{\text{Local Customs}}.$$

The first condition describes demand for the Pill, or the share of women whom would engage in non-marital sex using the Pill as a function of the social sanction, γ_j . If social sanctions are large, few women engage in non-marital sex, and demand for the Pill will be low. The social sanction reflects past behavior, in particular the share of women who engaged in non-marital sex in past periods.³¹ The second condition captures the effect of local customs that prevent out-of-wedlock birth. If local customs are ineffective at preventing unwed births, reflected by a large p_j , women will choose to adopt the Pill as a means to prevent costly out-of-wedlock births.

Small sanctions on engaging in pre-marital sex, γ_j , tend to raise the rate of out-of-wedlock birth, all else equal, as do poor customs for preventing out-of-wedlock birth, large p_j . Past out-of-wedlock birth rates proxy for both of these forces.³² The model illustrates how social forces influence demand for contraceptives. Social sanctions and customs affect demand for the Pill just as they influenced out-of-wedlock birth rates. It is not out-of-wedlock birth rates *per se* that cause increased demand for the Pill, but differences in the social sanction incurred by engaging in non-marital sex, or the ability of local institutions to enforce promises of marriage in the case of pregnancy. The model illustrates how local customs and social sanctions from the past shape demand for modern contraceptives.

4 Data Description

To explain the striking differences in demand for oral contraception in Sweden from 1970-1974 data on current demographic and economic conditions, characteristics of the local marriage market, non-pecuniary costs of obtaining the Pill, as well as demand shocks in the form of venereal disease (VD) prevalence are constructed. In addition to extensive contemporaneous

³¹The economy does not move to a new stationary equilibrium immediately in response to the introduction of pill, but social sanctions will adjust over time to the existence of the pill.

³²Both forces are important and the possibility of multiple equilibria makes clear that customs alone do not determine illegitimacy behavior as a given custom can be consistent with different degrees of social sanction.

controls, alternative historical factors related to the role of religion and women’s education attainment are also included. Table 1 presents summary statistics for the variables used in this analysis.³³

The main explanatory variable is out-of-wedlock births per 100 births in 1910. The left panel of Figure 2 maps unwed births per 100 births in 1910. The data is compiled from the *Befolkning Statistisk Årsbok* for each year.³⁴

The dependent variable is the sale of oral contraceptives per woman aged 16-40 for 70 markets.³⁵ These data, from the quarterly *Swedish Drug Market* publication, are unique to this paper.³⁶ Average expenditures per woman was 9.6 SEK per year. This corresponds to approximately 10 days of the most popular variety of the Pill.³⁷ A year of the Pill would cost less than one percent of the average woman’s income at the time. Since different communities face the same supply curve, differences in quantities sold reflect differences in demand.³⁸ The right panel of Figure 2 maps demand for the Pill across markets. Areas of high and low demand are found in the North and South, and in both densely and sparsely populated areas. Urban areas, such as Stockholm and Malmö, are among the highest Pill demand areas, but Gothenburg, the second largest city, is not among the top ten markets.

³³The values reported in Table 1 are unweighted averages.

³⁴The data reported in the statistical yearbooks comes from population censuses performed every decade, supplemented by data from local church books. Church books contain extensive birth, death, and marriage records in addition to the minutes of the *husförhör* (home interrogations) conducted by local priests. The 1900 census resulted in a discrepancy of only 310 missing individuals in the Church records of a total population of just over 5 million. The dual collection of population statistics, and the high level of agreement between these measures during the period I investigate argues for the reliability of the birth statistics used here.

³⁵These 70 markets account for the total universe of oral contraceptive sales in Sweden.

³⁶Previous studies have relied on retrospective surveys to determine which types of contraception women had used at different points in time. These surveys are useful in eliciting information on the birth control methods women have used, but they present an incomplete picture of demand for the Pill.

³⁷Expenditures per month would correspond roughly to the cost of two movie tickets, or three bottles of wine.

³⁸Non pecuniary costs, such as access to pharmacies, may have differed across markets, but I account for this in the empirical specification.

5 Empirical Specifications and Results

5.1 Fixed Culture: A Model in Levels

Culture as a persistent characteristic is consistent with non-marital fertility patterns in Sweden. The correlation between non-marital fertility across counties from 1860 to 1910 is 0.76, and it is nearly as large for the subsequent fifty year period. An empirical model in levels evaluates whether out-of-wedlock births, a proxy for differences in sanctions and customs, can explain demand for the Pill across markets.

All of the models considered share a common linear specification. $Pill_{jt}$ represents demand for the Pill per fecund female in locality j at time t . X_{jt} contains contemporaneous factors that vary over locality and time. OWB_j captures past out-of-wedlock birth behavior in locality j , an outcome that reflects differences in cultures that have persisted over time. The estimated model is

$$Pill_{jt} = X_{jt}\beta + OWB_j\alpha + \eta_t + \varepsilon_{jt}.$$

The full set of time fixed effects are captured by η_t , and ε_{jt} represents unobservables in community j at time t .³⁹ The model relates demand for the Pill from 1970 through 1974 to historical out-of-wedlock birth rates.

Out-of-wedlock births are measured at the market level. Most results are clustered by county to allow for arbitrary correlation at the market level, within county, in the unobservables.⁴⁰ Clustering at the more disaggregated market level, is appropriate and produces somewhat smaller standard errors. A battery of robustness tests are presented in Section 5.2.1 to evaluate the sensitivity of the baseline results.

³⁹We consider specifications with time fixed effects to capture aggregate trends in demand for the pill, but omitting these fixed effects has little impact on the estimated coefficient on culture. Similarly, estimating the model for each year instead of by pooled OLS yields similar estimates with regard to the influences of out-of-wedlock births.

⁴⁰There are 70 markets and 24 counties in Sweden. While some markets and counties correspond one to one, the island of Gotland is one example of this, there are roughly three markets per county, and a maximum of four markets in any one county.

5.2 Levels of Out-of-Wedlock Birth and Pill Demand Results

Historical out-of-wedlock birth rates are positively correlated with demand for the Pill, as seen in Table 2, and this relationship is robust to whether contemporaneous economic, demographic, epidemiological and supply side controls are included as well as the period in which past out-of-wedlock births are measured. The first specification in Table 2 includes out-of-wedlock births per 100 births from 1860 and year fixed effects. The coefficient on the out-of-wedlock birth rate is 0.20 and highly significant. Including the full set of contemporaneous controls which include employment and income controls for both men and women, age characteristics by marital status, the sex ratio for unmarrieds aged 16-40, the number of pharmacies normalized by the geographic area to control for differences in the non-pecuniary costs of obtaining the Pill, and demand shocks such as the prevalence of venereal disease in a community results in a slightly larger and more highly significant coefficient.^{41,42} Columns 3 and 4 presents estimates from models with and without contemporary controls when out-of-wedlock birth rates are measured in 1900. Coefficient estimates are similar in magnitude and significance to the estimates obtained using unwed births measures from 1860. The final two specifications in Table 2 report results for the same two specifications using out-of-wedlock birth rates from 1910. Coefficient estimates are positive and significant at the one percent level and somewhat smaller in magnitude. Although persistent differences in cultures regarding sex, marriage, and contraception are not variable price or income measure, it is still informative to compute the elasticity of Pill demand to out-of-wedlock birth. The elasticity in the final specification is 0.23, in the middle of the range of similar elasticity estimates using data from other periods.⁴³

⁴¹The fraction of the population that has VD per 1000 of the population aged 15-40 lagged one year captures the prevalence of VD in the locality. VD includes congenital or acquired syphilis, gonorrhea, or cancrroid.

⁴²In alternative specifications, not reported here, I control for other moments of the income distribution including median income measures and ratios of the 70th to the 30th percentiles of the income distribution for the whole population, the ratio of male to female income, and other source incomes, but the coefficient on unwed births is unchanged. Alternative specifications that take into account migration, using the share of the population that is foreign born, as well as differences local schooling systems, such as the share of high school students enrolled in programs that qualify them to attend university have similar results with respect to the importance of out-of-wedlock birth rates. Similarly accounting for additional characteristics of married women in the locality, such as the share with two or more children, does not affect the coefficient on unwed births.

⁴³The coefficient estimate in specification 2, using unwed birth measures from 1860, corresponds with an elasticity estimate of 0.20, and the coefficient from specification 4 implies an elasticity of 0.25, using

The results reported in Table 2 are consistent with persistent social constraints affecting contraception decisions. The point estimate in the last specification suggest that a one standard deviation increase in the rate of out-of-wedlock birth would result in an increase of 0.42 standard deviation in demand for the Pill. Regardless of whether minimal or extensive covariates are included, or the time period considered, be it 1860, 1900, or 1910, historical illegitimacy has a strong positive correlation with demand for the Pill when introduced in Sweden.

5.2.1 Robustness Checks

The results presented in Table 2 are robust to alternative assumptions regarding the behavior of residuals, the estimator used, and the measure of unwed birth. Sensitivity analyses using the same model as in column 6 of Table 2, the baseline specification, and alternative measures of out-of-wedlock birth are reported in Table 3 and discussed below. Estimates reported in Table 2 are unweighted, but weighting by the fecund female population in the 1970s results in similar estimates, slightly smaller in magnitude, consistent with social sanctions and marriage customs having a stronger effect in less populous areas.

Alternative Measures of Out-of-Wedlock Birth Rates All specifications in Table 2 measured out-of-wedlock births per 100 births, but alternative per woman measures yield similar results. The coefficient reported in the first column of the top panel of Table 3 corresponds with the baseline specification, while column 3 is identical to the baseline, but the measure of unwed birth is computed per 1000 women instead of per 100 births. The coefficient is positive and significant regardless of which measure is used, and the elasticity is similar to the per birth measure.

The model posited that unwed births had a social component, but illegitimacy may also be driven by economic factors or local marriage market conditions. A two-step estimation procedure is used to address this. I regress out-of-wedlock birth rates on the sex ratio, women’s wage rate in levels as well as relative to men’s wages, and the urbanization rate, all measured in 1910. These are the factors emphasized in Hecksher (1949) and Willis (1999).

illegitimacy measures from 1900.

The residual from this regression is used to measure the cultural component of unwed births. The approach partials out the components of out-of-wedlock births driven by factors one may argue are unrelated to culture. Results from the second stage regression are reported in columns 2 and 4 of Table 3 for unwed births per 100 births and per 1000 females.⁴⁴ The point estimate for the per birth measure are similar to the results reported in Table 2. Although differences in economic and marriage market conditions influenced illegitimacy rates in 1910, these factors do not drive the strong relationship between illegitimacy at the turn of the century and subsequent demand for the Pill.

The Between Estimator The same four specifications are estimated using the between estimator in the bottom panel of Table 3, in effect regressing averages by market. The coefficients on out-of-wedlock birth rates are unchanged and remain highly significant when using the between estimator for all four specifications. The coefficient estimates on the per birth measures in column 1 and 2 range from 0.16 to 0.18 using the between estimator or pooled OLS. Coefficient estimates on unwed birth per woman range from 0.33 to 0.35. The relationship between past illegitimacy and demand for the Pill is robust to alternative estimators.

Measurement Error According to Myrdal (1968) high non-marital fertility rates in Sweden were due to more accurate birth statistics.⁴⁵ Yet birth statistics may overstate illegitimacy if many illegitimate births are the product of stable partnerships that ultimately lead to marriage. The tradition of long engagements in Sweden, with betrothals announced years in advance of marriage, may have led to births being classified as illegitimate which, from the perspective of the model, may have been quite different.⁴⁶ Until 1900 the number of

⁴⁴Results from the first stage suggest that urbanization has a positive and highly significant effect on out-of-wedlock births, regardless of how they are measured, while the sex ratio is a significant determinant of out-of-wedlock birth per women.

⁴⁵Only if illegitimate births included children born from extramarital relations could the statistics understate illegitimacy according to Myrdal (1968).

⁴⁶An alternative definition of illegitimate births including all children conceived outside of wedlock is not well aligned with the model, nor can it be calculated for the broad group of communities considered here. According to Linner (1967) 35 percent of all brides in Sweden are pregnant on their wedding day, which is similar to Myrdal (1968) who estimated that 34 percent of marriages in 1916 resulted in births in less than eight months, and that from 1931-35 25 percent of all children born to women under the age of 30 took place within eight months after the marriage.

illegitimate births that occurred to engaged women were reported in the birth statistics.⁴⁷ Estimating the baseline model using a measure of the illegitimate births per 100 births in 1900 which excludes births to engaged women yields a slightly larger and still highly significant coefficient estimate of 0.26 (0.06). Accounting for measurement error related to the timing of marriage for engaged couples does not alter the strong positive relationship between past illegitimacy and demand for the Pill.

The discrepancy between church book and the census records was largest in Stockholm. Omitting Stockholm from the estimation of the baseline model results in a slightly smaller though still highly significant coefficient on out-of-wedlock birth of 0.16 (0.04). Stockholm does not drive the positive relationship found in the data.

Placebo Tests One may be concerned that it is not marriage customs, nor norms about pre-marital sex that drive differences in demand for the Pill, but persistent differences in the use of medicine, contraceptive or otherwise. Such differences may have led to less use of contraceptives at the turn of the century, higher rates of out-of-wedlock birth, and lower subsequent demand for the Pill. A series of placebo tests are run to address this, replacing demand for the Pill in the baseline specification with measures of demand per adult for a variety of drugs such as antibiotics, nonprescription analgesics, cough medicine, and multivitamins. Regardless of how unwed births are measured, coefficient estimates are not significantly different from zero, and demand for these medicines shows no consistent relationship with non-marital fertility in 1910. For the case of vitamins demand is positively related to non-marital fertility, while for antibiotics, aspirin, and cough medicine demand is negatively correlated with past unwed birth rates.⁴⁸ These results are not consistent with a general disapproval of medicine driving the result.

⁴⁷In 1900, 9 percent of illegitimate births were to women engaged to be married. In rural areas these births accounted for 10 percent of illegitimate births, 7 percent in cities and villages. In Stockholm births to engaged women accounted for only 4 percent of illegitimate births compared to 6.6 percent in Gothenburg and 12 percent in Malmö.

⁴⁸With regard to vitamin demand per adult, the mean demand is 3.7 SEK and the coefficient estimate on unwed births is 0.01 with a standard error of 0.05. Demand per adult for antibiotics is 15 SEK on average and the coefficient on unwed births is -0.12 with a standard error of 0.13. Analgesics such as aspirin which do not require a prescription face a demand of 2 SEK per adult on average across the 70 markets, and the coefficient of unwed births in the demand equation is -0.01, with a standard error of 0.02.

5.2.2 Alternative Historical Factors

Illegitimacy remains an important determinant of demand for the Pill even after controlling for historical religious environment, education attainment, and development. Presence of Pentecostals and the share of the community opposed to prohibition significantly influence future demand for the Pill. Yet, accounting for these factors does not affect the quantitative importance of past illegitimacy, as seen in Table 4.

Wages, Sex Ratios and Urbanization in 1910 Differences in out-of-wedlock birth rates may reflect differences in women’s economic opportunities, as argued by Willis (1999) and Heckscher (1949). These differences may have a persistent component that could influence demand for the Pill. Including the urban to rural population ratio, the ratio of women to men, and women’s wages in levels and relative to men, all from 1910, addresses this concern. The first column of Table 4 reports these results. While female wages have a negative and significant relationship with subsequent demand for the Pill the coefficient on out-of-wedlock birth is not significantly different from the baseline estimate. This exercise differs from the two-step approach in Table 3 since historical measures are not restricted to work through past illegitimacy.

Out-of-Wedlock Births in 1961 One may argue out-of-wedlock birth is caused by an omitted economic variable that is highly persistent and this variable, not culture, drives demand for the Pill. If this were the case, including recent measures of non-marital fertility correlated with this economic factor could address whether this omitted economic factor can also explain pill demand. Out-of-wedlock birth rates from 1961 are included in column 2 to proxy for this omitted economic condition.⁴⁹ The coefficient on out-of-wedlock births from 1910 is unchanged, and recent unwed births are not significant.⁵⁰

Unwed births in 1910 are highly correlated with unwed births in 1961; they have a correlation coefficient of 0.59. Yet, the variation that is important in explaining Pill demand is

⁴⁹Care is taken to select a period that strictly predates the legalization of the pill, but results are similar when using later data.

⁵⁰This exercise is meant to illustrate how historical unwed births remain a significant predictor of pill demand even after controlling for recent measures, not to test whether the coefficient estimates on current unwed birth rates differ from historical measures, which cannot be rejected in this specification.

specific to 1910. As discussed in the historical literature, out-of-wedlock births at the turn of the century carried a strong social penalty. As attitudes toward cohabitation became more liberal, out-of-wedlock birth became more common, and no longer reflected community norms regarding single motherhood as they once had. The changing social context of marriage must be considered as one reason for the insignificance of recent non-marital fertility behavior on Pill demand.⁵¹ The common occurrence of cohabitating households with children and the social acceptance of cohabitation as an alternative to marriage make recent measures of non-marital fertility less reflective of norms regarding promiscuity.

Using variation in out-of-wedlock births specific to the turn of the century is important to examining the hypothesis. The results reported in column 2 affirm the argument that norms from the past matter. The identification of the coefficient on past non-marital fertility comes from variation that is specific to the early twentieth century.

Women's Education Norms regarding education may influence women's demand for the Pill. The share of women with a high school degree in 1930 is used as a proxy for local norms about female human capital investment.⁵² Column 3 evaluates how women's past education attainment affects Pill demand. High school attainment in 1930 reflects the education environment faced by the mothers of the fecund females studied. The women whose high school attainment is measured are no longer fecund and do not affect demand for the Pill directly, but the culture that shaped their education decisions may continue to influence future generations of women. The coefficient on high school attainment is positive, but not significant. Although education norms may be an important factor in women's demand for the Pill, accounting for such factors does not change conclusions about the importance of past out-of-wedlock birth rates.⁵³

⁵¹Cohabitation was uncommon at the turn of the century, and generally regarded as inferior as reflected by the derogatory reference to such arrangements as "Polish marriages." I thank Torben Traenas for this insight. Such arrangements were also referred to as "Stockholm marriages."

⁵²I also account for local differences in women's literacy in these same communities. The literacy (småskolan) education corresponds to less than an elementary education.

⁵³Alternative specifications that include measures of women's literacy rates have similar results where the coefficient on literacy is positive but not significant, and the coefficient on unwed births is unchanged.

Religion The vast majority of Swedes are members of the Church of Sweden (Svenska Kyrkan), but several other Protestant denominations have been prevalent in certain communities.⁵⁴ Including the share of population that was a member of a Pentecostal Church in 1930 quantifies how religious composition affects demand for the Pill. The coefficient estimate on the Pentecostal share is negative and significant at the tenth of a percent level suggesting that the more prevalent Pentecostals the lower is demand for the Pill, though the coefficient on the out-of-wedlock birth rate is little changed.⁵⁵

The important role of religious institutions is consistent with the hypothesis that culture matters for shaping contraceptive demand. Guiso, Sapienza and Zingales (2006) and others have emphasized the role of religion in transmitting cultural norms, and the results are consistent with religious institutions playing an important role in regulating demand for contraception. Cursory analysis does not suggest that there are strong complementarities between the prevalence of certain religious denominations and the community norms captured by historical unwed birth rates. Including an interaction term for the prevalence of Pentecostals and the unwed birth rate does not alter the results, and the interaction term is not significant.⁵⁶

Prohibition In order to capture differences in religious culture when over 95 percent of the population was part of the Church of Sweden an alternative proxy is constructed based on the results of the 1922 referendum to ban alcohol sales. The temperance movement in Sweden was closely aligned with the Church, so less support for the ban corresponds with less religious communities.⁵⁷ Individuals may have had little choice with regard to their membership in the

⁵⁴In 1930 the largest religious minority in Sweden was the Swedish Mission Church, which claimed 2.4 percent of the population as members. The next largest religious minorities were the Baptists and Pentecostals with 1.3 and 0.7 percent of the population respectively. It should be noted that some members of dissenting religions were also members of the Church of Sweden.

⁵⁵Pentecostals were the only group among the three largest dissenting denominations that had a significant marginal effect, though all three had little impact on the unwed birth coefficient. Alternative specifications that take into account the share of the local population that are members of significantly smaller denominations, such as the Catholic Church, do not change our conclusions regarding the importance of local norms as proxied for by out-of-wedlock birth behavior in 1910.

⁵⁶The interaction term is constructed by demeaning both membership in the Pentecostal Church and the share of births outside of marriage, ordering both variables so that larger values indicate more liberal attitudes toward premarital sex, and computing the product.

⁵⁷Many civic organizations and unions also supported prohibition. In this regard prohibition does not only proxy for religion but civic ties more generally.

Church of Sweden, but the share of the population that supported the alcohol ban provides a measure of those sharing similar views to those espoused by the Church.

Opposition to prohibition has a significant positive effect on Pill demand, as seen in the fifth column of Table 4. This is consistent with more religious communities, which supported prohibition, having more conservative attitudes regarding sex. These attitudes are persistent, and in turn reduce demand for contraception. The out-of-wedlock birth rate coefficient remains highly significant and similar to the baseline estimate. This complements and validates the main results, highlighting the role of religion in transmitting culture.

The last column of Table 4 evaluates to what extent the share of the community aligned with the Church, and the norms it espoused, are complements to community customs that enforce marriage among the young and reduce the occurrence of out-of-wedlock fertility. An interaction term, increasing in both the proportion of births outside of wedlock in 1910 as well as the share of the population that opposed prohibition, is added in the last column. The coefficient on unwed birth in 1910 increases slightly in both magnitude and significance, as does the coefficient on prohibition opposition, relative to the results reported in column 5. The coefficient on the interaction term is positive and significant, suggesting that religion is complementary to community customs in influencing demand for contraception. This means that communities with high/low unwed birth rates and weak/strong presence of the Church also had disproportionally greater/lesser demand for the Pill.

5.2.3 Heterogeneous Effects

Is the effect of culture uniform across communities? Table 5 traces out the differential impact of culture on contraceptive decisions across communities with different characteristics by interacting out-of-wedlock birth rates with community indicators. The first column reports coefficients on non-marital fertility in 1910 for communities with high and low levels of unwed birth in 1910. Both coefficients are large, positive, and highly significant. The effect of culture is not significantly different across these two types of communities, and it is not only low or high illegitimacy communities that drive the result. The second specification quantifies Frykman's (1975) hypothesis that marriage customs were more important north of the *limes norrlandicus*, while stigma was more prevalent to the south. While the forces for

regulating out-of-wedlock fertility may differ their influence on demand for the pill is similar. The third specification considers communities with above and below average levels of in migration in 1910. While the impact on Pill demand is positive and significant in both types of communities, the marginal effect is significantly larger in communities where outsiders are a smaller fraction of the population. The next two columns look at two types of migration discussed in the demographic literature, namely areas where forestry was a sizable share of the work force and migration to cities, but find no evidence of significant differences. The final specification considers communities with relatively stronger/weaker religious or civic institutions, as measured by prohibition support. Communities where a majority of voters supported prohibition, indicating a stronger presence of the Church or civic groups, have a significantly stronger relationship between past non-marital fertility and demand for the Pill.

5.3 Evolving Culture: A Model in Differences

Relaxing the assumption that culture is constant, an empirical model is developed that links long run changes in the non-marital fertility rate to growth in demand for the Pill. Slowly evolving culture is consistent with Guiso, Sapienza and Zingales (2006). Studies of the transmission of trust and other cultural traits, as in Algan and Cahuc (2010), have emphasized how these traits change over decades.

Levels and changes in unwed birth behavior at the turn of the century are closely related. The rise in illegitimacy during the first decades of the last century was not uniform. Communities with low illegitimacy rates in 1900 also have low rates of illegitimacy in later years. A regression of the change in the out-of-wedlock birth rate from 1900-1910 on the illegitimacy rate in 1900 yields a positive and significant coefficient; a community with a 10 point higher rate of unwed birth would experience an increase in the illegitimacy rate of roughly one point more over the decade.⁵⁸ This fanning out of unwed birth rates over time can be seen in Figure 3, which presents county level data from 1860-1910. Illegitimacy evolved in a nonlinear fashion, increasing rapidly in communities with high illegitimacy, and remaining constant where illegitimacy was initially low.

Differential patterns of illegitimacy growth motivate the estimation of a model in differ-

⁵⁸Results are similar when comparing changes from 1900 to 1940.

ences. Do communities that became more liberal with regard to their tolerance of pre-marital sex at the turn of the century continue on this trajectory, and in turn do women in these communities find it more advantageous to adopt the Pill? Estimating a model in differences identifies the effect of culture from changes in unwed birth rates. This approach addresses concerns that omitted fixed characteristics, unrelated to culture, may drive past out-of-wedlock birth and subsequent demand for the Pill. Using variation across time within communities uses a very different source of variation than the model in levels. Even after differencing out the fixed component of unwed birth behavior, which may be driven in large part by culture, changes in unwed birth rates are still significant determinants of growth in demand for the Pill.

Consider an extended version of the model in levels that includes a market level fixed characteristic, μ_j ,

$$Pill_{jt} = X_{jt}\beta + OWB_{jk}\alpha + \eta_t + \mu_j + \varepsilon_{jt}.$$

These fixed characteristics could include constant differences in the public mood, as discussed by Sundbärg (1910), or other characteristics that may be fixed over time and possibly correlated with initial levels of non-marital fertility. I could explicitly control for the regional differences discussed by Sundbärg by including fixed effects for the three regions he outlined. Doing so results in larger and more highly significant coefficient estimates on non-marital fertility.⁵⁹ Identifying α from within region variation in unwed birth rates and Pill demand suggests local variation in culture within demographic regions is important.

A more flexible approach differences out the fixed effect for each market and estimates a model in differences. The model estimated is

$$\Delta Pill_{jt} = \Delta X_{jt}\beta + \Delta OWB_{jk}\alpha + \Delta \eta_t + \Delta \varepsilon_{jt},$$

where Δ is the time difference operator. The effect of culture is identified off of changes in the unwed birth rate, in this case changes in OWB_{jk} over periods k from 1860 to 1910 or 1900 to 1910, unaffected by the fixed characteristic μ_j . Changes in Pill use are equivalent to terminal period levels since the initial period is zero both 10 and 50 years earlier.⁶⁰ Using

⁵⁹In the baseline specification, including fixed effects that correspond to Sundbärg's three demographic regions results in an estimated α of 0.20 (0.08).

⁶⁰The results reported in Table 5 exclude the 1964-1974 difference since Pill sales from the last half of 1964 are not observed, although including it does not change the result.

longer horizon differences to identify how changes in culture affect the take-up of the Pill uses a very different source of variation than the model in levels. The long horizons over which differences are calculated is critical, as year to year differences would be dominated by measurement error or short run variations unrelated to the slow moving evolution of culture represented in Figure 3.

5.4 Changes in Out-of-Wedlock Birth and Pill Demand Results

Models in differences yield estimates that are similar to those obtained from the model in levels; changes in out-of-wedlock birth are positive and significant, regardless of whether the between or pooled OLS estimator is used, as seen in Table 6. Controlling for other historical trends, such as changes in total birth rates, local marriage market conditions, and urbanization from 1900 to 1910 improves model fit but does not alter the positive and significant coefficient estimate on changes in non-marital fertility. Results are positive and significant for both fifty year and ten year difference. This supports the conclusion that omitted fixed characteristics cannot explain the positive relationship between past illegitimacy and demand for the Pill. The strong positive effect of non-marital fertility on Pill demand is robust to whether the empirical model is estimated in levels or differences.⁶¹

Differencing controls for the fixed component of culture. Yet, increases in unwed birth rates, indicating a liberalization of sanctions and customs during the 19th century has a positive and significant effect on Pill demand. Differential growth in out-of-wedlock birth rates explains six percent of the variation in Pill take-up. Taken together with the results in levels, this makes a persuasive case that social constraints matter for contraceptive decisions.

6 Conclusion

There are few more compelling examples of technology as liberator than the Pill, yet the adoption of this new contraceptive technology was a social phenomenon that cannot be seen

⁶¹An alternative approach to accounting for unobserved community characteristics is instrumental variables. In a previous, longer version of this paper I used butter prices to instrument for out-of-wedlock birth rates. The approach yielded the same positive and significant relationship between out-of-wedlock birth and Pill use.

divorced from culture. The promise of the Pill, a technological innovation which allowed women to assert control over their fertility and their sex lives, stood at odds with centuries of custom and severe social sanction against promiscuity and out-of-wedlock childbearing levied against single women. In the absence of contraceptive technologies to effectively control fertility, facets of culture such as stigma and custom became a more or less effective check on women's fertility, achieved at the price of curtailed sexual freedom and severe punishments against women who deviated from social norms and customs. Women who bore children outside of marriage were social pariahs in the largely rural society of 19th century Sweden, a consequence of harsh punishments against promiscuity. While society had changed dramatically by the time the Pill was introduced, there remained a strong influence between the local customs that regulated women's sexuality in the past and the adoption of the Pill. The model presented here shows how the social forces that regulated out-of-wedlock childbearing in the past also drive demand for new contraceptive technologies. The predictions of the model are born out in the data; communities with higher out-of-wedlock birth in the past have greater demand for the Pill when it is introduced.

Legislating equal rights may bring equality in some domains, such as the ballot box as studied in Doepke and Tertilt (2009), but absent the remedies necessary to make rights operational, technological innovations such as the Pill being a prime example, equality in fact may be elusive. In many domains technology is more important than the law as a force for equality. This paper contributes to our understanding of how such technologies are adopted and makes clear the important role played by culture. While theory has emphasized the important interaction of culture and technology with regard to contraception, this paper is the first to address it empirically and demonstrate the quantitative importance of culture; culture, as measured by past out-of-wedlock birth rates, explain a quarter of the market level variation in Pill demand. Cultural factors are important even relative to current factors such as employment rates.

The question remains for future work to address whether the introduction of the Pill led to a convergence in the norms that govern the sexual choices of single women, and the ramifications of the Pill and evolving culture on the myriad choices made by women in Sweden and elsewhere. The results point to the importance of accounting for cultural

factors when analyzing contraception and fertility through the inclusion of relevant historical variables. I have shown how out-of-wedlock birth, a behavior influenced by social forces, varies systematically across communities and is persistent over time. Culture may work through many channels: differences in what Sundbärg (1910) called "public mood", the capacity of communities to enforce promises of marriage in the case of pregnancy, norms, beliefs, and other features of preferences. My findings are consistent with all of these interpretations, and together make a convincing case that culture matters quantitatively for contraception demand.

References

- [1] Akerlof, G., J. Yellen, and M. Katz (1996), "An Analysis of Out-of-Wedlock Childbearing in the United States." *The Quarterly Journal of Economics*, 111(2): 277-317.
- [2] Algan, Y., and P. Cahuc (2010), "Inherited Trust and Growth." *American Economic Review*, 100(5):2060-2092.
- [3] Bagge, G., E. Lundberg, and I. Svernilson (1935) *Wages, cost of living and national income in Sweden 1860-1930. Vol. 2*, London: King.
- [4] Bailey, Martha J. (2006) "More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply." *The Quarterly Journal of Economics*, 121(1):289–320.
- [5] Bailey, Martha J. (2010), "'Momma's Got the Pill': How Anthony Comstock and Griswold v. Connecticut Shaped US Childbearing." *American Economic Review*, 100(1): 98–129.
- [6] Bisin, Alberto, and Thierry Verdier (2000), "'Beyond The Melting Pot': Cultural Transmission, Marriage, And The Evolution Of Ethnic And Religious Traits," *The Quarterly Journal of Economics*, 115(3), pages 955-988.
- [7] Bisin, Alberto, and Thierry Verdier (2001), "The Economics of Cultural Transmission and the Dynamics of Preferences," *Journal of Economic Theory*, 97(2), pages 298-319.
- [8] Blau, Francine (1992), "The Fertility of Immigrant Women: Evidence from High-Fertility Source Countries " in Boras and Freeman, *Immigration and the Work Force: Economic Consequences for the United States and Source Areas*. Chicago: UCP.
- [9] Blau, Francine, Lawrence M. Kahn, Albert Yung-Hsu Liu, Kerry L. Papps (2008), "The Transmission of Women's Fertility, Human Capital and Work Orientation Across Immigrant Generations" NBER Working Paper 14388.

- [10] Carlsson, G. (1966) "The Decline of Fertility: Innovation or Adjustment Process" *Population Studies*, 20(2): 149-74.
- [11] Chiappori, P. A., and S. Oreffice (2008), "Birth Control and Female Empowerment: An Equilibrium Analysis." *Journal of Political Economy*, 116(1).
- [12] Easterlin, R. and E. Crimmins (1985), *The Fertility Revolution A Supply-Demand Analysis*. Chicago:UCP.
- [13] Doepke, M. and M. Tertilt (2009) "Women's Liberation: What's in It for Men?" *Quarterly Journal of Economics* 124(4):1541-1591.
- [14] Fernandez, R. (2007) "Women, Work and Culture," *Journal of the European Economic Association*, Vol. 5, No. 2-3: 305-332.
- [15] Fernandez, R. (2011) "Does Culture Matter?" in *Handbook of Social Economics*, Jess Benhabib, Alberto Bisin, Matt Jackson, eds., North-Holland.
- [16] Fernandez, R. and A. Fogli (2006), "Fertility: The Role of Culture and Family Experience." *Journal of the European Economic Association*, 4(2-3): 552-561.
- [17] Fernandez, R. and A. Fogli (2009), "Culture: An Empirical Investigation of Beliefs, Work, and Fertility." *American Economic Journal: Macroeconomics*, 1(1): 146-77.
- [18] Fernandez-Villaverde, J., J. Greenwood and N. Guner (2010), "From Shame to Game in One Hundred Years: An Economic Model of the Rise in Premarital Sex and its De-Stigmatization." NBER Working Paper 15677.
- [19] Frykman, J. (1975) "Sexual Intercourse and Social Norms: A Study of Illegitimate Births in Sweden 1831-1933." *Ethnologia Scandinavica*, 1975: 110-150.
- [20] Frykman, J. (1977) *Horan i Bonde Samhället*. LiborLäromedel, Lund.
- [21] Gaunt, D. (1973), "Family Planning and the Preindustrial Society: Some Swedish Evidence." in *Aristocrats, Farmers, Proletarians: Essays in Swedish Demographic History*, Studia Historica Upsaliensia XLVII, Almqvist and Wiksell Informationsindustri, Uppsala, 1973.
- [22] Goldin, C. and L. Katz (2002), "The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions." *Journal of Political Economy*, 110(4):730-770.
- [23] Greenwood, J. and N. Guner (2010), "Social Change: The Sexual Revolution" *International Economic Review*, 51(4):893-923.
- [24] Grönqvist, Hans (2009), "Putting teenagers on the Pill: the consequences of subsidized contraception." Institute for Labor Market Policy Evaluation Working Paper No. 2009:8.
- [25] Guinnane, T., C. Moehling, and C. O'Grada (2006) "The Fertility of the Irish in the United States" *Explorations in Economic History*, 43(3): 465-485.

- [26] Guiso, L., P. Sapienza and L. Zingales (2006), "Does Culture Affect Economic Outcomes?" *Journal of Economic Perspectives*, 20(2):23-48.
- [27] Heckscher, Eli (1949), *Sveriges Ekonomiska Historia Från Gustav Vasa: Andra Delen Det Moderna Sveriges Grundläggning Fösta Halvbandet*. Albert Bonniers, Stockholm.
- [28] Hedren, Gunnar (1901) "*Om fosterfördrivning från rättsmedicinsk synpunkt*." Karolinska Institute Dissertation, Stockholm.
- [29] Helmfrid, S. (1961) "The Storskifte, Enskifte and Laga skifte in Sweden - General Features" *Geografiska Annaler*, 43(1): 114-44.
- [30] Lewin, Bo (2000) *Sex in Sweden : on the Swedish sexual life 1996*. Stockholm : National Institute of Public Health.
- [31] Liljeström, Rita (1974) *A Study of Abortion in Sweden: A Contribution to the United Nations World Population Conference*. Royal Ministry of Foreign Affairs. Norstedt, Stockholm.
- [32] Linner, Birgitta (1967), *Sex and Society in Sweden*. New York : Pantheon Books.
- [33] Läkemedelstatistik, A.B. "Swedish Drug Market: Statistical Survey of Registered Pharmaceutical Specialties in Sweden." Stockholm. 1970(I)-1974(IV).
- [34] Low, Bobbi (2000) *Why sex matters: a Darwinian look at human behavior*. Princeton University Press.
- [35] McLaren, Angus (1992) *A History of Contraception: From Antiquity to the Present Day*. Wiley Blackwell.
- [36] Myrdal, Alva (1968) *Nation and Family*. Boston: MIT Press.
- [37] Oreffice, S. (2007) "Did the legalization of abortion increase women's household bargaining power? Evidence from labor supply." *Review of Economics of the Household*.
- [38] Santow, Gigi (1993) "Coitus Interruptus in the Twentieth Century." *Population and Development Review*, 19(4):767-792.
- [39] Sklar, June (1977), "Marriage and Nonmarital Fertility: A Comparison of Ireland and Sweden." *Population and Development Review*, 3(4): 359-375.
- [40] Socialstyrelsen (1972), "Allmän Hälso- och Sjukvård." 1969-1974 editions, Sveriges Officiella Statistik (SOS), Stockholm.
- [41] Statistics Central Byrån (1864) "Befolkning Statistisk Årsbok 1860." SOS, Stockholm.
- [42] Statistics Central Byrån (1904) "Befolkning Statistisk Årsbok 1900." SOS, Stockholm.
- [43] Statistics Central Byrån (1914) "Befolkning Statistisk Årsbok 1910." SOS, Stockholm.
- [44] Statistiska Central Byrån (1945) "Statistisk Årsbok 1945." SOS, Stockholm.

- [45] Statistiska Central Byrån (1962) "Statistisk Årsbok 1962." SOS, Stockholm.
- [46] Statistiska Central Byrån (1970) "Statistisk Årsbok 1970." SOS, Stockholm.
- [47] Statistiska Central Byrån (1975) "Statistisk Årsbok 1975." SOS, Stockholm.
- [48] Sundbärg, Gustav (1907), *Bevölkerungsstatistik Schwedens 1750-1900*. Reprinted in Urval 3, Statistiska Central Byrån.
- [49] Sundbärg, Gustav (1910), *Emigrationsutredningen Bilaga V: Ekonomisk-statistisk beskrifning öfver Sveriges olika landsdelar*. Royal Publisher, P. A. Norstedt and Sons, Stockholm.
- [50] Sundin, Jan and Erik Söderlund (1979), *Time, space and man : essays on microdemography : reports from the symposium Time, space and man in Umeå, Sweden, June 1977*, Stockholm: Almqvist & Wiksell.
- [51] Wikman, K. (1937) *Die Einleitung Der Ehe: Eine Vergleichend Ethno-Soziologische Untersuchung Über Die Vorstufe Der Ehe In Den Schwedischen Volkstums*. Das Institut Für Nordische Ethnologie An Der Åbo Akademie, Åbo.
- [52] Willis, Robert J. (1999) "A Theory of Out-of-Wedlock Childbearing." *Journal of Political Economy*, vol. 107(S6):S33-S64.
- [53] Wohlin, N. (1915), *Den äktenskapliga fruktsamhetens tillbakagång på Gotland*. Stockholm.

Table 1: Summary Statistics

	Mean	Std. Dev.	Min	Max
Pill Demand	9.61	1.70	3.64	14.86
1910 Historical Factors				
Out-of-Wedlock Births (per 100 Births)	12.34	4.01	6.11	27.90
Out-of-Wedlock Births (per 1000 Women)	6.02	2.01	2.81	12.94
Urban to Rural Ratio (x100)	24.97	31.68	0	183
Female to Male Sex Ratio (x100)	103	3.68	95	114
Female to Male Wage Ratio (x100)	60.1	4.08	50	69
Woman's Wage (Öre per Day)	161.5	19.9	125	225
Other Historical Factors				
Out-of-Wedlock Births 1860	7.98	3.08	3.98	26.33
Out-of-Wedlock Births 1900	10.13	3.18	5.29	24.64
Women's HS Attainment 1930	0.35	0.23	0.16	1.35
Pentecostal Church Percent 1930	0.76	0.38	0.17	2.02
Prohibition Opposition in 1922	0.44	0.19	0.18	0.81
1970-1974 Contemporaneous Factors				
Women's LFP Rate	0.64	0.05	0.53	0.79
Working Women's Mean Labor Income	214.9	63.18	122.7	357.2
Men's Mean Labor Income	256.4	38.1	170.4	384.6
Male Income Inequality (70:30)	2.66	0.72	1.63	9.90
Agriculture Income	4.2	2.4	0.3	14.5
Value of Forestry	0.7	0.4	0.0	1.7
Population Density	5.2	11.8	0.1	83.4
Single Women's Mean Age	21.7	0.47	20.8	23.4
Married Women's Mean Age	31.1	0.52	29.9	32.7
Unmarried Male to Female Sex Ratio (x100)	91	17	60	125
Share of Women Single	0.55	0.08	0.36	0.66
Pharmacy Density	3.16	3.66	0.19	19.9
Venereal Disease	0.05	0.09	0.01	0.92

Note: Pill demand, out-of-wedlock births, sex ratios, urban share, and age are measured by market, other variables are measured at the county level. Pill demand is per woman 16-40 in current SEK. The male to female wage ratio is based on agricultural day rates from Bagge et al (1935). HS attainment is the share of women over 15 with a high school degree in 1930. Pentecostal is the percent of the population classified as members in 1930. Prohibition opposition is the share of votes cast against the 1922 ban on alcohol. Mean incomes are for those aged 16-64 in 100s SEK. Women's income is for working women. Population density variables are per square km and pop16-40. The sex ratio is the ratio of women to men16-40. Pharmacy density is per 1000 square kilometers. VD is cases per 1000 of the population aged 16-40.

Table 2: Pill Demand and Out-of-Wedlock Birth in the 19th and 20th Century

	1860 OWB		1900 OWB		1910 OWB	
	(1)	(2)	(3)	(4)	(5)	(6)
Out-of-Wedlock Birth (OWB)	0.20** (0.08)	0.24*** (0.08)	0.25*** (0.08)	0.24*** (0.06)	0.11*** (0.03)	0.18*** (0.05)
Share of Women Working		10.03 (6.05)		6.68 (5.94)		5.86 (6.31)
Mean Income of Working Women		0.01 (0.02)		0.02 (0.02)		0.01 (0.02)
Mean Male Earnings		-0.04*** (0.01)		-0.04** (0.01)		-0.04** (0.01)
70/30 Male Income Ratio		-0.34 (0.20)		-0.27 (0.17)		-0.34* (0.19)
Mean Farm Income		0.06 (0.13)		0.05 (0.13)		0.07 (0.14)
Forestry Value		0.35 (0.50)		0.50 (0.47)		0.30 (0.49)
Population Density		0.15** (0.06)		0.12* (0.06)		0.11 (0.06)
Pop Density Squared		-0.25*** (0.07)		-0.20*** (0.06)		-0.17** (0.06)
Mean Age of Single Women		1.17** (0.44)		0.90** (0.38)		0.85* (0.45)
Mean Age of Married Women		-0.31 (0.58)		-0.48 (0.45)		-0.60 (0.42)
Sex Ratio of Unmarried, 16-40		-0.01 (0.03)		0.01 (0.03)		0.01 (0.03)
Share of Women Married		4.06 (5.84)		-0.01 (6.00)		-0.06 (5.82)
Pharmacy Density		0.13 (0.11)		0.14 (0.11)		0.13 (0.10)
Lagged VD Cases		-0.11 (1.66)		0.76 (2.04)		0.94 (1.81)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.21	0.52	0.31	0.56	0.27	0.55
N	350	350	350	350	350	350

Note: Pill demand per woman 16-40 is the dependent variable. Standard errors, clustered by county, are reported in brackets. Out-of-wedlock births are measured per 100 births. Incomes are computed for those aged 16-64. Population density variables are per square kilometer for those aged 16-40 and the square is divided by 100. Age and share variables are computed for women 16-40. Sex ratio is 100 times the ratio of unmarried women to men aged 16-40. Pharmacy density is per 1000 square kilometers. Venereal disease is per 1000 aged 16-40.

* p<.1, ** p<.05, *** p<.01

Table 3: Pill Demand and Alternative Out-of-Wedlock Birth Measures

Panel 1: Pooled OLS Estimator				
	Per Birth		Per Woman	
	(1)	(2)	(3)	(4)
Out-of-Wedlock Births 1910	0.18*** (0.05)	0.17*** (0.04)	0.39*** (0.12)	0.35*** (0.08)
All Baseline Controls	Yes	Yes	Yes	Yes
Clusters	24	24	24	24
R-squared	0.55	0.53	0.65	0.54
N	350	350	350	350

Panel 2: Between Estimator				
	Per Birth		Per Woman	
	(1)	(2)	(3)	(4)
Out-of-Wedlock Births 1910	0.18*** (0.05)	0.16*** (0.05)	0.33*** (0.11)	0.34*** (0.11)
All Baseline Controls	Yes	Yes	Yes	Yes
Groups	70	70	70	70
R-squared	0.62	0.59	0.60	0.60
N	350	350	350	350

Note: Pill demand per woman 16-40 is the dependent variable. Unwed births are measured per 100 births in (1), and per 1000 women in (3). The dependent variable in (2) is the residual from a regression of unwed births per 100 births on urbanization rates, sex ratios, the ratio of women's to men's wages, and women's wage level. Unwed births per woman in (4) is defined by the same 2-step procedure. * p<0.1, ** p<0.05, *** p<0.01

Table 4: Pill Demand and Out-of-Wedlock Births: Alternative Historical Factors

	(1)	(2)	(3)	(4)	(5)	(6)
Out-of-Wedlock Births 1910	0.15*** (0.04)	0.16** (0.06)	0.17*** (0.05)	0.17*** (0.04)	0.16*** (0.04)	0.17*** (0.03)
Historical Controls						
Urban to Rural Ratio 1910	-0.44 (0.51)					
Female:Male Pop. Ratio 1910	0.11 (0.07)					
Female:Male Wage Ratio 1910	3.26 (3.50)					
Female Wage 1910	-0.02** (0.01)					
Out-of-Wedlock Births 1961		0.03 (0.07)				
Women's HS Education 1930			0.06 (0.11)			
Pentecostal Share 1930				-0.13*** (0.04)		
Prohibition Opposition 1922					5.16*** (0.91)	7.38*** (0.80)
Prohib X OWB						0.50*** (0.16)
All Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.59	0.55	0.55	0.59	0.63	0.75
Clusters	24	24	24	24	24	24
N	350	350	350	350	350	350

Note: Pill demand is the dependent variable. All specifications include the full set of contemporaneous controls. Out-of-wedlock birth measured per 100 births. 1910 wages are agricultural wages from Bagge(1935). Pentecostal is the share of the population that is a member of a Pentecostal Church. Prohibition opposition are voters opposed to the 1922 alcohol sales ban. Women's HS refers to the share of women with HS edu. Col 6 weighted by the 16-40 female population. * p<0.05, ** p<0.01, *** p<0.001

Table 5: Pill Demand to Out-of-Wedlock Birth: Heterogeneous Responses

	(1)	(2)	(3)	(4)	(5)	(6)
High OWB in 1910	0.20*** (0.06)					
Low OWB in 1910	0.22** (0.10)					
OWB in 1910x N. limes norrlandicus		0.18*** (0.04)				
OWB in 1910x S. limes norrlandicus		0.18*** (0.04)				
OWB in 1910 x High Migration			0.16*** (0.03)			
OWB in 1910 x Low Migration			0.23*** (0.04)			
OWB in 1910 x High Forest Employment				0.17*** (0.03)		
OWB in 1910 x Low Forest Employment				0.19*** (0.04)		
OWB in 1910 x High Urban Share					0.18*** (0.04)	
OWB in 1910 x Low Urban Share					0.18*** (0.04)	
OWB in 1910 x High Prohibition Support						0.26*** (0.05)
OWB in 1910 x Low Prohibition Support						0.18*** (0.03)
All Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.55	0.55	0.57	0.55	0.55	0.58
N	350	350	350	350	350	350

Note: Pill demand per woman 16-40 is the dependent variable. Standard errors, clustered by county, in brackets. OWB is measured per 100 births in 1910. High OWB refers to above average OWB. Above median immigration in 1910 defines high migration and high forestry includes communities in counties with at least 7 pct of the population employed in forestry in 1910. High urban share refers to above average population share living in urban areas, while high prohibition support denotes communities where at least half of voters supported prohibition. * p<0.10, ** p<0.05, *** p<0.01

Table 6: Pill Demand and Out-of-Wedlock Births: A Model in Differences

	Between Estimator			Pooled OLS		
	1860-1910	1900-1910	1900-1910	1860-1910	1900-1910	1900-1910
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Out-of-Wedlock Births	0.17*** (0.07)	0.31** (0.12)	0.34*** (0.11)	0.17** (0.07)	0.31** (0.13)	0.34*** (0.12)
Δ Sex Ratio			0.01 (0.03)			0.01 (0.06)
Δ Urbanization Rate			1.51 (2.08)			1.51 (1.73)
Δ Birth Rate			2.30*** (0.55)			2.30*** (0.56)
R-Squared	0.16	0.17	0.34	0.09	0.08	0.28
N	350	280	280	350	280	280

Note: Pill demand per woman aged 16-40 is the dependent variable. Levels and changes in pill demand are identical since demand is zero prior to 1964. Since the pill was approved for use during 1964, and sales for 1964 are not observed we omit the 1974-1964 difference in the specifications where changes are computed over the ten year interval 1900-1910.

Changes in unwed births are measured per 100 births, and birth rates are defined as 100 times the number of births divided by the population of women. Market level data for sex ratios, urbanization, and birth rates per woman are not yet available in the earliest period. Pooled OLS specifications are clustered at the market level. All estimates are unweighted.

* p<.1, ** p<.05, *** p<.01



Figure 1: Gustav Sundbärg's Map of Sweden's Three Demographic Areas (1910)

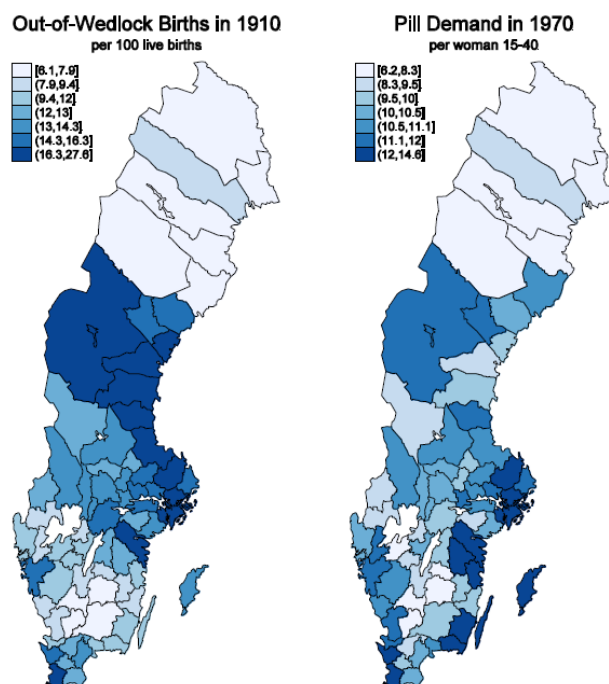


Figure 2: Maps of Out-of-Wedlock Birth and Demand for the Pill by Market

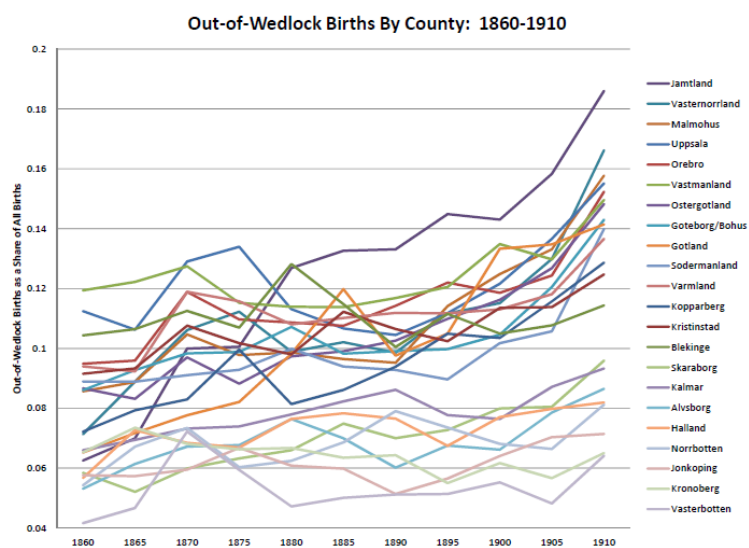


Figure 3: Out-of-Wedlock Births by County: 1860-1910