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The impact of age-based financing of screening tests on utilization and outcomes: the case of amniocentesis*

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Abstract

How does age-based financing of screening tests affect test utilization and outcomes? We use the variation over time and the sharp cross-sectional change in eligibility that were induced by a 1993 policy change in Israel's public healthcare system that lowered the eligibility age for amniocentesis testing from 37 to 35, to draw causal inference about this issue in a setting where financing may distort a woman's incentive to acquire information about her degree of risk. Financing is found to have increased amniocentesis testing by 35%. At ages above the eligibility threshold, utilization rates rose to roughly 33%, reflection nearly full takeup among prospective users of amniocentesis. Additionally, whereas below the age-35 threshold amniocentesis utilization rates increase with maternal age, this relation is muted above this age. Finally, no evidence is found that financing affects outcomes such as pregnancy terminations and births of children with Down syndrome. These results support the view that women above the eligibility threshold tend to refrain from acquiring inexpensive information about their degree of risk that absent the financing they would acquire, and instead, undergo the accurate and costly test regardless of additional information that noninvasive screening would provide.

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1 Introduction

Screening tests—the testing of seemingly well people to find those at increased risk of a disease or disorder (Grimes and Schulz, 2002)—figure importantly in various aspects of contemporary medical practice.[1] It is widely accepted that due to various market and individual failures, there is too little takeup of screening tests. Therefore, it is not surprising that many developed countries have national screening programs in place for various diseases and disorders. Screening tests, however, are associated with substantial costs.[2] Thus, it is important to understand the effects of screening programs in order to ensure their cost-effectiveness.

Given that the risk of many medical conditions rises substantially with age, age-based guidelines in screening for such conditions are widely recommended and applied.[3] Accordingly, age-based rules for financing of screening programs are common. This practice seeks to enhance the cost-effectiveness of such programs on the basis of the notion that when financing is provided above a given age threshold, it targets, on average, high-risk individuals. Despite the extensive use of age-based policies to increase the takeup of screening tests, in many countries and for many medical conditions,[4] there is a dearth of evidence about their effect.

This study examines the issue of aged-based financing of screening tests in regard to amniocentesis (or "amnio"), a routine prenatal test in which chromosomal disorders may be diagnosed. This setting is of particular interest because while amnio is an accurate invasive diagnostic test that is expensive in terms of financial cost and risk of miscarriage, other noninvasive screening tests[5] are available at low cost, albeit with less

[1] According to Cutler (2008), for example, cancer screening, mainly mammography for breast cancer and colonoscopy for colorectal cancer, is the main reason for the decline in cancer mortality since 1990. In the context of prenatal care, Boyd et al. (2008) posit that improvement in prenatal screening is responsible for the increase in detection rates of birth defects.

[2] The costs of screening for breast cancer and colorectal cancer, for example, are estimated at more than 30% of the cost of treating these conditions Cutler (2008). The cost of prenatal screening in the United States, is around $800 on average for the large majority of the four million women who give birth each year (see Song et al. (2013)).

[3] For example, the U.S. Preventive Services Task Force (USPSTF) recommends screening for colorectal cancer by using fecal occult blood testing, sigmoidoscopy, or colonoscopy in adults, beginning at age 50 years and continuing until age 75 years, biennial screening mammographies for women aged 50-74 years and so on.

[4] See for example (Loane et al., 2013) for details on prenatal screening policies in European Union countries. Many states have age-based mandates for mammographies for women over 35-39 (Bitler and Carpenter (2011)). The Affordable Care Act invokes the USPSTF age-based recommendations to improve individuals access to clinical preventive services by requiring insurers to cover a range of recommended preventive services with no co-pay (Koh and Sebelius (2010)). Breast cancer screening programmes in most European countries use age-based policies (Giordano et al. (2012)) and national colorectal cancer screening programs in most European countries are age-based (Riemann (2011)).

[5] Such as nuchal translucency and the triple test

accuracy. Such a context may elicit an "unintended" behavioral response among eligible women. Age-based financing of amniocenteses may induce women to skip noninvasive prenatal screening tests and undergoing amnio regardless of information about the extent of personal risk that noninvasive screening would provide. This behavioral response may lead to over-utilization of amniocentesis and, in turn, greater spending on invasive testing, and other costs such as more post-procedure miscarriages.

More generally, such behavioral response may arise when age-based financing is provided to expensive screening tests such as amniocentesis, chorionic villus sampling, colonoscopy, bone-density testing or transrectal ultrasonography. Since financing lowers the cost of the expensive test to those eligible for it, eligibles may refrain from acquiring inexpensive information about their degree of risk—information that they would acquire were it not for the program—and instead have the accurate and costly test. As a result, financing may result in takeup by low-risk individuals. To the extent that this issue is important empirically, it may challenge the cost-effectiveness of age-based financing of screening tests.

It is important to stress, however, that this issue is not unique to the financing of age-based expensive screening tests. It may arise in any context where a subsidy may distort individuals' incentives to acquire information about their condition or degree of risk. Interestingly, a recent study investigates a very different setting in which a similar interplay arises. Cohen et al. (2015) ran a field experiment in Kenya in which they subsidized a malaria medication (ACT) that, without accurate diagnosis, may be used presumptively, as well as a rapid malaria diagnostic test (RDT). This controlled setting allowed them to study the effect of the ACT subsidy on utilization and the effect of RDT subsidy on demand for ACT. Their results show that making information about the nature of the illness less expensive—namely, subsidising RDT—substantially increased the demand for RDT but did not lessen the demand for ACT. The former result suggests that individuals' demand for information about their condition is price-sensitive; the latter result is surprising because it suggests that in the case of ACT, information about the nature of the illness does not affect demand for the medication.[6]

The specific context in which this problem is studied below, prenatal screening, is important in its own right. Many developed countries run national prenatal screening programs that use age-based criteria for the financing of invasive tests. Private insurers, too, often cover invasive prenatal screening on the basis of age-based criteria.

Here, we examine empirically the causal role of government financing on the takeup and outcomes of amniocentesis tests. We investigate this issue by exploiting a 1993

[6] Cohen et al. (2015) are aware of this issue and point out that this response may gather strength over time as households learn that RDT is reliable.

policy change in Israel's public healthcare system that lowered the eligibility age for amniocentesis tests from 37 to 35 (hereinafter: "the reform"). We use two aspects of the reform to quantify the impact of government financing on the use of amniocentesis. The first is the change in eligibility over time. We examine the change in takeup of amniocentesis by women aged 35-36, the "treatment" age group, relative to that among comparison groups comprised of women in "untreated" age groups, following a standard DD approach. The second is the sharp eligibility threshold that the reform created. Since 1993, women aged 35 years or above at the time of conception have been eligible for public coverage.[7] We use this abrupt change in eligibility to compare the behavior of women who became pregnant within a narrow band on either side of the threshold, that we quantify using an RDD method.

The DD analysis indicates that utilization of amniocentesis by the treatment group increased by roughly 35%, relative to the comparison group. In an effort to validate this result by running a placebo analysis using two "untreated" age-groups, no evidence of such an increase is found. Our RDD analysis detected a 35% increase in the number of amniocentesis tests at the age-35 threshold—very similar to the DD estimate. In the period before the reform, we find a similar increase in the number of tests around age 37, the pre-1993 threshold, with no evidence of an increase in the number of tests around age 35. This confirms the interpretation of the results as tracing to government financing rather than physicians' "standard practice".

In addition to the extent of amniocentesis takeup, we study the impact of the reform on the relation between utilization rates and maternal age. Under the age-35 threshold, amniocentesis utilization rates, in natural log terms, grow, roughly linearly, with maternal age at the rate of about 25% per maternal age year, to approximately 22% just under the age-35 threshold. Just above the age-35 threshold, amniocentesis takeup rates jump discretely to roughly 33% and the slope of the utilization rate drops discretely and is statistically indistinguishable from zero. Importantly, over 60% of the population in the area we study (the Jerusalem vicinity), defines itself as religious (mostly Jewish and Muslim) and do not typically consider amnio as an integral part of prenatal care. Thus, the observed above-threshold takeup rate roughly corresponds to the proportion of women who are "prospective users" of amnio. Given that risk of Down syndrome increases substantially with maternal age, these results support the view that under age 35, the positive relation between maternal age and amniocentesis takeup rates exists because women tend to base their decision to undergo amnio on information about their degree of personal risk, which they acquired by

[7]Before 1993 the age of eligibility was 37.

noninvasive screening. Above age 35, in contrast, the relation between maternal age and the utilization rates is muted; this suggests that once the test is paid for, women tend to take it irrespective of their age conditional Down syndrome pregnancy risk.

We use a similar RDD approach to examine the effect of the age-35 threshold on outcomes. We find no evidence that the age-35 threshold is associated with higher rates of pregnancy terminations or lower rates of Down syndrome births. These results are consistent with the view that, on average, paying for the test encourages low-risk women to take it. Notably, however, small sample size makes it impossible to distinguish between lack of statistical power and the absence of an effect on outcomes.

In a recent pair of studies Bitler and Carpenter (2011, 2012) examine the effects of state health-insurance mandates that require coverage of screening mammograms and Paps smears, respectively. They find that the mandating insurance coverage increases takeup rates substantially and that mammography mandates increase early in-situ ductal carcinoma (DCIS) detections. Whereas Bitler and Carpenter (2011, 2012) investigate the impact of mandates relating to noninvasive and relatively inexpensive screening tests, this study focuses on the interplay between the price distortion of an invasive and expensive test and individuals' demand for inexpensive information about their degree of risk. As shown below, this interaction has important consequences.

The results of the study provide insights on the effects of age-based financing in screening programs. They show that, consistent with the foregoing literature, financing induces uptake substantially. The main contribution of this study, however, is its emphasis on the problem of distortion in individuals' incentives to acquire information about their personal risk or condition. The results show that in weighing the financing of screening tests, it is important to keep the availability of other screening options in mind. When an inexpensive screening test exists, financing may crowd-out individuals' propensity to acquire information about their degree of risk in a way that may impair the cost-effectiveness of the financing provided.

Furthermore, the effects of government financing of prenatal testing has not been, to the authors' knowledge, previously studied using quasi-experimental methods. Thus, our research makes an important contribution to the understanding of the nature of this relationship. Its results call into question the efficacy of an arbitrary cutoff edibility rule for prenatal testing, a rather common practice in many countries' public healthcare programs as well as private insurance policies. Hence, this study provides valuable information on policymaking in this field.

This study also contributes to a related strand of the economic literature that looks into the effects of insurance coverage on use of healthcare services including screening tests. In a recent example Finkelstein et al. (2012), using an Oregon Medicaid eligibility

lottery, find that coverage is associated with increase in takeup of mammograms, Paps smears and other recommended preventive care measures. In another famous study, Currie and Gruber (1996) use Medicaid expansions to find a connection between health-insurance coverage for needy women (Medicaid) and an increase in prenatal care use.

The rest of this paper is structured as follows: Section 2 provides relevant background information on prenatal diagnoses generally and in the Israeli context. Section 3 develops a conceptual framework for the analysis of age-based financing of prenatal testing. Section 4 presents evidence on the impact of eligibility for the financing of amniocentesis on its utilization. Section 5 examines the effect of financing on the relation between amniocentesis takeup rates and maternal age. Section 6 gives evidence on the impact of eligibility on outcomes, and Section 7 concludes.

2 Background

2.1 Prenatal diagnoses

Amniocentesis is a routine test for the diagnosis of prenatal chromosomal disorders. It is performed by withdrawing amniotic fluid and collecting and culturing exfoliated fetal cells, typically around fifteen weeks into gestation (Bodurtha and Strauss, 2012). While "invasive" screening tests such as amniocentesis are very accurate, they are thought to carry postprocedure miscarriage rates of around 1% or less (Tabor et al., 1986; Oster, 2013).[8] Non-invasive standard prenatal testing includes the combined test—nuchal translucency and a blood test,[9] typically performed during the first trimester—and the "triple test"—a blood test typically carried out during the second trimester.[10]

The most common chromosomal defect in fetuses is Down syndrome (DS or trisomy 21). DS is the most frequent cause of mental retardation associated with chromosomal abnormalities; it accounts for up to 12% of mental retardation cases and up to 22% of cases with a known etiology (Murphy et al., 1998). Canfield et al. (2006), recently, estimated the prevalence of DS at birth, on the basis of the surveillance of 22% of live births in the United States in 1999-2001, at one in 732 live births. By implication, roughly 5,400 of about four million births in the United States in a given year have DS.

In recent decades, the incidence of DS pregnancies has been on the rise in various

[8] Another invasive prenatal test, chorionic villus sampling (CVS), is usually done earlier—around weeks 11-13—and it also carries miscarriage risks.

[9] (PAPP-A, BHCG)

[10] (αFA, BHCG, Estriol)

parts of the world due to an upward shift in the age distribution of pregnancies. This trend is somewhat offset by the availability of screening tests such as amniocentesis and CVS (see Loane et al. (2013) and references thereof and Collins et al. (2008)). Additionally, the prevalence of DS live births is characterized by very large disparities. Basing themselves on an analysis of the European Surveillance of Congenital Anomalies database, Loane et al. (2013) report huge differences among EU countries.[11] Canfield et al. (2006) report variations in DS prevalence among different American racial groups.

Also well documented is the existence of large variations in takeup of prenatal screening testing, including amniocentesis, among socioeconomic groups in many countries. For instance, Kuppermann et al. (1996), using data from California, show that non-Hispanic black women and Hispanic women are much less likely to undergo prenatal testing than others. Khoshnood et al. (2004) draw on data from a national sample of the United States to show a relation between higher levels of education and substantially higher rates of amniocentesis takeup among both non-Hispanic whites and African American women. Khoshnood et al. (2005), examining women from the Paris region in France, find that women in "low" occupational groups are much less likely to use prenatal testing than those in "high" groups. Overall, the mechanisms that sustain socioeconomic differences in the takeup of prenatal testing are poorly understood.

Given the availability of accurate prenatal screening tests, the large differences in their takeup and in the prevalence of DS suggest that public health interventions may have an important impact on the takeup of prenatal testing and prevalence of DS and other chromosomal disorders. By the same token, it is often argued in both the scientific and the public discourse that the use of prenatal testing is affected by strong attitudes against invasive prenatal testing.[12] Therefore, it is unclear how effective such government interventions would be in enhancing overall takeup, especially when populations that exhibit low utilization rates are targeted.

Surprisingly, in contrast to active national policy efforts in many countries aimed at increasing the utilization of prenatal testing,[13] there is little evidence on this issue. In health literature on the topic, Julian-Reynier et al. (1994), using french survey data,

[11]The large disparities remain in place after excluding countries in which termination of pregnancy for fetal anomaly is illegal (such as Malta)

[12]Anecdotally, in an interview on CBS's "Face the Nation" in Sunday, February 19th, 2012, Republican presidential candidate Rick Santorum expressed strongly opposed view towards mandates for amniocentesis coverage as part of the federal healthcare reform because it results "more often than not in this country in abortion." (See Rapp (1998) for more narrative based evidence). In Israel, Zlotogora et al. (2007) show that in ultra-orthodox cities 95.5% of down syndrome pregnancies ultimately lead to a live birth, whereas in the general population this figure is about 25%, indication that attitudes and tastes play a crucial role in utilization.

[13]See Boyd et al. (2008) for a review of policies in European countries

compare the responses of women aged 38 or more who were eligible for state-financed amniocentesis with younger women who were ineligible. They find that about 75% of the women aged 38 and above underwent amniocentesis as against only 23% in the 35-37 group. Khoshnood et al. (2005), comparing the use of amniocentesis in France with that in the United States, report that the rate of use is more than three times greater in the former country than in the latter and is even wider among women aged 38 or older. This may be explained by the fact that France, unlike the United States, entitles these women to publicly financed amniocentesis. Notably, however, unobserved fixed differences across countries may contribute both to the availability of financing and to prenatal testing behaviors.

2.2 Prenatal screening policy in Israel

Healthcare in Israel is a universal entitlement[14] that is delivered through a public system regulated by the Ministry of Health (MOH). Other major players in the National healthcare system are four not-for-profit "sick funds" (SF), which operate much like health maintenance organizations (HMOs). SFs, to one of which every resident typically belongs, provide the vast majority of health insurance in the country and deliver most of its primary care. They are required to provide members with a standard package of insured services and must admit any applicant for membership, thereby ensuring the freedom to choose and switch among SFs without obstruction.

In 1978-1992, women aged 37 or more at conception were eligible for state-financed amniocentesis testing. In 1993 MOH lowered the eligibility age to 35. In addition SFs may cover the cost of amniocentesis tests to women who are found to be at high risk on the basis of noninvasive screening tests. These arrangements aside, women are free to have the test and pay for it out of pocket.[15]

SFs may offer an additional tier of coverage—a supplemental package to which all members are entitled to subscribe. The type of services provided in this rubric is regulated and monitored by MOH according to principles set forth in the 1994 National Health Insurance Law (Gross and Harrison, 2001). Until 2006, MOH did not allow SFs to include amniocentesis testing in their supplemental tiers. The ban was lifted in 2006; since then, all four SFs have been offering amniocentesis testing as part of their supplemental coverage.

[14]Since the National Health Insurance Law of 1994 took effect in January 1995.
[15]The cost of amniocentesis in Israel is roughly $450 (see Shohat et al. (2003))

3 Conceptual framework

Below is a simple model of demand for an accurate and invasive (costly) screening test. The goal of the model is to inform the empirical analysis by highlighting the nature of the behavioral response to an age-based policy. We illustrate the impact of a threshold-of-eligibility (age-based) policy in two scenarios: when no alternative tests are available and when a noninvasive (inexpensive) alternative test is available.

3.1 Basic set up

Assume that there are two states of the world, a normal pregnancy and a Down pregnancy. A (risk-neutral) woman has a binary choice $\{Abortion, NoAbortion\}$. p is her risk of a Down pregnancy. Suppose that given the available information, such as her age, a woman knows only that she belongs to a risk type $\tilde{p}$ such that $p \in [0, 1]$ is drawn from some distribution with mean $\tilde{p}$. Also assume that women are heterogeneous in their risk type. Let $G(\tilde{p})$ denote the distribution of women's risk types: the share of cases in which women's risk type, $\tilde{p}$, is less than or equal to some $\hat{p}$, Let $g(\tilde{p})$ denote the density function of women's risk. The number of women is normalized to unity; thus the total number of women with perceived risk $\tilde{p} \leq \hat{p}$, equals $G(\hat{p})$. Since $\tilde{p}$ is typically small, on the basis of available information a woman forgoes abortion and thus makes the wrong choice with probability $\tilde{p}$, i.e. $\tilde{p} = P(Noabortion|Down))$.

At a cost k, women can undergo an amniocentesis that detects Down with certainty, where k includes both financial costs and the cost of the risk of miscarriage following an amniocentesis. If the value of the wrong choice is 0 and the value of the right choice is 1, the women's pay-off is given by

$$U = max\{1 - \tilde{p}, 1 - k\} \tag{1}$$

Panel (a) of Figure 1 illustrates this situation. Since it is optimal for a woman to undergo amniocentesis when $k < \tilde{p}$, the share of women undergoing amnio, depicted by the solid red line, is zero for women of risk type $k > \tilde{p}$ and it jumps discretely to 1 at $k = \tilde{p}$.

3.2 Scenario 1: no alternative screening tests available

Suppose now that the government intervenes and pays for testing on the basis of a threshold policy. Specifically, it subventions amnio to k' for women of type $k' < \tilde{p}$. Panel (b) of Figure 1 illustrates the effect of a threshold financing policy on the takeup

of amnio. With the policy in place, the cost of amnio for women above the policy cutoff falls from k to k'. At this level, it is optimal for women of risk type $k' < \tilde{p}$ to choose to undergo amnio. As the figure shows, the share of women undergoing amnio is zero for women of risk type $k' > \tilde{p}$, and jumps discretely to 1 at $k' = \tilde{p}$, reflecting the fact that women of type $k' < \tilde{p} < k$, change their behavior and decide to have the test.

It is convenient to express the "efficacy" of the financing policy as the average risk of the additional amnio tests that are induced by the government's policy:

$$E[p(\Delta\tilde{p})] = \frac{\int_{k'}^{k} \tilde{p} \cdot g(\tilde{p}) d\tilde{p}}{\int_{k'}^{k} g(\tilde{p}) d\tilde{p}} \tag{2}$$

It is evident that, the average risk of the additional amnio tests is greater than k' because all women who choose to undergo amnio are, on average, of a greater-than-k' risk type.

3.3 Scenario 2: available alternative screening tests

Suppose that at cost r there is another prenatal test, one that is noninvasive (inexpensive) yet less accurate—e.g., maternal serum triple biochemical markers (MSTT)—that can determine p. It is optimal for women to choose to undergo MSTT when its costs are lower than its benefits. Let us consider two cases. The first is of a woman whose risk type is $k > \tilde{p}$, i.e. low-risk. Such a woman either undergoes neither amniocentesis nor MSTT or undergoes MSTT and, based on its outcomes, decides whether to have amnio. If MSTT reveals that $p > k$, it is optimal for the woman to undergo amnio. If MSTT shows that $p < k$, she eschews amnio. This implicitly defines a $\underline{p}$ such that for women of risk type $\tilde{p} \leq \underline{p}$, the benefits of MSTT are lower than its expected costs; these women undergo neither MSTT nor amniocentesis:

$$Pr(p > k) \cdot E[p - k | p > k] > r \tag{3}$$

Analogously, for $k < \tilde{p}$, a woman either undergoes MSTT and decides on the basis of its outcomes whether to have amnio; alternatively, she may undergo amnio when the benefits of MSTT are low. Here, a $\overline{p}$ exists such that for $\tilde{p} \geq \overline{p}$ a woman undergoes amnio without MSTT, implicitly defined by the following condition:

$$Pr(p < k) \cdot E[k - p | p < k] > r \tag{4}$$

Panel (a) of Figure 2 illustrates this scenario. As the figure shows, $\tilde{p}$ may be divided

into three ranges. In the, $0 < \tilde{p} < \underline{p}$ range, the share of women who undergo amnio is zero because the women at issue are of a low-risk type, for whom it is optimal to undergo neither amniocentesis nor MSTT. In the second range, the share of women who undergo amnio jumps discretely at $\underline{p}$ and increases monotonically at $\underline{p} < \tilde{p} < \overline{p}$. Women in this range undergo MSTT and decide whether to undergo amnio on the basis of the results. The pattern of amnio utilization emerges because these women choose to have amnio when $k < p$, and their proportion is increasing in $\tilde{p}$. At the risk-type level of $\overline{p}$, the share of women who have amnio jumps to 1 and remains constant at 1 within the $\overline{p} < \tilde{p} < 1$ span. This is so because these women, who are of a high-risk type, find it optimal to undergo amnio without doing MSTT.

Let us reconsider the effect of a threshold policy of paying for amniocentesis among women in the $\tilde{p} > k'$ set. As Panel (b) of Figure 2 demonstrates, such a policy has two effects. The first, a direct effect, pertains in the $k' < \tilde{p} < \overline{p}$ range of risk types; here the utilization rate jumps discretely at k' and then increases monotonically. Women of these risk types get MSTT and, if they find out that they have $k' < p < k$, they take the government subsidy into account and switch from not having amnio to having it. One can show that this response is desirable from the policymaker's perspective, namely that the average risk of the additional amnio tests that are induced by this effect is larger than k'. This results is unsurprising because the direct effect induces takeup of amnio only among women for whom $k' < p$, for which reason their average degree of risk must be greater than k'.

The second effect, an indirect effect, arises in the $\overline{p}' < \tilde{p} < \overline{p}$ range of risk types. For women in this range of risk, it is optimal to switch to *not* undergoing MSTT and doing only amnio. Otherwise, they would buy inexpensive information (that elicited by MSTT) and base their decision on whether to undergo amnio on it but due to the price distortion created by the policy, they have amnio and skip MSTT. In this case, it is no longer guaranteed that average risk of the additional amnio tests induced by this response to the policy is greater than k' because this effect induces takeup of amnio by low-risk women. To be more precise, since, absent the reform women of risk type $\overline{p}' < \tilde{p} < \overline{p}$ would get MSTT and undergo amnio whenever $p > k$, the average risk of induced tests for women of this risk type range is $E[p|p < k]$. Intuitively, the additional amnio tests are done by women who, based on the information yielded by MSTT would choose *not* to have the amnio but due to the policy, skip MSTT and go straight to amnio.

Figure 3 illustrates the special case in which the indirect effect dominates—Namely, when the public subvention induces full takeup. As the figure shows, in the $\underline{p} < \tilde{p} < k' = \overline{p}''$ range, the share of women who undergo amnio increases monotonically. At k',

the eligibility threshold, this share jumps discretely to 1. Since for women of risk type $k' < \tilde{p}$, the choice of amnio is no longer a function of their degree of individual risk, the monotonic relation between risk type and the share of women who undergo amnio ceases to exit.

The foregoing model although stylized, provides key insight for analysis of the impact of financing. It shows clearly that distorting the price of an invasive test may induce a behavioral response captured in eschewing the acquisition of inexpensive information about one's risk. If so, it is important to examine, in addition to the magnitude of the response to financing, the efficacy of the screening tests induced by the financing policy.

Furthermore, the model illustrates an important intuition about the link between the relation of takeup rates and maternal age and the extent of the indirect effect that financing creates. The behavioral response to financing breaks the link between personal degree of risk and the decision to undergo amnio. Thus, if the indirect effect dominates and all eligible women have amnio, this relation is muted entirely. This suggests an empirical indication of the degree of indirect effect: a discrete drop in the magnitude of the relation between the share of amnio users and age to zero indicates that the indirect effect of the threshold policy induces full takeup above the threshold.

4 The impact of age-based financing of amniocentesis on takeup

The objective of the analysis in this section is to quantify the impact of government financing on takeup of amniocentesis tests. We do so by utilizing two aspects of MOH's 1993 policy change with respect to eligibility to employ two distinct empirical approaches. The first exploits the change in eligibility over time. Because the reform lowered the eligibility age from 37 to 35, after the reform, women who were 35-36 years old at the time of conception became eligible for free amniocentesis tests after the reform, while the policy for all other women remained unchanged. We therefore study the impact of eligibility for free amniocentesis testing on utilization by examining the change in takeup among newly eligible women aged 35-36, the "treatment" age group, relative to comparison groups comprised by women in "untreated" age groups.

The second approach uses the sharp eligibility threshold that the reform created. After 1993, eligibility for amniocentesis was lowered to age 35, namely, women aged 35 years or over at the time of conception became eligible for free amnio testing while those under this age were, by default, ineligible. We use the abrupt change in eligibility to

compare the behavior of women who became pregnant within a narrow band on either side of the threshold.

4.1 Data from diagnostic tests

Our analysis draws on data from all files of amniocentesis tests that were analyzed since 1991 at the Hadassah Medical Center Prenatal Cytogenetic Laboratory.[16] The lab, one of fourteen labs in Israel, analyzes roughly 10% of amniocentesis tests countrywide. In the relevant time period, it analyzed nearly all amniocentesis tests in the Jerusalem area. The data in its files include each woman's date of birth, date of last menstruation, date of amniocentesis test and personal characteristics such as occupation, country of birth, parents' country of birth, religion, primary payer and identity of SF. These data are used to create two data sets—one for each of the empirical approaches elaborated in this section.

As noted above, since 2006, it is no longer prohibited to include amniocentesis tests in the supplemental coverage tier; consequently, such coverage became available at all four SFs. Thus, women under 35 who have supplemental coverage may choose to have their test analyzed by another lab, depending on their SF's requirements. Since these women may "drop-out" of our sample but still undergo the test, our estimates may be biased. Therefore, the analysis that follows estimates the age-35 effect for the period ending in 2005.

Columns (1) and (2) of Table 1 provide summary statistics for the data used in the DD and RDD analyses, respectively. The large majority of women in both samples are Jewish, over 70% were born in Israel and only 20% or so did not participate in the labor force. Their mean age was 35 and 36 in the RDD and the DD samples, respectively. Eligibility in both samples was a little over 60%. Trisomy 21 (DS) was the most common chromosomal disorder found at around five and seven cases per thousand tests in the RDD and DD samples, respectively.

4.2 The impact of age-based financing on utilization—the DD approach

We study the effect of eligibility by examining the change in takeup among women in the eligibility ages 35-36, the "treatment" age group, relative to comparison groups comprised of "untreated" age groups. For this purpose, we assign to each test in our sample an "eligibility age"—the woman's last birthday before the date of conception.

[16] Hadassah Ein Kerem Medical Center in Jerusalem.

We focus attention on tests of women aged 31-40 at the time of conception and we divide the sample into ten one-year age groups. We implement the analysis on the basis of a standard differences-in-differences methodology. In the basic specification we estimate the model:

$$y_{it} = \alpha + \beta_1 Reform + \beta_2 treat + \beta_3 Reform * treat + \varepsilon_{it} \tag{5}$$

where y_{it} is the utilization of amniocentesis, measured in terms of the number of tests in natural log terms, by age group i at time period t with $t \in 1991Q1...1995Q4$ measured in quarters. $Reform$ is a dummy for observations in the post-reform period, i.e., $Reform$ equals 1 if an amniocentesis test took place in or after the first quarter of 1993, and 0 otherwise. The estimates of β_3, the coefficient of $Reform * treat$, capture the relative effect of the reform on the outcome variable among the treatment group relative to the comparison group.

We estimate another specification in which we replace the post-reform periods dummy and the treatment-group dummy with full sets of time and age-group dummies as follows.

$$y_{it} = \alpha + \beta_1 Time_t + \beta_2 Age_i + \beta_3 Reform * treat + \varepsilon_{it} \tag{6}$$

where $Time_t$ is a vector of dummy variables for each quarter in the relevant time period and Age_i is a full set of age group indicators—e.g., $Age_{35} = 1$ if a woman belongs to the age-35 group. As in the model in Equation (5), the estimates of β_3, the coefficient of $Reform * treat$, capture the relative effect of the reform on the outcome variable among the treatment group relative to the comparison group.

4.2.1 Main Results

Figure 4 plots the mean number of amniocentesis tests in natural log terms for the treatment group, women aged 35-36, and the comparison group, women aged 31-34 and 37-40. Before the reform, there is a small disparity in the number of tests between the treatment group and the comparison group. Immediately after the reform, the number of tests among women in the treatment group appears to have increased sharply while the number of tests among women in the comparison group show no evidence of a similar change. Hence, a gap of about 35% opens after 1993 when the reform occurred.

Table 2 reports the estimates of β_3. Columns (1) and (2) correspond to the models in equations (5) and (6), respectively. The estimates in both columns reflect an increase of about 37% in the number of tests in the treatment group relative to the comparison

group after the reform; they are statistically significant at the 1% level. In columns (3) and (4) we repeat the analysis using a narrow comparison group comprised only of women in age groups "adjacent" to the treatment group: 33-34 and 37-38. The estimates are in the order of 30% and remain statistically significant at the 1% level, indicating that the results are robust to the choice of comparison group.

4.2.2 Validity checks

We examine the validity of the DD results by running a placebo analysis. As noted above, financing policy for all other age groups remained unchanged. Consequently, if the reform is responsible for the effect estimated above, a statistically significant effect among other age groups should not be encountered. To test this hypothesis, we use the two age groups closest to the treatment group as "placebo" treatment groups and run an analogous DD analysis using the remaining age groups (omitting age group 35-6) as comparison groups. Panels (a) and (b) of Figure 5 show the graphic evidence from the "placebo" analysis with age groups 33-34 and 37-38 as treatment groups, respectively. In both panels there appears to be no evidence that the reform had an effect on the number of amniocentesis tests among members of the placebo groups. Panels (a) and (b) of Table 3 display the corresponding estimates. Consistent with the impression given in Figure 5, the estimation results show no evidence of a statistically significant effect on the placebo group.[17]

4.3 The impact of age-based financing on utilization—the RDD approach

We continue our examination of the impact of eligibility for amniocentesis tests on utilization using the sharp age-35 eligibility rule. A woman whose conception date follows her thirty fifth birthday is eligible for free amniocentesis whereas a woman whose conception date is just before her thirty fifth birthday is ineligible.[18] Conceptually, we compare the behavior of women whose date of conception lies within a narrow band on either side of the age-35 threshold. Assuming that the date of conception around age 35 is effectively random, these two groups may be thought of as randomly assigned and hence should differ only in their eligibility for amniocentesis tests.

Therefore, an underlying assumption in our approach is that women and their physicians do not manipulate the record of the exact timing of conception around age

[17]There is one statistically significant estimate in Column (3) of Panel (a)—the age 33-34 narrow DD—but when we add Year quarter and age group fixed effects in Column (4) the estimates become insignificant.

[18]She may, however become eligible if she is found to be at a risk of 1:386 or higher of a DS pregnancy.

35. There are two main reasons to think that such manipulation is not prevalent, one relating to the viability of manipulation and the other regarding the incentives to manipulate. In respect of the first, the date of conception is initially recorded according to the time of last menstruation, as reported by the woman. As the pregnancy develops, however, it is verified by using a pregnancy age derived from the results of routine ultrasound tests; wherever discrepancies greater than 10 days are found, the ultrasound results prevail. This leaves very little room for manipulation of conception date. As for the second reason, while the eligibility rule for amniocentesis tests may create an incentive to "push forward" the conception date in order to become eligible for amniocentesis, such a ruse may hinder prenatal care, increasing the risk of miscarriage and of misdiagnosis of fetal condition. Physicians are very unlikely to allow this to happen on a habitual basis.[19] Overall, then, manipulations of the recorded timing of conception are highly improbable.[20]

Let us formally specify the estimation strategy. Let $35bday$ and doc denote a woman's thirty fifth birthday and the date of conception, respectively. We define $\tau(35bday,\ doc)$ as the difference between the woman's date of conception and her thirty fifth birthday, $\tau = doc - 35bday$. Hence τ expresses the womans age at the beginning of the pregnancy in terms of days elapsed since age 35. Suppose, for example that a woman's thirty fifth birthday is in June 15 2006 and that the pregnancy began on June 3 2006, twelve days before her thirty fifth birthday. Thus, $\tau(June\ 15\ 2006,\ June\ 3\ 2006) = -12$, and in terms of weeks elapsed since her thirty fifth birthday τ would be -2 in this example.

Let the eligibility indicator, D, equal 1 if the age of a woman at the time of conception is 35 or more, and 0 otherwise. Consider the following model

$$y = \alpha_0 + \beta_0 D + f(\tau) + \epsilon \tag{7}$$

where y is an outcome variable such as the number of amniocentesis tests. $f(\tau)$, is a completely flexible control function, and is continuous at $\tau = 0$. The parameter of interest in this model is the coefficient β_0 which measures the causal effect of eligibility for free anmio on y. Intuitively, given that $f(\tau)$ absorbs any continuous relationship between a womans age and the outcome variable, the coefficient β_0 estimates the discontinuous relations between age 35 and the outcome variable. Therefore, we may

[19]The estimated due date, for instance, is calculated according to this date. Additionally, gestational age may be important for prevention of miscarriage; some of the routine prenatal monitoring is done using the conception date.

[20]We further validate this assumption by repeating the analysis, excluding from the sample amniocentesis tests within two weeks of the age-35 threshold (not reported here) and we find virtually identical results.

attribute its estimates to the causal effect of eligibility for free amnio on the outcome variable.

We estimate such a model on the basis of standard regression discontinuity design methods. As the form of the control function $f(\tau)$ is unknown, it is approximated with a n^{th} order polynomial, all terms of which are interacted with D, the "age 35" indicator. On this basis, we estimate the following specification of Equation (7):

$$y_\tau = \alpha_0 + \beta_0 D + \sum_{k=1}^{n} \left[\alpha_k(\tau)^k + \beta_k(\tau)^k \cdot D\right] + \eta_\tau. \tag{8}$$

4.3.1 Main results

In this section we report our findings with respect to the effect of eligibility for amniocentesis testing on utilization, first graphically and then numerically. To illustrate the effect visually Figure 6 plots the natural log of the number of tests against age on date of conception in terms of weeks elapsed since a woman's thirty fifth birthday, 200 weeks below and 200 weeks above age 35. To create a visual reference, we fit two quadratic regression models to the data separately, one below age 35 and one above it. The age-35 threshold appears to show a 35% increase in the average number of tests.

To quantify numerically the effect of the age-35 threshold on the number of tests, we estimate the model in Equation (8). Table 4 reports regression discontinuity estimates of β_0, the effect of the eligibility rule for amniocentesis tests on utilization. Columns (1)-(3) report estimates of β_0 within eight week, four week and two week bands, respectively. With a linear polynomial specification, all three columns indicate that eligibility increases takeup by roughly 45%. This result remains stable and precisely measured. Using a quadratic polynomial, columns (1)-(3) provide estimates of β_0 that reflect a statistically significant increase of 35% in utilization of tests.

4.3.2 Validity checks

Additional empirical evidence that validates the foregoing results follows. In 1993, eligibility was lowered from age 37 to age 35. Thus, prior to 1993 we would expect to find a similar sharp increase in the number of tests at around age 37 with no evidence of the same around age 35. We use data from 1991-1992 to examine whether the patterns in these data are consistent with this policy change.

Figure 7 shows the graphic results of this analysis. Panel (a) of Figure 7, depicting the log number of tests around age 35, gives no impression of a discrete increase in the number of tests. By contrast, the graphic analysis of the age-37 threshold, albeit

noisy, suggests that there is an increase in the number of tests around that age. Table 5 confirms the graphic results, showing, in Panel (a), a small negative and insignificant effect around the age-35 threshold and in panel (b) a positive and significant effect of about 25% around the age-37 threshold. These estimates reinforce our previous results as reflecting a response to the eligibility rule rather than merely mirroring physicians' "standard operating procedure". One should bear in mind ,however, that these data cover a much shorter period of time and include fewer observations and therefore their statistical power is limited.

5 The impact of age-based financing on the relation between utilization rates and maternal age

In this section we examine the *slope* of the relation between amnio utilization rates and maternal age around the age-35 threshold. First the data are transformed to reflect the rate of amniocentesis tests to known pregnancies. To do this, our amniocentesis test data are merged with data on the number of pregnancies in the Jerusalem area. Given that these data are available starting at the year 2000, the analysis covers the 2000-2005 period. Figure 8 depicts the rate of amnio tests to known pregnancies, in natural log terms, in the Jerusalem area during that period. As the figure shows, below the age-35 threshold, the rate rises with maternal age in a roughly linear trajectory of about 25% per maternal age year, and crests at around 22% just under the age-35 threshold. Consistent with our previous results (Section 4.3), amniocentesis utilization rates jump discretely to roughly 33% as soon as the age-35 threshold is crossed. Takeup rates above this threshold appear to remain constant, i.e., their slope seems to drop discretely to zero. Importantly, over 60% of the population of Jerusalem defines itself as religious (mostly Jewish and Muslim); these populations typically consider neither amnio nor pregnancy termination in the case of DS pregnancy as an integral part of prenatal care. Thus, the observed above-threshold takeup rate roughly corresponds to the proportion of women in the Jerusalem area who are "prospective users" of amnio.

To examine this visual impression numerically, we run the following regression:

$$y_\tau = \sum_{k=0}^{1} \left[\alpha_k(\tau)^k \cdot (1-D) + \beta_k(\tau)^k \cdot D\right] + \eta_\tau. \tag{9}$$

where α_1 and β_1 estimate the slope of the relation between amnio utilization rates, in natural log terms, and maternal age below and above the age-35 threshold, respectively.

Table 6 confirms the impression given by Figure 8. Columns (1)-(3) of the table show the estimates of α_1 and β_1 for bands of 200, 100 and 50 weeks around the age-35 threshold, respectively. The estimates of α_1 are all positive and statistically significant whereas those of β_1 are negative, very small and statistically indistinguishable from zero.

Given the substantial increase in Down risk with maternal age, the results in this section support the view that under age 35, the positive relation between maternal age and amniocentesis utilization rates reflect women's tendency to base their decision to undergo amnio on information about their degree of personal risk, which they acquire by noninvasive screening. Above the age-35 threshold, conversely, the relation between maternal age and utilization rates is muted and the takeup rate is roughly 100% because women in this group tend to have the amnio test regardless of their personal degree of age-conditional Down pregnancy risk. As discussed in Section 3, these results suggest that the efficacy of the amnio tests that are induced by financing may be hampered: with financing in place, low-risk women who, absent financing, would get noninvasive screening and, based on this information, choose to refrain from amniocentesis, decide to undergo amniocentesis.

6 The impact of age-based financing on outcomes

In this section we study the impact of age-based financing of amniocentesis on the outcomes of the test. We accomplish this by examining the effect of the age-35 threshold on pregnancy terminations and on the incidence of births of children with Down syndrome on the basis of an RDD approach similar to that employed in Section 4.3.

The following outcome estimates may be used to calculate the elasticity of these outcomes with respect to amniocentesis takeup; this elasticity in turn , may be invoked to assess the efficacy of the free amniocentesis policy. Intuitively, if a 10% increase in amnio tests is accompanied by a 10% increase in, say, pregnancy terminations (an elasticity of 1), then the average degree of risk among women who are induced to utilize the test by government financing should resemble the degree of risk among women who are ineligible for financing. By the same token, the closer this elasticity is to zero, the lower the average risk of the "induced" women is. Using this approach, one may place bounds on the degree of selection that eligibility for free testing causes.

6.1 Pregnancy terminations and Down syndrome data

The estimate draws on a comprehensive database of children born with Down syndrome in 2000-2005, culled from MOH's national registry of Down syndrome. These data include mothers' and infants' dates and weeks of birth and mothers' city of residence and religion. Also used are data on the number of pregnancies and pregnancy terminations in 2000-2005, obtained from the Israel Central Bureau of Statistics.

6.2 Results

Pregnancy terminations. To examine how eligibility for free testing affects pregnancy terminations, we first perform a graphic analysis analogous to that in Figure 6. Panel (a) of Figure 9, depicting the share of pregnancy terminations of known pregnancies in Israel in 2000-2005, shows no sign of sharp changes in this share at around age 35. The corresponding estimates, reported in Panel (a) of Table 7 reveal no statistically significant change in the total number of all pregnancy terminations. The coefficient is negative at a magnitude of around -0.6 percentage point. Given that at this maternal age the rate of pregnancy terminations is roughly 12.5%, this coefficient reflects an insignificant decrease of 5% in the rate of birth terminations. combining this estimate with the estimates of the change in amnio takeup derived in Section 4.3, we find, using the delta method, an elasticity of about -0.12 with a 95% confidence interval between -0.3 and 0.06.

Pregnancy terminations associated with Down syndrome, however, are only a fraction of all pregnancy terminations. Thus, examining all pregnancy terminations may understate the effect of the eligibility rule. To correct for this, we exploit the fact that the documentation of a pregnancy termination includes information about the reason for it. We use this information in Panel (b) of Figure 9 to show only pregnancy terminations that are associated with Down syndrome—a much smaller sample of about 220 pregnancy terminations. The figure shows no sharp change in the number of pregnancy terminations associated with Down syndrome around age 35. Consistent with this impression, panel (b) of Table 7 shows no statistically significant change in the number of pregnancy terminations associated with Down syndrome. Importantly, the sample size in this case is too small to allow us to distinguish between a small elasticity result and lack of statistical power. In accordance with this issue, when we attempt to repeat the elasticity calculation and put bounds to its magnitude, we find a point estimate of about 0.5 and a 95% confidence interval between -2 and 3—a very large interval that does not provide much guidance.

The incidence of births of children with Down syndrome. Figure 10 visually illustrates

the effect of eligibility for amniocentesis testing on the incidence of births of children with Down syndrome in 2000-2005. The figure reveals no apparent effect of the age-35 eligibility threshold. Table 8 confirms the graphic impression; Columns (1)-(3) of the table indicate an insignificant effect of eligibility for amniocentesis testing on the incidence of births of children with Down syndrome, estimated at -0.027 percentage point. Given the baseline rate of about 1 in 800 for this age group, an elasticity estimate of -0.8 with a 95% confidence interval roughly between -3 and 1.5, is found. Here too, we cannot distinguish between a small elasticity result and lack of statistical power.

7 Conclusion

In this study we examine the effect of aged-based financing of screening tests as applied in the case of amniocentesis. This setting is of particular interest because while financing is provided for a diagnostic test that is accurate but invasive and expensive, other screening tests that are inexpensive, noninvasive yet less accurate are available. In this context, an "unintended" behavioral response by eligible individuals may occur. Specifically, since financing decreases the out-of-pocket cost of the invasive test, those eligible may refrain from acquiring inexpensive information about their degree of risk that they would acquire where it not for the program and instead, undergo accurate and costly testing regardless of any additional information.

We report empirical evidence about the magnitude of the effect of age-based government financing on the takeup of amniocentesis tests and its impact on pregnancy terminations and the incidence of births of children with Down syndrome. Specifically, we estimate the effect of government financing of amniocentesis tests on utilization using plausible variation in eligibility for testing in response to two aspects of a sharp change in Israel's public healthcare prenatal policy that lowered the age of eligibility for free amniocentesis tests from 37 to 35.

We find that eligibility raises amniocentesis takeup by roughly 35%. Additionally, We find that amniocentesis utilization rates are increasing with maternal age until the age-35 threshold and just above the threshold they jump to a level that roughly corresponds to full compliance and remain constant there. This result is consistent with a dominant indirect effect of financing, i.e., takeup of the financed test regardless of personal age-conditional risk. We estimate the impact of government financing of amniocentesis tests on pregnancy terminations and the incidence of births of children with Down syndrome we find no evidence of such an effect.

Taken together, these results suggest that age-based government financing of amnio-

centesis crowds-out the use of noninvasive screening tests. Women who are eligible for free testing tend to undergo amniocentesis regardless of their degree of age-conditional risk. Thus, the efficacy of financing may be impaired. The results of this research call into question the efficacy of an arbitrary cutoff in edibility for screening tests in this and similar settings.

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Table 1: Summary statistics - amniocentesis tests data

	RDD Sample (1)	DD sample (2)
Women's characteristics		
Share Jewish	0.93	0.94
Share Muslim	0.04	0.03
Share other religion	0.03	0.03
Share born in Israel	0.76	0.71
Share out of labour force	0.22	0.23
Mean age	35	36
Share eligible	0.61	0.64
Fetus's characteristics		
Share male fetus	0.49	0.50
Trisomy 21	0.0051	0.0071
Trisomy 18	0.0003	0.0004
Trisomy 13	0.0008	0.0015
Observations	11,845	4,783

NOTE: The RDD and DD samples include all the amniocentesis records in the periods 1993-2005 and 1991-1995 respectively.

Table 2: Impact of amniocentesis financing on takeup, DD Estimates

	DD Full		DD Narrow	
	(1)	(2)	(3)	(4)
$Reform * treat$	0.376**	0.376**	0.306**	0.306**
	(0.066)	(0.071)	(0.089)	(0.099)
Year quarter FEs	No	Yes	No	Yes
Age group FEs	No	Yes	No	Yes
Observations	200	200	120	120
Number of amniocentesis tests	4,783	4,783	3,344	3,344

NOTE: The results in columns (1) and (3) and (2) and (4) of this table show the estimates of Equations 5 and 6, respectively. The comparison group in the "DD Full" specification in columns (1) and (2) includes age groups 31-34 and 37-40. The comparison group in the "DD Narrow" specification in columns (3) and (4) uses age groups 33-34 and 37-38. Each regression includes a constant. The dependent variable in all models is the number of amniocentesis tests per quarter in natural log terms. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Table 3: Impact of amniocentesis financing on takeup, placebo DD estimates

	DD Full		DD Narrow	
	(1)	(2)	(3)	(4)
Panel a: placebo 1 - age 33-34 as treatment				
Reform*age 33-34	0.216	0.216	0.170*	0.180
	(0.105)	(0.114)	(0.068)	(0.110)
Observations	160	160	120	120
Number of amniocentesis tests	3,476	3,476	2,849	2,849
Panel b: placebo 2 - age 37-38 as treatment				
Reform*age 37-38	-0.029	-0.029	-0.040	-0.040
	(0.096)	(0.105)	(0.089)	(0.099)
Observations	160	160	120	120
Number of amniocentesis tests	160	160	120	120
Year quarter FEs	No	Yes	No	Yes
Age group FEs	No	Yes	No	Yes

NOTE: The results in columns (1) and (3) and (2) and (4) of this table show the estimates of Equations 5 and 6, respectively. The comparison group in the "DD Full" specification in columns (1) and (2) includes age groups 31-34 and 37-40 omitting the "treatment group" - age 33-34 in panel (a) and 37-38 in panel (b). The comparison group "DD Narrow" specification in columns (3) and (4) uses age groups 31-32 & 37-38 and 33-34 & 39-40 in panel (a) and (b), respectively. Each regression includes a constant. The dependent variable in all models is the number of amniocentesis tests per quarter in natural log terms. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Table 4: Impact of amniocentesis financing on takeup, RDD estimates

	8 week bins	4 week bins	2 week bins
	(1)	(2)	(3)
Linear polynomial	0.444**	0.456**	0.462**
	(0.043)	(0.043)	(0.043)
Quadratic polynomial	0.342**	0.353**	0.358**
	(0.065)	(0.064)	(0.064)
Observations	400	400	400
Number of amniocentesis tests	11,845	11,845	11,845

NOTE: The results in columns (1), (2) and (3) of this table show the estimates of Equation 8 with bandwidth of 8, 4 and 2 weeks, respectively. Each regression includes a constant. The dependent variable in all models is the number of amniocentesis tests per week, in natural log terms, in the sample period 1993-2005, 200 weeks before and after age 35. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Table 5: Impact of amniocentesis financing on takeup, RDD validation checks

	8 week bins	4 week bins	2 week bins
	(1)	(2)	(3)
Panel a: 200 weeks around age 35, 1991-1992			
Linear polynomial	-0.037	-0.032	-0.032
	(0.110)	(0.110)	(0.110)
Quadratic polynomial	-0.099	-0.091	-0.093
	(0.166)	(0.165)	(0.165)
Observations	379	379	379
Number of amniocentesis tests	1,268	1,268	1,268
Panel b: 200 weeks around age 37, 1991-1992			
Linear polynomial	0.238*	0.255*	0.261*
	(0.110)	(0.110)	(0.110)
Quadratic polynomial	0.361*	0.363*	0.363*
	(0.165)	(0.164)	(0.164)
Observations	381	381	381
Number of amniocentesis tests	1,229	1,229	1,229

NOTE: The results in columns (1), (2) and (3) of this table show the estimates of Equation 8 using bandwidth of 8, 4 and 2 weeks, respectively. Each regression includes a constant. The dependent variable in panels (a) and (b) in all models is the number of amniocentesis tests per week, in natural log terms, in the sample period 1991-1992, 200 weeks before and after age 35 and age 37, respectively. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Table 6: Impact of amniocentesis financing on the relation between takeup rates and maternal age

Bandwidth:	200 weeks	100 weeks	50 weeks
	(1)	(2)	(3)
Slope above threshold (β_1)	-0.0004	-0.0006	-0.0012
	(0.0004)	(0.0011)	(0.0028)
Slope below threshold (α_1)	0.0048**	0.0059**	0.0085**
	(0.0004)	(0.0011)	(0.0032)
Observations	400	200	100

NOTE: The results in this table show the estimates of Equations 9. The dependent variable in all models is the rate of amniocentesis test to known pregnancies per week, in natural log terms, in the sample period 2000-2005. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Table 7: Impact of amniocentesis financing on pregnancy terminations, RDD estimates

	8 week bins	4 week bins	2 week bins
	(1)	(2)	(3)
Panel a: All pregnancy terminations 2000-2005			
Linear polynomial	-0.006*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)
Quadratic polynomial	-0.006	-0.006	-0.006
	(0.004)	(0.004)	(0.004)
Observations	400	400	400
Number of pregnancy terminations	30,537	30,537	30,537
Panel b: Down syndrome pregnancy terminations 2000-2005			
Linear polynomial	-0.00009	-0.00010	-0.00010
	(0.00029)	(0.00029)	(0.00029)
Quadratic polynomial	0.00014	0.00018	0.00018
	(0.00043)	(0.00043)	(0.00043)
Observations	400	400	400
Number of pregnancy terminations	223	223	223

NOTE: The results in columns (1), (2) and (3) of this table show the estimates of Equation 8 with bandwidth of 8, 4 and 2 weeks, respectively. Each regression includes a constant. The dependent variable in panels (a) and (b) in all models is the rate of pregnancy terminations and Down pregnancy terminations to known pregnancies per week, in the sample period 2000-2005, 200 weeks before and after age 35. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

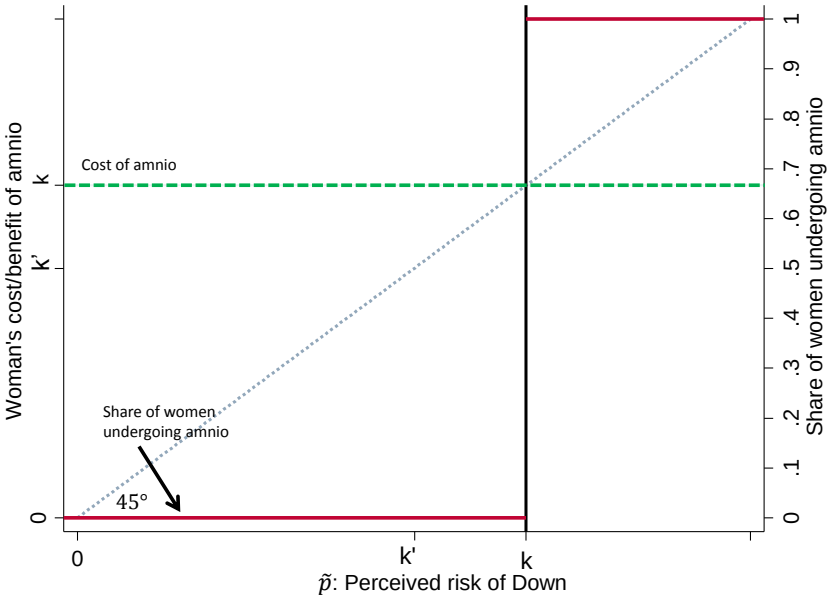
Table 8: Impact of amniocentesis financing on incidence of Down syndrome, RDD estimates

	8 week bins	4 week bins	2 week bins
	(1)	(2)	(3)
Linear polynomial	-0.00072*	-0.00071*	-0.00072*
	(0.00032)	(0.00032)	(0.00032)
Quadratic polynomial	-0.00027	-0.00024	-0.00023
	(0.00048)	(0.00048)	(0.00048)
Observations	400	400	400
Number of Down syndrome births	167	167	167

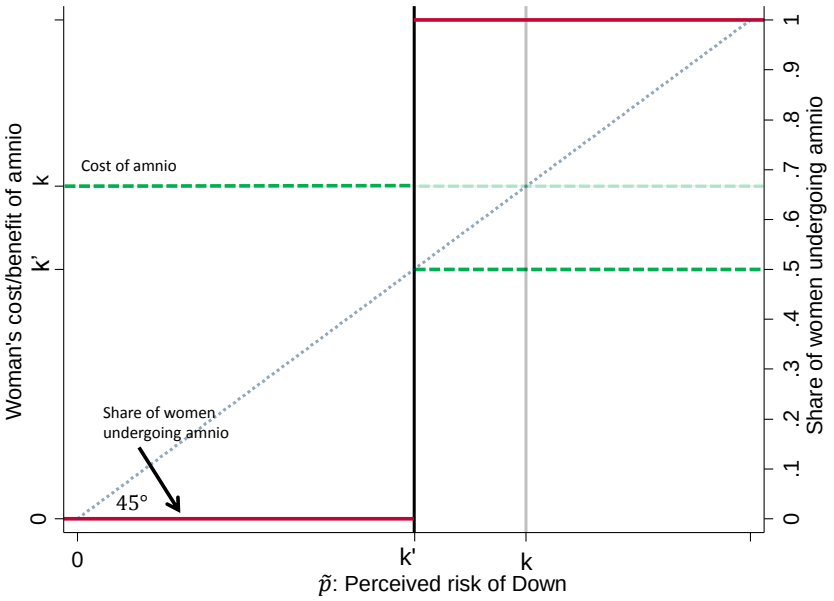
NOTE: The results in columns (1), (2) and (3) of this table show the estimates of Equation 8 using bandwidth of 8, 4 and 2 weeks, respectively. Each regression includes a constant. The dependent variable in all models is the rate of Down syndrome births to known pregnancies per week, in the sample period 2000-2005, 200 weeks before and after age 35. Standard errors are reported in parentheses. One or two asterisks indicate significance at 5% or 1%, respectively.

Figure 1: Impact of amniocentesis financing on takeup–model with alternative screening test

(a) Without financing



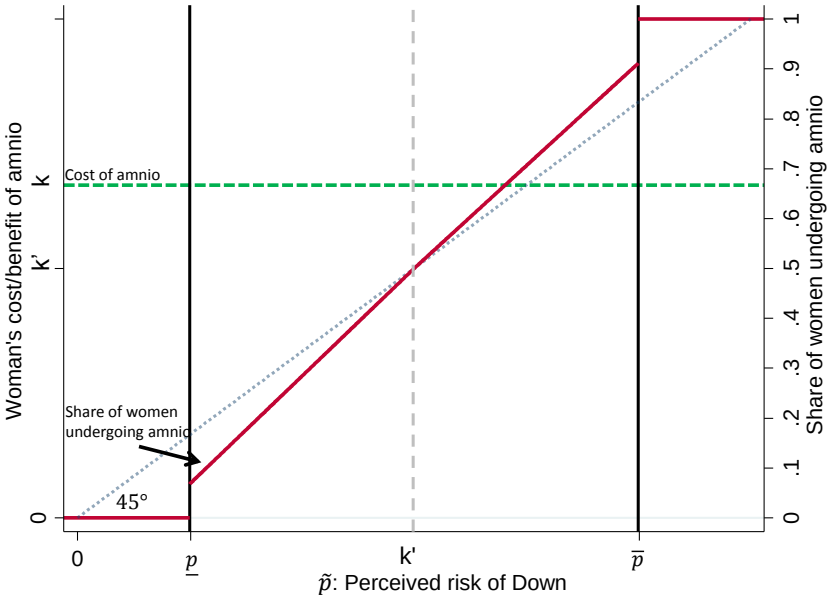
(b) With financing



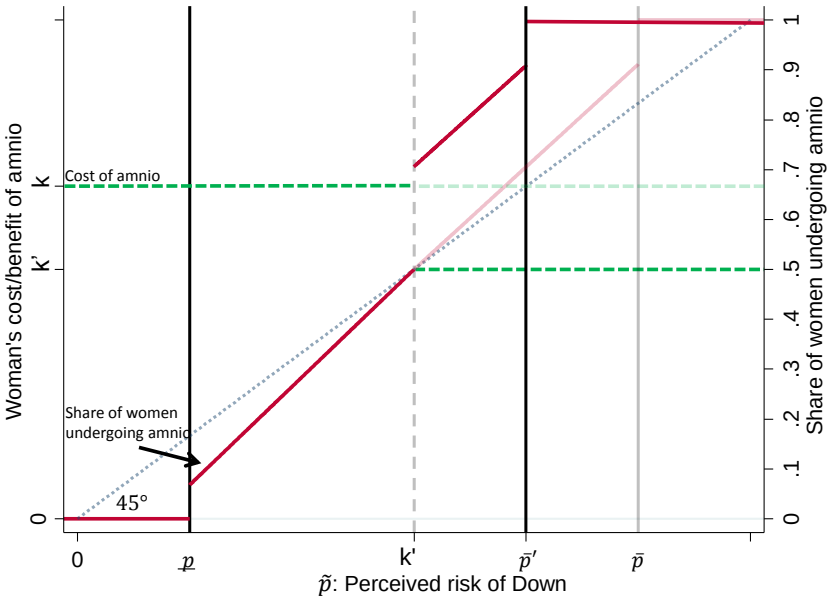
NOTE: Panels (a) and (b) of this figure illustrate women's response to a threshold financing policy when no other screening tests exist, without and with financing, respectively. In both panels, the x-axis represents women's risk-type, $\tilde{p}$ and the y-axis represents women's costs and benefits from an amnio test. The dashed line represents the cost of an amnio test. The solid line represents the share of women who undergo amnio.

Figure 2: Impact of amniocentesis financing on takeup–model with alternative screening test

(a) Before financing

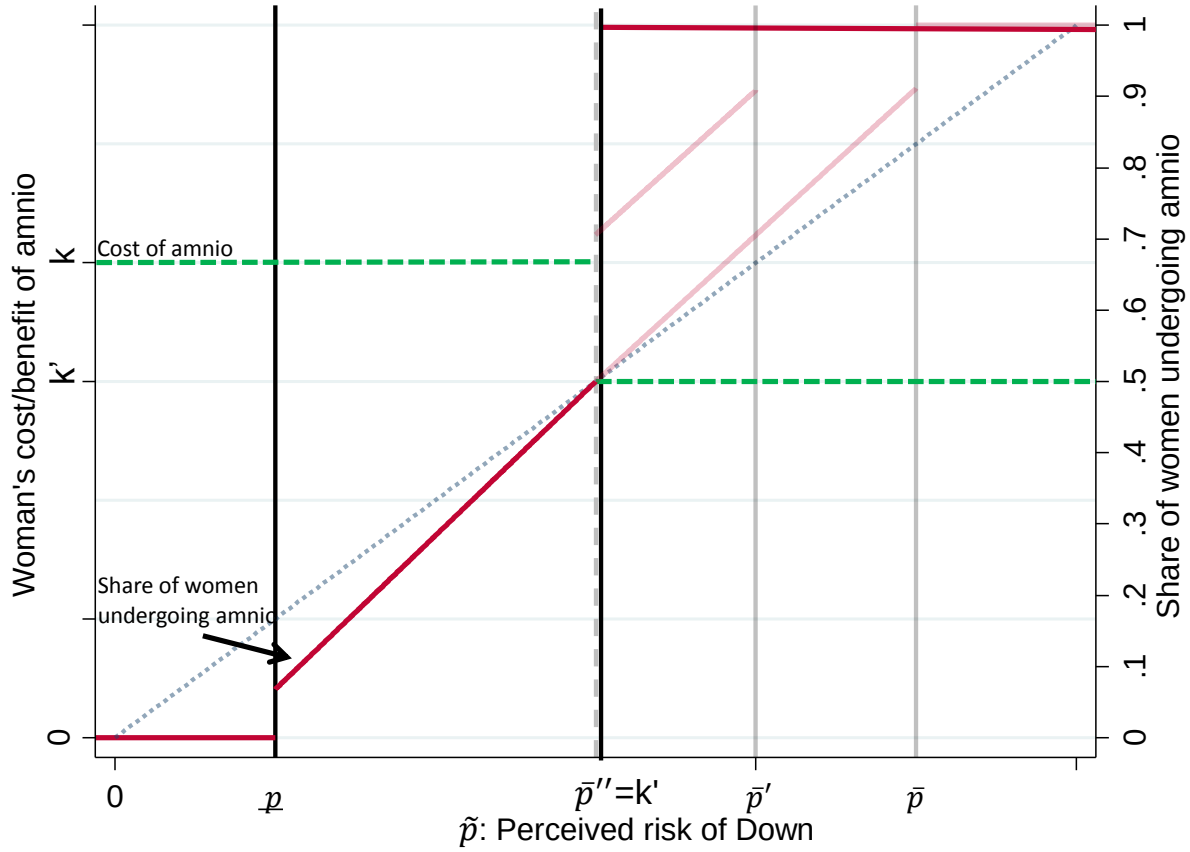


(b) After financing



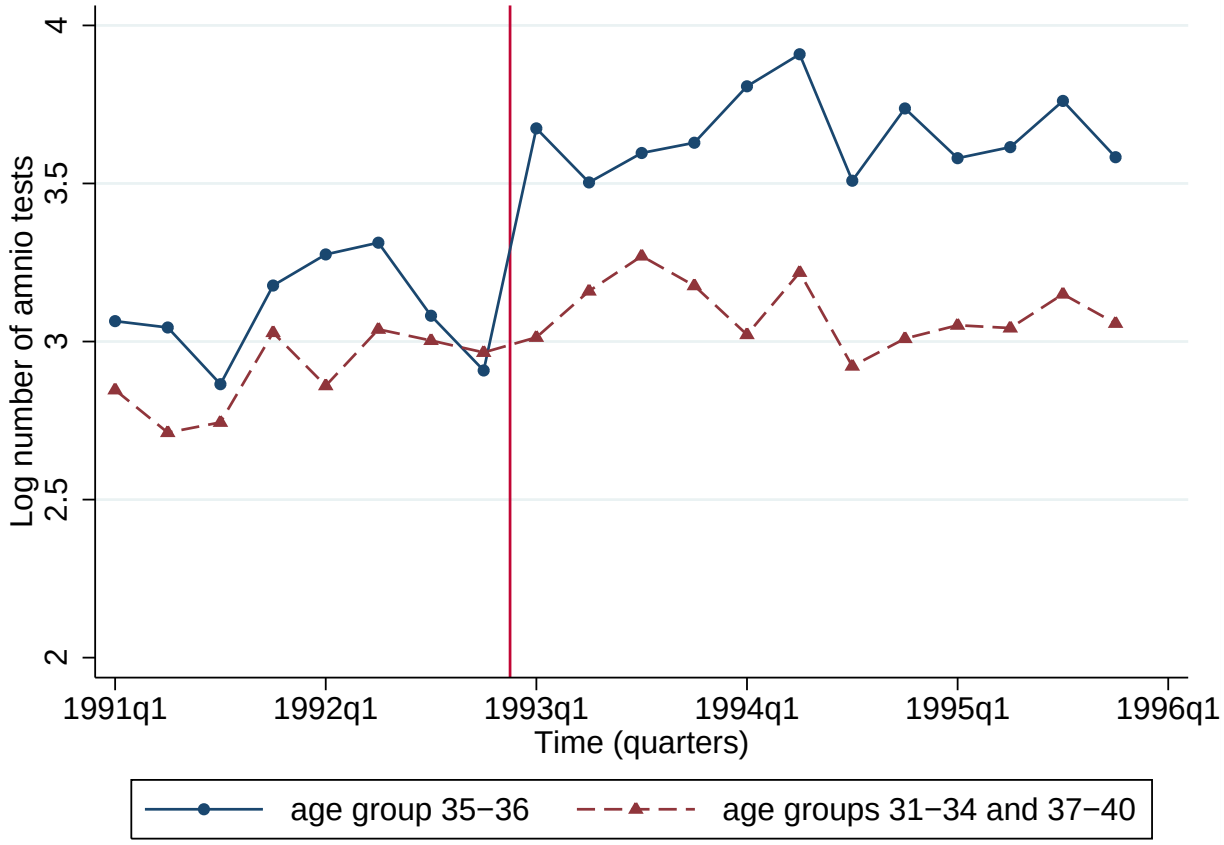
NOTE: Panels (a) and (b) of this figure illustrate women's response to a threshold financing policy when other screening tests exist, without and with financing, respectively. In both panels, the x-axis represents women's risk-type, $\tilde{p}$ and the y-axis represents women's costs and benefits from an amnio test. The dashed line represents the cost of an amnio test. The solid line represents the share of women who undergo amnio.

Figure 3: Impact of amniocentesis financing on takeup–model with an alternative screening test, dominant indirect effect



NOTE: This figure illustrates women's response to a threshold financing policy when other screening tests exit. In both panels, the x-axis represents women's risk-type, $\tilde{p}$ and the y-axis represents women's costs and benefits from an amnio test. The dashed line represents the cost of an amnio test. The solid line represents the share of women who undergo amnio.

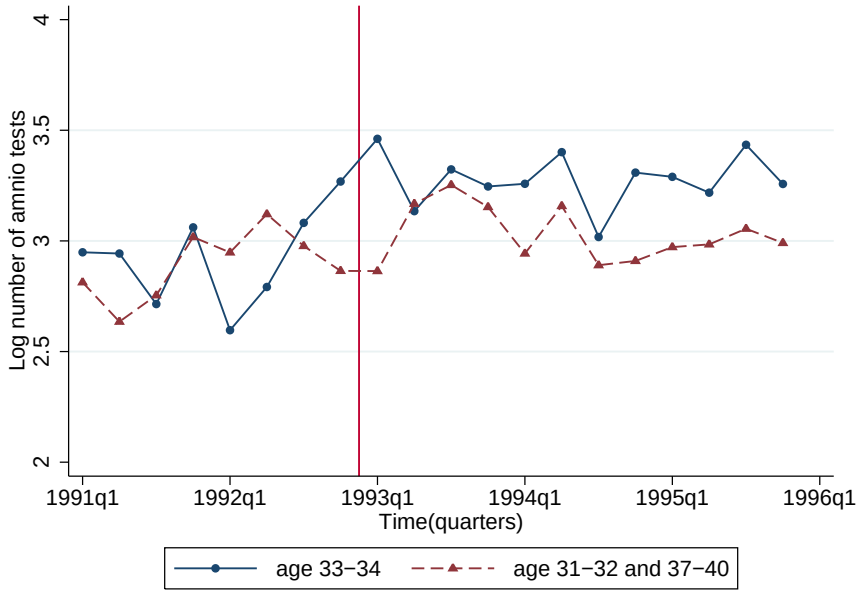
Figure 4: Impact of amniocentesis financing on takeup, DD analysis



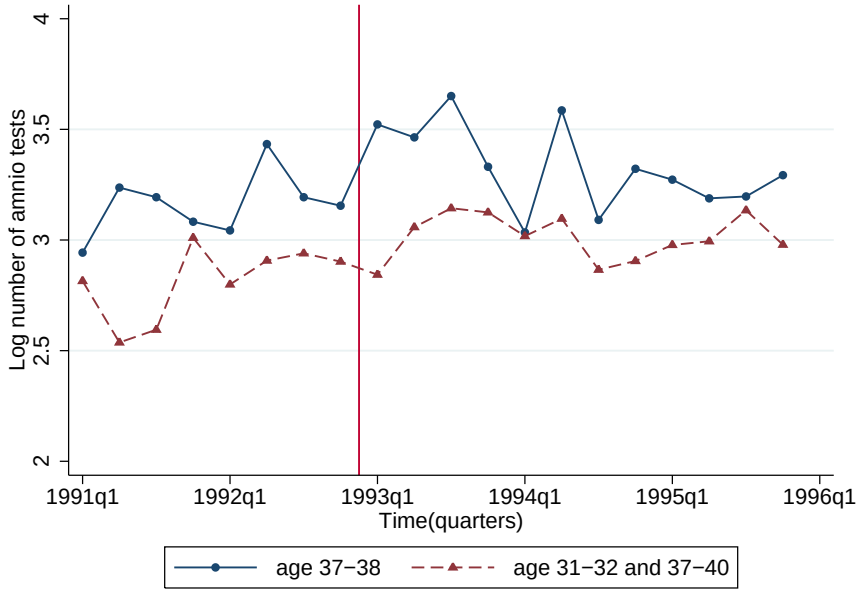
NOTE: The figure plots the mean number of amniocentesis tests per quarter, in natural log terms, in 1991-1995 among the treatment and comparison groups, age group 35-36 and age groups 31-34 and 37-40, respectively.

Figure 5: Impact of amniocentesis financing on takeup, placebo DD analysis

(a) Age group 33-34 as "treatment"

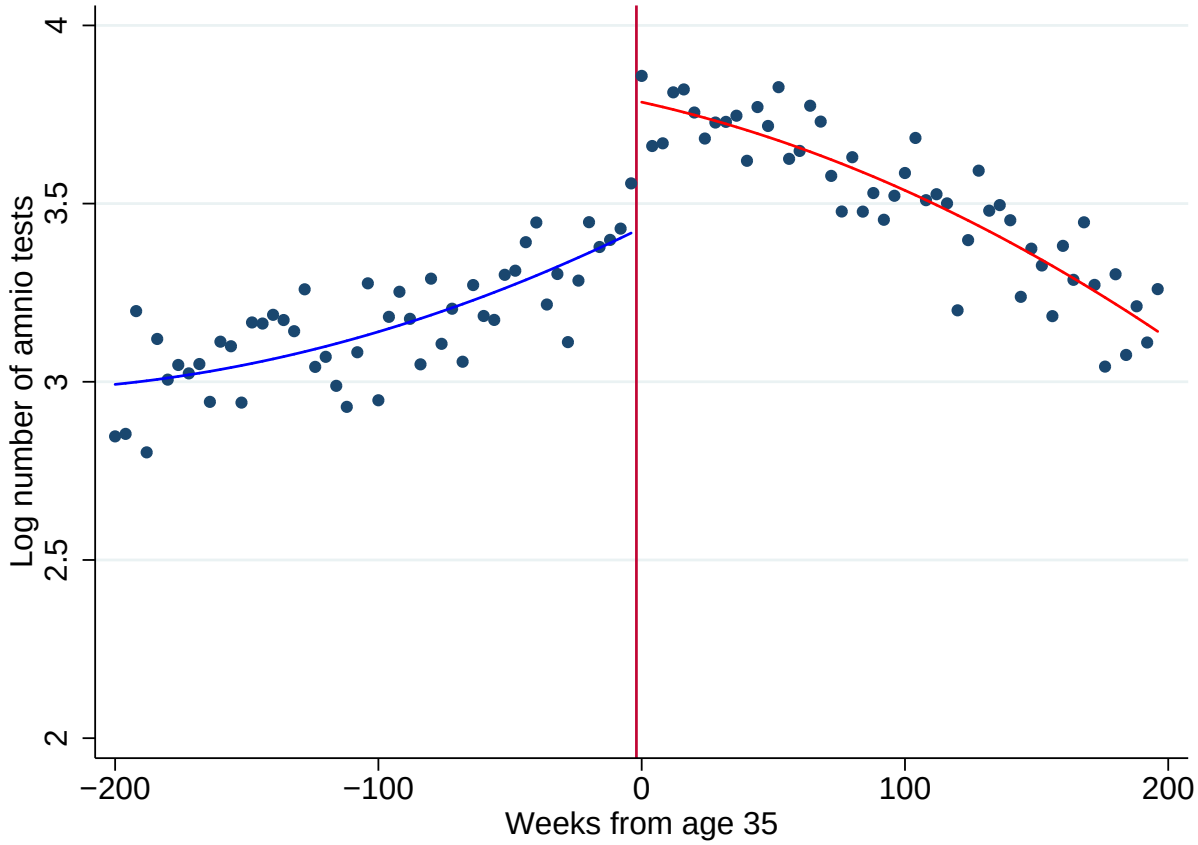


(b) Age group 37-38 as "treatment"



NOTE: Panels (a) and (b) of this figure plot the mean number of amniocentesis tests per quarter, in natural log terms, in 1991-1995 in the placebo-treatment and comparison groups.

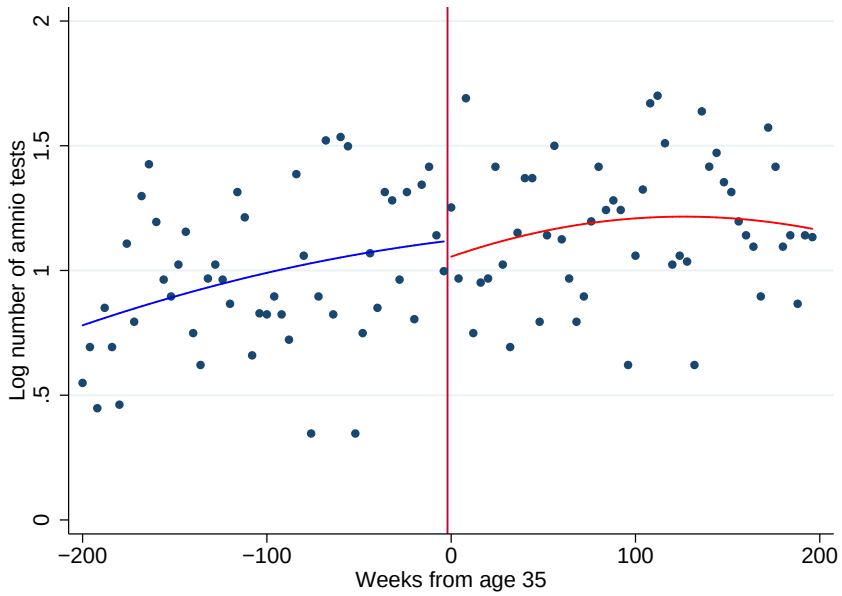
Figure 6: Impact of amniocentesis financing on takeup, RDD analysis



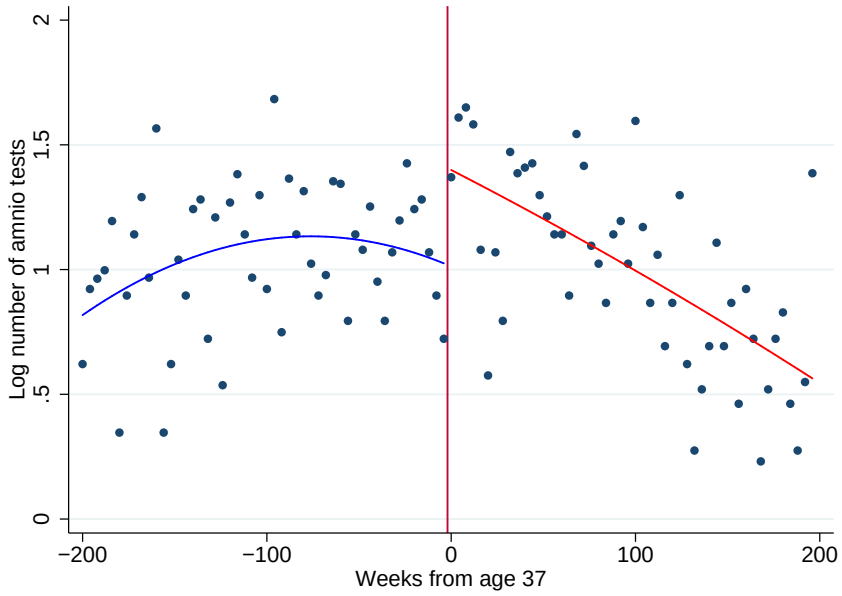
NOTE: The figure plots the number of amniocentesis tests in the sample, in natural log terms , by women's age at time of conception, in terms of weeks relative to thirty fifth birthday, 200 weeks before and after age 35 in four-week bins. The vertical solid line represents the eligibility threshold at age 35.

Figure 7: Impact of amniocentesis financing on takeup, RDD analysis validation checks

(a) Age 35

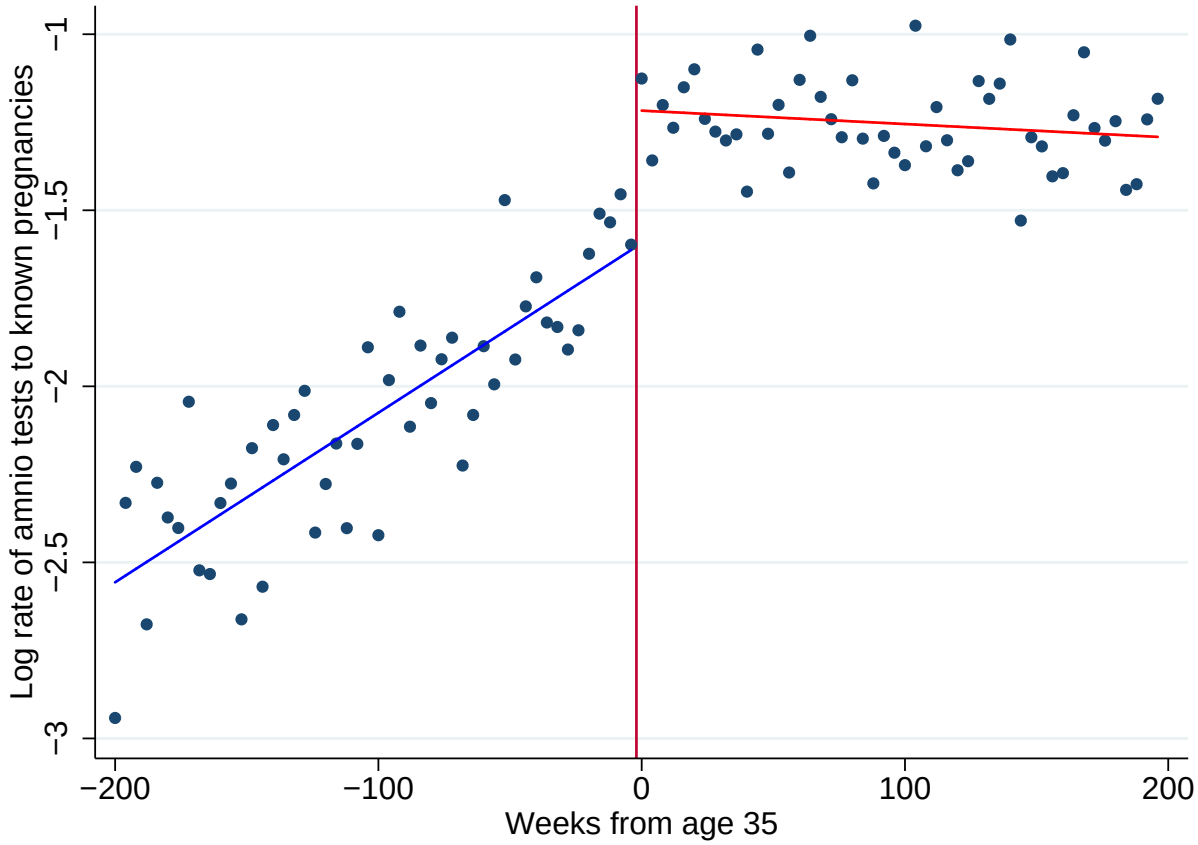


(b) Age 37



NOTE: Panels (a) and (b) of this figure plot the number of amniocentesis tests, in natural log terms, by women's age at time of conception, in terms of weeks relative to thirty fifth and thirty seventh birthday, respectively, 200 weeks before and after her birthday, in four-week bins. The vertical solid line represents the eligibility threshold at age 35 and age 37 in panels (a) and (b), respectively.

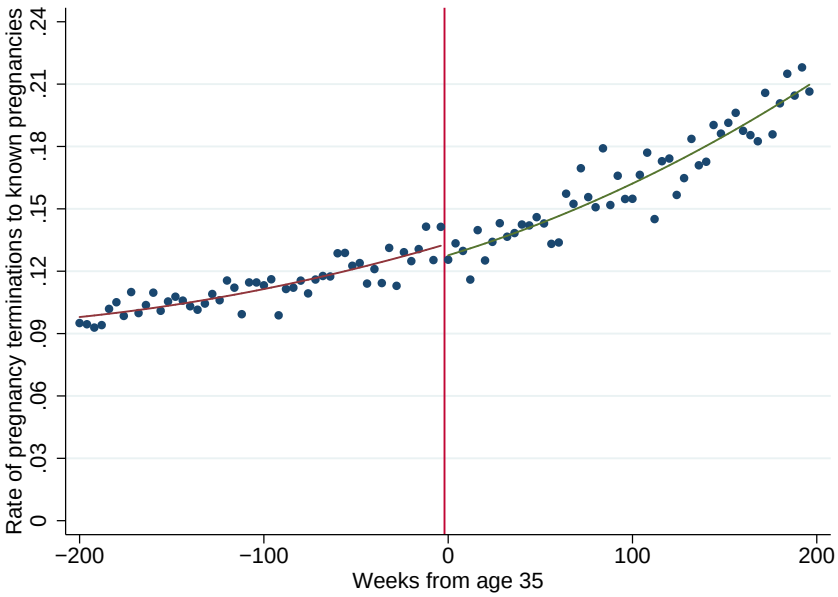
Figure 8: Impact of amniocentesis financing on the relation between takeup rates and maternal age



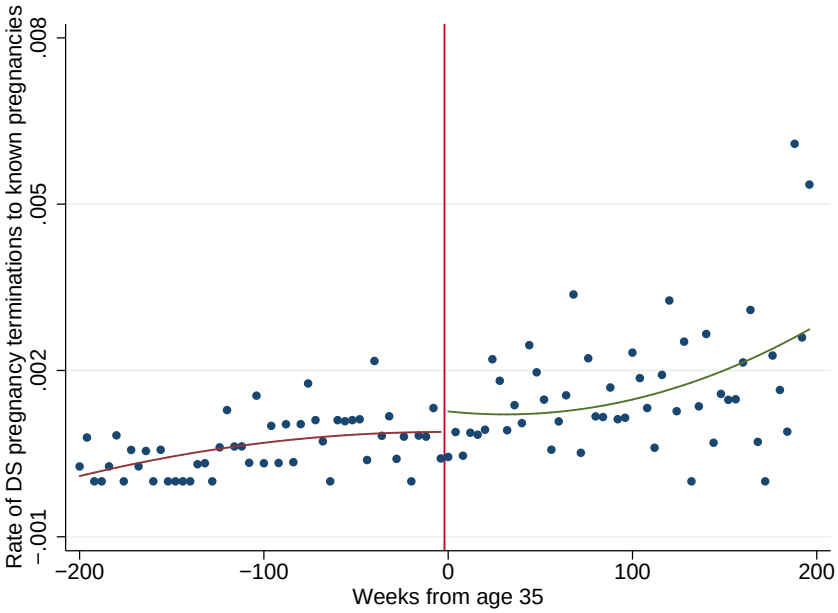
NOTE: The figure plots the rate of amniocentesis tests to known pregnancies, in natural log terms, by women's age at time of conception, in terms of weeks relative to thirty fifth birthday, 200 weeks before and after age 35 in four-week bins. The vertical solid line represents the eligibility threshold at age 35.

Figure 9: Impact of amniocentesis financing on pregnancy terminations, RDD analysis

(a) All pregnancy terminations 2000-2005

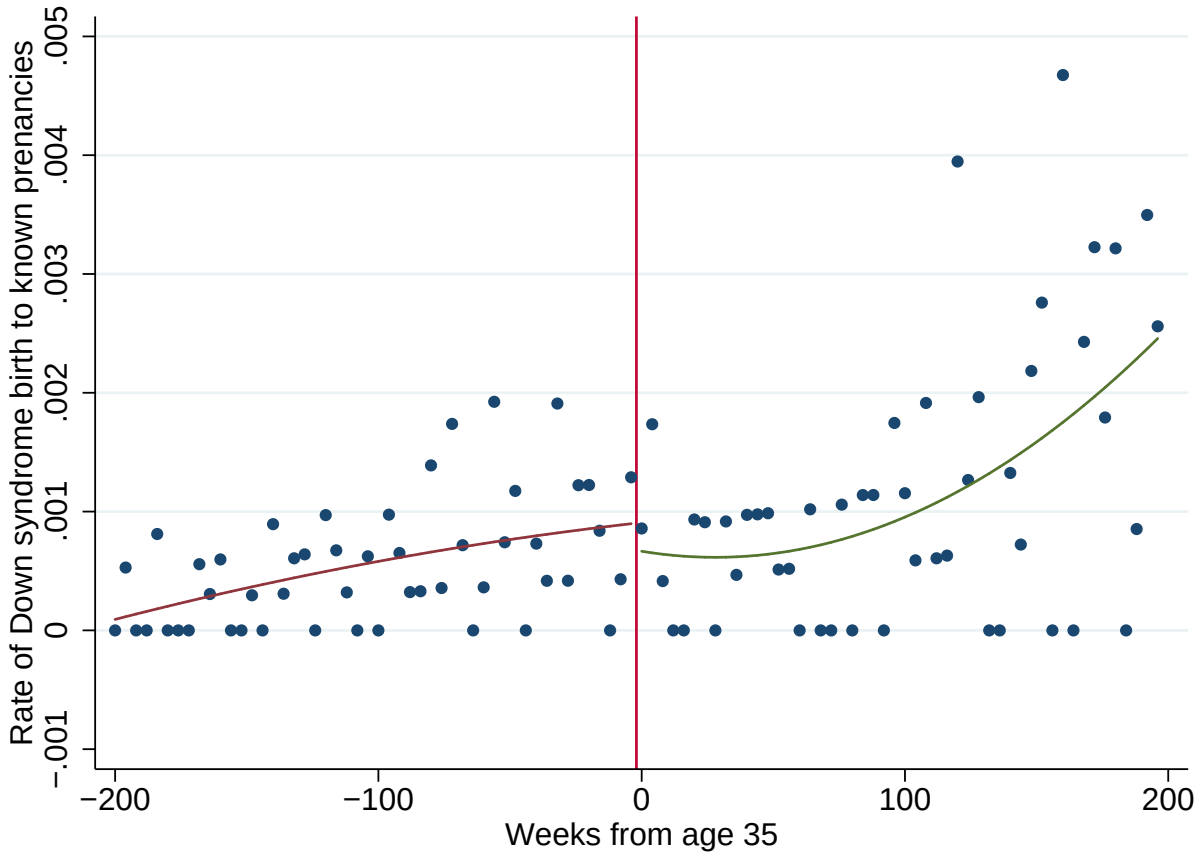


(b) Down syndrome pregnancy terminations 2000-2005



NOTE: Panels (a) and (b) of this figure plot the share of all pregnancy terminations and Down syndrome pregnancy terminations of known pregnancies, respectively ,in the 2000-2005 period, by a woman's age at time of conception, in terms of weeks relative to thirty fifth birthday, 200 weeks before and after age 35 in four-week bins. The vertical solid line represents the eligibility threshold at age 35.

Figure 10: Impact of amniocentesis financing on incidence of Down syndrome, RDD analysis



NOTE: The figure plots the share of Down syndrome births of known pregnancies, in the period 2000-2005, by women's age at time of conception, in terms of weeks relative to her thirty fifth birthday, 200 weeks before and after age 35 in four-week bins. The vertical solid line represents the eligibility threshold at age 35.