Pornography and Divorce

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Abstract

We test whether pornography causes divorce. Using state-level panel data on the divorce rate and sales of Playboy magazine, we document a strong cross-sectional and time-series relation between lagged sales of Playboy and the divorce rate. The simple correlation between divorce and sales lagged two years estimated with 1812 observations from 1962 to 1998 is 44 percent, with a T-statistic of 20. This large correlation is robust to (1) using only the first half of the sample, (2) adjusting for all state-level heterogeneity and for any time trends by including state and year fixed effects, and (3) using instrumental variables to correct for any possible endogeneity in Playboy sales. Our overall estimates suggest that sales of Playboy caused between 10 and 25 percent of all divorces in the United States between 1962 and 1979.

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Introduction

Over the past half century the consumption of pornography has increased dramatically as imaging technology has evolved and attitudes about sexuality have changed. Despite this dramatic increase, relatively little is known about the effects of pornography on the individuals who consume it, and even less is known about its potential impact on third parties, families, and society. This lack of knowledge is surprising given the long running debate about its regulation. State and local regulation of pornography is designed in part to keep pornography away from minors, but there are frequent reports that pornography affects families and society because it changes the behavior and attitudes of adults, demeans women, and otherwise harms third parties.[1] In this paper we examine one way in which pornography might affect families. Using both time series and cross sectional data on the divorce rate and pornography sales, we test the hypothesis that the availability of pornography causes divorce.

It is important to determine whether pornography causes divorce because divorce is widely perceived to be costly, and a better understanding of the causes of divorce may make it possible to reduce its prevalence. Waite and Gallagher (2000) argue that divorce has negative consequences for economic, educational, health and sexual outcomes. Others report that divorce leads to increasing poverty and inequality (e.g. Ananat and Michaels, 2008). There is ongoing debate about the costs of divorce to children, particularly about their educational, economic, and emotional well-being (Wallerstein, Lewis and Blakeslee 2000; Larson, Swyers and Larson, 1995). However, much of this debate asks whether parents that are unhappy together should remain married for the sake of their children. If pornography causes divorce by causing parents to be unhappy together then it is likely to be extremely costly for children. Moreover, to the degree that access to pornography is increasing, these costs may be growing with time.

We test our hypothesis by correlating the annual divorce rate with sales of Playboy magazine. We use both cross-sectional and time series data for the fifty United States and

[1] Paul (2004) reports that an increasing number of divorce lawyers say that online pornography is playing a significant role in divorces.

the District of Columbia from 1960 to 1998. Simple models find a very significant relation between Playboy sales and divorce. In fact, the correlation of the divorce rate and sales of Playboy lagged 2 years is 44 percent. Regressing the divorce rate on magazine sales suggests that almost one third of the nearly 35 million divorces during our sample period are associated with Playboy sales. Estimating the simple regression by year suggests that the relation has a strong cross-sectional component, and estimating it by state suggests a strong time-series component. We argue that Playboy sales are so strongly related to the divorce rate that it seems implausible that all of the relation is due to divorce causing sales of Playboy or some third variable causing both. It is so strong that sales of Playboy almost certainly cause some divorce.

Of course, these simple models do not control for any of a number of variables that might be related to divorce. We control for all state-specific and time-varying attitudes or attributes that might be important by including both year and state fixed effects in more sophisticated regressions. In these specifications Playboy sales are still very strongly related to the divorce rate. In fact, the correlation between sales and divorce after demeaning the data by state and by year (and after excluding the outlier state of Nevada and the second half of the sample) is a very statistically significant 13.3 percent.

Because it is possible that some third variable affects both pornography and divorce, simple models can only suggest a causal relation. To have more evidence about whether the relation between pornography and divorce is causal, we employ two classic econometric techniques. First, we determine whether lagged, contemporaneous, or leading sales of Playboy are better predictors of divorce. If sales rise in response to divorce then leading sales of Playboy should be a good predictor of divorce. If instead sales of Playboy cause divorce then lagged sales should be a better predictor. We find that lagged sales are a much better predictor, particularly when contemporaneous and leading sales are simultaneously included in the regression.

Second, we use an instrumental variables technique to address causality. In econometric terms, the problem of causality can be considered a problem of endogeneity. If a completely exogenous variable is related to a dependent variable in a well specified model then the exogenous variable can be said to cause the dependent variable. If, however, a third variable

which is omitted from the regression explains both the dependent and explanatory variables then the explanatory variable is not truly independent, or it is endogeneous. Instrumental variables methods are the standard way for econometricians to deal with endogeneity.

An alternative way to think about our instrumental variables method is to think of supply and demand effects for pornography. We are essentially asking whether the divorce rate would be different if pornography were less available. The best way to answer our question might be to conduct an experiment in which we first supply pornography to some randomly chosen set of 'treatment' households, second supply some other reading material to a set of 'control' households, and third observe which households experience a subsequent divorce. This experimental approach is appealing because any correlation of the divorce rate and our random supply of pornography would clearly be driven by supply effects rather than any demand effects.

While such experimentation is neither ethical nor feasible, our instrumental variables method approximates such a procedure by separating supply and demand effects. The idea behind our instrumental variables model is to identify some variables that measure state-specific disparities in the supply of Playboy that should be unrelated to the demand for Playboy. We use two sets of instruments for our tests. One set consists of the fraction of both Time and Playboy magazines that are sold without subscriptions. The second set consists of population density and the total number of copies of Time magazine sold divided by the population. We argue that all of these instruments help to measure the availability of Playboy in any given state, since in states with fewer locations to purchase magazines more readers will have to subscribe. Neither set seems likely to be related to the demand for pornography. Our instrumental variables estimates are consistent with all the other estimates in the paper and with the conjecture that sales of Playboy causes divorce.

We focus most of our analysis on the 1960s and 1970s simply because this is a time period in which Playboy sales were growing rapidly and there were few other large-scale providers of pornography in the United States. We estimate that the overall magnitude of the effect we examine implies that between 1.4 and 3.5 million of the 14 million divorces between 1962 and 1979 are due to the availability of Playboy. We conclude that between 10 and 25 percent of the divorces in the United States during the 1960s and 1970s were caused by pornography.

In the next section, we develop our hypothesis more completely and discuss some related research. In Section 2 we describe the data that we use and in Section 3 we review the results of our statistical tests. Section 4 concludes.

1 Hypothesis

We hypothesize that the availability of pornography has a causal effect on divorce. To motivate our hypothesis, we need a working definition of pornography. We consider pornography to consist of images, text, or other visual or auditory material that is designed to cause sexual arousal. Any media that affects sexuality is likely to affect marriage. However, there are conflicting arguments about how pornography affects marriage. Some argue that by causing sexual arousal, pornography helps spouses to be more intimate and thus pornography has a positive effect on marriage. Others argue that pornography reduces marital intimacy and therefore encourages divorce.

Pornography might strengthen marriage if it allows couples to overcome inhibitions or if it encourages intimacy by helping spouses become aroused. Strossen (2000) argues that pornography can be beneficial to couples, pointing out that some sexologists recommend it as a mode of treatment for couples with clinical sexual problems. She also argues that pornography can improve the sexual satisfaction of women by providing instructional information about intimacy to their partners. In both of these conjectures, pornography might be viewed as a compliment to intimacy in marriage. Pornography might also help to prevent infidelity if it is a substitute for extra-marital relationships. If pornography helps to strengthen marriage or reduces the frequency of extra-marital affairs then we should find that an increase in pornography causes a decrease in the divorce rate.

Pornography might alternatively act as a substitute for intimacy in marriage, reducing marital satisfaction and causing divorce. Zillman and Bryant (1994) report that exposure to pornography leads to reduced sexual satisfaction with one's spouse. By reducing sexual satisfaction, an important predictor of marital success, pornography may thus disrupt marriages by weakening an important tie between spouses. Pornography may also weaken the marital bond because it requires time and resources that could otherwise be available to the spouse

and family. The possibility for such resource diversion is significant, since many therapists consider pornography to be addictive (Cline, 1994; Schneider, 2000; Mitchell, Becker-Blease and Finkelhor, 2005; Griffiths, 2001). Some estimate that pornography is $10 billion a year industry - bigger than any of the major league sports and perhaps bigger than Hollywood.[2]

The consumption of pornography may also cause divorce through its effect on spouses that do not use it. If spouses view pornography use as a form of infidelity, as argued by Whitty (2003), then the marital conflict that using pornography creates might lead to divorce. Survey data suggest that many people view a spouse's consumption of pornography as disloyal and a form of infidelity (ABC News Poll, 2004) and that it thus creates marital tension, and reduces trust, intimacy, and the spouse's self esteem (Bridges, Bergner, and Hesson-Mcinnis, 2003). Consistent with this, many therapists and researchers find that market innovations that allow more anonymous consumption of pornography often increase the effects of pornography that they observe. Consumers presumably prefer to remain anonymous at least in part to avoid upsetting a spouse.

Pornography may create other problems for married couples. Researchers have examined the connection between pornography use and aggressive behavior (Donnerstein, 1983; Allen, 1995) and some have suggested that pornography changes men's attitudes toward women, including the acceptability of violence toward women (Check and Guloien, 1989; Malamuth and Check, 1981; Donnerstein and Berkowitz, 1981; Fisher and Grenier, 1994). Eberstadet and Layden (2010) argue that pornography negatively affects attitudes, marriages and society in a number of different ways. If consumption of pornography tends to increase aggression or negatively affects men's view of women, it may exacerbate existing marital difficulties and create additional tension.

In sum, there are several different reasons to suspect that pornography might affect divorce in either a positive or a negative way. Our null hypothesis is that there is no relation between pornography and divorce. Of course, there are also reasons to suspect that divorce might cause consumption of pornography. It is also possible that some third unobserved variable, such as attitudes toward sexuality and fidelity or the health of the marriage relationship, causes both divorce and pornography use. We try to disentangle

[2]This was reported by Frank Rich in the *New York Times* on May 18, 2001

these possibilities in our tests below.

Prior research on the social costs of pornography has focused on a possible connection to rape (Kutchinsky, 1991; Baron and Straus, 1984). Most of this research regresses pornography consumption on reported rapes. This approach does not establish causality since a third variable might easily cause both rapes and pornography use. Some recent papers examine this relation using an instrumental variables approach. Kendall (2007) and Wongsurawat (2006) both use variation in the cost of privately accessed pornography; Kendall examines how rape changes with access to the internet and Wongsurawat examines its connection with post office boxes, both of which facilitate the private consumption of pornography. Although the focus of Wongsurawat's paper is rape, in a brief look at divorce he concludes that the effect is not robust to an instrumental variables approach. Using changes in survey responses over a five year period, Kendall (2010) finds that there is almost no correlation between internet adoption and divorce. Internet adoption measures a number of things, including access to pornography, the ability to meet others online, and increased exposure to a number of communication technologies and information sources. Since internet adoption measures so many different things simultaneously, it is difficult to interpret Kendall's results. In fact, it is difficult to think of an easy way to measure pornography consumption in the last couple of decades. We have not found related papers that examine the connection between pornography and divorce as directly or in as much detail as our study.

We hypothesize that there is a causal relation between pornography and divorce. We test our hypothesis in a number of ways, including both time-series and instrumental variables tests. We describe these tests in more detail in Section 3.

2 Data

We test our hypothesis by regressing the divorce rate on the sales rate of pornography. We use the divorce data used in Stevenson and Wolfers (2006), which are available for download on Justin Wolfer's webpage. For most states, the divorce data start in 1956 and end in 1998. For some states, most notably Louisiana, Indiana, New Mexico and California, the time-series of available divorce data is shorter. The divorce rate is defined as the number of

divorces taking place in a state during a year per thousand people that live in the state.

We merge these divorce data with data on the sales rate of Playboy magazine. We collect Playboy sales data largely by hand from series of Magazine Publisher's Statements published by the Audit Burea of Circulations (ABC). The ABC statements are published every June and December, and they report sales numbers for each of the 50 states and the District of Columbia for one month during each six-month interval. The statements also give the number of magazines sold by subscription and the number sold without a subscription. We average the sales numbers for the two reports for each year and divide this number by the state population divided by one hundred (provided by Stevenson and Wolfers) to get an average sales figure per hundred people that live in the state. We collect from ABC statements both the number of sales by subscription and the number of non-subscription sales for each year from 1960 to 2004.

As explained above, we are concerned about the possibility that Playboy sales are endogenous to divorce. We select instrumental variables that are unlikely to be related to the demand for pornography but are likely to be related to the supply. For two instrumental variables, we also collect data on ABC sales data for Time magazine from 1960 to 1978. One of our sets of instruments is the fraction of Time that is sold without a subscription and the fraction of Playboy that is sold without a subscription. Our second set of instruments is the sales rate of Time and population density.

In an effort to measure our independent variable as precisely as possible, we also collect data on sales of Penthouse magazine from 1970 to 1993. In 1970, the sales rate of Penthouse is only about 0.2 percent, but it climbs to almost 2 percent by 1979. In unreported results, we combine sales of Penthouse with sales of Playboy for all of our major regressions. None of our qualitative results are changed by the additional data, but some estimated coefficients became smaller as the average magnitude of the independent variable grows. We report results based solely on Playboy sales because we want to measure how many people are consuming pornography rather than how many magazines each person that consumes pornography reads. To the extent that some consumers buy both Penthouse and Playboy, using the sum of magazine sales is double-counting.

Some summary statistics about the divorce rate and sales of Playboy across states appear

in Table 1. Because our pornography data begin in 1960 and our divorce data end in 1998, we restrict the sample to this 39-year period. The overall divorce rate varies from lows of about 2.5 in states like Massachusetts, New York, and New Jersey, to a high of 17.46 for Nevada. Nevada is an obvious outlier in these data, presumably because Nevada state law makes it fairly easy to obtain a divorce. Residency requirements in Nevada are unusually lenient and divorces for irreconciliable differences are very common in Nevada. Because many of the divorces in Nevada may be driven by people from out of state, we exclude Nevada from much of our subsequent analysis. Excluding Nevada, high divorce rate states include Oklahoma, Arizona and Wyoming with rates around 6.5. The overall divorce rate average is about 4.5.

Playboy sales are low in southern states like Mississippi, Arkansas and West Virginia, with rates around 1.0. Sales are high in Nevada, Alaska, Washington DC and Colorado, with rates around 3.0. The overall average sales rate is about 1.8.

Some plots of the time series characteristics of both divorce and pornography sales appear in Figures 1 through 4. Figure 1 shows that the average divorce rate first climbed from 1960 to the early 1980s and then declined somewhat. Figure 2 illustrates the path of sales of Playboy magazine over the sample period. At the beginning of the sample the average sales rate is close to 0.5, but sales climb rapidly during the sixties and early seventies, reaching a maximum of about 2.9 in 1972. After 1972 sales declined slowly as competing magazines and other products were introduced. At the end of the sample the rate is substantially below its peak in 1972 but it is still a bit more than twice as large as the rate in 1960.

The sharp rise of Playboy sales and their subsequent fall are significant empirical facts for our tests. The low value of sales in 1960 confirms that sales were probably not sufficiently large to affect the aggregate divorce rate before 1960. This is the primary reason that we start collecting sales data in 1960. The sharp rise in sales in the early part of the sample suggests that Playboy had the potential to cause significant social changes in the seventies. The decline of sales after 1972 implies that we should exclude some later years from our sample. In the 1970s Playboy began to face more competitors and thus lost some of its market share.

Figures 3 and 4 plot the fraction of Playboy sales that are non-subscription and the

cross-sectional standard deviation of Playboy sales over time. Figure 3 shows that while in the sixties most copies of Playboy were sold without a subscription, the fraction of sales made by subscription climbed steadily through the late seventies and the eighties. By the nineties only about twenty percent of the copies of Playboy were sold at newspaper stands, convenience stores and other retail outlets. Figure 4 shows that the cross-state variation in sales of Playboy was quite low in 1960 but increased rapidly through the sixties. Cross-state variation peaked in the early seventies and then declined through the rest of the sample. This implies that our statistical power to examine cross-state effects is likely to be particularly large in the first half of the sample. Both figures are consistent with the conjecture that Playboy's importance for marriage and divorce probably peaked in the first half of the sample. Given these observations, in much of our subsequent analysis we restrict our regressions to the period between 1960 and 1980.

3 Results

In this section we describe our results. First we report the results of simple pooled regressions. The simple pooled regressions imply an extremely strong positive relation between sales and divorce. To determine the nature and robustness of this relation, we examine a number of additional models that control for various potential features of the data, giving progressively more conservative estimates of the relation. After the pooled regressions we describe yearly cross-sectional and state-by-state time series regressions. Next we report results of panel-data regressions using various lags and leads of Playboy sales, and we report results of our instrumental variables estimation. Finally, we discuss the likely magnitude of the effects we estimate.

3.1 Pooled Regressions

We begin our tests by examining simple pooled regressions of the divorce rate on the Playboy sales rate that are described in Table 2. In Panel A we report regression results that use the entire sample. In Panel B we omit the outlier state of Nevada from the data, and in

Panel C we restrict our data to the first half of the sample, from 1960 to 1979. In each of the panels, Models 1 through 5 are simple univariate regressions with no control variables or fixed effects of the form,

$$\text{Divorce}_{i,t} = \alpha + \beta \text{Playboy}_{i,t-k} + \epsilon_{i,t}, \tag{1}$$

where i indicates the state, t indicates the year and both Divorce and Playboy are divided by state population[3]. The models differ only in the timing of Playboy sales (from leads of two years to lags of two years, so that k varies from -2 to 2). Models 6 and 7 are multiple regressions with several years of Playboy sales included in each regression, of the form

$$\text{Divorce}_{i,t} = \alpha + \beta_2 \text{Playboy}_{i,t+2} + ... + \beta_{-2} \text{Playboy}_{i,t-2} + \epsilon_{i,t}, \tag{2}$$

for Model 7. While these multiple regressions are seriously affected by the multicollinearity of Playboy sales in adjacent years, they are helpful to determine whether past or future sales are more strongly associated with divorce.

All of the univariate regression estimates are extremely statistically significant, with T-statistics greater than 15 in every model with lagged and concurrent sales. This is good evidence that there is at least a statistically important relation between divorce and pornography. The magnitude of the coefficients suggests a socially important relation as well. Overall there were about 34.61 million divorces in the data during the time period of our study (from 1961 to 1998). Over the same horizon (with a lag of one year, so from 1960 to 1997), about 1,666 million copies of Playboy were sold. Since the divorce rate is calculated per thousand people while the sales rate is calculated per hundred, the implied number of divorces from Model 2 of Panel B, with a coefficient of 0.73, is 0.73/10 * 1,666/12 million = 10.10 million divorces, or about 29 percent of all the divorces observed during our sample period. This is consistent with the R-squared values that we observe for these models, which range from 19 percent to 11 percent. As mentioned in the introduction, the correlation coefficient corresponding to Model 1 of Panel A is 44.0 percent. The correlation for Model 1

[3]Divorce is measured per 1000 people and Playboy per 100 people

of Panel C (without Nevada and the second half of the sample) climbs to 52.3 percent. By contrast, the correlation between lagged sales of Time magazine and divorce from 1960 to 1979 is only 6 percent and is not statistically significant.

Considering which of these models is most reasonable, it seems likely that it generally takes some time for sales of Playboy to cause divorce, suggesting that models with concurrent sales are probably not the best. It also seems like a good idea to exclude Nevada from the analysis, since its divorce rate is clearly an outlier and is likely to be at least partially due to divorces among people from neighboring states like California. Finally, the coefficients for sales lagged one year are generally smaller than those lagged two years. To be conservative, we believe the best pooled regression estimate is that of Model 2 of Panel B (0.73), which again suggests that close to one third of all divorces from 1961 to 1998 were related to sales of Playboy.

While the magnitude and the significance of the pooled regression estimates are impressive, they seem almost unreasonably large. It is likely that either heterogeneity across states or some other non-causal relation between divorce and pornography sales partially drives these results. We investigate these possibilities below.

3.2 Cross-Sectional Regressions

We further test whether pornography is related to divorce by examining the simple cross-sectional relation between divorce and sales of Playboy, of the form,

$$\text{Divorce}_i = \alpha + \beta \text{Playboy}_i + \epsilon_i, \quad \text{Estimated by Year.} \tag{3}$$

We describe several different versions of these regressions, the coefficients of which are reported in Table 3. In all of the regressions, we regress the divorce rate in year t on the playboy sales rate in year $t-2$. Again, we lag the rate because it takes at least a few months to get divorced and thus it seems unlikely that any relation between contemporaneous Playboy sales and divorce can be due to sales causing divorce.

The first column of Table 3 reports the coefficients of simple OLS regressions by year. Remarkably, the coefficients in these regressions are quite large and 28 out of 37 of the

coefficients are statistically different from zero at the five percent level or higher. Also remarkably, all of the coefficients before 1989 are significant, and the largest coefficients appear to occur at the beginning of the sample.

The second column of Table 3 reports the coefficients of cross-sectional OLS regressions that include both Playboy sales and dummy variables for the nine regions of the country described in Table 1. Adjusting for regional heterogeneity actually appears to strengthen the results of the first column. Model 3 replicates Model 2 without data for the state of Nevada. Excluding Nevada reduces the magnitude and significance of the coefficients substantially, but it is still the case that all but one of the estimated coefficients is positive and four are statistically significant. Model 4 keeps the regional dummy variables, includes data for Nevada, and estimates the regressions with population-weighted least squares. Population-weighting reduces the magnitudes and significance of the coefficients substantially, but 10 of the coefficients are still significantly positive and only 3 out of 37 are negative.

The last column of Table 3 reports the estimated coefficients of cross-sectional regressions that include regional dummies, exclude data for Nevada, and use population weights. Since these regressions control for heteroskedasticity, regional heterogeneity, and outliers, they are our most conservative estimates of the relation between divorce and Playboy sales. In this column none of the individual coefficients is statistically significant. However, all but six of the coefficients is positive and five of the six negative coefficient estimates occur after 1988. Looking just at the coefficients from 1962 to 1979, 17 out of 18 coefficients are positive and the average coefficient is 0.24. If each coefficient's sign is an independent draw from a binomial distribution with $p = 1/2$, the probability of finding either zero or one negative coefficient out of 18 is 0.00007. Thus, while none of the coefficients is individually statistically significant, consistent with the pooled regressions of Table 2 they are extremely significant in a joint test.

The cross-sectional evidence in Table 3 is strongly suggestive of a relation between divorce and pornography. It confirms that this relation appears to be strongest in the first half of the sample, and it shows that the relation is not driven by either Nevada, regional differences, or the influence of very low-population states. However, the cross-sectional results in Table 3 do not adjust for the potential endogeneity of Playboy sales, and they tell us little about

any possible time series correlation between the divorce rate and sales. We examine both of these issues below.

3.3 Time Series Regressions by State

To determine whether the relation we document in Table 2 is due completely to the strong cross-sectional relations described in Table 3, we estimate analogous time series regressions for each state and report the results in Table 4. The first column in Table 4 gives the simple OLS regression coefficient (β) in a model of the form,

$$\text{Divorce}_t = \alpha + \beta \text{Playboy}_{t-2} + \epsilon_t, \quad \text{Estimated by State.} \tag{4}$$

The second column in the table reports coefficients corrected for third order autocorrelation using the Yule-Walker method. Louisiana is excluded from the results because its time series is too short to estimate a coefficient accurately.

The results in Table 4 show a remarkably strong time series relation between Playboy sales and divorce rates. In the simple OLS specification, 47 out of the 50 coefficients is statistically significant at the five percent level or better. In the autocorrelation-corrected specification, 31 of the 50 coefficients is significantly positive and only one estimated coefficient is negative. Interestingly, the states that do not have significant coefficients (or even have negative coefficients in two cases) are Nevada, New York and Rhode Island. The fact that Nevada has an insignificant coefficient is consistent with its status as an outlier, and it gives us a little bit more reason to exclude the state from our subsequent analyses.

Looking at the coefficients in Table 4 together, there is no question that the relation between the time series of state divorce rates and sales rates is jointly very significant. The average corrected coefficient is 0.61, which is reasonably close to the coefficient estimates in our pooled regressions reported in Table 2.

We have documented that there is a strong positive relation between divorce rates and Playboy sales. This relation seems to be driven both by the cross-section and by the time series of both variables. The remarkable 44 percent correlation of sales and divorce is a fairly robust finding. We have not examined whether this relation is causal, or whether

sales actually cause divorce. It is likely, of course, that divorce causes some consumption of pornography or that some third unobserved variable drives both divorce and sales. However, given the strength of the relation documented in Tables 2, 3 and 4, it would be very surprising if pornography did not cause at least some divorce. We turn to tests of causality in the next section.

3.4 Causality with Lag Structures

To help determine whether Playboy sales actually cause or are simply correlated with divorce, we use two classic econometric techniques. The first technique we use is an adaptation of the causality tests of Granger (1969). Because Granger's causality test is designed to be performed with time-series data rather than the panel data that we have, our tests are similar but not identical to standard Granger causality tests. The idea behind Granger causality is that if a variable x predicts another variable y and y does not predict x then it can be said that x causes y. After controlling for the time-series path of divorce rates and for various types of heterogeneity, we test whether lagged, leading, or contemporaneous values of Playboy sales rates have the most power to forecast divorce rates.

We estimate pooled regression models for divorce rates with year fixed effects, different sets of geographic effects and various lags and leads of Playboy sales, of the form

$$\text{Divorce}_{i,t} = \gamma_i + \delta_t + \beta \text{Playboy}_{i,t-k} + \epsilon_{i,t}. \tag{5}$$

These regressions are similar to those in Panel C of Table 2 but these include year and geographic fixed effects. We use only data from the 1960s and 1970s in the regressions, and we allow k to vary from 2 to -2. The year and geographic fixed effects in the models control for a large number of potentially important variables, including the time-series path of aggregate divorce rates and any region or state-specific heterogeneity that does not vary with time. Because Playboy sales rates are very persistent, it is likely that both past and future values of Playboy sales will be significantly related to divorce rates in univariate regressions. Therefore, our most revealing tests will consist of multiple regressions with both

lags and leads of Playboy sales rates included, such as,

$$\text{Divorce}_{i,t} = \gamma_i + \delta_t + \beta_{-1}\text{Playboy}_{i,t-1} + \beta_0\text{Playboy}_{i,t} + \beta_{+1}\text{Playboy}_{i,t+1} + \epsilon_{i,t}. \qquad (6)$$

If lagged values forecast divorce in these regressions and leading values do not, we will consider that evidence suggesting that Playboy sales cause divorce.

The results of our pooled regression models appear in Table 5. Panel A reports regressions with no geographic fixed effects, Panel B reports regressions with regional fixed effects, and Panel C reports regressions with state fixed effects. The first three panels in Table 5 report OLS regression results while Panel D reports population-weighted least squares estimates. All the regressions contain dummy variables to control for year fixed effects. Looking at the univariate results, the pattern of the coefficients and their significance is interesting. The largest coefficients in most of the panels are the contemporaneous coefficients, followed by the coefficients for Playboy sales lagged one year. Sales lagged two years are somewhat significant, and future values of sales are largely insignificant and relatively small.

Looking at the multiple regression results in all the panels, we can infer that the persistence in sales rates causes a great deal of multicollinearity in these regressions, which reduces the magnitudes and significance of the coefficients. In fact, only in Panel C are any of the coefficients significantly positive. Looking at Model 6 in Panels C and D, the lagged sales coefficients are positive, reasonably large, and statistically significant (though only marginally so, at the 10% level for the weighted least squares regression). The future sales coefficients are both negative in these regressions, and the contemporaneous sales coefficients are close to zero.

In unreported results we include the unilateral divorce law variables of Stevenson and Wolfers (2006) in these regressions. The unilateral divorce law variables are generally not statistically significant in these regressions, and the coefficients on sales of Playboy are almost unchanged.

While all of the results in Table 5 are of interest, there are a few reasons to take the population-weighted least squares results a little less seriously than the OLS results. First, the correlation between the squared errors from the panel regressions described in Table 5

and the inverse of state population is only about seven percent, and the correlation is only marginally statistically significant. Apparently, using state and year fixed effects helps to resolve any heteroskedasticity problem in using state-level data. Second, while much of the identification of our regressions is from smaller to mid-sized states, the population-weighted least squares results focus primarily on large states like New York and California. We report population-weighted least squares results for completeness, but it is not clear that those estimates are superior to the OLS estimates in the other panels. Overall, the evidence in Table 5 suggests pornography causes divorce and that the relation between these two variables is robust to controlling for time-series and cross-sectional fixed effects.

3.5 Causality with Instrumental Variables

While the results of the previous section certainly suggest that pornography causes divorce, a more widely accepted way to determine causality is with instrumental variables. To explain our instrumental variables approach requires some discussion of the potential endogeneity of Playboy sales to divorce.

There are two alternative explanations for the correlation we observe between pornography and divorce. The first explanation holds that as pornography becomes more available or cheaper, some people consume more of it. As discussed above, consuming pornography causes their marriage relationship to deteriorate either because they neglect their spouses, their spouses equate pornography with infidelity, or their attitudes toward their spouses change. When their relationship is sufficiently weakened, they divorce. In this explanation for the correlation, pornography causes divorce and some part of the variation across states in the divorce rate is driven by variation in the supply of pornography.

The second explanation holds that over time some relationships suffer and one spouse or the other begins to consume pornography because he or she feels neglected in the marriage. One variant of this explanation is that spouses only begin to consume pornography when they are already separated or divorced. Because of the persistence in pornography sales and the time involved in acquiring a divorce, this explanation cannot be ruled out by the evidence presented above. In this explanation, divorce will occur regardless of the availability

of pornography, and variation in pornography sales across states will primarily be driven by variation in demand.

The main difference between these two explanations is that in the first the supply of pornography truly causes divorce while in the second the demand for pornography happens to accompany divorce. Of course, some of both of these explanations is almost certainly required to explain the correlation between divorce and pornography sales. However, we cannot make inferences about the degree to which pornography causes divorce without separating the effects of these two explanations. In econometric terms, the second explanation is characterized by endogenous consumption of Playboy while the first is characterized by exogenous consumption. Instrumental variable techniques have been developed by econometricians to separate endogenous and exogenous effects. In this subsection we describe an instrumental variables estimator that allows us to separate the effects of the demand for and the supply of pornography.

Solving our endogeneity problem requires us to identify some additonal variables, or instruments, that are correlated with the supply of Playboy but are not correlated with the demand for Playboy. If we can identify such instruments then we can use them to estimate our model by the generalized method of moments (GMM), which is a generalization of the well-known method of two-stage least squares. In two-state least squares estimation, the first stage involves constructing a proxy for Playboy sales that is driven by the supply of Playboy rather than the demand. We estimate a regression of the form,

$$\text{Playboy}_{i,t} = \gamma_i + \delta_t + \sum_{j=1}^{J} \theta_j Z_{j,i,t} + \epsilon_{i,t}. \tag{7}$$

In this regression equation the variables identified as $Z_{j,i,t}$ are the instruments, which again are designed to identify variation in the supply of Playboy but not in the demand for Playboy. Econometrically, our instruments need to be correlated with sales of playboy but uncorrelated with the error terms in our regression equation of interest, or uncorrelated with the residuals in equation (5). In the second stage we estimate our original regression model replacing

actual Playboy sales with the fitted value from our first stage regression,

$$\text{Divorce}_{i,t} = \gamma_i + \delta_t + \beta \hat{\text{Playboy}}_{i,t-k} + \epsilon_{i,t}, \tag{8}$$

where $\hat{\text{Playboy}}_{i,t-k}$ denotes the fitted or predicted values from Equation (7). It is well known that under suitable econometric conditions the estimator defined by Equations (7) and (8) is consistent, or that it solves the endogeneity problem.

In considering potential instruments to identify the supply of Playboy, it is important to remember that in the early years of our sample the bulk of Playboy sales occurred without a subscription. Looking again at Figure 3, in 1960 more than eighty percent of sales were from news stands, convenience stores and other magazine retailers. By 1980 that percentage had dropped substantially but it remained well above fifty percent. Only after the 1980s did the bulk of Playboy sales come from subscriptions. This observation is important because we estimate our regressions with data from the 1960s and 1970s. While the costs of subscribing to a magazine are probably fairly uniform across states, the costs of acquiring a magazine from a news stand or other magazine retailer almost certainly varies substantially across states.

We use two instrumental variables to identify the cost of acquiring Playboy in any given state. Our first instrument is the fraction of Time magazine that is sold without a subscription in a given state in a particular year, and our second instrument is the fraction of Playboy that is sold without a subscription. These variables vary between zero and one, and are relatively small in large, sparsely populated states. A higher fraction of either magazine sold without a subscription indicates a more developed retail magazine market, so we expect higher non-subscription sales to be related to higher total sales. In other words, we expect the instrumental variable coefficients in (7) to be positive. Our nonsubscription instruments seem likely to be good measures of the cost of acquiring pornography. At the same time, it does not seem likely that either of these two instruments is related to the demand for Playboy, or that either measures the drivers of divorce in the second explanation discussed above. One potential concern with our instruments is that they are driven by the population density of each state in each year, which may not satisfy the econometric requirements

described above. To address this concern, we include population density in some of our regression tests.

Having identified two reasonable instrumental variables, we estimate our regression with a GMM procedure and report the results of our estimation in Table 6. In the first stage regression, the fraction of Time sold without a subscription is extremely statistically significant and the fraction of Playboy sold without a subscription is marginally statistically significant. This is not surprising because for many sample years the sales rate of Time is much higher than that of Playboy, so the fraction of Time sold at retail outlets is probably a better measure of the cost of acquiring magazines. The F-test for the hypothesis that the coefficients on the instruments in the first stage regression are jointly zero vary is 8.33, with a corresponding p-value of 0.0002. This indicates that these instruments do a pretty good job of identifying variation in sales of Playboy, giving us some confidence in the results we obtain in the second stage.

As in other tables, in Table 6 we report results with different sets of fixed effects. All the regressions use Playboy lagged two years as the independent variable of interest and all exclude Nevada. We do not use population weights because we are using GMM standard errors for our inferences. In Panel B we report results for models that include the logarithm of population density. Looking at our instrumental variables regression coefficients in Panel A, all of the coefficient estimates are large and statistically significant. Surprisingly, several coefficients are closer to the values of Table 2 than they are to those of Table 5.

In Panel B most of the sales coefficients are large and significant and most of the density coefficients are negative and significant. The exception is Model 4 in Panel B, which seems likely to be overspecified. Neither the coefficient for sales of Playboy nor that for population density is significant in Model 4, and the density coefficient is positive. Apparently, having density, sales, and state and year fixed effects all in the same instrumental variables regression introduces too much multicollinearity. In an OLS regression with the same specification (year and state fixed effects, sales of playboy and density) the sales coefficient is 0.12 with a t-statistic of 2.45. Panel B provides results that make it unlikely that the instrumental variable results in Panel A are driven primarily by population density. The fact that the correlation documented above is robust to using reasonable instruments to correct for endogeneity is

strong evidence that sales of Playboy causes divorce.

Of course, it is difficult to find instruments that all researchers agree are completely exogenous. Our use of population density as an instrument can be criticized on the grounds that in more dense locations it is easier to find other partners for extramarital relationships. The fraction of Playboy sold without a subscription might possibly measure the stigma associated with pornography consumption. We have not yet found a complaint about the fraction of Time sold without a subscription, but given time and imagination we are sure such a complaint can be generated. The J-tests of overidentifying restrictions reported in the table suggest that our instruments are not perfect. Those tests reject all of our models but they do not give particularly severe rejections, and it is surprisingly common for the J-test to reject models in empirical work like this. While this rejection may indicate that our choice of instrumental variables is imperfect, it may also signify that our linear specification or some other feature of our models is imperfect.

We believe that our instruments are quite good. But even if they are imperfect, we believe that the importance of the question our work addresses and the magnitude of the raw correlation between sales and divorce make our findings of great interest. Like Deaton (2009) and Heckman and Urzua (2009), we argue that having only imperfect instruments should not prevent us from testing hypotheses that have large social implications. The large correlation between sales and divorce that is so evident in simple panel data is sufficiently robust to remain after using instruments to adjust for endogeneity. The evidence that pornography causes divorce is quite strong.

3.6 Magnitude of the Effect

We have shown that divorce is significantly positively correlated with Playboy sales, in both the cross-section and time series. We have also provided evidence that this correlation is causal, or that Playboy sales actually cause divorce. We have yet to discuss in detail the magnitude of the effect that we estimate.

In our pooled regressions, we estimate a coefficient of 0.73. As we state in Section 3.1, this corresponds to Playboy sales being related to almost thirty percent of all divorces.

However, this is almost certainly an overestimate of the effect of Playboy on divorce because it does not control for state characteristics, the time series of aggregate divorce rates, or the endogeneity of Playboy sales to divorce. In our cross-sectional results, the average coefficient is 0.24, and in our time series results it is 0.61. In our panel regressions that include year and location fixed effects, the coefficient varies from 0.35 to 0.16. In our final set of results, our instrumental variables regressions reported in Table 6, the coefficients of Playboy sales lagged two years with location and time effects vary from 1.05 to 0.45. Looking at all of these results, we conclude that the correct coefficient to measure the causal effect of sales on divorce is likely to be between 0.5 and 0.2.

Using a coefficient estimate of 0.5, we can revisit our calculation of how many of the divorces in the 1960s and 1970s can be attributed to sales of Playboy. There were approximately 14 million divorces between 1962 and 1979, and there were about 69.86 * 12 = 838 million copies of Playboy sold. A coefficient of 0.5 implies that about 0.5/10 * 69.86 million = 3.5 million of those divorces were caused by Playboy. Using our more conservative coefficient estimate of 0.2 implies that 1.4 million divorces were caused by Playboy. We conclude that sale of Playboy caused between 10 and 25 percent of all the divorces in the 1960s and 1970s. This is a remarkably high estimate, implying that pornography sales have important social consequences.

4 Conclusion

Using panel data at the state level, we provide strong evidence that sales of Playboy magazine is significantly related to aggregate divorce rates. The correlation between divorce rates and Playboy sales is strong in both the cross-section and the time series in our panel, reaching a level of 44 percent when sales is lagged two years. Future values of Playboy sales do not predict divorce but lagged values do. An instrumental variables estimator confirms that Playboy sales cause divorce rather than simply being correlated with it. Looking at the magnitude of our coefficient estimates, between 10 and 25 percent of all divorces in the 1960s and 1970s can be attributed to sales of Playboy.

One caveat that we must add to the interpretation of our results is that we are using

sales of Playboy magazine in the sixties and seventies to measure pornography consumption. Playboy is marketed primarily to men. While it is possible that pornography that is produced primarily for women or for couples has a different effect than sales of Playboy, it seems likely to us that pornography still has a significant causal role in divorce. Using different measures of pornography consumption to explore this relation is a promising idea for additional analysis.

Given the way that both marriage and the pornography industry have developed, it is difficult to extrapolate from our results to know how much divorce is being caused by pornography today. The development of the internet has increased the availability of pornography tremendously. It is possible that people have become accustomed to pornography and its effect has decreased. Some evidence suggests that people adapt to changes in the institution of marriage by avoiding marriages that they expect to fail (Stevenson and Wolfers, 2006). However, since pornographic material is much more prevalent now than it has ever been, it seems unlikely that the total effect of pornography on divorce has attenuated much. While some anecdotal and survey evidence points to a significant role for pornography in divorce, examining more recent data for evidence of this role is a promising area for future research.

Divorce is widely perceived to be costly to society in various ways. As a society we regulate a number of things that are perceived to have the potential to harm people, like the consumption of alcohol and illicit drugs or the ability to drive an automobile. If policies exist that can prevent a large number of divorces from occurring with relatively low cost then those policies seem to be worth exploring.

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Table 1: Summary Statistics

Table 1 reports means of the dependent and independent variables by state (including the District of Columbia). The dependent variable in most regressions is the annual divorce rate (per 1000 people) and the independent variable is the average monthly playboy sales rates (per 100 people). For most states, the data are measured from 1960 to 1998. However, as indicated by the columns labeled "Obs," some observations are missing, giving us a total of 1914 observations. Some time-series properties of the data are described in Figures 1 through 4.

State	Region	Obs	Divorce Rate	Playboy Sales	State	Region	Obs	Divorce Rate	Playboy Sales
AK	9	39	6.11	3.31	MT	8	39	4.76	1.98
AL	6	39	5.53	1.02	NC	5	39	3.89	1.26
AR	7	39	5.97	0.99	ND	4	39	2.62	1.59
AZ	8	39	6.50	2.08	NE	4	39	3.26	1.81
CA	9	31	4.79	2.45	NH	1	39	4.19	1.99
CO	8	35	5.22	2.61	NJ	2	38	2.58	1.76
CT	1	38	2.92	1.87	NM	8	30	5.74	1.57
DC	5	38	3.72	2.99	NV	8	36	17.46	3.49
DE	5	39	3.80	1.97	NY	2	39	2.49	1.65
FL	5	39	6.01	1.76	OH	3	39	4.19	1.58
GA	5	39	4.80	1.43	OK	7	39	6.66	1.58
HI	9	39	3.91	2.25	OR	9	39	5.15	2.04
IA	4	39	3.19	1.79	PA	2	39	2.68	1.47
ID	8	39	5.66	1.75	RI	1	39	2.77	1.55
IL	3	38	3.59	1.79	SC	5	39	3.21	1.15
IN	3	25	5.37	1.63	SD	4	39	3.00	1.50
KS	4	39	4.37	1.93	TN	6	39	5.34	1.14
KY	6	39	4.25	1.10	TX	7	38	5.27	1.64
LA	7	8	3.39	1.68	UT	8	39	4.37	1.46
MA	1	39	2.44	1.69	VA	5	39	3.61	1.67
MD	5	39	3.09	1.85	VT	1	39	3.52	1.83
ME	1	38	4.18	1.49	WA	9	39	5.49	2.17
MI	3	39	3.82	1.61	WI	3	39	2.78	1.62
MN	4	39	2.91	1.87	WV	5	39	4.17	1.02
MO	4	39	4.49	1.57	WY	8	39	6.31	2.42
MS	6	39	4.39	0.85					

Table 2: Pooled Regressions

Table 2 reports the results of simple pooled regressions of the divorce rate on the Playboy sales rate. The dependent variable for each regression is the annual divorce rate in a particular state for a particular year. The independent variables are the monthly sales rate of Playboy magazine for some years prior to, concurrent with or after the divorce rate being analyzed. Panel A is estimated with the entire sample. Panel B reports results that exclude the outlier state of Nevada. Panel C reports results for the first half of the sample (1960-1979), excluding Nevada. In all panels OLS T-statistics are reported in parentheses.

Panel A: Full Sample Results (1960-1998)

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	1.222						1.186
	(20.8)						(6.05)
Playboy_{t-1}		1.202				1.445	0.289
		(20.0)				(7.48)	(1.11)
Playboy_{t}			1.173			0.289	0.189
			(18.9)			(1.11)	(0.71)
Playboy_{t+1}				1.105		-0.579	-0.228
				(16.8)		(-2.92)	(-0.87)
Playboy_{t+2}					1.031		-0.281
					(14.9)		(-1.39)
R-Squared	19.36	17.67	15.71	13.22	10.93	18.31	20.25
Correlation	44.0	42.0	39.6	36.4	33.1	–	–
Observations	1812	1863	1914	1863	1812	1812	1710

Panel B: Excluding Nevada (1960-1998)

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.774						1.198
	(18.3)						(9.34)
Playboy_{t-1}		0.727				1.670	0.355
		(16.8)				(12.9)	(2.09)
Playboy_{t}			0.667			0.213	0.151
			(15.1)			(1.23)	(0.87)
Playboy_{t+1}				0.533		-1.325	-0.277
				(11.3)		(-9.99)	(-1.63)
Playboy_{t+2}					0.381		-0.963
					(7.64)		(-7.29)
R-Squared	15.88	13.41	10.86	6.58	3.18	20.35	26.37
Correlation	39.8	36.6	32.9	25.6	17.8	–	–
Observations	1778	1828	1878	1828	1778	1778	1678

Table 2: Pooled Regressions (continued)

Panel C: First Half of Sample (1960-1979), Excluding Nevada

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.900						1.764
	(18.1)						(7.95)
Playboy_{t-1}		0.862				1.173	-0.976
		(17.2)				(6.06)	(-2.83)
Playboy_{t}			0.841			0.163	0.671
			(17.1)			(0.56)	(2.18)
Playboy_{t+1}				0.789		-0.541	-0.424
				(15.1)		(-2.77)	(-1.37)
Playboy_{t+2}					0.714		-0.299
					(12.7)		(-1.44)
R-Squared	27.37	24.26	23.05	19.00	14.24	25.27	30.70
Correlation	52.3	49.3	48.0	43.6	37.4	–	–
Observations	875	925	975	975	975	925	875

Table 3: Yearly Cross-Sectional Regressions of Divorce on Playboy Sales

Table 3 reports the results of annual cross-sectional regressions of the divorce rate in year t on the Playboy sales rate in year $t-2$. The first column reports coefficients from a simple OLS regression. Model 2 adds dummy variables to control for the nine regions described in Table 1, and Model 3 excludes data from the state of Nevada. Model 4 uses population-weighted least squares but includes Nevada, and Model 5 uses population weights and excludes Nevada. Each regression is estimated with about 50 observations. * indicates statistical significance at the five percent level, ** indicates significance at the one percent level, and *** indicates significance at the one thousandths level.

Dependent Variable: Annual divorce rate in year t
Independent Variable: Playboy sales rate in year $t-2$

Year	Model 1	Model 2	Model 3	Model 4	Model 5
1962	5.997***	7.632***	0.350	2.363	0.479
1963	4.609**	5.611**	0.415	1.685	0.406
1964	6.050***	7.277***	0.275	2.891*	0.043
1965	3.107**	3.811**	0.124	1.177	0.025
1966	1.849*	2.075**	0.324	0.646	0.097
1967	1.781*	2.144**	0.202	0.562	0.008
1968	1.569*	1.677*	0.121	0.478	-0.068
1969	1.543**	1.630*	0.238	0.543	0.042
1970	0.921*	0.978*	0.194	0.465	0.161
1971	1.009**	1.040*	0.133	0.412	0.054
1972	1.439***	1.717*	0.324	0.822	0.253
1973	1.093**	1.257*	0.200	0.727	0.316
1974	1.160**	1.433***	0.143	0.632	0.128
1975	1.316***	1.529***	0.494	0.979*	0.551
1976	1.566***	1.808***	0.684	1.026*	0.636
1977	1.466***	1.501***	0.582	0.871*	0.428
1978	1.250***	1.186***	0.446	0.999*	0.541
1979	1.501***	1.538***	0.691*	0.800	0.189
1980	1.795***	1.958***	1.006**	1.141	0.576
1981	1.488***	1.710***	0.765**	1.015*	0.408
1982	1.344***	1.464***	0.647*	0.901*	0.436
1983	1.499***	1.591***	0.552	0.871	0.318
1984	1.597***	1.833***	0.634	1.048	0.396
1985	1.386**	1.404**	0.355	0.817	0.235
1986	1.264**	1.368**	0.072	0.866	0.014
1987	1.072*	1.264*	0.133	0.863	0.034
1988	1.490**	1.697**	0.325	1.006	0.057
1989	0.570	0.678	-0.006	0.007	-0.537
1990	1.280*	1.824**	0.852	2.085**	1.597
1991	-0.041	0.317	0.317	-0.263	-0.263
1992	-0.348	0.340	0.340	-0.780	-0.780
1993	0.914	1.480**	0.210	0.813	-0.463
1994	-0.235	0.170	0.170	-0.534	-0.534
1995	0.991	1.424*	0.845	1.149	0.565
1996	1.020	1.911**	0.778	1.686*	0.477
1997	1.390	2.024*	0.495	1.813	0.363
1998	0.969	2.161**	1.245	2.378**	1.591
Region Dums	No	Yes	Yes	Yes	Yes
Pop Weights	No	No	No	Yes	Yes
Excludes NV	No	No	Yes	No	Yes

Table 4: Time Series Regressions by State

Table 4 reports the results of time-series regressions of divorce rates in year t on Playboy sales in year $t-2$ estimated for each state. In the columns labeled 'OLS Coeff,' ordinary least squares estimates are reported. In the columns labeled 'Corrected Coeff,' estimates that are corrected for third order autocorrelation are reported. The number of observations for most regressions is 39, since this is the number of years in the sample for most states. Louisana is excluded because it has very few available observations. * indicates statistical significance at the five percent level, ** indicates significance at the one percent level, and *** indicates significance at the one thousandths level.

Dependent Variable: Annual divorce rate in year t
Independent Variable: Playboy sales rate in year $t-2$

State	OLS Coeff	Corrected Coeff	State	OLS Coeff	Corrected Coeff
AK	0.887***	0.289	MT	1.288***	0.835***
AL	2.539***	1.044*	NC	2.103***	0.613*
AR	3.231***	2.450***	ND	1.444***	0.660***
AZ	0.806***	0.822***	NE	1.116***	0.377**
CA	0.929***	0.656***	NH	0.917***	0.400
CO	0.822***	0.488**	NJ	0.569*	0.129
CT	0.609*	0.142	NM	3.069***	2.889***
DC	0.378*	0.281	NV	-0.151	0.094
DE	0.720*	0.486	NY	0.176	0.181
FL	1.372***	0.858***	OH	1.335***	0.433
GA	1.503***	0.657**	OK	1.507***	1.029***
HI	0.730***	0.305	OR	1.116***	0.515**
IA	0.919***	0.307	PA	0.750**	0.337*
ID	1.051***	0.647***	RI	0.368	-0.037
IL	0.980***	0.510***	SC	2.079***	0.570*
IN	1.967***	1.578**	SD	1.531***	0.550**
KS	1.154***	0.597**	TN	2.744***	1.063*
KY	1.571**	0.369	TX	1.158***	0.646**
MA	0.489**	0.289	UT	0.741**	0.303
MD	0.459**	0.129	VA	0.640*	0.160
ME	1.309***	0.705**	VT	0.961*	0.230
MI	1.017***	0.445**	WA	0.972***	0.534**
MN	0.870***	0.374**	WI	0.966***	0.398**
MO	1.143***	0.242	WV	2.388***	0.879*
MS	2.575***	1.372**	WY	1.153***	0.837***

Table 5: Panel Regression of Divorce on Playboy Sales, 1960-1979

Table 5 reports the results of a number of regressions of divorce rates on rates of Playboy sales with various lags and leads. Each regression is estimated with state and year dummy fixed effects, and the data for Nevada are excluded from each regression. The number of observations used by each panel regression varies because the lags of Playboy sales are not available at the beginning of the sample period. In Panel A OLS regressions with year fixed effects are reported. In Panel B region fixed effects are added and in Panel C state fixed effects are added. Finally, in Panel D population weighted least squares estimates with year and state fixed effects are reported. In all panels T-statistics are reported in parentheses.

Panel A: OLS Estimates with Year Fixed Effects

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.394						-0.121
	(5.85)						(-0.04)
Playboy_{t-1}		0.406				-0.123	-0.175
		(6.21)				(-0.44)	(-0.39)
Playboy_{t}			0.415			0.145	0.244
			(6.64)			(0.36)	(0.55)
Playboy_{t+1}				0.417		0.390	0.110
				(6.82)		(1.47)	(0.26)
Playboy_{t+2}					0.405		0.248
					(6.74)		(0.91)
Observations	875	925	975	975	975	925	875

Panel B: OLS Estimates with Year and Region Fixed Effects

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.350						0.236
	(5.43)						(1.21)
Playboy_{t-1}		0.308				0.108	-0.132
		(5.61)				(0.58)	(-0.44)
Playboy_{t}			0.391			0.157	0.179
			(6.01)			(0.59)	(0.61)
Playboy_{t+1}				0.304		0.051	0.129
				(5.83)		(0.29)	(0.46)
Playboy_{t+2}					0.269		-0.097
					(5.19)		(-0.53)
Observations	875	925	975	975	975	925	875

Table 5: Panel Regression of Divorce on Playboy Sales, 1960-1979 (continued)

Panel C: OLS Estimates with Year and State Fixed Effects

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.159						0.137
	(3.54)						(1.58)
Playboy_{t-1}		0.159				0.180	0.035
		(3.59)				(2.12)	(0.27)
Playboy_{t}			0.165			0.030	-0.001
			(3.81)			(0.26)	(-0.00)
Playboy_{t+1}				0.111		-0.074	0.125
				(2.61)		(-0.91)	(1.03)
Playboy_{t+2}					0.028		-0.230
					(0.65)		(-2.35)
Observations	875	925	975	975	975	925	875

Panel D: Population-Weighted Estimates with Year and State Fixed Effects

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Playboy_{t-2}	0.091						0.097
	(1.77)						(0.88)
Playboy_{t-1}		0.101				0.171	0.042
		(2.00)				(1.65)	(0.27)
Playboy_{t}			0.107			-0.010	-0.017
			(2.18)			(-0.07)	(-0.12)
Playboy_{t+1}				0.065		-0.087	-0.005
				(1.36)		(-0.89)	(-0.04)
Playboy_{t+2}					0.029		-0.083
					(0.62)		(-0.83)
Observations	875	925	975	975	975	925	875

Table 6: Instrumental Variables Estimates

Table 6 reports the results of instrumental variables regressions of divorce rates on Playboy sales rates, using panel data from 1962 to 1979. The regressions use the fractions of both Time and Playboy sales that are sold without a subscription as instruments. OLS estimates for the "first stage" regressions yield:

$$(1)\quad \text{Playboy}_{i,t-2} = \underset{(5.12)}{3.53}\left[\tfrac{\text{Nonsub Time}}{\text{Total Time}}\right]_{i,t-2} + \underset{(1.80)}{0.71}\left[\tfrac{\text{Nonsub Playboy}}{\text{Total Playboy}}\right]_{i,t-2} + \gamma_i + \delta_{t-2} + \epsilon_{i,t-2}$$

where the γ_i and δ_{t-j} terms represent state and time fixed effects, respectively, and where T-statistics are given in parentheses. The F-test for the hypotheses that the coefficients on the instrumental variables are jointly equal to zero in the first stage regression with state fixed effects is 8.33 with a corresponding p-value of 0.0002. The table reports coefficients for Playboy sales when the divorce rate is the dependent variable. The regressions exclude data for Nevada and they include various sets of fixed effects. GMM t-statistics are in parentheses. The adjusted R^2 values reported in the table are for the full model, including all of the dummy variables. Values of the J-test of overidentifying restrictions are reported.

Panel A: GMM IV Estimates

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4
Playboy_{t-2}	1.529	0.936	0.449	1.054
	(3.59)	(7.44)	(2.58)	(2.23)
R^2	14.0	37.9	75.0	93.5
J-Test (Overid)	2.77	35.09	0.22	6.87
J-Test P-Value	0.096	0.000	0.638	0.009
Time Dummies	None	Year	Year	Year
Location Dummies	None	None	Region	State

Panel B: GMM IV Estimates controlling for Population Density

Dependent Variable: Annual divorce rate in year t

	Model 1	Model 2	Model 3	Model 4
Playboy_{t-2}	2.334	0.970	0.488	0.468
	(11.1)	(8.97)	(4.72)	(0.94)
$\text{Ln(Density}_{t-2})$	-0.483	-0.409	-0.210	0.228
	(-7.54)	(-15.78)	(-7.77)	(0.21)
R^2		52.5	76.7	95.4
J-Test (Overid)	3.92	0.95	7.60	13.4
J-Test P-Value	0.048	0.330	0.006	0.000
Time Dummies	None	Year	Year	Year
Location Dummies	None	None	Region	State

Figure 1: Divorces per 1000 People

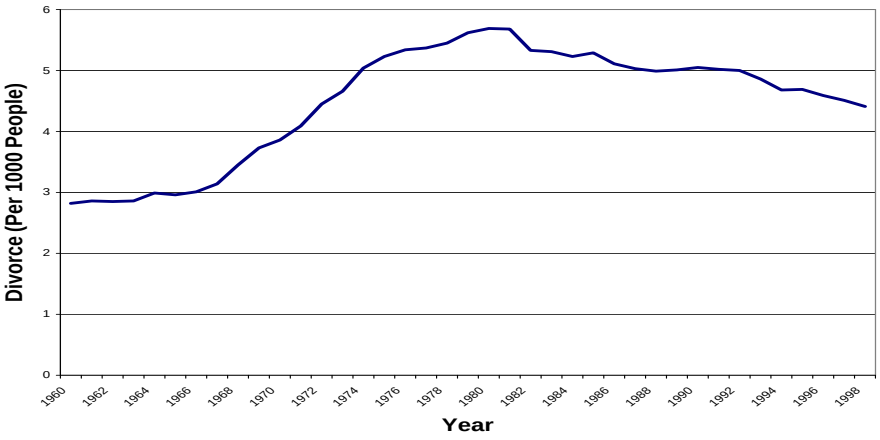

Figure 1 plots the average divorce rate across states from 1960 to 1998.

Figure 2: Playboy Sales per 100 People

Figure 2 plots the average sales rate of Playboy magazine across states from 1960 to 1998.

Figure 3: Nonsubscription versus Subscription Sales of Playboy

Figure 3 plots the average percentage of Playboy sales that are sold without a subscription for each year from 1960 to 1998.

Figure 4: Standard Deviation of Playboy Sales

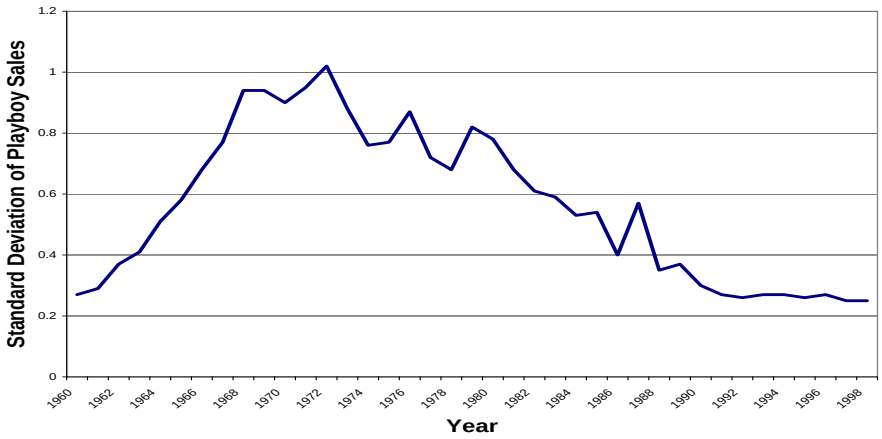

Figure 4 plots the cross-sectional standard deviation of Playboy sales for each year from 1960 to 1998.